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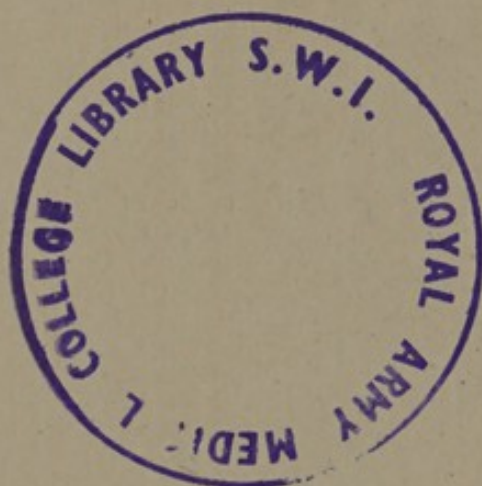
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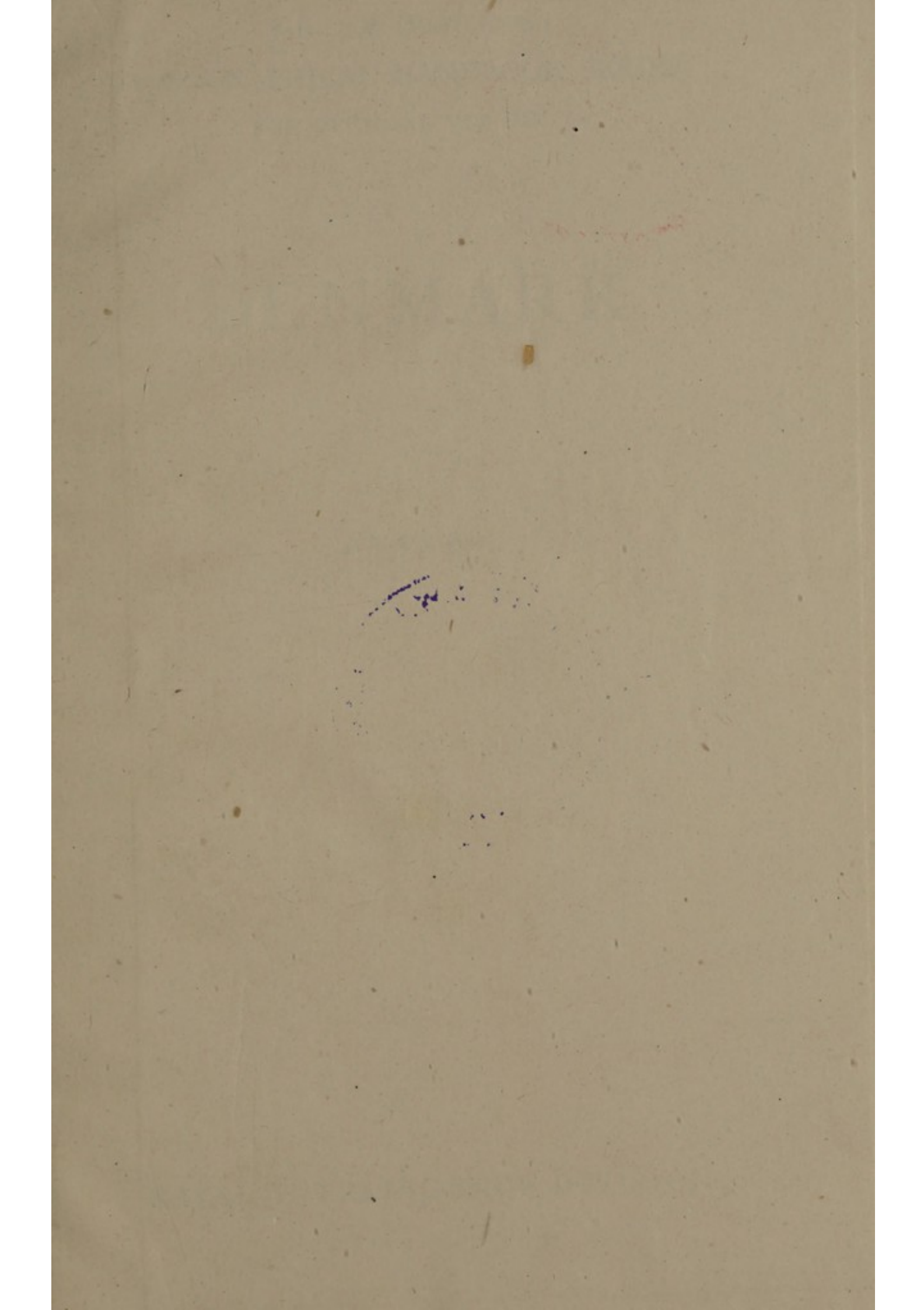
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GEOGRAPHICAL HANDBOOK SERIES

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DENMARK

January 1944

NAVAL INTELLIGENCE DIVISION

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PREFACE

IN 1915 a Geographical Section was formed in the Naval Intelligence Division of the Admiralty to write Geographical Handbooks on various parts of the world. The purpose of these handbooks was to supply, by scientific research and skilled arrangement, material for the discussion of naval, military, and political problems, as distinct from the examination of the problems themselves. Many distinguished collaborators assisted in their production, and by the end of 1918 upwards of fifty volumes had been produced in Handbook and Manual form, as well as numerous short-term geographical reports. The demand for these books increased rapidly with each new issue, and they acquired a high reputation for accuracy and impartiality. They are now to be found in Service Establishments and Embassies throughout the world, and in the early years after the last war were much used by the League of Nations.

The old Handbooks have been extensively used in the present war, and experience has disclosed both their value and their limitations. On the one hand they have proved, beyond all question, how greatly the work of the fighting services and of Government Departments is facilitated if countries of strategic or political importance are covered by handbooks which deal, in a convenient and easily digested form, with their geography, ethnology, administration, and resources. On the other hand, it has become apparent that something more is needed to meet present-day requirements. The old series does not cover many of the countries closely affected by the present war (e.g. Germany, France, Poland, Spain, Portugal, to name only a few); its books are somewhat uneven in quality, and they are inadequately equipped with maps, diagrams, and photographic illustrations.

The present series of Handbooks, while owing its inspiration largely to the former series, is in no sense an attempt to revise or re-edit that series. It is an entirely new set of books, produced in the Naval Intelligence Division by trained geographers drawn largely from the Universities, and working at sub-centres established at Oxford and Cambridge, and is printed by the Oxford and Cambridge University Presses. The books follow, in general, a uniform scheme, though minor modifications will be found in particular cases; and they are illustrated by numerous maps and photographs.

The purpose of the books is primarily naval. They are designed first to provide, for the use of Commanding Officers, information in a comprehensive and convenient form about countries which they may be called upon to visit, not only in war but in peace-time; secondly, to maintain the high standard of education in the Navy and, by supplying officers with material for lectures to naval personnel ashore and afloat, to ensure for all ranks that visits to a new country shall be both interesting and profitable.

Their contents are, however, by no means confined to matters of purely naval interest. For many purposes (e.g. history, administration, resources, communications, etc.) countries must necessarily be treated as a whole, and no attempt is made to limit their treatment exclusively to coastal zones. It is hoped therefore that the Army, the Royal Air Force, and other Government Departments (many of whom have given great assistance in the production of the series) will find these Handbooks even more valuable than their predecessors proved to be both during and after the last war.

J. H. GODFREY

Director of Naval Intelligence

1942

The foregoing preface has appeared from the beginning of this series of Geographical Handbooks. It describes so effectively their origin and purpose that I have decided to retain it in its original form.

This volume has been prepared for the Naval Intelligence Division at the Cambridge sub-centre (General Editor, Dr H. C. Darby). It has been edited and mainly written by Dr Elwyn Davies, with contributions from Mr S. H. Beaver, Mr W. F. Reddaway, and the Research Department of the Foreign Office. The maps and diagrams have been drawn mainly by Miss Margaret Alexander, Mr D. J. Bennett, Mr A. O. Cole, and Miss J. D. I. Tyson.

E. G. N. RUSHBROOKE

Director of Naval Intelligence

January 1944

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Fig. 1. The relief of Denmark
Based on the *Geodætisk Institut's* 1 : 1,000,000 map.

Chapter I

GEOLOGY AND PHYSICAL FEATURES

Solid Geology: Quaternary Geology: Physical Features: Drainage

Denmark covers an area of 42,929 sq. km. which is rather more than twice the area of Wales and half the area of Scotland; its highest point is 172 m. above sea level. Yet within this small area and low elevation there is considerable variety in land forms and scenery. More than half the area of the country is below 30 m. in height but Denmark is not flat. The dunes and lagoons of the west coast of Jylland pass into low sandy heaths which rise gently to a landscape of low hills, ribbon-like lakes, shallow meres, and meadow-fringed valleys which wind between the hills. East of the peninsula of Jylland, which is roughly the area of Belgium, lies the Danish archipelago comprising some four hundred islands varying in size from Sjælland, which is slightly larger than Devonshire, to tiny islets, 280 of which are uninhabited. The eastern side of the country is threaded with sea channels, narrow straits and estuary-like gulfs, while here and there chalk formations rise from the sea in steep white cliffs.

The island of Bornholm lies 150 km. east-south-east of Köbenhavn and is composed of old rocks, all older than those of Jylland and the archipelago. While it is politically part of Denmark, it is geologically part of Sweden. Its granites and sandstones, its rocky coasts and craggy core, are so different both in age and structure from the remainder of Denmark that they are best considered separately (see Appendix I, p. 494). In the following account therefore, Denmark is taken to connote the peninsula and islands at the entrance to the Baltic Sea.

Geologically, Denmark is a young country and its surface features date largely from the Quaternary Ice Age. The ice sheets, after their retreat, left a mantle of boulder clay, sand and gravel, which is on the average some 50 m. thick, though there are wide local differences. These earthy products of ice erosion were sorted and arranged during the later phases of the Ice Age, as the ice sheets melted and retreated across the country. This mantle of glacial deposits covers almost everywhere the rocky foundations on which the surface relief of

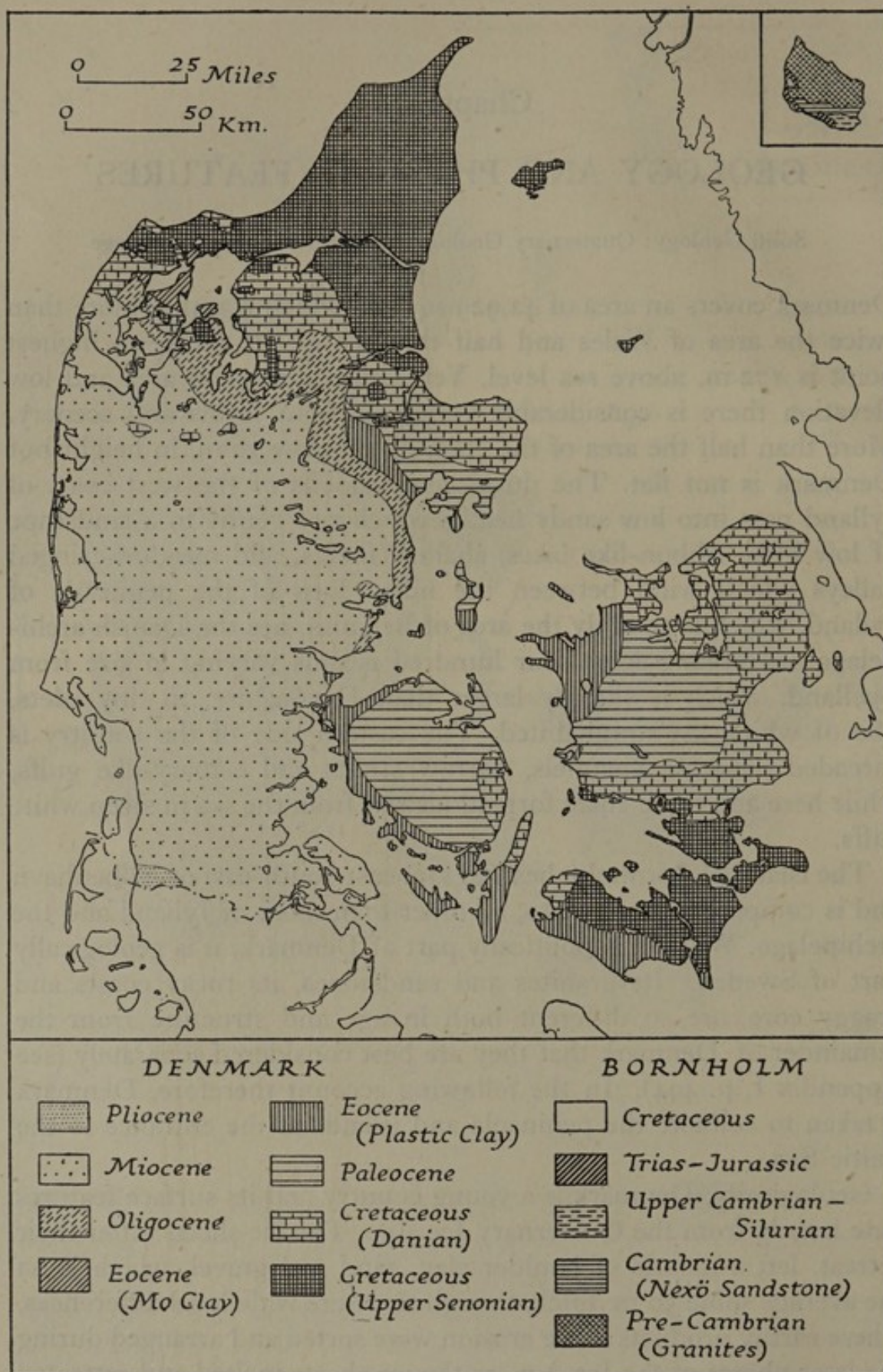


Fig. 2. The solid geology of Denmark

Based on a map in *Meddelelser fra dansk geologisk Forening*, Bind IX, Heft 4, Tvl. II (Köbenhavn, 1939).

Note that the formations older than the Upper Cretaceous are found in Bornholm only and are therefore keyed separately.

Denmark rests. Consequently the solid geology of the country is of only secondary importance in the morphology of the face of Denmark except where rocks outcrop, more particularly along the eastern coasts of the country. Denmark is not therefore a land of craggy heights and rocky escarpments, but is a soft-textured, smooth-featured terrain of low, undulating plains and rounded hills and ridges.

SOLID GEOLOGY

The essential features of the underlying solid geology can be summarized briefly. The foundations of Denmark are formed of a thick layer of white chalk which was laid down on the sea floor in late Cretaceous times. It appears in the form of a saucer with its rim extending in an arc from north Jylland, through the islands of Læsö and Anholt in the Kattegat, to southern Sjælland, Mön, Falster and Lolland in the south (see Fig. 2). Along this rim, the chalk is overlain by glacial deposits only, but on the concave side of the rim it is overlain by Tertiary rocks. In Lolland and Falster the chalk rim is low and does not rise above sea level, but northwards in Mön and Sjælland it rears its head, particularly along the east coast, to form cliffs such as Möns Klint (140 m. high), and Stevns Klint (40 m.). The chalk also outcrops here and there in the form of low cliffs around Mariager Fjord and along the coast to Aalborg and in localities around the western part of Limfjord, while Jammerbugt, on the north-west coast of Jylland, is bounded by the two chalk headlands of Bulbjærg and Lönstrup.

On this basal platform of chalk rest later deposits which are superimposed on one another in simple succession according to age. Since these strata lie in a gentle slope towards the south-west, their borders follow in sequence inwards from the concave borders of the bounding chalk rim and beneath the mantle of glacial deposits which covers them. Within the bounding rim the chalk is overlain everywhere (except in the extreme south at Gedser) by the calcareous deposits of the Danian period, which are composed of chalk and limestone of younger date and which is generally hard in its lower layers and soft in its upper layers, and contains thin bands of clay and layers of flint. These rocks lie immediately underneath the glacial deposits in an arcuate belt extending from eastern Fyn, across the northern half of Langeland, to the extreme north-east corner of Lolland and thence through southern, eastern and northern Sjælland, to the north of Jylland where it extends in a broad belt through Djursland, across

the upper parts of the Randers and Mariager Fjords and thence beneath Limfjord to rise again immediately beneath the glacial deposits in a band mainly between the latitudes of Nykøbing in Mors and Tisted in Ty, to reach the North Sea coast. The Danian chalk and limestone help to form Stevns Klint, and the Sangstrup, Karlby and Bredstrup cliffs.

Table of main geological subdivisions

Recent		Marsh clay, peat, etc.
Quaternary	Late-glacial and post-glacial emergences and submergences	Marine clay and sands (Yoldia clays and Saxicava sands, Zirphæa sands and gravels). Fresh-water clays and sands
	Third Glacial period	Morainic clays
	Second Inter-glacial period	Marine clays (Eem and Skærumhede series), fluvio-glacial sands and gravels. Fresh-water clays, sands and peat
	Second Glacial period First Inter-glacial period First Glacial period	Morainic clays and sands Marine (Yoldia and Tellina) clays, sands, fresh-water sand and alluvium Morainic clays
Tertiary	Pliocene	Sands
	Miocene	Micaceous sands and clays with lignite
	Oligocene	Micaceous and sandy clays
	Eocene	Plastic clay, Mo clay and volcanic tuffs and sands
	Paleocene	Greensand, marls, clays
Mesozoic	Cretaceous (Upper)	Danian chalk, limestone and clay Upper Senonian chalk

The remainder of the pre-glacial floor of Denmark is composed of Tertiary deposits, which are mainly clays and marls containing quartz and mica sands (which have in places been consolidated into sandstones), and beds of lignite which occur in Miocene strata. The Paleocene, which overlies the Danian deposits, lies immediately beneath the glacial deposits in a belt enclosed within the curve of the Danian deposits and extending from the north and centre of Fyn, across the middle of Sjælland and through the northern half of Samsø, to be pinched out between the Danian and the Oligocene rocks between Æbeltoft and Randers. The deposits consist of conglomerates, sands, marls, and clays. Overlying the Paleocene deposits are the Eocene clays. These lie against the lower border of the glacial deposits in a much broken belt which can be traced from southern

Lolland, across the southern half of Langeland, to the southern and western coastlands of Fyn and thence through south Samsö to western Sjælland. In these areas, the Eocene deposits occur as plastic clays containing concretions of barytes and clay-ironstone. The plastic clay, when dry, is firm, but moisture brings out its plasticity so that where it is exposed at steep angles in cliffs, as at Røgle Klint (in the Little Belt), it becomes squeezed out by the weight of the overlying beds and landslides are common. Along the north-western shores of the great bay into which Limfjord opens in its middle course, and in the north of the island of Mors, the Eocene deposits occur as the so-called Mo clay, which lies immediately beneath the glacial deposits. The Mo clay contains numerous beds of tuffs, volcanic sand, diatom earth, impure grey limestone and calcareous concretions. Oligocene deposits of micaceous and sandy clays overlie the Eocene beds and occur immediately beneath the glacial deposits in a curve extending along the coastlands south-east of Horsens and south of Aarhus and thence in an S-shaped belt to the shores of the south-eastern branch of Limfjord, to reappear beneath the drift in central Mors and just south of Tisted in Ty. Finally come the Miocene deposits which lie immediately beneath the glacial deposits over the whole of the peninsula of Jylland south of a line roughly from Aarhus to Skive, but which do not occur on the islands. The Miocene deposits are composed of micaceous clays and sand with a few seams of lignite among the older strata.

QUATERNARY GEOLOGY

During the Quaternary glaciation ice sheets advanced over Denmark in two main directions, southwards from Scandinavia and westwards from the Baltic. They planed down the original surface of the Tertiary and Mesozoic deposits and covered them with glacial deposits which were the products of their own erosion. The ice sheets at one time or another covered the entire country, which was always lowlying, so that the glacial deposits were spread everywhere, evenly if not uniformly. Although inter-glacial and post-glacial erosion and drainage have re-sorted these deposits to some extent, they have never been severe enough to remove the glacial deposits. Thus the relief of Denmark is young in age, even though it may often be mature in form, since it dates almost entirely from Quaternary times. To understand its diverse forms, it is necessary to consider the main features of the glacial history of the country.

First and Second Glacial Periods

Three glacial periods can be recognized in Denmark, as in north Europe generally, in contrast with the four periods generally described for the Alps. The earliest, or Gunz, glaciation of the Alps cannot be distinguished in northern Europe where the first glacial period corresponds to the second or Mindel glaciation of the Alps; the second and third glacial periods of northern Europe correspond to the Riss and Würm glaciations of the Alps respectively. The first glacial period, during which the whole of Denmark was covered by ice, may be dismissed briefly, since its effects were largely obliterated by the deposits of the second glacial period which also invested the whole country. The morainic clay which was laid down during the first glacial period has been identified, beneath later deposits, in some localities as a dark grey, hard and sandy clay, with small stones and fine gravel forming a much larger proportion of the deposit than the true clay. Large stones are relatively few, but the foreign boulders in it indicate that the ice came first from west Sweden and east Norway, and later from the Baltic.

The first and second glacial periods were separated by an interglacial period which corresponds to the Mindel-Riss interglacial period of the Alps. During this period of warmer climate and water drainage, parts, if not all, of the country lay beneath the sea, and marine clays were deposited. Such are the Yoldia clays and the Tellina clays which in the west, as around Esbjerg, are sometimes covered by marsh and alluvium only or by fluvio-glacial deposits of the second glaciation; in the east the Tellina clays are covered by glacial drift.

During the second glacial period, the ice sheets advanced once more from Scandinavia and the Baltic and extended across the whole country. They spread a covering of morainic clay and sand over the deposits of the first glacial and the first interglacial periods. Improvement in climate brought a second interglacial period during which the sea invaded western Slesvig and communicated through narrow straits with a large inland sea which seems to have occupied approximately the basin of the modern Baltic Sea from east Slesvig to East Prussia. On the floor of this interglacial sea, marine deposits of gravel, sand, mud, clay and sand in succession (the Eem deposits and the Skærumhede series) were laid down. On the land from which the ice had temporarily retreated, fresh-water deposits of clay, mud, peat and sand were laid down in lake basins and depressions, while interglacial streams eroded valleys in the glacial deposits.

Third Glacial Period

The third glaciation, although it did not cover the whole country, is of paramount importance for understanding the relief of Denmark. In the islands and east Jylland, which were covered by the ice sheets, the glacial deposits of this period form the surface of the country and the relief features were formed according to the movements of the ice, and the stages of its retreat. In west Jylland, which lay beyond the ice margin, the surface of the country was widely affected by the drainage from the ice sheet, since the waters derived from its melting drained westward carrying heavy loads of detritus which were deposited outwards from the margins of the ice sheet in great outwash plains. The limits to which the ice sheets advanced during the third glaciation are marked by a line which runs eastwards from just south of Bovbjerg on the west coast of Jylland, to Dollerup, south-west of Viborg, and thence southward, bending westward to Brörup and passing west of Rødding and Tinglev to the southern boundary of Jylland which it passes at Padborg (see Fig. 3). The right-angled direction of this line is due to the derivation of the ice sheets from Scandinavia and from the Baltic; the area lying north of the general latitude of the Bovbjerg-Dollerup line was affected mainly by Scandinavian ice, while the glaciated area south of this region was affected mainly by ice sheets which advanced along the basin of the Baltic Sea.

The ice sheets appear to have been withdrawn progressively, if in stages, from northern Jylland, but over east-central and south-east Jylland and over the islands the ice sheet retreated only to advance again. Three such secondary advances are recognizable. The first of these secondary advances reached westward to an average depth of about 25 km. beyond the east coast of Jylland south of about latitude $56^{\circ} 20' N$, and is known as the East Jylland Advance (see Fig. 3). The next of these secondary advances covered most of Sjælland at least as far north as the line of Røsnæs and Holbæk Fjord, the coastlands of the Little and Great Belts in south-east Jylland (a little west of the line of Kolding—Haderslev—Aabenraa approximately) and the west, south and east coastlands of Fyn and is known as the Belt Advance. The third of these secondary advances reached as far as the Ristinge peninsula, and the west coast of Langeland and thus invested not only Mön, Falster, Lolland and Langeland but also the south and east coasts of Sjælland, behind a sinuous line extending behind the coast from about Korsör to Helsingör; it is known as the Lange-

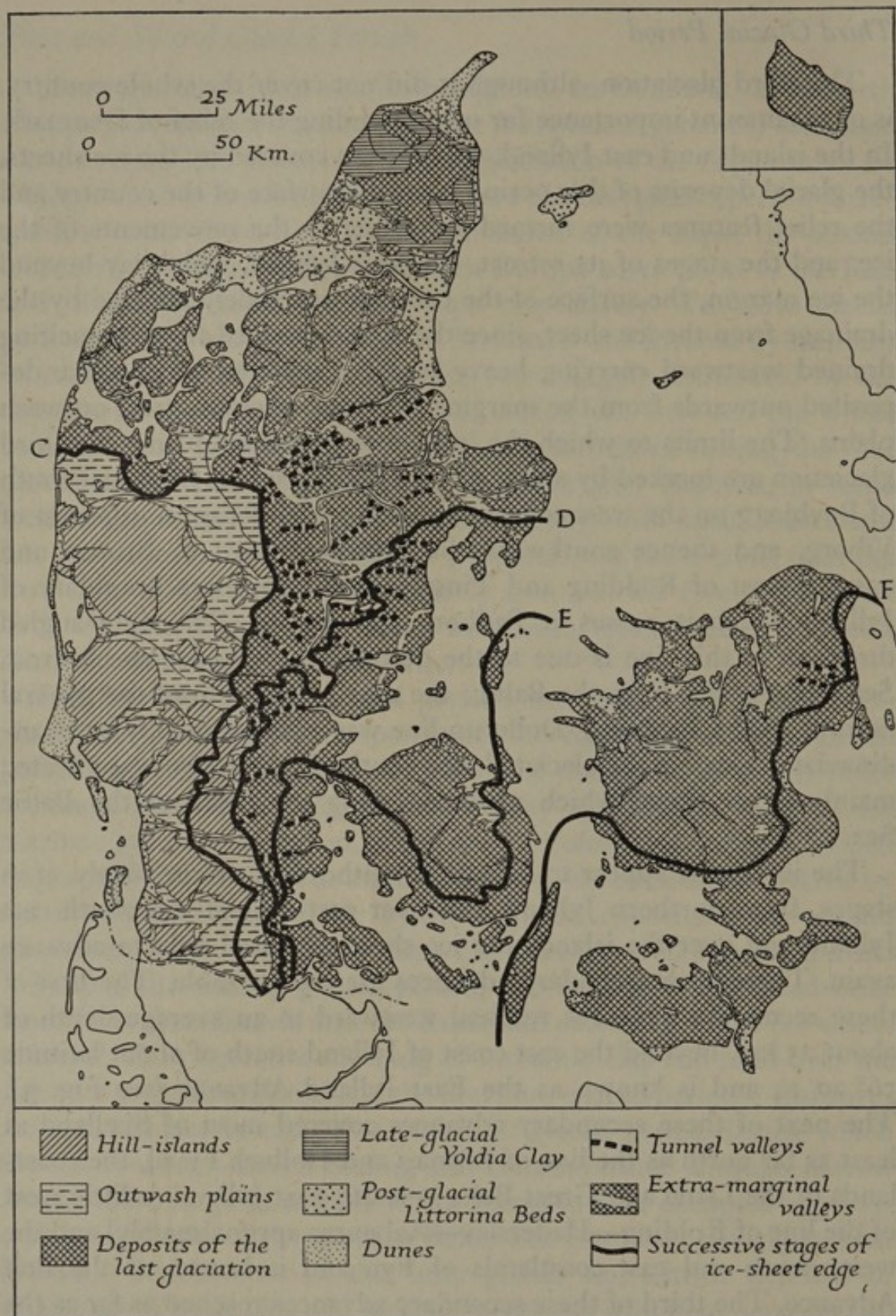


Fig. 3. The drift deposits and landforms of Denmark

Based on a map in 'Summary of the Geology of Denmark', *Danmarks geologiske Undersøgelse*, 5. Række, Nr. 4 (Copenhagen, 1928).

The line C indicates the maximum extension of the ice-sheets during the last glaciation. Lines D, E and F indicate the borders along which the ice sheets remained stationary during the East Jylland (Jutland), Belt, and Langeland Advances respectively.

land Advance. Thus in east-central and south-east Jylland and in the islands not only are there layers of the ground moraines of these different glacial advances separated by shallow fluvio-glacial deposits, but ice-margin conditions, with terminal moraines and outwash plains on their western flanks, were reproduced in stages eastwards across the country behind the line of the maximum extent of the ice sheets during the third and last glacial period.

The Effects of Glaciation

During the time when the country lay under the ice sheets, stony clay, sand and some gravel were deposited more or less evenly underneath the ice and between it and the pre-glacial surface, thus forming morainic flats which give gently undulating topography, usually low-lying, but which may occur as higher platforms or morainic plateaux of moderate height. This ground moraine, as it is called, is usually blue-grey in colour in its unweathered state, but weathering oxidizes the iron compounds in it and it becomes reddish; it is the most widespread and most important of the glacial deposits. When the ice melted, the sand, gravel and stones which lay within the ice and covered the ice surface were deposited on top of the ground moraine; these are loose and incoherent and the finer particles have been washed out or blown away. Beneath the ice sheets there were also drainage channels which carried the melt-water outwards to the margins of the sheets. These sub-glacial streams carried considerable loads of sand, and less gravel and clayey particles, which were deposited along their courses and especially over the land in front of the ice margin where they were arranged in vast stretches, of gentle gradient, called outwash plains. Where the streams formed deltas at, or under the margin of, the retreating ice front, the detritus would be deposited in deltaic banks which grew lengthwise as the ice retreated, thus forming eskers. Sometimes these streams of melt-water ran into or through small lakes whose basins were gradually filled with stoneless melt-water clay. Sometimes such clay was deposited in a hollow in the surface of the ice and in these cases the clay occurs as isolated banks. The melt-water running in channels underneath the ice eroded valleys in the underlying ground; such valleys are called tunnel valleys. Since this water was flowing under pressure it could force its way uphill. This, together with the fact that the channels in the ice might be of uneven gradient, and at different elevations in different parts, meant that the bed of the sub-glacial river was irregular, so that the erosion of the land beneath was unequal although often deep. Thus these tunnel valleys

which score the surface of the glacial deposits are often of irregular gradient and may contain long lakes in the depressions in the valley floor. Along their channels, the streams deposited stratified sand and gravel in long, winding, narrow, rounded ridges (eskers), which may be up to, or even over, 30 m. high. These ridges extend across hills and depressions alike.

Where the margin of the ice sheet remained more or less stationary for a long time, glacial detritus became banked up into long ridges where the ice front melted and terminated. These terminal moraines, as they are called, may occur as considerable hills of smooth contour arranged parallel to the ice front; sometimes they run as long continuous mounds, but more frequently they occur as short ridges, a few hundred yards long, and arranged in long rows.

As the ice sheets approached their margins the load of earthy material and stones which they carried increased to such an extent that it could no longer be carried along by ice sheets which were becoming thinner as they melted. Most of this material became piled up underneath the ice and appeared, after the ice sheet had melted, as hill country in which the glacial material is arranged irregularly in close-lying hills, of various sizes and form, jumbled together. The slopes of the hills are often steep but they may be gentle, and they enclose depressions which often have lakes and bogs in their bottoms. Behind the hill country, unless the terminal moraines and hill country of another glacial advance follow closely, come morainic flats or morainic plateaux. The morainic flats have sometimes become invaded by the sea to form bays such as Köge Bugt, Kalvö Vig, Æbeltoft Vig, and the broads of the western part of Limfjord.

When the ice front melted quickly behind these zones where it had long remained stationary, the melt-water might be unable to cut a channel through the terminal moraines and the edges of the outwash plains. When this occurred, they cut valleys between the terminal moraines and the margin of the ice sheet. These extra-marginal valleys, as they are called, have even gradients and the occurrence of lakes along their courses is much less frequent than in the tunnel valleys. The bottoms of the extra-marginal valleys are usually broad and flat, although they are not always of even width and may close in to form narrower stretches. The bottom lands usually carry much water meadow and bogland and they have streams running along their entire courses much more frequently than do the tunnel valleys. Their sides may be smooth or they may slope fairly sharply to the level of the surrounding land. Sometimes the stream found a short way to

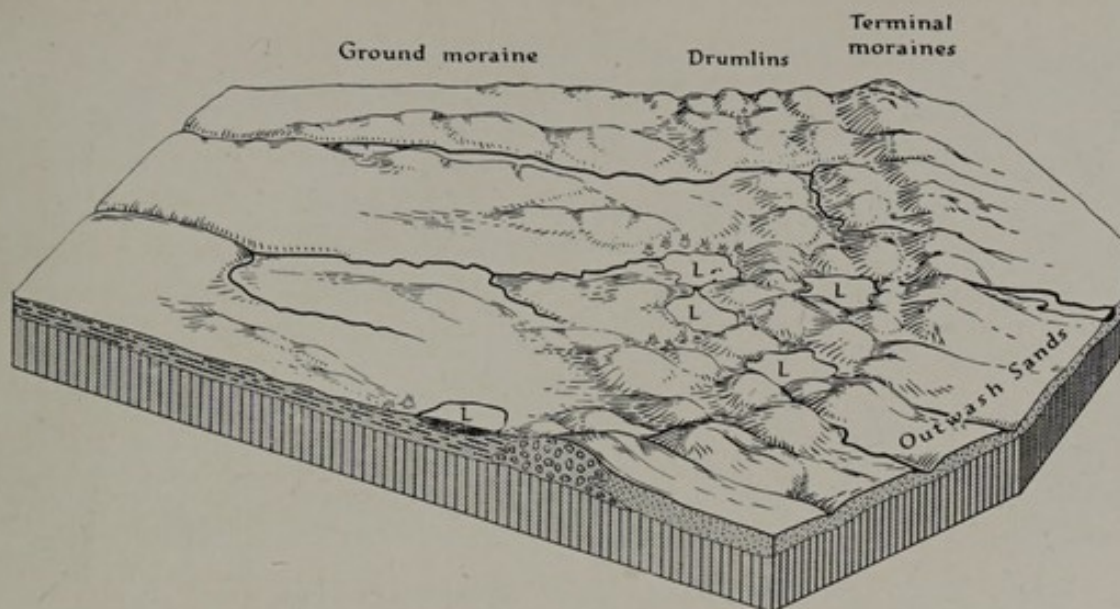


Plate 1. Diagrammatic representation of the deposits and land forms formed during a glacial stage

The terminal moraines and drumlins form a belt of hill country which contains many lakes (L) in depressions. In front of the hill country is the outwash plain and behind is gently undulating ground moraine landscape.



Plate 2. Hill island and outwash plain in west Jylland (Jutland)

In this case the hill island rises from the outwash plain more steeply than is usual.



Plate 3. The marshes of south-west Jylland

The marshes, formed of marine deposits, have been reclaimed by drainage.



Plate 4. Morainic hills in north Jylland (Jutland)



Plate 5. The 'Alps' of Fyn (Fünen)

The *Fynske Alper* are a belt of hill country formed near the ice margin during the Belt Advance (see p. 7).

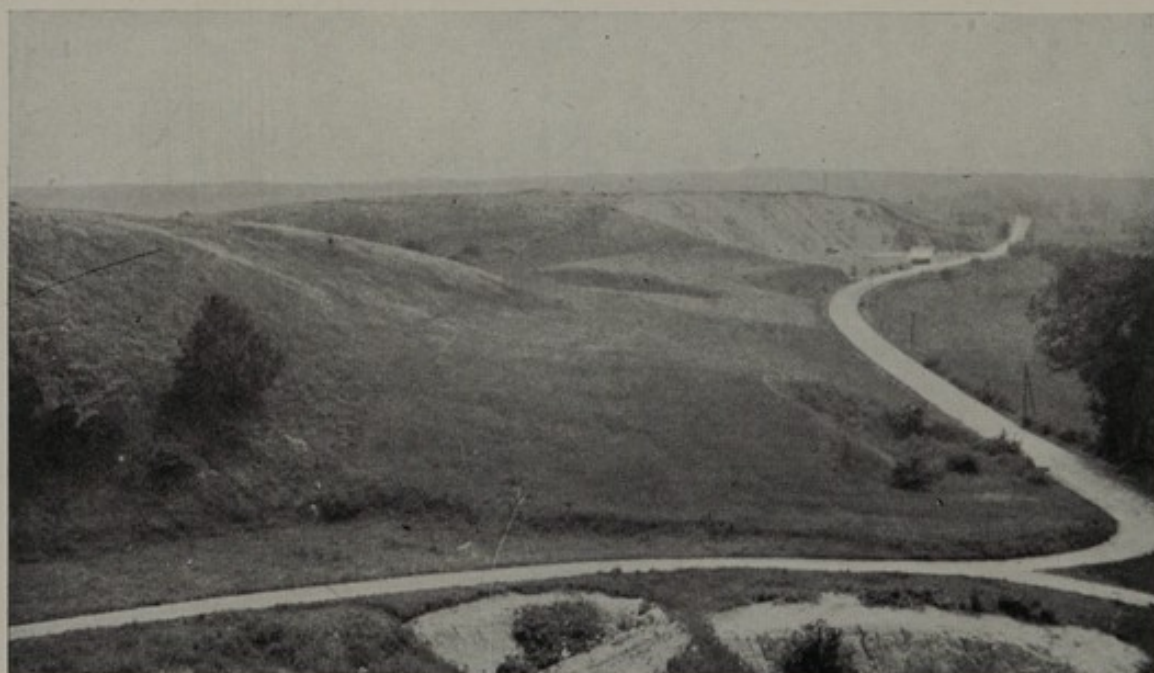


Plate 6. An esker near Roskilde Fjord

Eskers are formed of sand and gravel which are often, as in this case, quarried.

the sea, and then its eroding power increased and river terraces were formed. Examples of extra-marginal valleys are the valleys of the Gudena and Skalsaa.

At the end of the third glacial period the basic features of the land of Denmark were virtually completely formed and the main changes which have occurred since that time have been due to agents of erosion and deposition. Rivers have evened out their beds and have sometimes changed their courses, winds have removed sand from some areas and deposited it in others, while peat has accumulated in badly drained and poorly aerated depressions. There have also been changes in the distribution of land and sea, and occasional submergences have led to the accumulation of marine deposits. As the ice melted and retreated finally across the country the land became submerged and a deposit known as Late Glacial Yoldia Clay* was laid down, in some localities to a thickness of 20 m. This clay occurs over large areas of north Jylland and west and east of Aalborg. When the land emerged the Yoldia clay was covered with sand (Upper Saxicava Sand). This was followed by a probably short period of slight submergence when shallow-water deposits of sand and gravel (known as Zirphaea Beds) were laid down. Then followed a long period of emergence, the Ancyclus Period, when the Baltic was a fresh-water lake (Ancyclus Lake). This was succeeded by the Littorina, or Tapes, submergence during which deposits, varying in character from place to place, were laid down in the Littorina Sea. In regions which then formed narrow gulfs and straits where currents were weak, soft black mud was laid down, but in areas which were then straits with strong currents, or open broads, and along the outer coasts, sand and gravel were deposited often in beds of considerable extent and thickness. These Littorina deposits are particularly widespread in the areas adjacent to the central and eastern parts of Limfjord, the east coast of Jylland between the Skaw and the Djursland peninsula, along the west coast of Jylland south of Esbjerg and in localities along the north coasts of Fyn and Sjælland. The areas of marine deposits, especially in north Jylland, form large flat terraces of clay and sand from which hills and ridges stand out.

Of more recent formation are the marsh clays which are deposited by tides on the shoals and lowlying coasts of south-west Jylland to form soft wet surfaces, and the fresh-water alluvial deposits of peat and mud which have been laid down, sometimes to a depth of 11 m.,

* This is distinct from the Esbjerg Yoldia Clay which was laid down during the first inter-glacial period.

through the filling in of lakes and parts of river courses, or in high-lying wet, poorly drained depressions, or where springs occur along the sides of valleys. Bog iron-ore has sometimes been found near the surface in some bogs.

PHYSICAL FEATURES

It follows, from the effects of glaciation described above, that the surface of Denmark presents two main regions which have different forms of landscape. The boundary between them lies broadly along the line which marks the maximum extent of the ice sheets during the last glacial period (line C, Fig. 3). To the west of this line the landscape is that which was formed during the second glacial period, with the addition of outwash material which was deposited on it by the streams draining from the ice sheets of the last glaciation, and modified by sub-aerial denudation and deposition. To the east and north of the boundary line the landscape is younger and dates from the last glacial period. Since the last glacial period was characterized by periodic retreat and re-advance of the ice sheets, the country is traversed by successive series of topographical forms which were formed at the margins of ice sheets, but since the retreating ice sheet drained on to regions where the ice front had lingered, outwash plains and extra marginal valleys were formed among the lines of terminal moraines thus giving the region great variety of land forms. The country can be described conveniently in four main regions, which are: (a) West Jylland, (b) East Jylland, (c) North Jylland, (d) The Archipelago.

West Jylland (Jutland)

In the area south and west of the line of the maximum extension of the ice sheet during the last glacial period, the land forms consist of what the Danes call 'hill islands' (*Bakkeøer*) which rise out of sandy outwash plains. The hill islands are the surfaces formed during the second glacial period and which were too high to be covered by the sandy outwash which was spread around their base. They appear therefore as islands rising out of the sandy heath-covered plains (see Fig. 4). Their surfaces, which were originally the morainic hills of the second glacial period, have been long exposed to sub-aerial erosion so that the original surface has been much modified. The ridges and crests have been flattened, steep slopes have been evened out, lake basins have been filled in or else incorporated in valley

systems, the rivers have smoothed out their valleys which are wide, with even slopes and gentle gradients, although the streams are small, shallow and winding. The sides of the hill islands have long gentle slopes which pass smoothly into the general level of the surrounding countryside. Their surfaces are composed of sands and gravels which have been deeply weathered and in parts washed away. The moraines on them may be composed of sand or of clay which may even be stoneless, but sandy material is usually the chief component. The

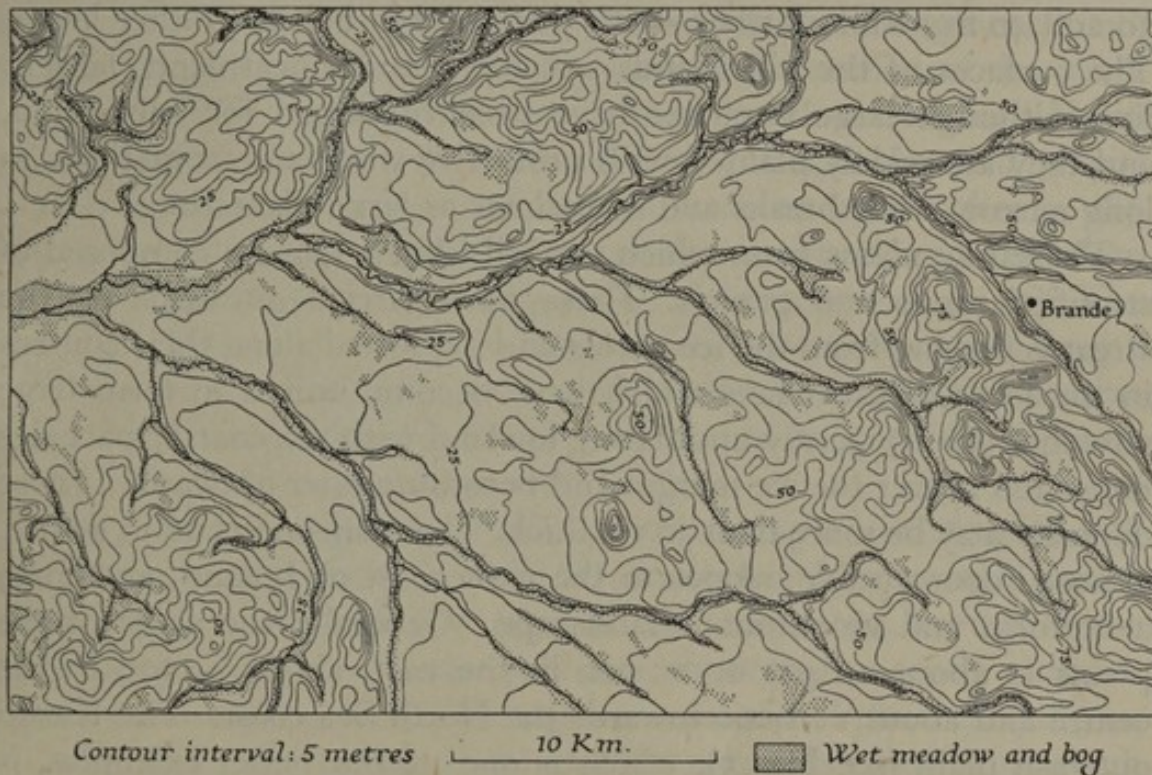


Fig. 4. The relief of hill islands and outwash plains

Based on the *Geodætisk Institut's* 1 : 100,000 maps, sheet 27.

The hill islands can be seen, in the north, south-west and east, as more closely contoured tracts rising out of the gently-sloping outwash plain, which is well shown on each side of the main river flowing SE-NW. The main river flowing E-W is the Skern Aa and the town of Herning lies just off the northern boundary of the map.

hill islands form mature, gently undulating topography. Their extent varies from small, flat-topped, surfaces to large undulating expanses covering many square miles. They are never very high, although some may reach over 75 m. in elevation. Their surfaces carry long, rounded, broad-backed mounds and low knolls of circular form, smooth contour and gentle slopes, with occasionally steeper hillocks. These mounds and knolls alternate with shallow open valleys having stretches of wet meadow and marsh along the river courses. Here

and there are small shallow lakes of rounded form with low smooth banks. In the large hill island which lies between the Storaa and Skern Aa, the general surface level slopes very gently from about 50 m. in the east to about 20 m. in the west with mounds and hillocks rising to between about 40 and 90 m. The hill island lying between the Skern Aa and the Varde Aa has a general level of about 35 m. in the east sloping to about 20 m. in the west, and with hillocks and mounds rising to between about 40 and 50 m. The hill islands behind Esbjerg have a general level of about 25 m. with eminences rising to between 30 and 40 m., while farther south they tend to become rather lower. The surfaces of the hill islands still carry much heathland, largely ling, although large stretches have been reclaimed for cultivation, and they are widely planted with protective woodland, sometimes as long narrow wind-breaks and sometimes as large plantations.

The sandy plains from which the hill islands rise are composed of stratified sands and gravels. These were carried outwards by the streams flowing from the ice sheets and deposited along their courses in the form of great fans which have become united to form large stretches of very gently undulating lowland with the coarser particles deposited nearer the ice margin and becoming finer outwards. These deposits may be more than 30 m. thick. The plains descend in gentle, almost imperceptible, slopes to the west coast of Jylland, and form a uniform and monotonous landscape. Generally the slope of the plains is about 1 : 400 or 1 : 500 in the east, about 1 : 700 in the centre and about 1 : 1,000 towards the North Sea coast. The Karup outwash plain (see Fig. 5), which is one of the better examples, is about 60–70 m. high in the south-east, grades north-westwards to an elevation of about 40 m. around Holstebro and continues to slope gently westwards to about 20 m. behind the dunes between Nissum Fjord and Limfjord. The streams lie in shallow, scarcely marked valleys in the west but become rather more entrenched towards the south-east, but are never deep and have expanses of boggy land along their floors. Roads tend to avoid the plains and to run along the firmer border between them and the hill islands. Large areas are covered with heath and plantations of woodland. Settlement is very sparse and occurs mainly as scattered small holdings.

The hill islands and sandy plains are bounded on the west by a belt of dunes which extends along the entire length of the west coast of Jylland north of Blaavands Huk, and is in places about 10 km. wide. The dunes are arranged in rows roughly parallel with the coast. The sand is piled by the wind into steep crests separated by depressions

of varying width and unless they are anchored by vegetation they move inland in the direction of the prevailing wind. The moving dune is usually bare of vegetation, and occasionally occurs in the form of a parabola opening away from the direction of the wind. The older or 'grey' dunes carry a vegetation of beach grass, moss and lichen. The wind may make a breach in the dune and then it piles the sand over on the leeward side to give the dune a parabolic shape opening towards the direction of the wind. The previously stationary dune begins to move and eventually the middle portion of the parabola is blown away while the wings of the parabola become lengthened, and are left as two parallel dunes lying along the direction of the wind. The detailed form of the dune coast is thus varied and fleeting. North of the Skalling peninsula the currents have arranged the sand in spits across the estuaries of the rivers to form haffs or lagoons (see p. 28), but south of the peninsula the dunes are found only along the western coasts of the islands which fringe the coast here (see p. 27). The coast of south-west Jylland is fringed along almost its entire length by salt marshes which are developed on the very lowlying *Littorina* beds which border the hill islands and outwash plains here. These marshes are lined seawards by dykes.

The hill islands and outwash plains form open countryside with few hedges, and scattered dwellings which cluster into small groups around cross-roads, railway stations and churches, or where the underlying morainic deposits protrude through the sandy outwash plains, but towns are few. The region forms a dull plain carrying on its back blocks of woodland and straight narrow shelter-belts which protect farms, villages and railways. The landscape is similar in many ways to the sandy heaths of Norfolk and Surrey. The network of communications is open but there are no natural barriers to cross-country communication. The ground away from the river valleys is well drained and becomes dusty and strewn with sand in summer, but the river courses are often flanked by bogland, and peat-filled depressions are common. The region is one of recent colonization; large areas have been settled since the middle of the nineteenth century only and expanses of unclaimed heathland are still left. The dune-fringed coast is almost uninhabited except for some groups of fishermen's huts. In south-west Jylland the land is lower and generally damp, with salt marshes along the coast and large areas of bog and fen inland. Settlement here is older, and is concentrated in villages and outlying farms on the islands of drier land which rise from the water meadows and boggy lands along the sluggish streams. Much

of the land is too damp for grain crops and is extensively used as cattle pasture. Behind the coast the wide stretches of marsh are flat and dreary, but farther inland the landscape has more diversity and hedged fields are much more common than on the heaths of west-central Jylland. The life of the region is almost purely agricultural.

East Jylland (Jutland)

To the north and east of the line which marks the maximum extension of the ice sheets during the last glacial period, the land forms are younger and contrast with the maturer forms of west-central and south-west Jylland. This is a region of more positive and more varied landscape, with steep hills, morainic flats which may be lowlying or elevated, hummocks, sand and gravel fans and outwash plains, all intermingled and threaded with tunnel valleys. Along and behind the line marking the maximum advance of the ice sheet during the third glacial period, the hill islands and sandy plains end against a zone of terminal moraines arranged in long ridges and mounds, grouped in lines breached by the openings of the tunnel valleys which end here (see Fig. 5). The ridges and mounds of the terminal moraines have their axes running roughly parallel with the line which was occupied by the margin of the ice sheets. Although they do not rise particularly steeply from the surfaces of the hill islands and outwash plains, yet they often present quite a distinct front, although this does not rise very high, and the relief behind the zone of the terminal moraines is quite different since there is more and sharper variation of slope. The summits of the morainic hills and ridges are on the whole higher in the north-south section of the zone (between Dollerup and Padborg) than in the west-east section (between Bovbjerg and Dollerup). Whereas the heights rise to between about 80 and 100 m. in the north-south section, they rise to about 50 m. in the east-west section, although south of the bend westward beyond Brörup the summits become generally lower. Hills and mounds of lower elevation are intermingled with the higher summits while others having their axes athwart the general trend intervene to break up the continuity and increase the complexity of the landscape.

Behind the zone of terminal moraines follows hill country composed of rounded hills, eskers and drumlins, sometimes with steep flanks, and separated by deep hollows occupied by long ribbon lakes, peat bogs and clayey and sandy deposits. Characteristic of this type of country is the Himmelbjerg district around Silkeborg and the country south and south-west of Viborg towards Dollerup. Here the hills lie

close together and have rounded slopes and elongated forms with their axes arranged sometimes parallel to the lines of the tunnel valleys and sometimes parallel to the line which was occupied by the ice margin in glacial times. Much of the country is above 75 m. in height and some hills rise well over 100 m. Between Horsens, Skanderborg and Silkeborg are the highest hills of Denmark—Ejer Bavnehøj (172 m.), Himmelbjærg (147 m.), Kollen (147 m.) and Himmelbjærg Gaard (157 m.). The flanks of the hills are rarely regular but are carved by small streams which sometimes flow in steep-sided valleys.

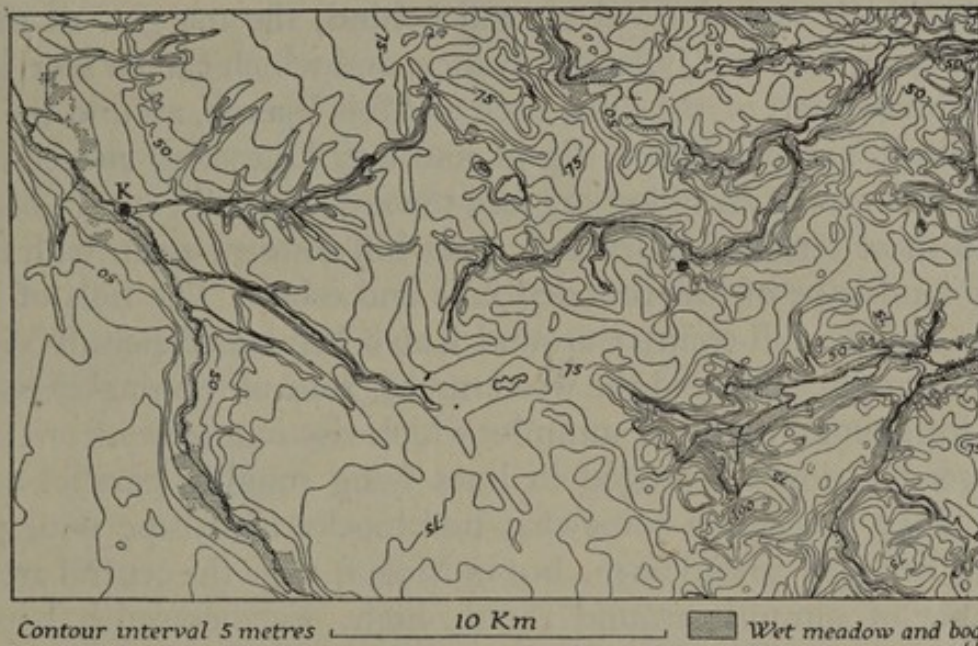


Fig. 5. The relief of outwash plains and terminal moraines

Based on the *Geodætisk Institut's* 1 : 100,000 map, sheet 23.

The western half of the map shows the Karup outwash plain which rises in the east to the terminal moraines which were formed at the margin of the ice-sheets. The watershed between the westward- and eastward-flowing streams indicates approximately the line of the morainic front. The two long lakes have been formed in depressions in the floor of a tunnel valley. The village marked *K* is Karup and the other village, marked by a dot, is Kellerup.

Small 'kettle-hole' lakes which were formed in depressions left by the melting of large isolated blocks of ice are sometimes found at the heads of the valleys which may, or may not, carry streams. The shorelines of the long ribbon lakes which occupy the valleys between the hills are often backed by sharp slopes covered with forests, while the tiny islands which are found in some of the lakes are also usually wooded. The drainage is mainly ENE-WNW but with some streams cutting across from one tunnel valley to another. The valley bottoms often carry long stretches of water meadow and marsh. South of

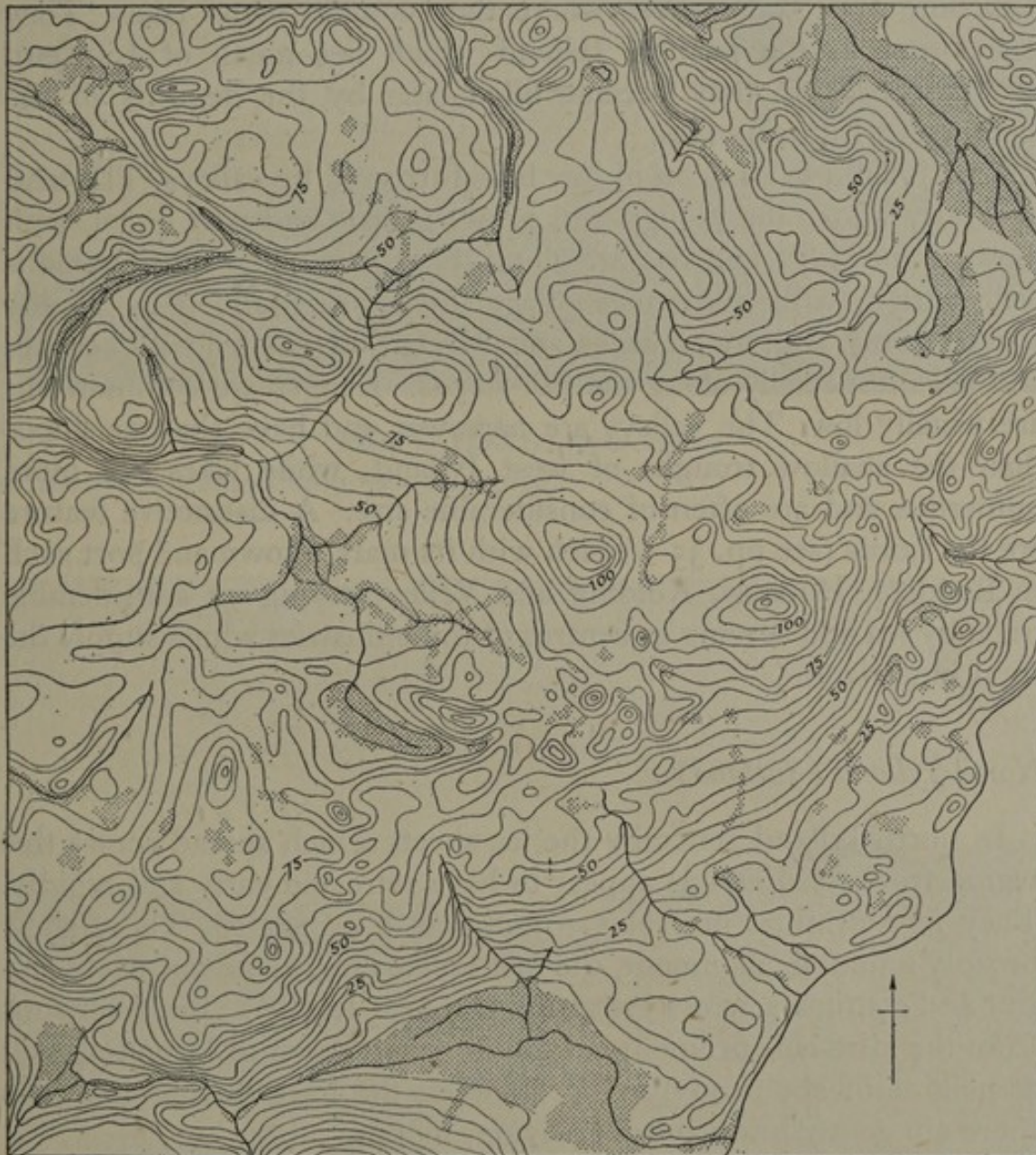
about the latitude of Vejle Fjord the hill country is not developed behind the zone of the terminal moraines of the third glacial period. Between this zone and the terminal moraines of the East Jylland Advance the landscape here forms essentially hill island topography of low platforms with a general elevation of about 50 m., but with some higher tracts rising to about 75 m. Here there are no prominent lines of morainic deposits but merely their flattened and eroded remains. The low platforms are separated by outwash plains along which the main watercourses flow.

Behind this hill country come the terminal moraines and hill country which were formed at, and behind, the margins of the ice sheets during the East Jylland Advance, and which can be seen in the northernmost part of the hills, such as Mols Bjærge, around the bays of Æbeltoft Vig and Kalvö Vig in southern Djursland and continue southwards east of Skanderborg and towards the hill country of Ejler. Behind these terminal moraines comes hill country again with hummocky landscape of low rounded hills and eskers. The hills of Mols Bjærge and the hill country around Kalvö Vig and Æbeltoft Vig are steeper than those behind the westernmost zone of terminal moraines. They form small rounded summits which rise in a series from larger and broader ridges arranged in lines lying roughly parallel to the coast. They produce a somewhat hummocky landscape with peaks ranging between 40 and 60 m., but in Mols Bjærge the central area has a number of summits around 130 m. high. Farther south, between about Aarhus and Kolding, the hills and ridges are on a larger scale with rounded hills rising generally to about 80–100 m. The axes of these hills vary in direction but run chiefly from east to west which is also the main direction of the drainage pattern. In parts of this area the glacial deposits form what might be termed a morainic plateau which rises rather abruptly from the coast to a general level of about 50 m., from which hills and broad ridges rise to above 100 m. (see Fig. 6). Along the plateau edges the rivers have cut fairly steep valleys down to the coast but elsewhere the valleys are open and have smooth slopes.

In south-east Jylland between the terminal moraine zones of the East Jylland and Belt Advances, the landscape is composed mainly of broad-backed, smooth-contoured, morainic ridges, usually below 60 m. in height, and running usually in an east-west direction.

Following eastward on these ridges in south-east Jylland are the moraines of the Belt Advance, which form the watershed between the streams flowing into the Little Belt and those flowing westward towards the North Sea.

Across eastern Jylland, among these land forms, run the tunnel valleys. These are troughs with broad floors and sloping sides. They are of irregular gradient, being sometimes deeply cut and sometimes very shallow, and their courses may lie in parts against the slope of the land. They are often occupied by strings of long, narrow, moraine-dammed lakes. Streams sometimes follow their courses, but the size



Contour interval: 5 metres 3 Km Wet meadow and bog

Fig. 6. The relief of a morainic 'plateau' near Aarhus

Based on the *Geodætisk Institut's* 1 : 100,000 map, sheet 24.

The morainic deposits rise sharply from the coast to a plateau-like formation on which lie small hummocky moraines in the south-east and long smooth ridges farther inland.

of the stream is small in proportion to the scale of the tunnels which were cut under the ice by the swollen glacial rivers. The valley floors usually carry water meadows and bogland. A series of these tunnel valleys traverse south-east, and especially east-central, Jylland where some can be traced from the margins of the sandy plains of western Jylland to the shores of the Baltic where they often end in the broad estuary-like fjords. They are numerous in the country between Silkeborg and Skanderborg where they contain many lakes. They are absent in the part of Jylland which lies north of Limfjord probably because they became filled later by the deposits of the Yoldia and Littorina seas.

East Jylland is a region of low hills furrowed by valleys. The land is mostly under the plough and grows cereals and root crops, with mowing meadows and pasture along the valleys. The countryside is well settled, with numerous village nuclei surrounded by closely spaced farms, and, by Danish standards, is well wooded with beeches and oaks, especially along the hill slopes. Hedges are common but are usually low. The valleys are narrower and have sharper slopes than the shallow troughs of west Jylland, while lakes are more numerous and are often of considerable size. A distinctive feature are the fjords (see pp. 35-6) each with its market town and port such as Randers, Horsens, Kolding and Vejle carrying on considerable trade by sea and serving as centres of the industries which supply the rural hinterland.

North Jylland (Jutland)

In north Jylland generally the ice sheets which spread across this region from Scandinavia appear to have retreated early and rapidly. They left terminal moraines running W-E or NW-SE. These show broadly a double alignment, the one crosses the islands of Mors and Fur and continues across Jylland to end near Randers; the other runs from the Hirtshals promontory, on the north coast, to Dronninglund at heights of about 90-100 m. Between the lines of morainic hills there are gently undulating, lowlying, morainic flats.

North Jylland is flat, bleak, monotonous country which resembles west-central Jylland more closely than east Jylland. Trees are few, scattered, and often stunted and much land is given to pasture. The area was long isolated and has retained old regional names, such as Ty, Han and Vendsyssel, which are unusual in Denmark, and it has some archaic dialects.



Plate 7. Hald Sö, near Viborg

The lake lies in a tunnel valley (see pp. 19-20).



Plate 8. A tunnel valley in central Jylland (Jutland)

The tunnel-valleys often carry no watercourses or lakes and appear as broad troughs in the morainic deposits.



Plate 9. Ground-moraine landscape

The gently undulating landscape, mainly under the plough and with scattered farms, is characteristic of much of the area of Fyn (Fünen) and Sjælland (Zealand).



Plate 10. Mols Bjerge in Djursland, Jylland (Jutland)

The hummocky landscape, formed behind the margin of the ice-sheets, is characteristic of this area (see p. 18).

The Danish Archipelago

In the islands of the Danish archipelago the ice sheets left low morainic plains between, and on each side of, the terminal moraines and hill country of the Belt Advance and the Langeland Advance. Along the zone where the ice margin lay during the Belt Advance lie lines of hills and ridges of rounded contours and composed of morainic gravel. These are backed by hill country which is specially prominent behind Faaborg and in north-east Fyn, especially behind Nyborg, and continue around the southern lobe of the fjord behind Kerteminde. In western Fyn these morainic hills are generally 30-40 m. high, but southward and eastward they rise to between 75 and 100 m. to form the Fynske Alper with hill summits rising above 100 m. Occasionally tiny 'kettle-hole' lakes are to be found among the hills. On the outer border of the ice margin in north-east Fyn an outwash plain was formed extending from the south coast of Odense Fjord south-eastward to Langeskov, and bordered on its eastern flank between Birkinde and Rynkeby by lines of eskers where the streams which formed the sandy plain flowed (see Fig. 7). Elsewhere in northern Fyn the ice sheet deposited its load of detritus fairly evenly and smoothly to form a morainic flat, or plain, with a gently undulating surface. The relief here consists of low undulating country, about 50 m. high inland and sloping gently to about 20 m. behind the coast. Surface features are few and consist chiefly of rounded, oval or elongated mounds and flat-topped ridges rising perhaps to 10-15 m. above the general level but usually lower. The valleys are small and open and have only very occasional stretches of marsh. Villages and groups of farms are more characteristic here than scattered habitations.

In Hindsholm and Samsø the relief consists of transverse hills composed of sand and gravel and running in the same direction as the ice margin. These hills rise, to between about 25 and 35 m., out of the surrounding morainic clay which forms usually low and gently undulating landscape.

Across Langeland and southern and eastern Sjælland, the Langeland Advance of the ice sheets left yet another belt of terminal moraines and hill country. In Langeland the long, low, rounded hills, rising mostly to between 20 and 30 m., extend along the length of the island. In Sjælland, the moraines and hills extend in a curved zone from Korsør south-eastward behind Skælskør and then swing round past Næstved and behind the east coast to Helsingør and form a landscape

of broad rounded hills usually between about 30 and 50 m. high. In the north-western quadrant of Sjælland there are groups of rounded hills with rather abrupt slopes rising to summits between about 70 and 90 m.

In the islands of the Danish archipelago the country between the zones of the terminal moraines is composed largely of low plains

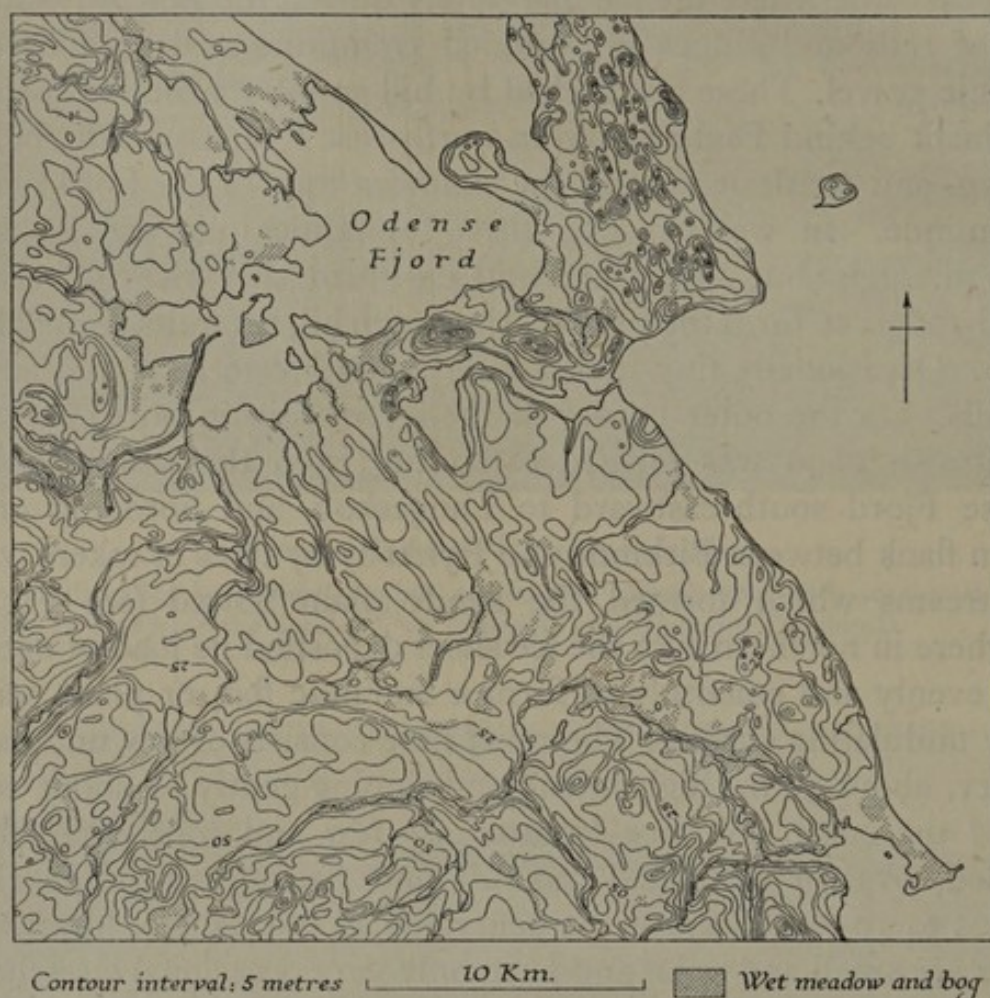


Fig. 7. The relief of the morainic plain of north Fyn (Fünen)

Based on the *Geodætisk Institut's* 1 : 100,000 map, sheet 46.

The morainic plain forms gently undulating relief rising to about 80 m. (260 ft.) in the south. The northern part of the plain has been invaded by the sea to form Odense Fjord. The peninsula called Hindsholm, which flanks the fjord on the east, consists of a series of low glacial hills (moraines), composed of sand and gravel, which were formed near the edge of the ice sheets. South of the southernmost shore of Odense Fjord is a small outwash plain.

covered with boulder clay. These plains are partly flat but are more often slightly undulating and have, here and there on their surface, sandy and gravelly hills which may or may not be covered with glacial clay. In northern Fyn, in Falster and in Lolland the plains are very smooth as is also that lying behind Køge Bugt and extending roughly within the triangle formed by Køge, Roskilde and København. Here

the land has a general elevation of about 50 m. and slopes gently seawards. The rivers lie in open valleys which carry few wet areas, and the surrounding country has low flattened mounds which rise above the general level. The island of Lolland is in general a lowlying featureless plain which varies only between 5 and 15 m. in height but has some small depressions which lie below sea level, especially along the south coast which is lined with dykes along almost its entire length. Falster has similar relief, but lies a little higher and ranges between about 10 and 30 m. In Mön the landscape has more definite features with rounded hills rising to usually between about 30 and 40 m., while in the east of the island the country rises in fairly steep hills to over 100 m. behind Möns Klint.

The landscape of the Danish islands is broadly similar to that of east Jylland but is, on the whole, lower and has larger areas of flat land. It is a region of villages and market towns, and has numerous castles and manor houses especially in south-east Fyn between Svendborg and Nyborg and in south Sjælland. Along the coasts sandy beaches alternate with earth bluffs and are dotted with fishing villages and ferry ports. The hills of Fyn and Sjælland contrast with the flatness of Lolland, Falster and Mön, but everywhere the landscape is less broken than in east Jylland. In Sjælland the countryside is generally open, but in Fyn and the southern islands the fields are commonly enclosed by hedges, with hazel, honeysuckle and black-thorn, and oak and beech woods, together with lines of poplars and willows, combine with orchards to break up the continuity of corn-fields and green crops, and to give the landscape a verdant appearance.

DRAINAGE

Rivers

A country of small extent and small altitude such as Denmark, with a surface composed mainly of glacial deposits, often sandy and gravelly in nature, does not provide large and deep rivers. Denmark has only streams and since the Baltic Sea is almost non-tidal and the rivers which flow to the North Sea empty into shallow, spit-sealed bays or into mud-choked shallows, they are unnavigable. The largest river is the Gudenaa which rises in the hill country around Silkeborg and flows over a course of 158 km. into Randers Fjord. The only other river which is over 100 km. is the Storaå which empties into Nisum Fjord. The largest rivers in Sjælland and Fyn are 83 and 53 km. long respectively.

The drainage of the country has been determined largely by its glacial history. The lines of the terminal moraines and the hill country behind them form the usual watersheds between the drainage basins. Since the streams which carried the melted waters from the ice sheets drained westwards during glacial, inter-glacial and post-glacial times, those rivers of Jylland which flow into the North Sea follow, for the most part, inter-glacial river beds; parts of their courses may follow the tunnel valleys which extend across Jylland east of the Dollerup-Brörup-Padborg line of terminal moraines. This line of terminal moraines marks broadly a divide on each side of which the river valleys generally show different forms. In the area west of the divide the valleys have mature features with wide floors and even gradients. In the area east of the divide the valleys show younger features: here the cycle of erosion is active, and the streams are busy levelling their beds. Frequently their courses break into, and follow for some distance, the lines of the tunnel valleys and the extra marginal valleys, and in such cases the valleys are much broader than the streams would warrant, because they were once eroded by streams of much greater volume and force than those which occupy them now. The rivers often pass through lakes which occupy depressions in the irregular floors of the tunnel valleys, or depressions left in the surface of the glacial deposits. Sometimes morainic barriers occur across valleys and dam back the water to form lakes. The rivers of Denmark often empty into the wide openings which go under the name of fjords; they are essentially different in character from the fjords of Norway (see pp. 35-6).

Lakes

The lakes of Denmark are mostly small. They were formed in depressions, on the surface of deposits, or in valleys through blocking of drainage by morainic deposits, and since the valleys are never very deeply scooped out, the lakes are shallow. From the nature of their origin it follows that they occur chiefly in eastern Jylland and in the islands, because deposition and erosion by glacial streams, as well as sub-aerial erosion, have smoothed out valleys and gradients and filled in depressions in western Jylland. Some of the largest lakes are Mossö, west of Skanderborg, in east-central Jylland, Arresö and Esrom Sø in northern Sjælland, and Tissö in west-central Sjælland, the areas of which are 16.9, 40.6, 17.4 and 13.3 sq. km. respectively.

Chapter II

COASTS

The North Sea Coast: General Character—Detailed Description: German Frontier to the Skalling Peninsula; Skalling Peninsula to Limfjord; Limfjord; Limfjord to the Skaw

Coasts of East Jylland and of the Islands: General Character—Detailed Description: The Skaw to Limfjord; Limfjord to Randers Fjord; Randers Fjord to Aarhus; Aarhus to the German Frontier; Fyn; Sjælland; Mön; Falster; Lolland; Langeland; Minor Islands

The coastlines of Denmark are 7,438 km. (4,622 miles) long and show considerable variety of form, especially as between those which border the North Sea and the Skagerrak and those that border the Kattegat and the Baltic Sea. The former are accumulation coasts (or shorelines of emergence) along which dunes and sandspits have been built by winds and currents; the latter (which are shorelines of submergence) owe their form largely to glacial action and have cliffs and headlands alternating with lobed bays and the long low openings which the Danes term fjords.

THE NORTH SEA COAST

GENERAL CHARACTER

Denmark borders the North Sea along a front of 420 km. (260 miles). The coast is lowlying and is bordered by shallow water which shelves away so gradually that in parts the depths are only 4 m. (2 fathoms) at distances of 4 km. from the coast. Generally, between 54° and 56° N the 20 m. (11 fathoms) line lies about 50 km. from the coast and sometimes farther still, while currents and tides running from south to north deposit mud, sand, and shingle in shifting banks. Between Blaavands Huk and Hanstholm the 10 m. (6 fathoms) line lies mostly within 2 km., and nowhere more than 4 km., from the coast except in an area extending off the north side of Horns Rev. Farther north, between Hanstholm and the Skaw, the 10 m. (6 fathoms) line lies at varying distances up to 10 km., while the 20 m. (11 fathoms) line lies at distances up to 30 km. from the coast. Within the 10 m. line a succession of shallow, narrow, sandy ridges lies parallel to the coast and is arranged in one, two, three or more

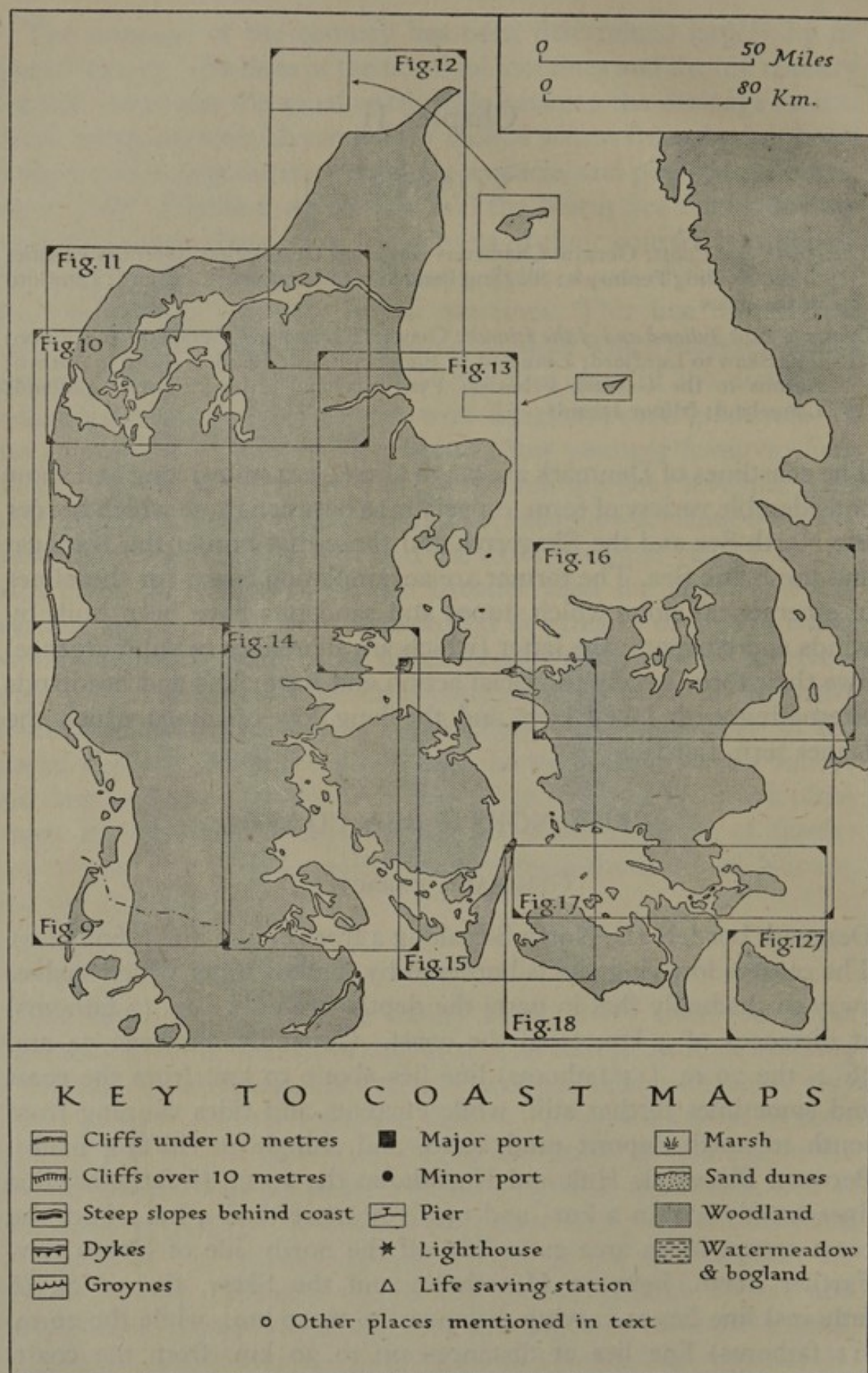


Fig. 8. Key to coast maps (Figs. 9-18)

The following coast maps (Figs. 9-18) have been compiled from various sources including, among others, Danish official large-scale maps, British Admiralty charts, *Sailing Directions* and other hydrographical publications.

broken lines. On account of the shallowness of the sea bed here, and the fact that the coast is exposed to the full force of the westerly gales, the water becomes piled up and often causes great floods along the shores of Ringkøbing Fjord. An old moraine left by the ice sheets as a submarine ridge, the Horns Rev, projects about 20 miles beyond Blaavands Huk and checks the play of the currents, thus aggravating the problem of sanding up along the coast south of it. Along the whole length of the coast north of Blaavands Huk no navigable river opens to the sea, and the indentations have been partly or completely sealed off by sandpits, so that ships must anchor well offshore, without shelter, and in winter the danger of running aground is increased by coastal fogs.

The section of the coast between the Skalling peninsula and the German frontier became submerged during late Quaternary times with the result that the outer line of dunes which fringes the coast farther north is here represented by the line of islands formed by Fanö, Mandö, and Römö and continued in Sylt and the North Frisian Islands. Behind the dunes, which rise to about 15–20 m. on these islands, lies heathland, fringed on the east by mud flats which are continually overrun by the sea. The coast offers few facilities for navigation, but access to the shores is possible along the lines of submerged estuaries called 'dyber', e.g. Graadyb, Juvre Dyb, and Römö Dyb, which provide narrow curved channels usually with depths of over 5 m. (16 ft.) and sometimes going down to 15 m. (8 fathoms). They also provide access to restricted anchorages with some shelter from the islands. The sides of these channels are fairly steep and rise to shallow banks; their deeper courses rarely continue beyond the line of the east coasts of the fringing islands. They are liable to frequent change, they all have bars at their entrances and, with the exception of Knude Dyb and Graadyb, they are shallow and are used by only small local craft. These submerged estuarine channels were responsible for the importance of Ribe as a port in late medieval times and have made possible the creation of Esbjerg as a modern port.

North of the point of the Skalling peninsula the nature of the coast changes. Along the stretch of 350 km. from here to the Skaw, sand-dunes and sandspits form the coast except where morainic ridges reach the coast as at Bovbjerg and, farther north, where chalky outcrops, such as Hanstholm (67 m.), Bulbjerg (47 m.), Rubjærg (72 m.) and Hirtshals, form headlands, but the wide open bays included by these headlands are lined with dunes fronted by beaches



Fig. 10. The west coast of Jylland (Jutland) from Ringkøbing Fjord to Limfjord. For key see p. 26

are about 10–15 m. high near the coast and rise inland with smooth slopes to between about 25 and 50 m. Where the outwash plains (see p. 14) flank the coast, stretches of marsh occur. Streams meander across these wet areas which have been reclaimed by drainage and are lined seawards by dykes. Even the areas of firm ground are fringed alongshore by marshes which occur on the *Littorina* beds that border the coast here and it is only between Ballum and Emmerlev, where a hill island reaches the sea, that firm ground forms the shoreline. Settlement in these coastlands is sporadic and occurs as villages and groups of farms on the firm land rising out of the ribbons of water meadows and the monotonous expanses of marsh which occupy the valleys and fringe the coast.

Communications (see folder-map at end of volume). The key road of south-west Jylland lies parallel to the coast behind the areas of marshes. It runs through Tönder, Skærbæk, Ribe and Bramming to Varde, with a branch to Esbjerg. This road is of generally straight stretches and lies mainly on the firm open ground of the hill islands but runs through areas of water meadow and marshland where it crosses the river valleys. Few roads connect this longitudinal road to the coast; one runs from Höjer to Tönder, another runs eastwards from Hjerpsted, a third extends eastwards to Brede, and a fourth runs from Baadsbol to Skærbæk, but north of this there is no highway from the coast until Esbjerg is reached. Thus, it is from this longitudinal road that the main west-east roads rise. The most direct west-east roads run, from Esbjerg through Holsted to Kolding, from Ribe to Kolding, from Ribe through Gramby to Haderslev, from Skærbæk to Aabenraa and from Höjer through Tönder to Sønderborg. The west-east roads are less straight than the north-south roads since they follow lines of firm ground and avoid the damper and softer ground of the valleys. Their courses lie across the 'grain' of the country and so they cross low hills and gentle undulations, but there are no very steep gradients. Behind the longitudinal coast road already described, another north-south road system runs through Lögumkloster, Rødding and Brörup to Grindsted where this central artery effectively stops. East of this road the ways are chiefly west-east with short north-south links, and no direct north-south road system develops until the main highway which runs behind the east coast of Jylland is reached.

The north-south road behind the west coast of Jylland is followed closely by the railway which enters Denmark from Germany, crossing the frontier south of Tönder, and runs to Esbjerg. The other direct

north-south railway runs on the average about 10 km. behind the east coast longitudinal road and crosses the German frontier at Padborg. The direct linking railways which extend from west to east between these lines run from Tönder to Tinglev and from Bramming through Brörup to Kolding. The only railway which reaches the coast south of Esbjerg is a branch line from Tönder to Höjer.

Esbjerg has a direct railway eastwards to Kolding and Fredericia and thence across the Little Belt to Fyn, and a northward line through Bramming and Grindsted to Herning, but otherwise the centre of roads and railways in this area is Varde, which is some 15 km. to the north. It has roads and railways leading northwards to Ringköbing, northwards and eastwards, through Grindsted to Herning and on to Viborg and Aalborg, and to Vejle and on to Horsens and Aarhus. The country behind Esbjerg forms hill island topography* of gently undulating landscape, without hills but with long flattish mounds. Inland, heath-covered areas increase in extent and plantations become more numerous covering areas of 25 sq. km. and less.

Skalling Peninsula to Limfjord (Fig. 10)

The coastline consists of a firm sandy beach, backed by dunes. Behind the dunes between Blaavands Huk and the southern end of Ringköbing Fjord lie stretches of marsh and a number of small lakes, of which Filsö is by far the largest. Farther inland comes hill island landscape. The dunes and the low land behind them have been widely planted, giving large blocks of woodland with stretches of heathland extending between them. From the southern end of Ringköbing Fjord to the western end of Limfjord the dunes are backed by an almost continuous line of haffs, the largest of which are Ringköbing Fjord and Nisum Fjord. The landward fringes of the haffs are lowlying and form areas of damp meadowland and marsh. Farther inland the ground becomes firm and rises very gently to the hill islands with their undulating, dry surfaces which are widely covered with heathland on which plantations, varying in area from 1 to 10 sq. km., have been made to provide shelter. Ringköbing and Nisum Fjords mark the seaward ends of the lowlying outwash plains which lie between the hill islands and along which the larger streams (the Skern Aa and the Storaas) meander in shallow valleys. The bottoms of these valleys carry extensive areas of wet meadow and bog, especially in their lower reaches. Many streams also wind in

* See Chapter II, pp. 13-14.



Plate 11. The dune belt at Nørre Lynvig, west Jylland (Jutland)

The dunes lie behind a beach of hard sand. In the right foreground are lines of marram grass planted to anchor the dunes and so prevent their landward movement.

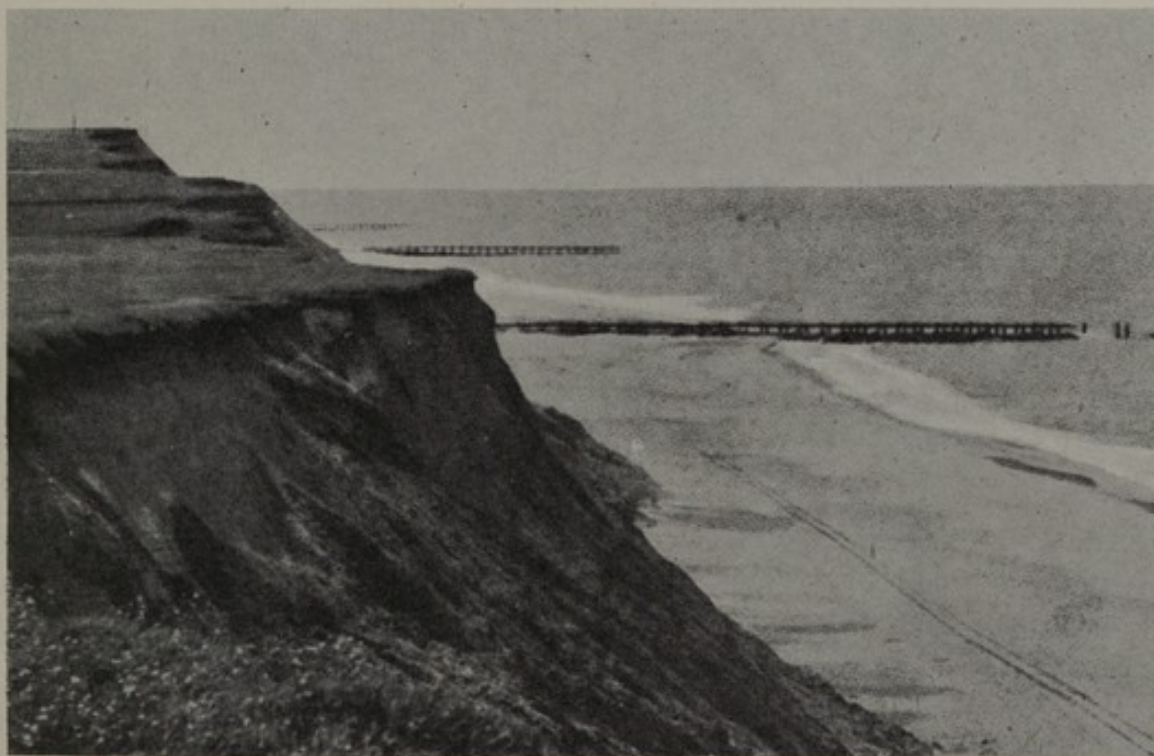


Plate 12. Bovbjerg, west Jylland

Here the terminal moraines reach the sea to form steep slopes of clay which are protected by breakwaters against further encroachment.



Plate 13. Bulbjerg, north-west Jylland (Jutland)



Plate 14. Svinkløv, north-west Jylland

Along the north-west coast of Jylland the limestone reaches the sea and forms headlands which enclose open bays lined by dunes.

open valleys across the surfaces of the hill islands and their valleys often have stretches of wet meadows in their bottom-lands. The courses of the roads indicate the lines of the firmer and more evenly graded ground and the routes that involve the smallest number of stream crossings, which is of special importance for transport because, in addition to having stretches of marsh and bog, some of the valleys have tiny lakes, ox-bow lakes and back-water channels, now abandoned by the streams but still carrying water. North of Nissum Fjord the shoreline has usually a sandy fringe backed by earthy cliffs behind which lies a landscape of long rounded ridges rising to average altitudes of about 50 m. and lying roughly at right angles to the coast.

The hinterland of this coast, from Esbjerg northwards to Limfjord, is especially difficult of access, not only because of the dunes but also on account of the haffs and lakes behind them and the stretches of marsh and bog which often extend between the water areas. Access to the fjords is by narrow, shallow channels. Ringkøbing Fjord is entered through a lock at Hvidesande where the channel has a least depth of 2.5 m. (8 ft.), but within the fjord depths reach 4 m. (13 ft.) in some parts. At Hvidesande are three stone quays, each about 15 m. (50 ft.) long, but with no lifting appliances. Ringkøbing has a small harbour with depths of 2.5 m. (8 ft.) alongside; the western quay which is 150 m. (490 ft.) long has depths of 2.8 m. (9½ ft.) and is connected with the railway system. The entrance to Nissum Fjord is through a lock at Torsminde: the channel is kept open by sand-pumping vessels but is subject to change. The navigation of these fjords is confined almost entirely to small local fishing vessels.

Communications. The system of land communications begins behind the marshlands and water-meadow fringes of the lagoons, and lies along the borders of, and across, the hill islands. The main north-south road runs from Varde through Skern to Holstebro. From Skern another principal road runs to Ringkøbing and continues to Lemvig, but it is the former which is the key-road since it gives communication, by a bridge across Oddesund, with that part of Jylland which lies north of Limfjord. Access from the coast to the main road system is provided by secondary roads which run from Nymindegab to Varde and from Søndervig to Ringkøbing. Other roads begin at villages behind the dune belt and lead to Varde, Ulfborg, Bækmarksbro and Lemvig. The railway, on the other hand, runs through Varde and Skern to Ringkøbing and continues through Holstebro and across Oddesund to northern Jylland, while a branch proceeds behind the haffs to Lemvig and ends on the

southern bank of the Tyborön channel at the entrance to Limfjord. Two fairly direct west-east roads run from Tarm to Vejle and from Holstebro through Viborg to Randers, but the key transverse road across central Jylland runs from Ringköbing through Herning and Silkeborg to Aarhus. These transverse roads lie across the morainic 'grain' of the country and so traverse the hilly country which lies east of the hill islands, but gradients are never very steep. The partly reclaimed heathlands of the outwash plains and hill islands of west-central Jylland, which form the hinterland of the coast between Blaavands Huk and Limfjord, were closely settled relatively recently and have few towns, so that the web of highways is meagre and open. The centre of communications here, for roads and railways alike, is Herning, from which they radiate and lead to Holstebro, Viborg, Silkeborg, and Vejle, while a direct road, but no direct railway, leads to Ringköbing. Viborg and Silkeborg are, in turn, the route centres for east-central Jylland.

Limfjord (Fig. 11)

Limfjord provides a waterway, some 145 km. long, across Jylland from the North Sea to the Baltic Sea. The importance of the fjord to navigation is restricted by the small depths which occur in parts, so that a channel of only 4 m. (13 ft.) deep can be carried along the main fairway to the Kattegat and, even so, depths are liable to change on account of frequent alterations in the channel and of varying water level which is influenced by the winds. Limfjord is entered through Tyborön channel, most of which is filled with partly drying sandbanks. Depths in the channel are liable to frequent, and sometimes considerable, change, but normally a depth of 5.2 m. (17 ft.) can be carried through the fairway to the outer harbour at Tyborön. The harbour is enclosed by moles and is divided within into four basins in which the depths alongside the quays range from 3 to 5 m. ($9\frac{3}{4}$ – $16\frac{1}{4}$ ft.). The port contains an electric crane to lift $2\frac{1}{2}$ tons, one boatyard and three machine shops. The quays in the northern part of the port have railway connexions.

The dunes on each side of the entrance to the fjord are low and the coast is protected by groynes. The shores of Limfjord are generally low but rise southwards to hummocky hill country backed by larger and longer ridges and hills. On the north the hinterland is the low, bleak, undulating plain of north Jylland. Where streams enter the fjord, especially at the heads of bays, marshy tracts occur. Marshes



Fig. 11. Limfjorden and the adjacent coast of west Jylland (Jutland). For key see p. 26



Fig. 12. The coasts of north Jylland (Jutland). For key see p. 26

are extensive along the northern shores, between Tisted and Aalborg, where dykes have been built.

The chief ports within Limfjord, apart from Aalborg-Nörre Sundby (see pp. 373-8), are Lemvig, Struer, Nyköbing (Mors), Tisted, Skive and Løgstør, each of which has at least one quay with depths alongside equal to the maximum depth that can be carried through the fjord (4 m.), as well as shallower basins for other local and fishing craft. All these minor ports, except Nyköbing and Skive, have slips capable of taking vessels of between 100 and 150 tons and can undertake small repairs. Railways run on to the quays at all the ports.

Communications. Numerous roads reach the shores, but direct communication across the fjord by road and rail bridges occurs only at Oddesund, Aggersund and Aalborg (for navigational details see pp. 449-50). Several ferries cross the western part of the fjord using the large island of Mors as a link. From the mainland the ferries cross to Mors between Glyngøre and Nyköbing and also a short distance farther south. Other ferries cross Næs-sund, and Feggesund and a road-bridge crosses Vilsund, to the northernmost part of Jylland. A main road and railway follow the north coast of the fjord at a short distance inland, but on the southern side cross-communication is less direct although road and railways reach the coast at several points. The chief road and rail termini on the south side are Lemvig, Struer, Glyngøre, Skive, Hvalpsund, Løgstør, Nibe and Aalborg.

Limfjord to the Skaw (Figs. 11, 12)

North of Limfjord the coastline consists of a series of wide, open bays enclosed between chalk and limestone headlands. From the western end of Limfjord to the eastern end of Vigsö Bugt the dunes which line the shore are backed by lowlying heathland and a line of lakes; plantations cover much of the land between the lakes. Hanstholm at the western end of Vigsö Bugt is a chalk and limestone promontory which rises inland to a summit of 67 m. At Roshage, the northern extremity of Hanstholm, a breakwater, 310 m. long, extends offshore into a depth of 5 m. (16½ ft.) and affords sheltered landing for boats. Bulbjærg at the eastern end of the bay is of similar composition to Hanstholm and has a steep seaward face forming a cliff 47 m. high, with a detached limestone rock, 15 m. high, named Skarreklit, lying 60 m. offshore from it. Behind Bulbjærg a hilly ridge runs inland. Dunes with occasional plantations extend behind

the shore along the entire line of Jammerbugt along which the chalk and limestone face of Svinklöv and the steeply sloping hill of clay and sand called Rubjærg Knude are conspicuous landmarks rising to 63 and 72 m. respectively. The hilly land behind the port of Hirtshals (see pp. 440-2) slopes to the coast and ends in low cliffs 5-10 m. high, fronted by a narrow boulder-strewn beach. The shores of the western half of Tannis Bugt are fringed by a narrow line of dunes, but north-east of Skiveren the dunes increases in height and extend across to the shores of the Kattegat.

Communications. In Jylland, north of Limfjord, several roads come down to the beach as at Ager, Vorupør, Klitmøller, Hansted, Lökken and Tværsted. The key road and railway run from Oddesund, through Tisted, to Aalborg and to Hjörning, which is the route-centre and from which a road and a railway run to the coast at Hirtshals.

COASTS OF EAST JYLLAND AND OF THE ISLANDS

GENERAL CHARACTER

The east coast of Jylland and the coasts of the islands of the Danish archipelago owe their form largely to the effects of glaciation. The ice sheets, moving over the shallow platform on which the Danish archipelago stands, sent out lobes along their front which gouged out their beds in the surrounding land. The lobed bays of Kalvø Vig and Æbeltoft Vig mark the terminal basins of the East Jylland Advance (see pp. 7-8). The southern corridor of the Little Belt, from Ærø to the narrow gut separating the north-western peninsula of Fyn from Jylland, represents the bed of a large lobe of the ice sheets during the Belt Advance. At the same time another lobe penetrated along what is now the Great Belt and determined the orientation and contours of the peninsulas of Hindsholm, Asnæs and Røsnæs. The great bay of Smaalandsfarvandet, between Langeland, Lolland and Sjælland, was the basin of a large lobe of the ice sheets during the Langeland Advance when a secondary lobe, pushing its way between Möns Klint and Stevns Klint, modelled the shores of Fakse Bugt; another pressed in to mould Køge Bugt, and a third penetrated along the line of the Sound. Along the flanks of, and between, these lobes, lines of morainic material were deposited to form hills. These deposits, which formed, as it were, the lateral 'wash' of the ice lobes, give peninsulas such as Hindsholm, Asnæs, Røsnæs and Sjællands

Odde their characteristic shape. In north Fyn and north Sjælland the sea has invaded depressed portions of the morainic flats, to form Odense Fjord and Isefjord.

Where the glacial deposits form the shoreline the coasts are generally low and undulating, occasionally forming low earthy cliffs which are easily eroded, but where the Danian limestone rises well above sea level steep chalky cliffs occur. Along those stretches where the glacial deposits reach down to the shore, the detailed form of the coastline depends on the alternation of morainic hills and intervening hollows, morainic plains and tunnel valleys.

From the Skaw to Læsø Rende the 10 m. (5 fathoms) line follows the line of the coast about 5 km. (3 miles) offshore; from Læsø to Fornæs it lies at about 20 km. (12 miles) from the coast. South of Fornæs the 10 m. line closes the coast and follows it closely, seldom more than a mile away, but the channels between the peninsula and the islands, and also between the islands, have numerous shoals.

That part of the east coast of Jylland which lies north of the peninsula of Djursland, and forms the shores of the Kattegat, is different from the east Jylland coast south of this peninsula, and from the coasts of the archipelago lying along the Belts and the Sound. North of Djursland the coast is smooth in outline and the coastlands are usually lowlying, while to the south, where ice sheets advanced and retreated more frequently, the more varied relief of the hinterland reflects itself in the irregularity of the coastline and the diversity of the land forms which come down to the sea. A feature of the east coast of Jylland are the long inlets which are called fjords but which are different from the spit-enclosed bays or haffs of the west coast which also go under the name of fjords. A better name for these east-coast inlets is *förden*, because they are quite different in character from the fjords of Norway. They are wide at their mouths, they narrow inland and extend in broad curves from east to west, but they have no long lateral ramifications. Sometimes they lead into a river valley but often streams are absent, and sometimes they are continued as chains of lakes. They represent the lines of tunnel valleys (see p. 19) which were formed under the ice. Their sides rise to usually low, flat, earthy banks, but where the surrounding land lies well above sea level their sides may rise fairly steeply, but nowhere do they resemble the high, almost vertical, rock walls of the Norwegian fjords. They differ greatly in length, some being 30-40 km. long, while others may be only 3-5 km. in length. Their beds also differ. Some, like Vejle Fjord, Flensborg Fjord and Aabenraa Fjord,

form wide channels with depth of over 10 m. (5 fathoms), while others, such as the eastern branch of Limfjord, Mariager Fjord, Randers Fjord and Haderslev Fjord, resemble long river beds with relatively narrow and shallow channels, which have been dredged to depths of usually about 6 m. (20 ft.) to give access to the ports at their heads. Generally, the fjords lying north of the Djursland peninsula are long and narrow, while those to the south, where ice action and marginal drainage were more continuous, are both wider and deeper and resemble gulfs or lobed bays more closely than they do river estuaries. The fjords are navigable by sea-going craft, and at the heads of nearly all of them stands an important port such as Aalborg, Randers, Horsens, Vejle and Kolding.

The coasts of the islands of the Danish archipelago present great variety of form. On the northern sides of the islands large ramified gulfs and bays such as Odense Fjord, Sejerø Bugt and Isefjord, flanked by promontories such as Hindsholm, Asnæs, Røsnæs and Sjællands Odde, pointing north-eastwards, are characteristic. In the interior of the archipelago the form of the coast reflects directly the relief of the hinterland. Along the east coasts of Sjælland and Mön the limestone rises to form cliffs such as those of Möns Klint and Stevns Klint. Where lines of terminal moraines, or hill country, march down to the sea they tend to form seaward bulges into the coastline. The sheltered character of these coasts means that beech forests often stretch down to the water's edge.

Aarhus Bugt, in its northern part, offers secure anchorage, in 7-10 fathoms, for a large fleet. There are very numerous smaller anchorages in the fiords, bays and inlets and in the shelter of the smaller, as well as the larger, islands of the archipelago. Holding ground is usually good, with mud and sand, but some localities are liable to drift ice in winter.

DETAILED DESCRIPTION

The Skaw to Limfjord (Fig. 12)

The shores of Aalbæk Bugt are lined with dunes, 10-15 m. high, as far south as Aalbæk; south of Aalbæk cultivated land reaches the shore. Inland the country passes into heather-covered terrain which rises to 20-30 m. and carries some plantations of woodland. Between Frederikshavn and Sæby the coast is backed by hills rising to peaks of 111 and 122 m. Off Frederikshavn extends a flat which is less than 3 fathoms deep and on which lies the group of islands known as



Plate 15. The port of Lemvig in Limfjord

The main quay (depth $13\frac{3}{4}$ ft.) can be seen beyond the boat harbour. The entrance to another basin (depth 13 ft.) can be seen between the end of the breakwater and the mole in the left-centre of the photograph.



Plate 16. Mariager Fjord, east Jylland (Jutland)



Plate 17. The port of Skagen

The view shows the greater part of the inner harbour and was taken before work on the new basin, which is under construction north of the northern breakwater, was undertaken. The new basin, which is rectangular, lies between the coast road and the foreshore and has 1,550 ft. of quayage. In the distance is the northernmost tip of Jylland—the Skaw

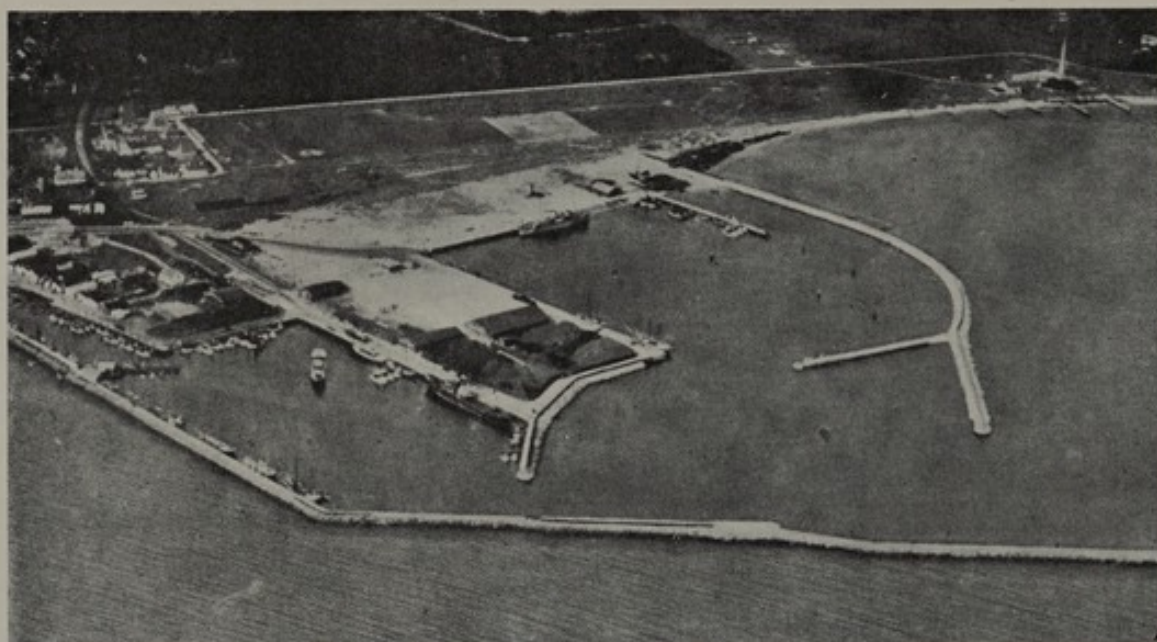


Plate 18. The port of Grenaa

The main quay (depth alongside $18\frac{1}{2}$ ft.) is on the north side of the central mole. In the angle between this mole and the northern basin is the berth of the ferry to Hundeste in Sjælland (Zealand). The quay on the south side of the central mole has depths of $16\frac{1}{4}$ ft. alongside.

Hirsholmene. South of Sæby the coast remains low (usually below 5 m. with small plantations generally less than 6 sq. km. in area on heathland) to Limfjord, but about 2.5 km. inland the ground rises to swelling hill country, with heights over 50 m., which continues southward to Limfjord. Across this hill country runs a belt of greater heights, sometimes rising above 100 m., called the Jyske Aas which mark a line of moraines extending from Hirtshals south-westwards to about Asaa.

The chief port along this coast is Frederikshavn (see pp. 393-6). At Skagen there is a small harbour with depths of from 2.2 to 5.0 m. (7-16½ ft.), two slips for ships up to 100 tons, a workshop for repairing motor boats, and a crane to lift 5 tons. Aalbæk, Strandby, Sæby and Asaa are boat harbours with depths ranging between 1.5 and 3.8 m. (5-12½ ft.). Sæby has a slip for vessels of up to 100 tons and 3 m. (10 ft.) draught, and can do small repairs.

From the Kattegat a channel with a least depth of 7.2 m. (23½ ft.) extends along Limfjord as far as the port of Aalborg (see pp. 373-8). Near the entrance to the fjord is the small harbour of Hals which is formed by breakwaters enclosing depths of from 1.8 to 3.1 m. (6-10 ft.). Along the fjord there is an earthen pier at Mov (depth at head 3.7 m.), and north-east of Aalborg a number of piers belonging to a cement company have been built out from the banks of the fjord.

Communications. A coast road and railway extend from Skagen, through Frederikshavn, to Sæby and continue inland to Aalborg. A branch railway connects Asaa to this main line, and highroads reach the coast at Asaa and Hals. All these roads and railways find their way across Limfjord through Aalborg.

Limfjord to Randers Fjord (Figs. 12, 13)

Lille Vildmose, which flanks the east coast south of Limfjord, is an extensive area of moor and bog covered with heather; patches of wet ground occur behind the coast as far south as Randers Fjord. Inland, the ground rises to hummocky hill country with peaks up to about 50 m. This is backed by higher hills which sometimes rise above 75 m., the highest of them, around Madum Sö, carrying extensive plantations. The hills are of rounded or oval form with their axes arranged north-south or north-west-south-east.

The sides of Mariager Fjord are well marked and rise fairly sharply to between about 40 and 60 m. Side-valleys descend to the fjord along fairly steep slopes, but the streams are short and small in volume. A dredged channel with a least width of about 25 m. (82 ft.)

and a least depth of 5.7 m. (18½ ft.) leads to the head of the fjord and gives access to the port of Hobro which has depths of 5.7 m. (18½ ft.), a slipway for vessels up to 30 m. (98 ft.) long and a crane to lift 8 tons. At Hadsund and Mariager there are wharves along the side of the fjord; these wharves have maximum depths of 5.7 m. (18½ ft.) alongside. A railway and road bridge crosses the fjord at Hadsund; this bridge has openings with navigable widths of 22 m. (72 ft.). Piers have been built out from the side of the fjord at several places, the chief being the piers of the cement factories on the south bank of the fjord about 3 km. south-west of Hadsund; these piers have depths between 4.7 and 5.7 m. (15½–18½ ft.) alongside.

The fringes of Randers Fjord are wet and low, but behind them the banks are distinct and rise, less steeply than those of Mariager Fjord, to about 25 m. The country inland has smoother relief than the hinterland of Mariager Fjord and presents undulating landscape, mostly between 25 and 50 m. and with few hills rising above 75 m. The dredged channel to Randers (see pp. 406–8) at the head of its fjord has a least depth of 7 m. (22¾ ft.) and a least width of 22 m. (72 ft.). There are piers in the fjord at Udbyhøj and Mellerup. Adjoining the pier on the north side of the fjord at Udbyhøj is a small harbour which is used when the fjord is frozen. Both the pier and the winter harbour have depths of 2 m. (6½ ft.).

Communications. In the area between Limfjord and Randers Fjord access to the hinterland from the sea lies along the waterways of the fjords for, apart from a road which runs from the mouth of Randers Fjord to Randers, there are no good land communications reaching the coast. The key roads here extend from north to south between the towns which lie at the effective heads of the fjords. Roads and railways alike lie on the landward side of the damp and marshy areas which flank the coast. They run in two lines, the one through Hadsund, and the other through Hobro, to Aalborg with connecting lateral roads on each side of Mariager Fjord between Hadsund and Hobro. Randers is an important route centre with roads and railways radiating in all directions, to Viborg, Silkeborg, Aarhus, Æbeltoft and Grenaa as well as to the north, but the routes of the railways are markedly less direct than those of the roads.

Randers Fjord to Aarhus (Fig. 13)

The coast of northern Djursland east of Randers Fjord is low but rises gradually to Stavnshoved (35 m.). East and south of Stavnshoved the coastline lies athwart the general direction of the hills and



Fig. 13. The east coast of Jylland (Jutland) from Mariager Fjord to Horsens Fjord. For key see p. 26



Fig. 14. The east coast of Jylland (Jutland) from Horsens Fjord to the German frontier, and the west coast of Fyn (Fünen). For key see p. 26

ridges which form the surface of Djursland. It is composed therefore of fairly steep slopes and cliffs where the coast truncates the hilly masses, alternating with lower stretches where lines of intervening depressions and valleys reach the sea. Since the hilly hinterland is mostly below 50 m. the coast is not very high, except where Gerrild Klint and Sangstrup Klint form two white-faced cliffs each about 15–20 m. high and about a mile long, and farther south at Jærnhatten which has a white cliff on its south-eastern side, all exposing the Danian limestone which underlies the morainic deposits in this region. Elsewhere hilly promontories, with sharp slopes but of no great height, abut on the coast and are flanked by lower stretches which sometimes drop abruptly to the shore. Grenaa is the only port along this stretch of coast and is the terminus of a car-ferry to Hundested in Sjælland. The harbour is enclosed within two breakwaters and has two basins separated by a central mole; the total quayage is about 850 m. Depths in the harbour are between 3·7 and 6 m. (12–19½ ft.). The port has a slipway for ships up to 100 tons and another for small vessels, a crane to lift 5 tons, an iron foundry and a machine shop. Small repairs can be carried out (see Plate 19).

The shore lands of Æbeltoft Vig and Kalvö Vig are low and flat but rise inland everywhere to very hummocky country composed of a maze of small rounded hills (Plate 10). They rise to about 50 m. and are backed by a line of lakes, water meadows and marshes which merge into the lower-lying drainage line marked by the river valleys which extend westwards from Grenaa. Along the coast, especially of Kalvö Vig, hillocks stand out to form small steep headlands with smooth, open, low bays between them. The harbour of Æbeltoft consists of two small basins enclosed between breakwaters and which have maximum depths of 5·3 (17¼ ft.) and 3 m. (9¾ ft.) respectively. In Kalvö Vig there are several piers with depths of 2·5–3·4 m. (8–11 ft.).

Aarhus to the German Frontier (Figs. 13, 14)

Hills and broad rounded ridges backing the coast are characteristic of the eastern coastlands of Jylland from Aarhus (see pp. 378–84) southwards to the German frontier, while the hinterland has in general the features of morainic hill country. South of Aarhus the coast is steep and wooded for about six miles and then becomes low and open as far as the entrance to Horsens Fjord. The hinterland is of broad, rounded and oval-shaped hills and long, broad-backed ridges which are backed by the lake district of central Jylland. South

of Aarhus, the small harbour of Norsminde has a wharf with a depth of 2.5 m. (8 ft.) alongside. Farther south at Hov, there is a small harbour which is 4 m. (13 ft.) deep in its deepest part. Southwards behind the northern coast of Horsens Fjord the landscape becomes more hummocky with smaller hills ranging mainly between 25 and 75 m. high, so that the northern sides of the fjord, which rise fairly sharply, have an undulating skyline while the southern side rises more gently to similar landscape. A dredged channel, 7.5 km. long, 32 m. (105 ft.) wide and 6.9 m. (22½ ft.) deep, leads to the port of Horsens at the head of the fjord (see pp. 413-15). Within the fjord there are piers at Gyllingnæs, Elbæk, Boller, Snaptun and on the south-west sides of the small islands named Alrö and Hjarnö. The depths at the heads of these piers vary from 1 m. (3¼ ft.) at Gyllingnæs to 3.7 m. (12 ft.) at Snaptun where a small harbour is under construction.

The seaward coast between Horsens and Vejle Fjords consists of Ashoved, a long point ending in a low yellow face and flanked on each side by bays with low shores rising inland to hill country with peaks ranging between 25 and 120 m. The small harbour of Juelsminde has maximum depths of 3.7 m. (12 ft.). The sides of Vejle Fjord rise steeply on both sides usually to about 50 m., and along these slopes streams have cut deep, sharply-graded valleys. The sides of the fjord and the slopes of the valleys are fringed almost continuously with woods which are, however, rarely more than 1 km. deep. The hinterland consists of hilly country rising to between about 75 and 100 m. From the inner part of the fjord a dredged channel 6.9 m. (22½ ft.) deep leads to the harbour at Vejle (see pp. 415-17). Within the fjord there are five piers with depths of 2.5-3 m. (8-9¾ ft.) off their heads.

South of Vejle Fjord the immediate hinterland of the coast is composed of clustered hill country which carries a good deal of woodland and passes inland to smoother, more expansive, landscape with longer streams in gently graded valleys which have water meadows and marshes along their floors. Fredericia (see pp. 408-11) is the chief port along this coast, and although the Little Belt bridge (see p. 449) has replaced the train- and car-ferry service the small harbour of Snoghøj, with maximum depths of 2.8 m. (9 ft.), still serves some traffic. Kolding Fjord has well-marked lateral slopes rising to about 30 m. In the inner part of the fjord a dredged channel 7 m. (23 ft.) deep leads to the port of Kolding (see pp. 404-5) at the head of the fjord. The coastline between Kolding Fjord and Aabenraa Fjord presents the usual succession of hilly headlands enclosing bays

which have low shorelands rising inland to hill country. At Hejelsminde are a pier with depths of 3 m. (10 ft.) and a boat harbour with depths of 2 m. ($6\frac{1}{2}$ ft.). The sides of Haderslev Fjord are well marked and backed by hill country. A dredged channel, 6.5 m. ($21\frac{1}{4}$ ft.) deep, leads through the fjord to the port of Haderslev (see pp. 417-19) at its head. South of the fjord the harbour of Aarösund, which is 2.5 m. (8 ft.) deep, is a terminus of the ferry to Assens. The east coast of the peninsula immediately south of Haderslev Fjord, and the shores of the inner part of Aabenraa Fjord, have steep slopes rising to about 10 m., but elsewhere the coastlands slope gently to heights of about 20 m.; everywhere the hinterland rises to hills which vary between 30 and 100 m. in height. Dredged channels lead to the port of Aabenraa (see pp. 428-30) at the head of the fjord. The Jylland coast of Als Fjord is lined with steep bluffs and is almost unindented, while the opposite coast has alternating steep and low ground and is much indented. The east coast of Als follows the lie of the hills and is therefore backed by moderate slopes along most of its length. In the north the coastline cuts across the lie of the hills which here descend to the shore in low earthy cliffs that are broken at intervals by sandy stretches backed by damp depressions. The chief harbour on the east coast is Mommark which is a terminus of a ferry to Faaborg; the maximum depth in the harbour is 5.5 m. (18 ft.). On the west side of the island a dredged channel leads through the shoals in Augustenborg Fjord to the wharves at Augustenborg, where there are depths of 4 m. (13 ft.) alongside. The chief port of the island is Sønderborg (see pp. 433-4) which stands at the southern end of Alssund. There are several piers for local traffic on each side of the island.

The Danish flank of the inner part of Flensborg Fjord rises fairly sharply to the hilly hinterland. Egernsund harbour has a number of small loading piers, with depths of 3.7-4.6 m. (12-15 ft.) and a slip to take vessels of up to 100 tons, while the harbour of Graasten has a wharf and a pier which are approached by a dredged channel 5 m. ($16\frac{1}{4}$ ft.) deep. Most of the coastal villages on the north shore of the fjord have piers, especially in the area around Nyböl Nor where they serve the tile works in this locality.

Communications. The communications of the coastlands of east Jylland, between Aarhus and Flensborg, centre on the ports of Aarhus, Horsens, Vejle and Haderslev, each of which is the centre of a radiating web of high roads. A longitudinal road, which lies at varying distances behind the coast, runs from Flensborg across the

frontier into Denmark and passes through Aabenraa, Haderslev, Kolding, Vejle and Horsens, where it bifurcates and continues, one branch passing through Skanderborg and the other through Aarhus, to Randers. Randers is the collecting point for road communications to northern Jylland on the east side of the peninsula, just as Viborg is the collecting point on the west side. Vejle is important as giving direct routes to Herning and Holstebro and to Viborg. The key transverse roads have already been indicated in dealing with the communications of the coastlands of western Jylland (pp. 29, 31). The railway web of east Jylland is less simple and direct. A north-south line lies west of the coast road and well inland from the coast. It runs from Padborg to Lunderskov (west of Kolding) and sends out branches to Sønderborg, Aabenraa and Haderslev. North of Lunderskov the key railway continues behind the heads of the fjords and passes through Kolding, Fredericia, Vejle, Horsens, and Skanderborg to Aarhus and thence through Langaa, Randers, Hobro, Aalborg and Hjørring to reach the coast at Frederikshavn. The key east-west railway is that which continues the line across the islands and extends from Fredericia to Esbjerg. Trunk lines run diagonally across Jylland from Fredericia through Vejle and Herning to Holstebro and from Aarhus through Viborg and Skive to Struer. A subsidiary line connects Grenaa to Randers and to Aarhus, but apart from lines already mentioned the other railways along the east coast of Jylland are private railways of less importance. Apart from the road and rail foci of Aarhus, Fredericia, and the fjord ports, both roads and railways reach the coast at Grenaa, Æbeltoft, Juelsminde and Hejlsminde but nowhere along this coast are roads and railways far away.

Fyn (Fünen) (Figs. 14, 15)

North Coast. The north coast of Fyn, west of Odense Fjord, is generally low, almost flat, except for the peninsula of Agernæs and the shores of Baaring Vig, where hill slopes rise behind the coast to over 60 m. Along the northern shores of the peninsula, which encloses this bay on the west, the coastline is steep and rises to about 30 m., forming, in part, the cliff of Røgle Klint. These higher parts are backed by hilly country, but elsewhere the hinterland is an undulating plain usually below 50 m. and often below 30 m. in height. Bogense has a small and narrow harbour which is 4 m. (13 ft.) deep and is enclosed between two breakwaters. Ships of 47 m. length can turn in the outer part of the harbour and there is a slip to take ships of up to 100 tons. At Strib there are a pier, a ferry harbour



Fig. 15. The east coast of Fyn (Fünen) and the west coasts of Sjælland (Zealand) and Lolland (Laaland). For key see p. 26

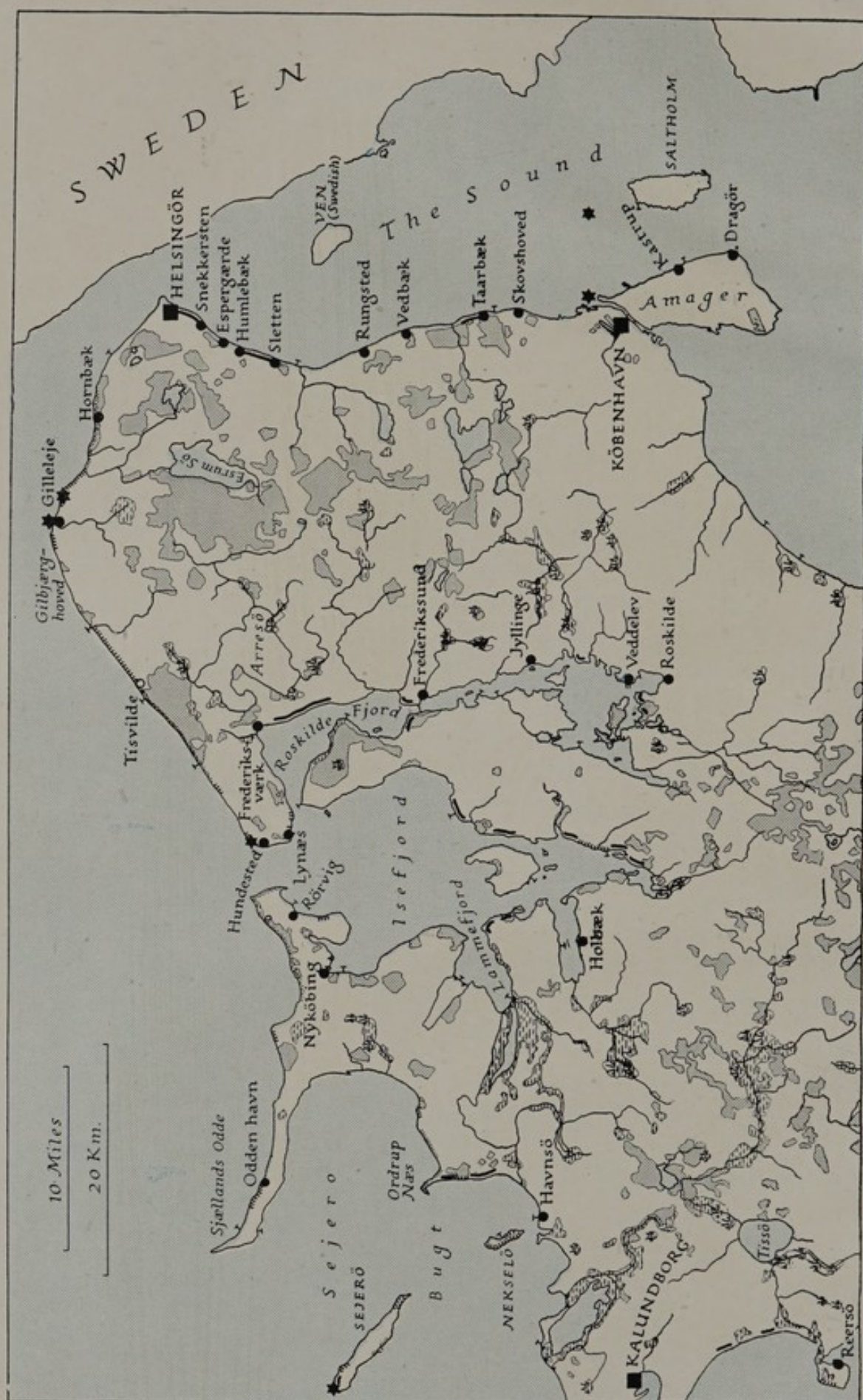


Fig. 16. The coasts of north Sjælland (Zealand). For key see p. 26

and an oil harbour. The depths in these harbours vary between 2.5 and 5.5 m. (8–18 ft.), and the quays, which have a total length of some 500 m., have railway communication but no cranes. The Nordiske cable and wire factory nearby has its own pier which has depths of 7 m. (23 ft.) off its outer end. Odense Fjord is shallow, but a narrow dredged channel with a least depth of 7.5 m. (24½ ft.) leads through the fjord to the entrance to the canal which connects it to the port of Odense (see pp. 390–3). Within the fjord there is a pier, with a depth of 3 m. (10 ft.) at Klintebjærg. East of Odense Fjord the peninsula of Hindsholm is built mainly of elongated hills rising mostly to between 20 and 35 m. and lying more or less parallel to the axis of the peninsula. Where the coast cuts the flanks of these hills the land rises steeply from the shore, but these steep slopes are not usually higher than about 10 m. while between them the coast is almost flat.

West, South and East Coasts. The coastlands of Fyn, from Middelfart south-eastwards to Svendborg and thence northwards past Nyborg, have broadly similar features since they are backed by hill country. The land behind the coast slopes fairly evenly to the hills and ridges which rise to heights of usually 60–100 m. with occasional higher peaks. In places the shorelands are low, but elsewhere hills and rounded ridges reach the coast to form steep bluffs. Behind the coast between approximately Faaborg and Nyborg (see pp. 401–3) a number of short streams have cut fairly deep valleys into the hills, but the valley floors are not very steeply graded; the hills in this area are well wooded on the higher slopes. North of Nyborg the hinterland becomes lower and passes inland into the plain of northern Fyn.

The chief ports along this stretch of coast, apart from Middelfart, Assens, Svendborg and Nyborg (see Chapter xv), are Faaborg and Kerteminde. At Wedellsborg there is a small and shallow boat harbour, and between Middelfart and Faaborg there are several loading places and piers, with depths of 1 or 2 m. The port of Faaborg consists of a large basin enclosed by moles and a smaller ferry harbour close south of it. The main harbour has depths of 4.7–6.2 m. (15¼–20¼ ft.) alongside its quays and the ferry harbour is 4.5 m. (14¾ ft.) deep; the quays have a total length of about 700 m. The main harbour contains a slip to take ships of up to about 400 tons and the port has a machine shop which can undertake small repairs. Ferries run to Mommark in Als and to Lyö, Avernakö and Söby. Between Faaborg and Svendborg there is a small harbour, with depths of 2–3 m. (6½–10 ft.), at Fjælebroen (at the head of Nakkebölle fjord) and there

is a pier at Ballen. Lundeborg, which is approximately half-way along the coast between Svendborg and Nyborg, is a fishing village with a harbour 2.8 m. (9 ft.) deep and is a terminus of a ferry to Lohals near the north end of Langeland. The harbour of Kerteminde, at the base of the Hindsholm peninsula and at the outlet of Kerteminde Nor, is narrow, and vessels of over 40 m. (130 ft.) cannot turn; depths in the harbour are between 2.5 and 5 m. (8–16½ ft.). There is a slip to take ships of about 100 tons and wooden ships can be repaired (see Plate 20).

The small islands which lie between Fyn and Jylland are generally lowlying in the northern part of the Little Belt, but the more southerly ones are fairly high and hilly. Almost every island has a pier.

Communications. The key road and railway of Fyn extend from Middelfart, through Odense to Nyborg. Odense is the hub of the island's communications and has roads and railways radiating along direct routes to the numerous ports along the coast, of which the chief are to Bogense, Assens, Faaborg, Svendborg, Nyborg and Kerteminde. These routes run across the hill country which lies behind the coasts of the southern half of the island, but gradients are not very steep. The communications to Svendborg give access to the island of Taasing and through Rudköbing to Langeland. Ferries cross from Svendborg to Vindeby and from Vemmenæs on Taasing to Rudköbing.

Sjælland (Zealand) (Figs. 16, 17)

North Coast. Isefjord and its branches form the most outstanding feature of the north coast of Sjælland. The entrance is encumbered by sandbanks, but three dredged channels lead into the fjord across which other channels lead to the chief ports. The depths in these channels are as follows: Nyköbing 4.7 m. (15½ ft.), Holbæk 5.6 m. (18½ ft.), Frederikssund 5.2 m. (17 ft.), Roskilde 3.0 m. (10 ft.). On the east side of the entrance to the fjord is the harbour of Hundested which lies between two breakwaters built outwards from the end of a stone embankment. Spurs jutting from the breakwaters subdivide the harbour into three basins of which the outer basin has a depth of 4.5 m. (14¾ ft.), and the inner basins have depths of between 2.2 and 3 m. (7–10 ft.). The outer harbour has two slips for ships of up to 60 tons. Lynæs, a short distance to the south, has a small harbour 3.2 m. (10½ ft.) deep and with a slip for ships of up to 65 tons, while the harbour at Rörvig on the west side of the entrance to the fjord has maximum depths of 2.8 m. (9 ft.). The chief ports within the

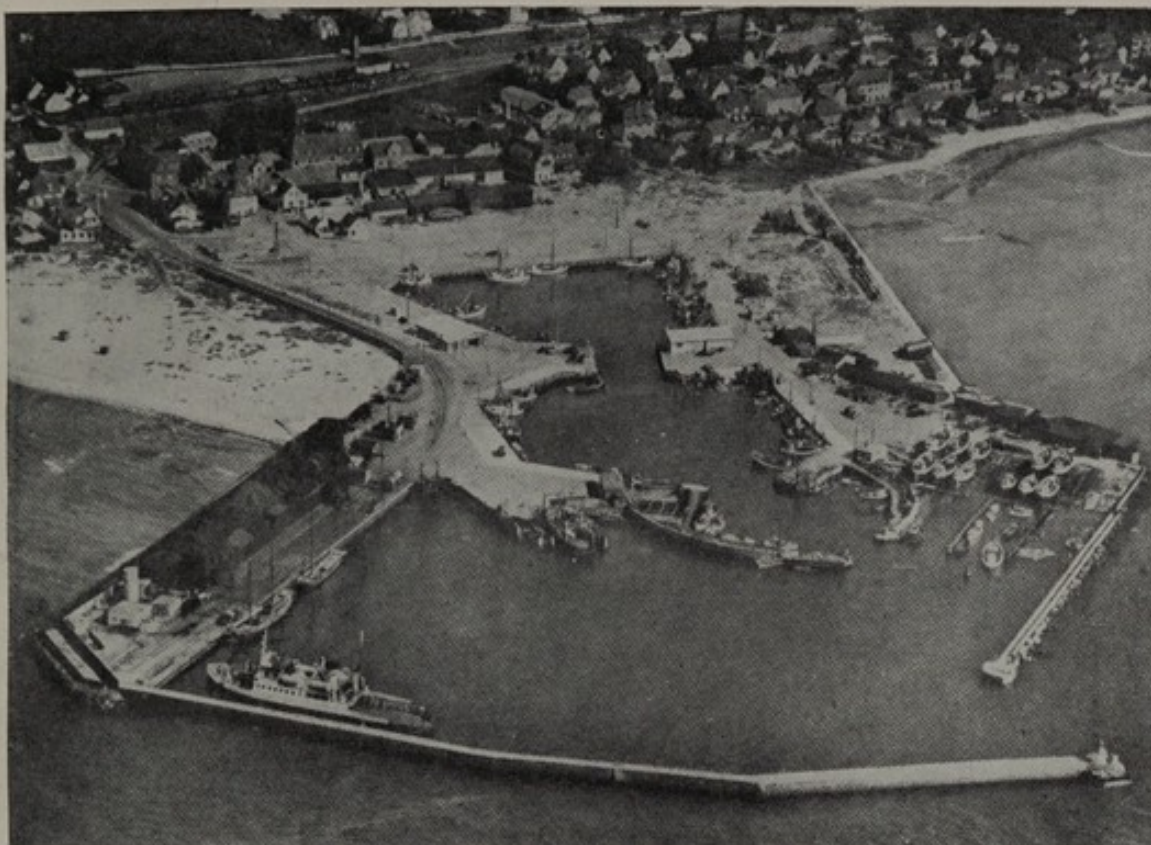


Plate 19. The port of Hundested

The port is an interesting example of seaward growth by infilling. The original harbour, which is the present innermost basin, was built outwards between two breakwaters and was joined to the shore by causeways carrying road and railway. Later two other breakwaters were built to enclose the middle basin. Finally the outer basin was built and the parts adjacent to, and behind, the two inner harbours were filled in.



Plate 20. The port of Kerteminde

The harbour lies in the entrance to the lake of Kerteminde Nor; the main quays, with depths of $15\frac{1}{2}$ ft., lie on the north side of the channel.

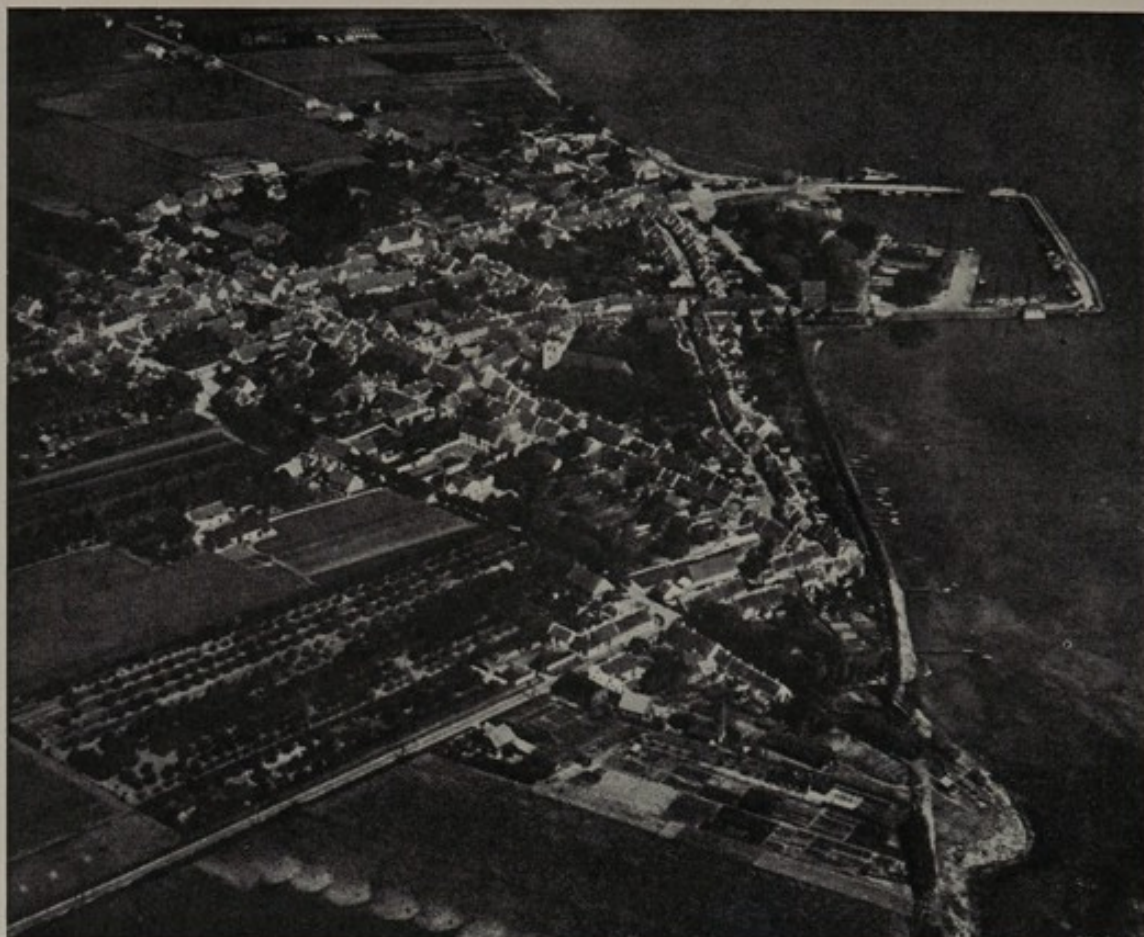


Plate 21. The port of Ærøsköbing, from the south

The main quays, with depths of $14\frac{1}{4}$ – $16\frac{1}{4}$ ft., lie around the south-west angle of the harbour. The berth of the ferry to Svendborg is on the outer side of the north breakwater.

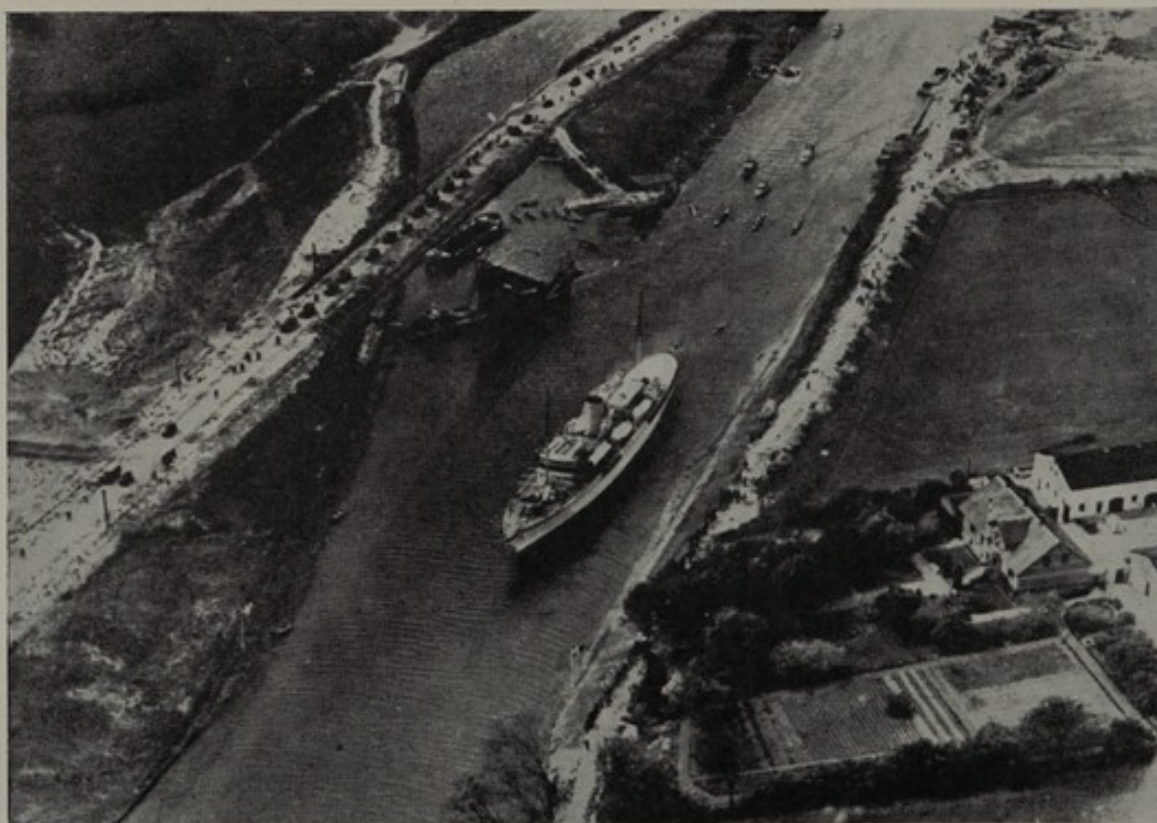


Plate 22. The Næstved canal, Sjælland (Zealand)

The view shows the Danish royal yacht sailing through the canal on its completion in 1937.

fjord are Nyköbing, Holbæk, Roskilde, Frederiksværk and Frederikssund. At Nyköbing and Frederikssund the maximum depths in the harbours are 4.7 m. (15½ ft.) and 5.2 m. (17 ft.) respectively, and the shipyard close north of the harbour at Frederikssund has a slip to take ships of 130 tons. Frederiksværk and Roskilde harbours have maximum depths of 3.5 and 3 m. (11½ and 10 ft.) respectively. Holbæk, the busiest of the ports, has depths of 5.6 m. (18½ ft.) alongside its main quay which is about 310 m. (1020 ft.) long, but in the two small basins the depths are only 2.8 and 3.8 m. (9 and 12½ ft.) respectively. One of these basins has a slip for ships of 2.2 m. (7 ft.) draught. Jyllinge and Veddelev, respectively 8 and 14½ km. south of Frederikssund, have small boat harbours each with a depth of about 1 m. (3¼ ft.). There are several piers in the fjord and a new harbour, 7 m. (23 ft.) deep, serves the power station at Kyndby.

The shores of Isefjord and Roskilde Fjord are of variable height with steep bluffs alternating with lowlying stretches. The hinterland consists of hill country of rounded contour and has, in general, altitudes ranging between about 25 and 50 m. with higher hills which nevertheless are usually below 100 m. in height. Eastwards towards Helsingör (see pp. 437-40) the coastline has similar features with a line of steep cliffs extending for about 6 km. north-east of Tisvilde and a steep cliff at Gilbjærg Hoved. The hinterland is of small rounded hills generally below 30 m. in height. West of Isefjord the long tongue-like peninsulas of Sjællands Odde, Røsnæs and Asnæs, enclosing between them the islands named Sejerö and Nekselö, stand out as prominent features. These peninsulas and islands have lines of morainic mounds and bare hills with their axes lying along their lengths. Where the coastline impinges on the flanks of these landforms, cliffs generally varying between 20 and 30 m. appear. The bays between these peninsulas have low shores, but behind Ordrup Næs, which has fairly high cliffs, there are numerous hills rising to nearly 100 m. and sometimes above this level. There is a small harbour 2.8 m. (9 ft.) deep at Odden and a pier at Havnsö.

West and South-West Coast. The west coast of Sjælland has generally low shores, except for the promontory of Halskov Odde. Inland the ground rises to rounded hills and broad-backed, smooth-contoured ridges with their axes arranged roughly parallel to the shore. The hinterland of Jammerland Bugt has a line of lakes, marshes and water meadows, with intervening wooded hills, running between Tissö and the western end of Lammefjord. The chief ports are Kalundborg and Korsör (see pp. 419, 398). In Kalundborg Fjord

there is a boat harbour 0.9 m. (3 ft.) deep at Ulstrup, and at Rösnaes the brickworks is served by a pier which has a depth of 3.7 m. (12 ft.) at its head. In Musholm Bugt there are small harbours at Reersö and Mullerup with depths of 3 m. ($9\frac{3}{4}$ ft.) and 4.3 m. (14 ft.) respectively.

The south-west coast of Sjælland from Skælskør to Vordingborg is lowlying, with spits and tongues enclosing shallow haffs and bays which have almost flat shores. The stretches between the haffs are higher and have low hills that are outliers of the hilly undulating hinterland which is about 25–50 m. high and slopes gradually to the coast. Skælskør and Karrebæksminde are the only ports of consequence along this stretch of coast which, from its nature, does not lend itself to harbour construction. A narrow channel leads through the fjord to Skælskør harbour which has inner and outer basins with maximum depths of 3.8 m. ($12\frac{1}{2}$ ft.) and 4.6 m. (15 ft.) respectively. Karrebæksminde is the port of Næstved with which it is connected by a dredged channel, through the shallow Karrebæksminde fjord and a canal along the Susaa; in 1937 the channel and canal were deepened to 6 m. Traffic to the wharf on the east bank of the river at Næstved was formerly by lighters towed by tugs. The harbour at Karrebæksminde is 6 m. ($19\frac{3}{4}$ ft.) deep in the entrance and the main channel, but the remainder of the harbour has smaller depths. Vordingborg has a small harbour of little importance, but at Masnedsund there are a basin and wharves (320 m. long and 5.3–6.3 m. deep) close south-east of the road and railway bridge which crosses Storström to Orehoved in Falster, whither there is also a ferry. East of Vordingborg the land rises rapidly along wooded slopes to a hilly hinterland which stands out eastwards in headlands of no great height. There is a small harbour 2.8 m. (9 ft.) deep at Kalvehave where a road bridge crosses the straits to Mön (see p. 450). Stavreby, farther north, has a pier and boat harbour 1.7 m. ($5\frac{1}{2}$ ft.) deep. The shorelands of Fakse Bugt are low and rise smoothly to a hinterland of smooth-featured ridges and hills. Præstö has a small harbour with depths of 4 m. (13 ft.). At Fakse Ladeplads the eastern harbour has become silted up, but the western and smaller harbour has depths of 4.3 m. (14 ft.) and serves the limestone quarry at Fakse. Rödvig harbour has depths between 2.5 and 3.7 m. (8–12 ft.).

East Coast. The broad peninsula between Fakse Bugt and Køge Bugt forms smoothly undulating country between 15 and 30 m. high, and ends seawards in a line of chalk cliffs, the central part of which is generally 30–40 m. high and is known as Stevns Klint, but the cliffs

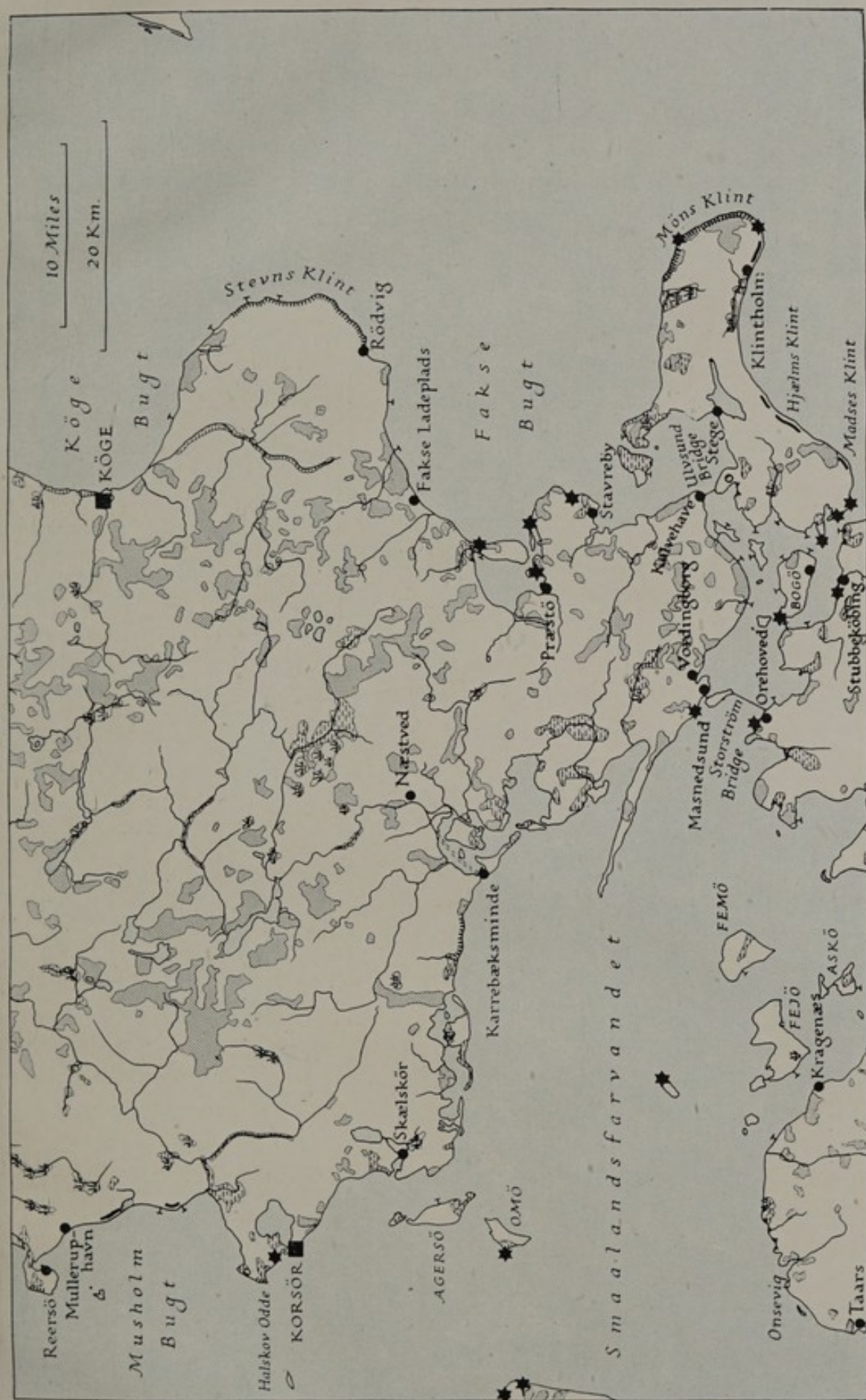


Fig. 17. The coasts of south Sjælland (Zealand). For key see p. 26

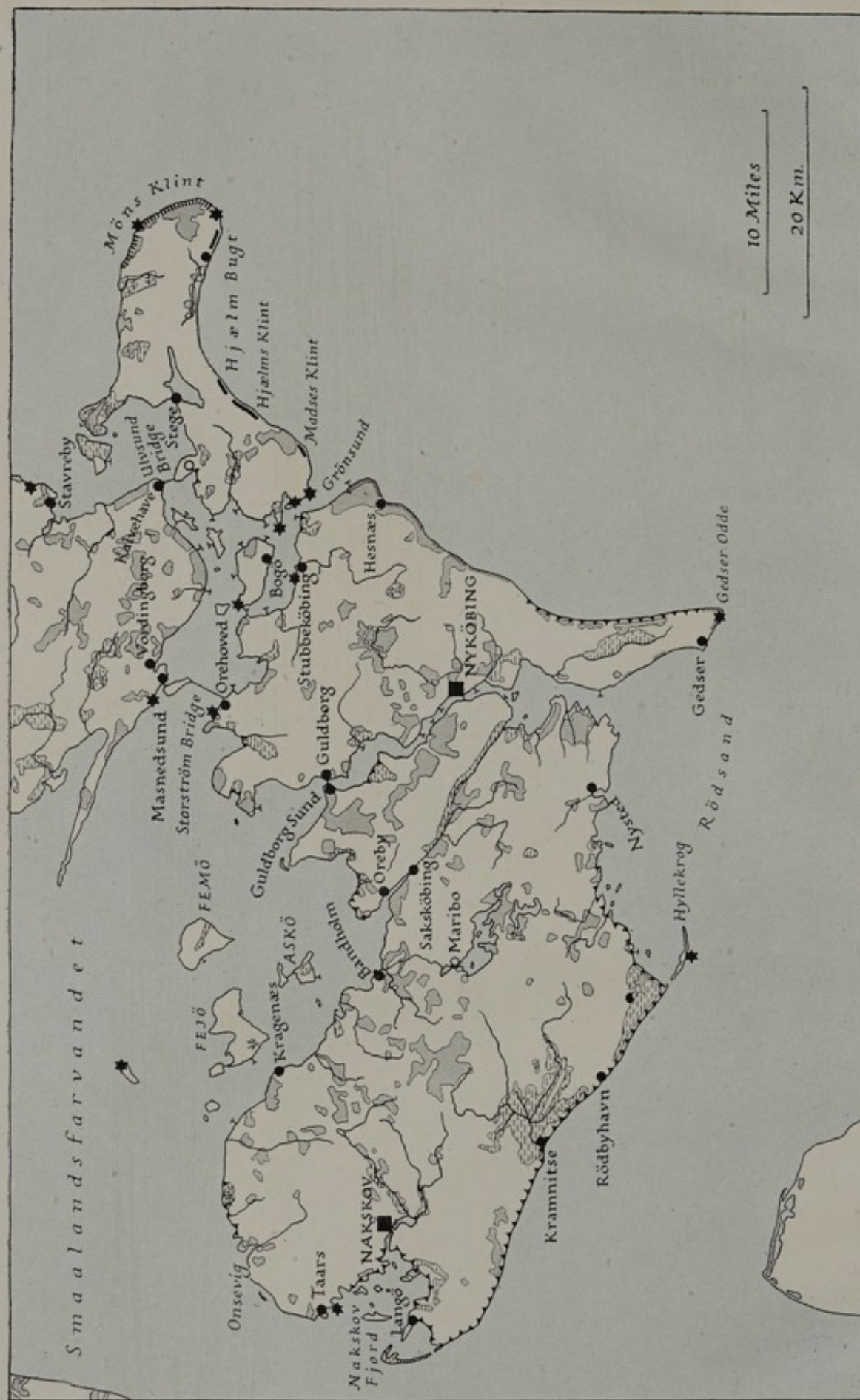


Fig. 18. The coasts of Lolland (Laaland), Falster and Møn (Moen). For key see p. 26

decrease in height northwards and southwards to heights between 15 and 30 m. There are piers with depths of 3.5 m. (11½ ft.) below the cliffs. The shores of Køge Bugt are generally low and somewhat marshy. They pass inland to a smoothly undulating plain which extends between Køge (see pp. 430-2), Roskilde and København. On the east coast of the island of Amager the chief centres are Dragør and Kastrup. Dragør harbour lies between two breakwaters and has depths of between 2.8 and 3.1 m. (9-10 ft.). At Kastrup there is a pier with a depth of 3 m. (10 ft.) belonging to a sulphuric acid and superphosphate factory and a harbour with depths of 3-5 m. (9½-16½ ft.) belonging to a lime works and having two cranes to lift 3½ and 1½ tons respectively. Close south of this harbour are a pier and a boat harbour. Between København (see pp. 355-73) and Helsingør the coast is well wooded, mainly with beech, and rises fairly sharply to hill country which includes some large lakes and extensive areas of woodland. Along this well-populated coast which flanks the narrow and busy waters between Denmark and Sweden there are several harbours used mainly by fishing vessels and yachts. The coast has no large inlets and the harbours have been constructed by building breakwaters out from the shores. Such harbours are at Skovshoved, Taarbæk, Vedbæk, Rungsted, Sletten, Humlebæk, Espergærde, Snekkersten, Hornbæk and Gilleleje; all these have depths between 2.5 and 3 m. (8-10 ft.). Gilleleje has two slips, the largest of which can take vessels up to 100 tons.

Communications. In Sjælland, as in Fyn, the road communications from the coast radiate from the ports, of which Næstved, Køge, København and Roskilde are the chief foci, with Slagelse, lying behind the west coast, forming the road centre for the western part of the island. The most direct west-east roads run from Kalundborg through Roskilde to København, from Kørsør through Slagelse and Ringsted to Køge, and from Skælskør through Næstved to Vordingborg and onwards to the southern islands of Møn, Falster and Lolland. The most direct north-south roads run from Kalundborg through Slagelse to Skælskør, from Helsingør through Hillerød, Roskilde and Ringsted to Næstved, and from København through Køge to Vordingborg. The most important railway runs from Kørsør through Slagelse, Ringsted and Roskilde to København and another line from Kalundborg joins this line at Roskilde. From Ringsted an important railway runs south through Næstved and Vordingborg to give access to Falster and Lolland. Roads and railways lie close behind the coast along the whole circumference of the island.

Mön (Moen) (Fig. 18)

The coast of Mön is generally low except in the south-west at Madses Klint and Hjælms Klint where it falls steeply, and in the east where it forms the steep chalk cliffs of Möns Klint which vary between 100 and 128 m. in height with slightly higher summits inland. From this high eastern part the land slopes gently westwards to undulating country which is generally below 50 m. Stege is the chief port of the island. It stands on the north-west side of Stege Nor from which it is separated by a dam. The port is approached along a dredged channel, 3.7 m. (12 ft.) deep, leading from Ulvsund. It has two small basins with depths of between 3.7 and 4.4 m. (12–14½ ft.) in its outer part. In the inner part of the harbour there is a small shipyard with a slip to take vessels of up to 200 tons. There is also a small harbour 2.5 m. (8 ft.) deep at Klintholm near the eastern end of Hjælm Bugt. The main road runs along the length of the island from Möns Klint to Grönsund; there are no railways.

Falster (Fig. 18)

The coast of Falster is also generally lowlying and flat with low wooded bluffs, rising to about 10 m., extending southwards from Grönsund for some 15 km.; farther south the coast is protected by dykes. The hinterland is low and undulating and does not rise above 44 m. Hesnæs is the only harbour along this coast and has depths of 2.5–3.1 m. (8–10 ft.). Gedser, at the southern end of Falster, is the terminus of a ferry service to Warnemünde in Germany (see pp. 442–3). The shores of Guldborg Sund are low and slope very gently to higher ground inland. From the north a dredged channel 6.1 m. (20 ft.) deep leads through the sound as far as Nykøbing (see p. 435), but the channel to this port from the south has least depths of only 2.2 m. (7 ft.). At Guldborg, at the northern entrance to the sound, the ferry harbours on each shore have become silted up but there are also piers and wharves with maximum depths of 4.3 m. (14 ft.). A road bridge with a double bascule, 30 m. wide, crosses the sound here. Between Guldborg and Nykøbing are several piers with depths of about 2 m. (6½ ft.). Stubbekøbing is the chief port on the north coast of Falster. Here the harbour consists of a rectangular basin with depths between 2.5 and 6 m. (8–19½ ft.) and a quay and turning basin dredged to 6 m. close west of it. The harbour has a slip to take vessels of 100 tons and the town has a machine shop and an iron foundry. There is a ferry harbour 3.7 m. (12 ft.) deep at

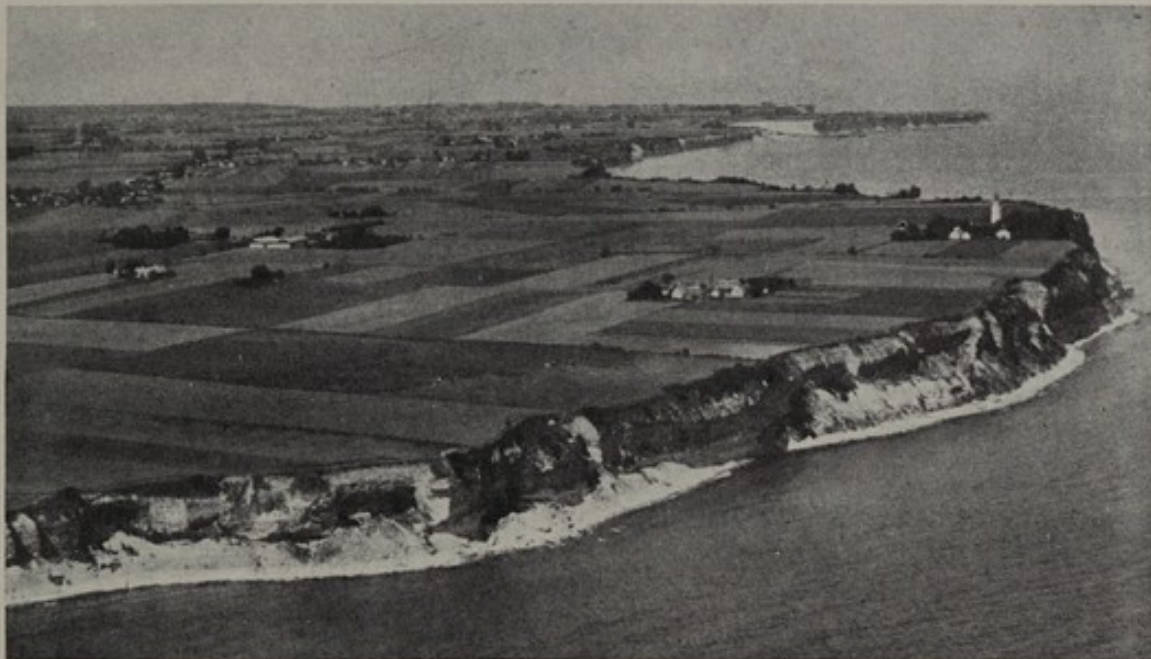


Plate 23. Stevns Klint

The cliff is formed of limestone, overlying chalk. The limestone strata can be seen clearly overhanging the chalk.



Plate 24. The harbour of Dragør, Sjælland (Zealand)

The harbour is shallow, except alongside the mole on the north side of the entrance where there are depths of 10 ft.; it is used mainly by fishing boats.



Plate 25. Möns Klint

The cliff is formed of Upper Senonian chalk. The highest pinnacle is 420 ft. high.

Orehoved. On the south coast of the island of Bogö there is a small basin 2.5 m. (8 ft.) deep. The key roads and railways run from the Storström bridge to Gedser and from Nyköbing to Stubbe-köbing.

Lolland (Laaland) (Fig. 18)

The coast of Lolland is low and the hinterland is a low plain. The south coast is sandy and is bordered along most of its length by dykes which protect areas reclaimed from the sea. Between Hyllekrog and Gedser Odde an area of shifting sand, called Rödsand, mostly awash but with a few islands which frequently change their shape and position, lies off the coast and is separated from it by a large shoal area. Nysted is the only harbour on this stretch of coast. It consists of a water area with maximum depths of 3.7 m. (12 ft.) fronting a wharf which is some 80 m. (260 ft.) long; there is a shipyard which can repair wooden vessels. Kramnitse on the western half of the south coast has a small and shallow fishing harbour, but Rödbyhavn farther east has four basins with depths ranging between 2.5 and 5 m. (8–16½ ft.). Nakskov Fjord, which occupies most of the west coast, is almost filled with shallow flats with depths of less than 1 m. (3 ft.). Two channels have been dredged to Nakskov harbour (see pp. 396–8); the main channel is 6.3 m. (20½ ft.) deep and an alternative, but crooked and narrow, channel has a least depth of 4.9 m. (16 ft.). Within the fjord, at Langö and at the north end of Albuen, are boat harbours 1.8 m. (6 ft.) deep and there are small and shallow harbours in Taarsvig and Onsevig, north of the fjord. The north coast has numerous fringing woods which are generally less than 2 sq. m. (¾ sq. mile) in area. There is a small harbour with depths of 3 m. (10 ft.) at Kragenæs whence a ferry crosses to Fejö. Bandholm is the port of Maribo with which it is connected by rail. The harbour consists of two basins which have maximum depths of 5.6 m. (18½ ft.) and a total quayage of 1050 m. (3450 ft.). It has a shipyard with a patent slip to take ships of 150 tons. On the north-east side of Saksköbing fjord there is a pier and a boat harbour 3.5 m. (11½ ft.) deep at Oreby and at the head of the fjord is Saksköbing harbour which is mostly 4.4 m. (14½ ft.) deep. Fejö and Femö, the largest of the islands north of Lolland, each have a small harbour with depths of 2–3 m. (6½–10 ft.). The key roads run from Nakskov through Maribo and Saksköbing, and through Rödby and Nysted, to Nyköbing; a railway also follows the former route.

Langeland (Fig. 15)

Langeland is built up of lines of pointed hills, flattened ridges and hummocks, generally between 20–40 m. high, and so the coastlands have steep earthy slopes, generally 5–10 m. high, where the coast cuts into these glacial deposits, especially along the east coast. The chief port on the island is Rudköbing (see pp. 411–13), which is the terminus of the main ferries from Ærø, Taasing and Fyn but the small harbour of Lohals near the north point of the island has a ferry service to Lundeborg. There are small harbours at Dageløkke between Rudköbing and Lohals, and also at Spodsbjærg on the other side of the island opposite Rudköbing; a ferry plies between Spodsbjærg and Nakskov. In all these smaller harbours the depths are between 2.5 and 3.7 m. (8–12 ft.). Bagenkop, near the southern end of the island, has a small harbour with depths between 2.8 and 4.1 m. (9–13½ ft.). A main road runs along the length of the island keeping near the central axis but passing through Rudköbing whence a transverse road leads across the centre of the island.

Minor Islands

Læsø (Fig. 12) is mostly heathland and has several small lakes. The island is generally low except along the north coast where a ridge of sandy hills reaches a highest point of 24 m. There are two small harbours, Vesterøhavn and Österby, on the north coast; both have depths of 2.5 m. (8 ft.).

Anholt (Fig. 13) consists of sandy hills which rise to 40 and 50 m. in the west. These hills, which have a downland character, are backed eastwards by sand dunes which are mainly between 15 and 25 m. high. The only harbour on the island is immediately south of its north-west point. The harbour lies between two breakwaters and has 150 m. of quay with maximum depths of 3.7 m. (12 ft.).

Samsø (Fig. 13) has bare hummocky hill country, but the coast is generally low with occasional steep faces where it cuts into the flanks of the hills which run mainly along the length of the island. The chief harbour is Kolby Kaas where the ferry between Aarhus and Kalundborg normally calls and where there are depths of 4 to 5.2 m. (13–17 ft.) alongside the main quays. Maaruphavn, at the northern end of the large bay on the west side of the island, is a small harbour with depths of 3 m. (9¾ ft.). Ballen harbour on the east coast has maximum depths of 5 m. (16¼ ft.) alongside the quays. Langør, on the north-west side of Stavns Fjord, has two short quays with depths

alongside of 3·4 and 4 m. (11 and 13 ft.) respectively. The only high-ways in the island run between Kolby Kaas, Ballen and Maarup. *Endelave* is lowlying and flat, and has one village with a small harbour 2·5 m. (8 ft.) deep.

The island of *Ærø* (Fig. 15), between Langeland and Als, is composed of ridges, up to 50 m. high, running along the axis of the island. The coast is backed along most of its length by earthy bluffs which are usually between 10 and 20 m. high. At Söby there is a small harbour with maximum depths of 4-13 ft. but the ports of the island are *Ærösköbing* and *Marstal*. *Ærösköbing* harbour has depths of between 3·8 and 5 m. (12½-16½ ft.) and a slip for vessels of up to 200 tons. *Marstal* has some 500 m. of wharves sheltered by a long breakwater. Depths alongside the wharves are mostly between 3·1 and 3·8 m. (10-12½ ft.). The harbour has a shipyard capable of repairing the largest vessels which can enter the harbour, two patent slips to lift 300 and 400 tons respectively, and a crane to lift 13 tons.

Chapter III

CLIMATE

Position and General Features: General Meteorological Conditions: Winds: Temperature: Precipitation: Fog: Cloudiness: Sunshine: The Sequence of Weather

POSITION AND GENERAL FEATURES

Denmark lies between the latitudes of $54^{\circ} 34'$ and $57^{\circ} 44' N$, which is approximately the same latitude as that part of Britain which lies between Scarborough and Aberdeen on the east coast, and Barrow and Gairloch on the west coast. The country extends across some $4\frac{1}{2}^{\circ}$ of longitude, which is approximately the same extent as that of Ireland, or that of Scotland between Skye and Aberdeen. Yet Denmark's climate is different in many respects from that of northern Britain. These differences arise primarily from its position nearer to the land mass of continental Europe and Asia.

The peninsula of Jylland and the Danish islands are as 'insular' in character as northern Britain, but they differ in that they are not so open climatically to the Atlantic Ocean. The North Sea lies, as it were, as a vestibule between the open ocean and the almost land-locked Baltic Sea. Thus the climate of Denmark is not truly oceanic. The country is not so directly affected by the tempering influences of the Gulf Stream Drift as are western Britain and Norway, nor do the westerly winds bring such a high rainfall to the Danish plain as to the highlands of western Britain. The country lies open to direct oceanic influences only in the north-west, and, to a lesser extent, in the south-west along the straits of Dover and the adjacent lowlands. The Baltic Sea is small in relation to the vast extent of Eurasia, and is dominated by continental climatic influences; its surface water is also relatively fresh. Thus while the Atlantic coasts of north-west Europe remain temperate and ice-free throughout the winter, the inner part of the Baltic Sea becomes frozen for a considerable time, and neither it nor the low north European plain offer barriers to cold winter winds which sweep outwards from the interior of Russia.

On account of its small area and low surface, Denmark shows no marked differences in climate from one part of the country to another. But its position between the oceanic influences of the west and the

continental influences of the east gives its climate a transitional character which is dominated, now by the temperate moist oceanic winds and now by the dry and more extreme continental winds which bring severe cold in winter and much heat in summer. It is the alternating dominance of these two influences which, in the main, determines the climate. The oceanic winds affect the western parts of the country most intimately, while the land winds have their greatest influence on the eastern areas. Thus, for example, while the west coast of Jylland has an average annual rainfall of 650–700 mm. over most of its length, the east coast of Jylland and the islands have 500–550 mm., and while sea ice is rare on the west coast of Jylland, a greater or smaller part of the Belts, the Sound, and the Kattegat freezes over for several weeks in severe winters. These differences between the eastern and western parts of the country, although slight, are the chief features of regional variations in climate and are much more significant than the differences between the northern and southern parts of the country.

GENERAL METEOROLOGICAL CONDITIONS

The climate of Denmark is governed by the pressure conditions which obtain over north-west Europe generally. The essential features are that in both summer and winter a belt of persistent high pressure lies across the Atlantic between latitudes 20 and 40° N. In winter, cold heavy air settles over the cold land mass of Europe and the zone of high pressure over the land links itself to that over the ocean. In summer, on the other hand, the land mass is hot, and low-pressure conditions lie over the continent. North of this high-pressure belt the average pressure decreases to a minimum around Iceland. Consequently warm moist winds blow polewards and come into contact with cold air which is flowing south from high latitudes. In this way the cyclones of temperate latitudes are formed and they travel north-eastwards in the direction of the prevailing winds.

In winter, when the continent has high-pressure conditions with outblowing winds, the depressions are frequently directed along the north-western margins of the continent. In spring, when the high pressure over the continent is beginning to break up, as the sun's influence becomes stronger, they tend to follow more southerly courses. In summer, low-pressure conditions lie over the hot land mass into which the westerly winds blow and the cyclonic tracks are, on the whole, directed still farther south, but since the sub-

tropical high-pressure belt is most marked in summer this pressure belt may spread north-eastwards over the continent to bring hot, dry, anti-cyclonic conditions. As the land cools again in autumn, cold heavy air settles over the continent, and depressions begin to take more northerly courses. Cyclonic activity off north-west Europe is much greater in winter than in summer. In winter the pressure gradient from the high-pressure belt is steepest and the winds are strongest. In summer the high-pressure belt extends farther north and the gradient is much less steep than in winter. Consequently the winds are lighter.

WINDS

It follows from these meteorological conditions that winds are variable. The general frequencies of both direction and force of winds at different stations are similar. This is due to the small extent of the country, its low altitude, and the absence of physical barriers, so that local differences of relief have little effect. The winds are mainly light. A wind force of 7-10 knots is commonest over the whole country, but gales are not rare, and there have been winters when the average wind strength has been 17-21 knots. West and north-west winds are on the whole strongest, and north and south winds are weakest. In most places the percentage of calms is low (2-4%), but it is naturally higher at land stations than at coast stations since the wind force, other things being equal, is less over land than over sea. The land stations also show greater variation, as between one another, in the frequencies of winds from various directions; this arises usually from diversities in local topography.

Seasonal variations in the force and direction of winds are more marked than regional diversities. The seasonal incidence of wind direction and force at different stations is shown in Figs. 19-22 and requires little comment. In January, when the continental anticyclone is well developed and cyclonic activity from the west is great, the cyclone tracks lie towards the north, and so the winds blow most frequently from the south-west and west (an average of about 38% of the observations record these directions), slightly less frequently from the south-east and least frequently from the north. When the continental anticyclone strengthens and spreads north, bitter east winds occur. In April, easterly winds are most prevalent in the islands, but in Jylland easterly and westerly winds are fairly evenly balanced. The frequency of calms and light winds is higher than in January. By July, low-pressure conditions have become established over the

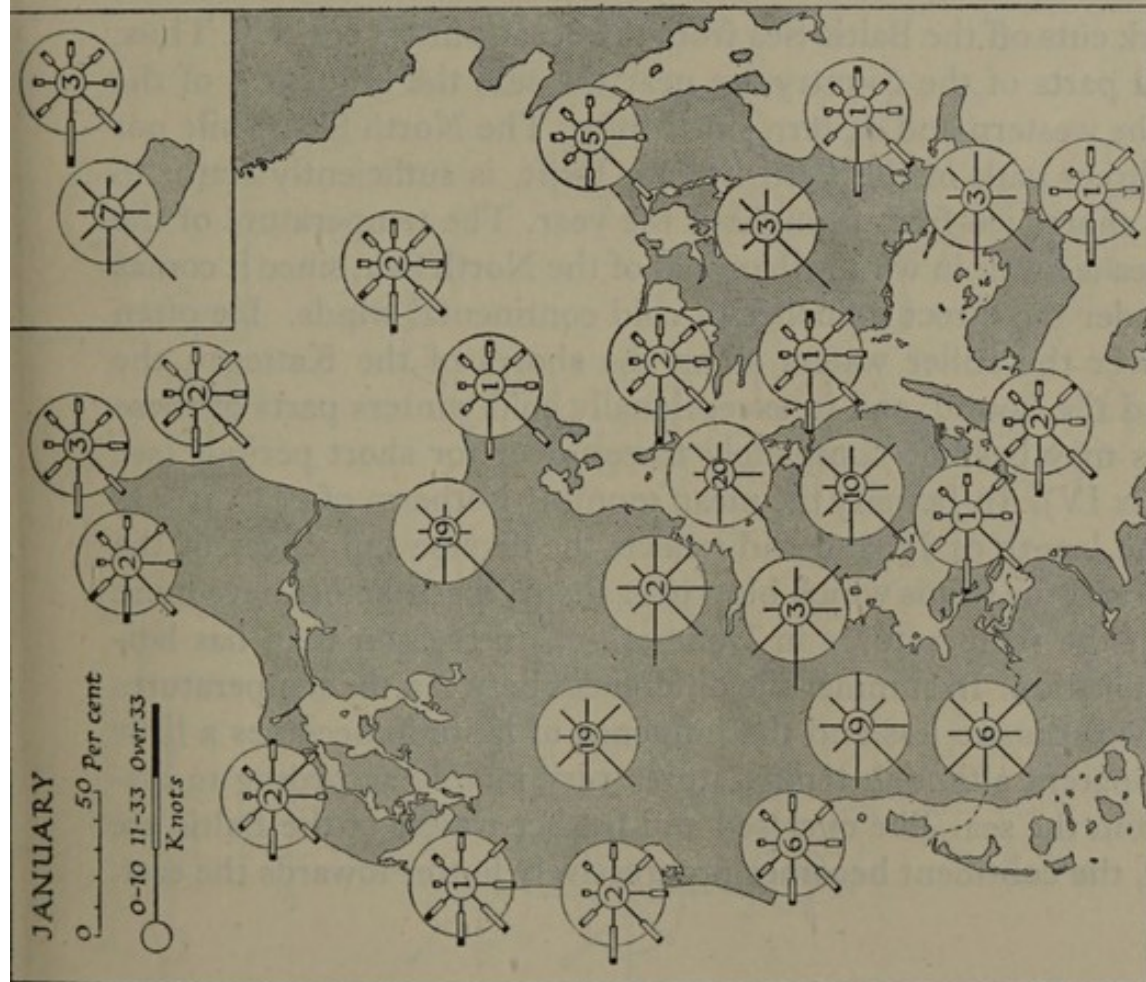


Fig. 19

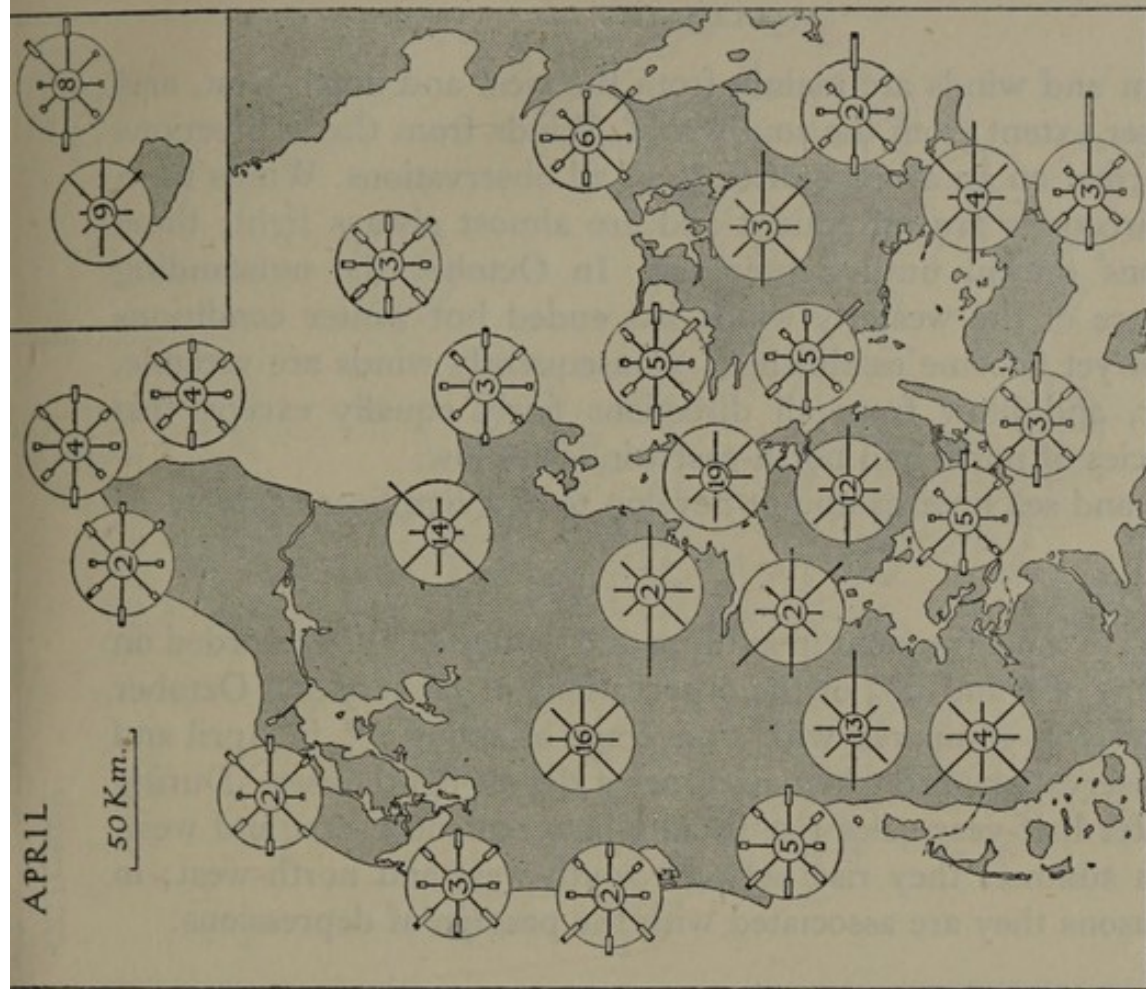


Fig. 20

Figs. 19 and 20. Wind direction and force in January and April

Based on data in *Danmarks Klima* (København, 1933).

The outer circle indicates a frequency of $12\frac{1}{2}\%$ which would be the common value if winds blew with equal frequency from each direction. The figure in the inner circle indicates the percentage of calms. Inland stations do not record force of wind. The values are averages over 44-50 years.

continent and winds are mainly from the west and north-west, and to a lesser extent from the south-west. Winds from these directions are recorded on an average of 62% of all observations. Winds from other directions are infrequent and are almost always light; these conditions prevail until September. In October the outstanding dominance of the westerly winds has ended but winter conditions have not yet become established. Consequently winds are variable, stronger, and blow from all directions fairly equally except that frequencies of north and north-east winds are low.

Land and sea breezes do not develop to any significant extent.

Gales

Gales are most frequent in autumn and winter and are recorded on an average of 6 and 5% of the observations in January and October respectively as compared with an average of about 2% in April and July; observations are taken six times a day at lighthouses. During the winter half-year gales rise usually between south-east and west, while in summer they rise between south-west and north-west; in both seasons they are associated with the passage of depressions.

TEMPERATURE

Denmark cuts off the Baltic Sea from the ocean almost entirely. Thus, while all parts of the country are near the seas the influences of the sea on the western and eastern sides differ. The North Sea, while not in the direct path of the Gulf Stream Drift, is sufficiently warm to keep its shores ice-free throughout the year. The temperature of the Baltic Sea is lower in winter than that of the North Sea, since it comes more under the direct influence of cold continental winds. Ice often forms over the stiller waters along the shores of the Kattegat, the Belts and the Sound, and in exceptionally cold winters parts of these channels may become completely frozen over for short periods (see Appendix IV). In January the mean monthly isotherm of 0° C. passes along the length of Jylland and reflects the diverse influences of the two seas and the winds which blow over them; these factors have more effect on the temperatures in Denmark at this season than has latitudinal position. In summer the differences between the temperatures of the two seas are less and the influence of latitude becomes a little more apparent although temperatures vary mainly according to distance from the sea. The enclosed and fresher waters of the Baltic are warmer, the continent becomes progressively hotter towards the east,

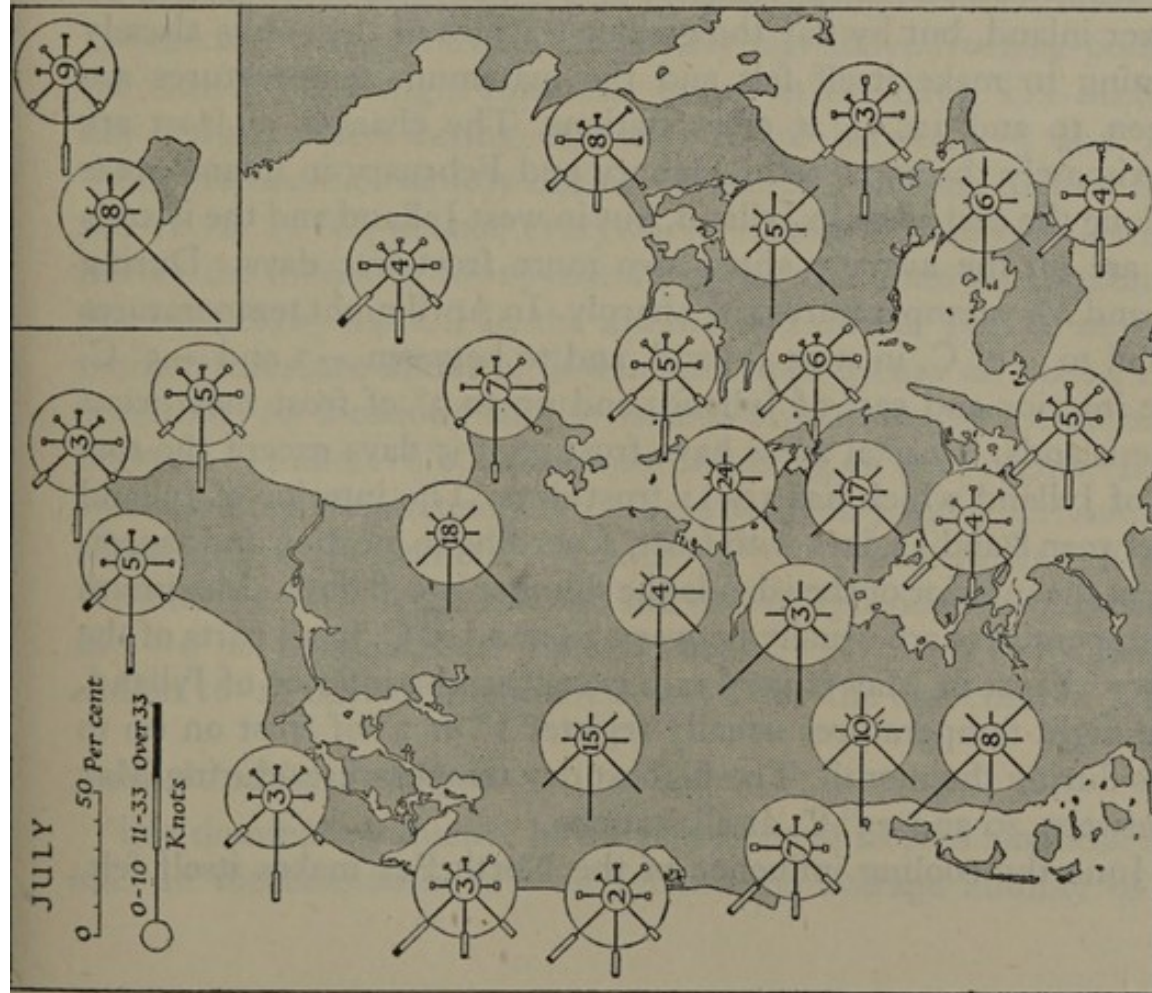


Fig. 21

Based on data in *Danmarks Klima* (København, 1933).

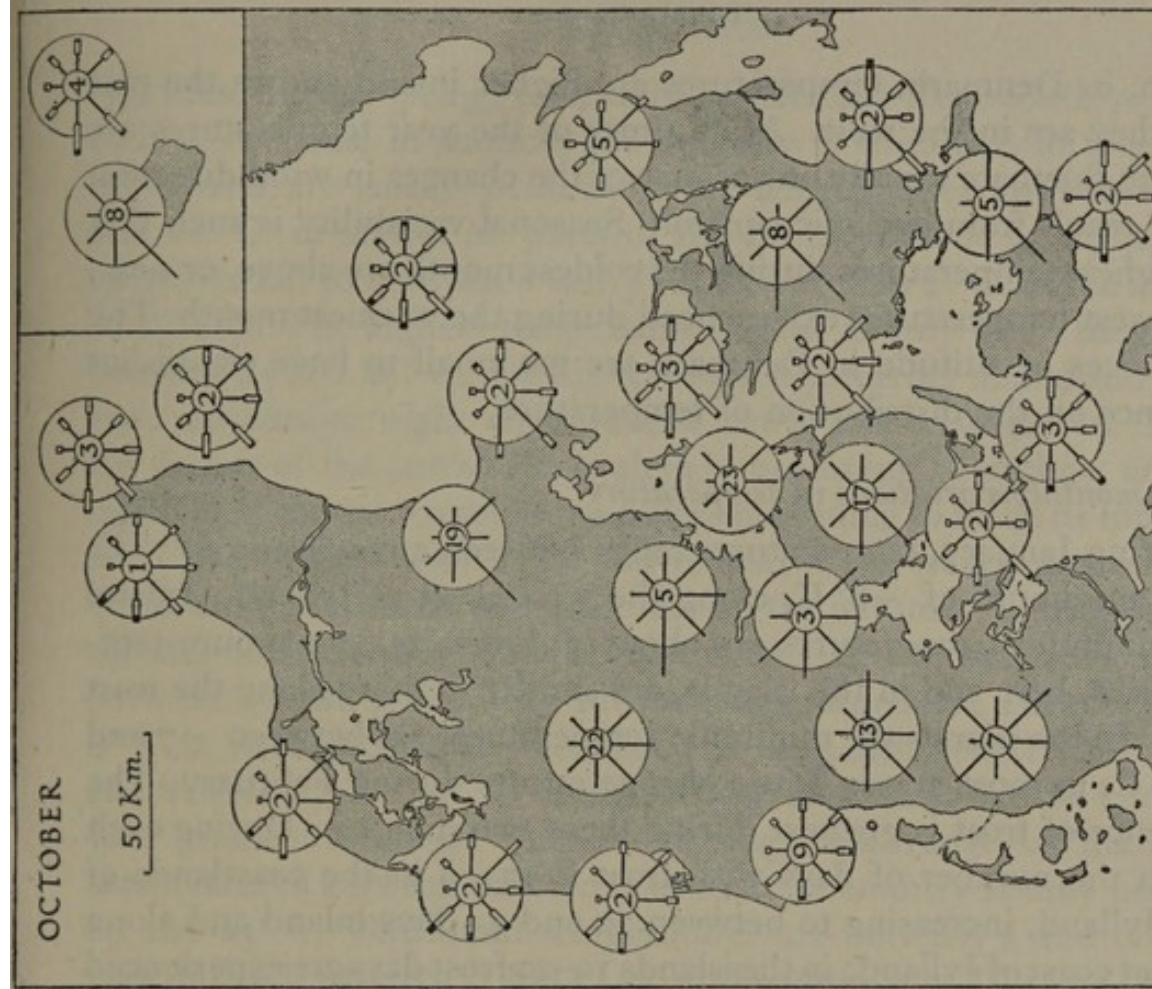


Fig. 22

Figs. 21, 22. Wind direction and force in July and October

The outer circle indicates a frequency of $12\frac{1}{2}\%$ which would be the common value if winds blew with equal frequency from each direction. The figure in the inner circle indicates the percentage of calms. Inland stations do not record force of wind. The values are averages over 44-50 years.

and so, in Denmark, temperatures are higher inland and in the east than they are in the west. At all times of the year temperatures are liable to fluctuate rapidly on account of the changes in wind direction which result from cyclonic control. Seasonal variability is such that the highest temperatures during the coldest month are above, or near, the lowest temperatures experienced during the warmest month. The differences in altitude in Denmark are too small to have significant influence on the distribution of temperature.

Mean monthly variations in temperature

During January, temperatures range between a maximum of 7° C. and a minimum of -8° C. along the west coast of Jylland. Inland the minimum temperatures are about 4° lower, but maximum temperatures, here and in the islands, are similar to those along the west coast. In the islands the minimum temperatures are between -7 and -10° C. in most areas. Little change occurs during February. The incidence of frost is greatest during these two months. During each month the number of days with frost is 17–19 in the coastlands of west Jylland, increasing to between 20 and 23 days inland and along the east coast of Jylland; in the islands 19–20 frost days are experienced in coastal districts and 20–23 frost days inland. In March the lowest temperatures are between -5 and -7° C. in coastal areas and about 2° lower inland, but by day the greater warmth of the sun is already beginning to make itself felt and the maximum temperatures are between 10 and 12° C. at most stations. The chances of frost are approximately the same as in January and February in inland areas and along the east coast in Jylland, but in west Jylland and the islands there are on the average about two more frost-free days. During April and May temperatures rise sharply. In April night temperatures may fall to -2° C. in west Jylland, and to between -3 and -5° C. in the interior and east of Jylland, and up to 3° of frost may occur on the islands. Coastal areas have frost on 3–5 days except the east coast of Jylland which has 10–11 frost days. The interior of Jylland has between 8 and 12 days with frost, according to location and aspect, while in the interior of the islands the number is 5–8 days. Maximum day temperatures are usually between 14 and 18° C. in all parts of the country. Frost in May is very rare except in the interior of Jylland, where night temperatures usually register 1° or 2° of frost on up to 3 days during the month. The highest day temperatures during May are between 20 and 25° C. at all stations.

In June the cooling influence of the North Sea makes itself felt.

Whereas, during spring, temperatures decrease from south to north in like locations, in summer the decrease is from east to west. The differences are small. Maximum day temperatures are between 24 and 28° C. in almost all parts of the country, while at night, temperatures fall to between 8 and 5° C. and even to 2° C. in the interior of Jylland. The highest temperatures occur in July when they range between 25 and 29° C., the highest values occurring inland and in the east. Minimum night temperatures show little change. In August the power of the sun's rays is already beginning to decline, and the capacity of the sea for retaining heat is beginning to make its influence felt. The greater warmth of the coastal areas comes progressively more and more into prominence during the autumn. During August the day temperatures are still highest inland, and reach maxima of between 23 and 27° C. The lowest temperatures are between 5 and 6° C. in west Jylland, between 6 and 9° C. in central and east Jylland, and between 7 and 11° C. in the islands. In September the temperature gradient becomes steeper, although the range of maximum temperatures between different parts of the country is only between 19 and 23° C. Minimum temperatures are between 4 and 6° C. in west Jylland, between 0 and 3° C. in the interior and east of Jylland, and between 4 and 10° C. in the islands. Up to 4° of frost may occur on 2-6 nights in central and east Jylland during October, but in west Jylland night temperatures are usually just above freezing-point. In the islands slight night frost may occur on 1-3 days. The maximum day temperatures during this month are between 15 and 17° C. Temperatures fall rapidly during November, and the highest figures are 10 or 11° C. almost everywhere. Frost occurs on 5-8 nights during the month in west Jylland but the minimum temperatures do not fall below -4° C. In the interior and east of Jylland minimum temperatures are about 4° lower and frost occurs on 10-14 nights according to location; in the islands minimum temperatures are between -2 and -6° C. with frost occurring on 8-11 nights. During December maximum temperatures are between 7 and 9° C.; minimum temperatures are between -5 and -7° C. in west Jylland, between -8 and -11° C. in the interior and east of Jylland, and between -4 and -9° C. in the islands. Frost occurs on 12-15 days in coastal areas and on 16-19 days in inland areas and along the east coast of Jylland.

Annual Incidence of Frost

The dominant influence in the incidence of frost is nearness to the sea. In the coastlands of west Jylland the average number of frost

days in the year is between 70 and 80. These may occur, normally, at any time between the last week in October and the end of the third week in April. Inland, the number of days with frost increases gradually to between 100 and 110 in south Jylland, and to between 110 and 120 in central and north Jylland. Figures for some British stations are:

Falmouth	48	Kew	101
Portsmouth	61	Birmingham	102
Sheffield	70	Buxton	111
Glasgow	79	Cambridge	112

Frost may come at any time between the end of the first week in October, and the end of the first week in May over most of inland Jylland. The Kattegat coast of Jylland has between about 100 and 110 frost days which normally occur between the second week in October and the end of April or the first week in May. The coastlands of the Little Belt and its approaches have 75–85 days with frost which can be expected to begin during the third week in October in the northern part, and during the first or second weeks in November in the southern part; the dates are later towards the south. In normal years the latest frost comes about the middle of April in these areas. The coastlands of the islands have 85–100 days with frost, while inland areas in Fyn and Sjælland have between 100 and 110 frost days, but in all these areas frost may be expected at any time between the last week in October and the third week in April.

These dates apply to average conditions. Frost may occur in most areas in May and in some localities in September. The three summer months (June, July, August) are free from frost except on very rare occasions, but July is the only month during which frost has never been recorded. The average time between the latest frost in spring and the first frost in autumn is about 150 days in central and north Jylland, about 170 days in the interior of the islands, and about 200 days in the coastlands. The hardest frosts occur in January and February, and there have been exceptional occasions when the temperature has fallen to -25°C .

PRECIPITATION

Denmark receives its winter precipitation mainly from depressions which approach from the west. In summer the rainfall results, partly from depressions, which may come from the ocean or from the con-

continent, and partly from thunderstorms. Widespread atmospheric disturbance may last for days and can be accompanied by a very heavy fall of rain in a relatively short time. In July 1918, 120.4 mm. of rain fell in 24 hr. Falls of over 100 mm. in a day have occurred several times in June or July during the 50 years between 1875 and 1925, while falls of over 50 mm. in a day have occurred during June, July or August in almost every year between 1875 and 1925, and in several years such falls occurred in each of these months. This contrasts with October, the month of secondary maximum, in which falls of over 50 mm. in a day occurred in only eight of the years (as compared with 33 and 34 in July and August respectively), and during which the maximum falls in one day have been mainly between 30 and 40 mm.

The Distribution of Precipitation

The distribution of precipitation over the country is fairly uniform (Fig. 23). The mean annual precipitation at different stations ranges between 415 and 807 mm. The wettest part of Denmark, which is south Jylland, receives between about 750 and 800 mm. of precipitation a year. This is considerably less than is received along most of the western side of Britain where the higher land has over 1,500 mm. and, in places, over 2,500 mm. a year. The driest areas of Denmark, which are the coasts of the islands, have an annual precipitation of between about 450 and 550 mm. This is less than the average figure for the south-eastern counties of England. For example, Shoeburyness, which has the lowest recorded rainfall in Britain, receives 480 mm. a year, while Cambridge, which is one of the driest places, has an annual precipitation of 554 mm. An annual precipitation of between about 650 and 800 mm. is characteristic of south Jylland and most of the west coast of Jylland; this is comparable with the amount received in the English midlands. The total annual precipitation decreases north-eastwards in Jylland, while in the islands it increases inland especially over the higher ground. This increase over the higher ground is probably only in a small measure due to orographical rainfall which is of small account in a low country such as Denmark, and the tendency for thunderstorms to develop inland is probably a more important factor than orography in producing a higher rainfall. Central Jylland has an annual precipitation of between 600 and 750 mm., while north Jylland, the coastal fringe of east Jylland and the interior of the islands, receive between about 550

and 700 mm.; the latter figures are similar to those recorded for the coastal areas of the north-eastern counties of England.

It will be seen in Fig. 24 that the precipitation during the latter half of the year is appreciably greater than during the earlier half. This is due to summer thunderstorms and to the fact that although cyclonic activity from the west is greater in winter, the cyclones have

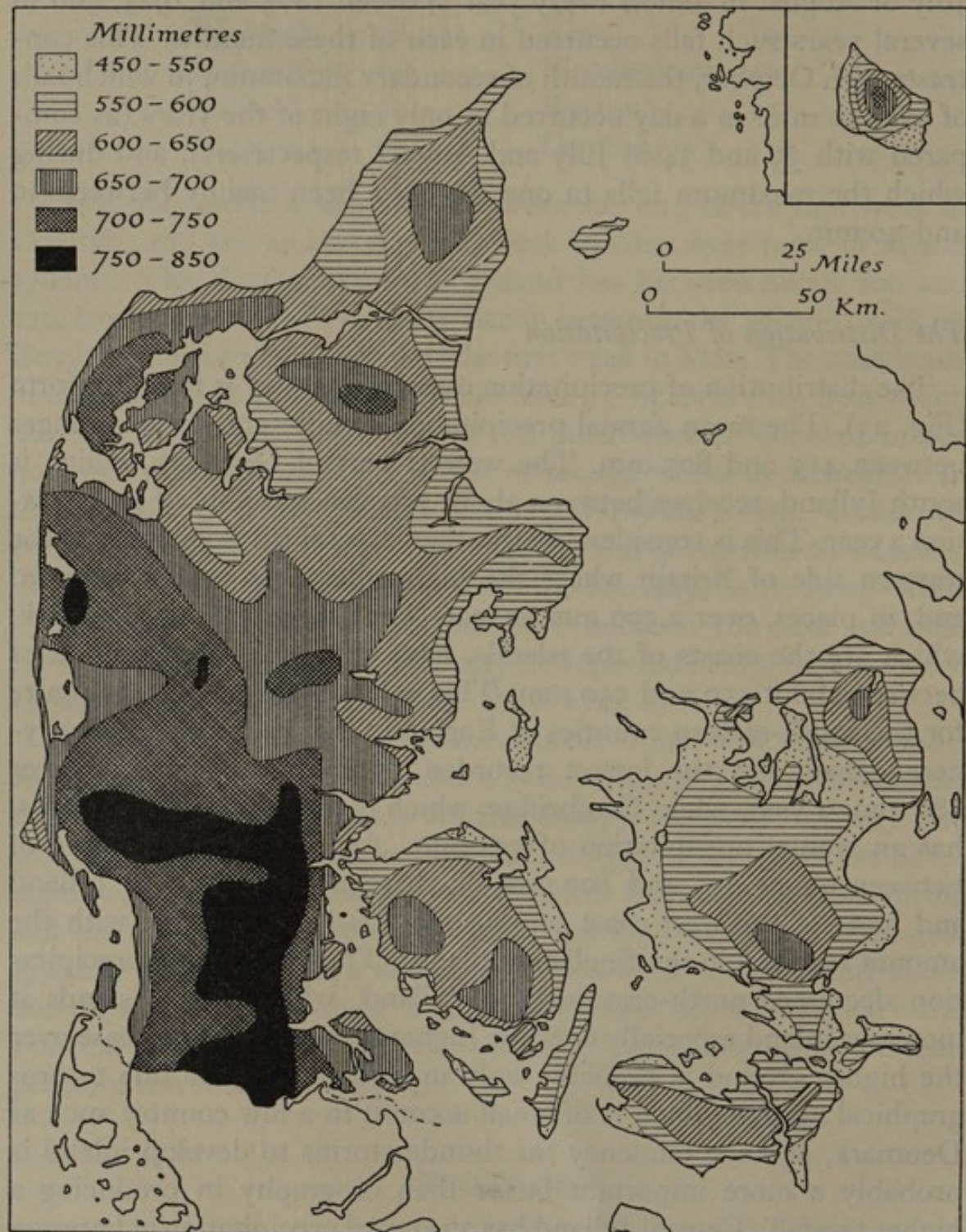


Fig. 23. Mean annual distribution of rainfall
Based on *Danmarks Klima*, Plate 40 (Köbenhavn, 1933).

easier access to the country in summer. The minimum precipitation occurs in February, and precipitation remains comparatively low until July when it rises towards the August maximum. The general level of precipitation is well maintained from September to December, with a secondary minimum in September and a secondary maximum in October.

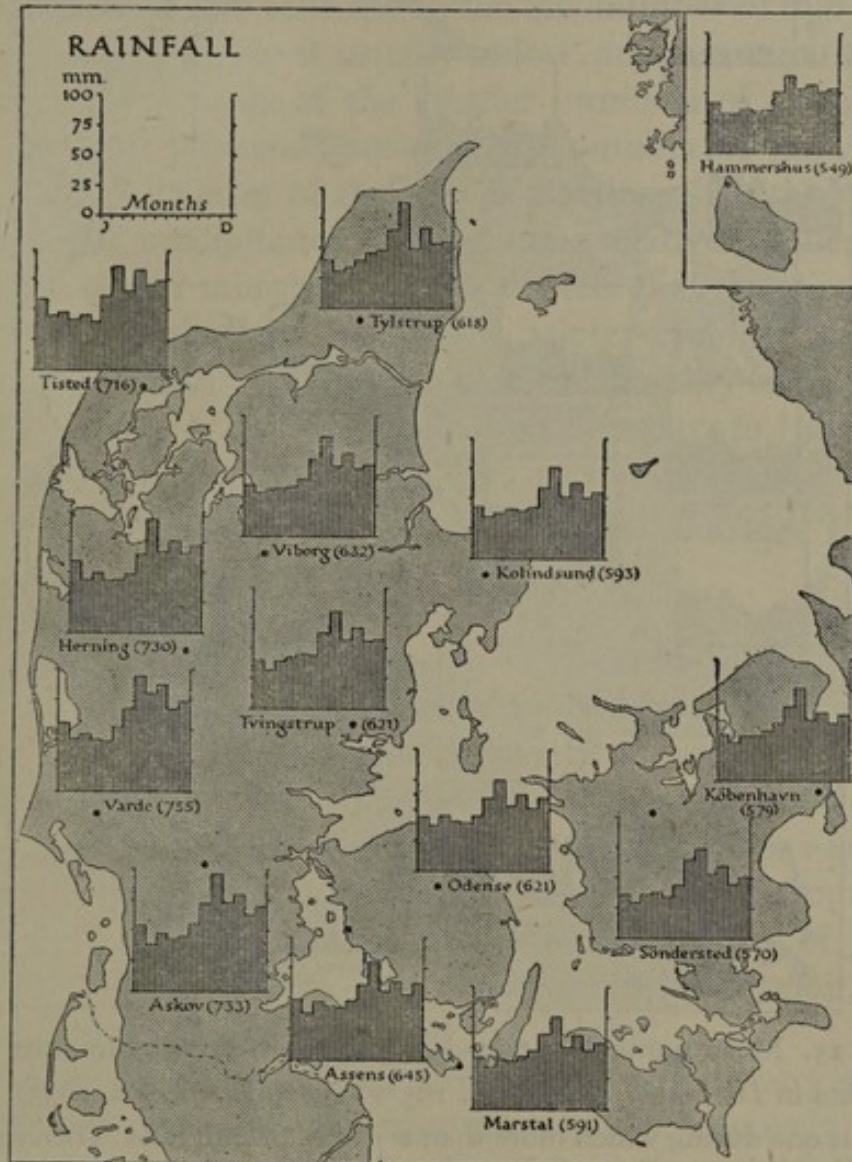


Fig. 24. Mean monthly rainfall, by stations

Based on data in *Danmarks Klima*, pp. 137-47 (København, 1933).

The values are averages for the period 1886-1925. The figures in brackets give the mean annual rainfall in millimetres for each station.

Rain Days

The average number of rain days (i.e. days during which more than 0.1 mm. of rain falls) in the year varies between 118 and 194 in different parts of the country. In west Jylland the average number at

different stations is between 150 and 190, in east Jylland it varies between 125 and 175, and in the islands the number at different stations lies between 140 and 190.

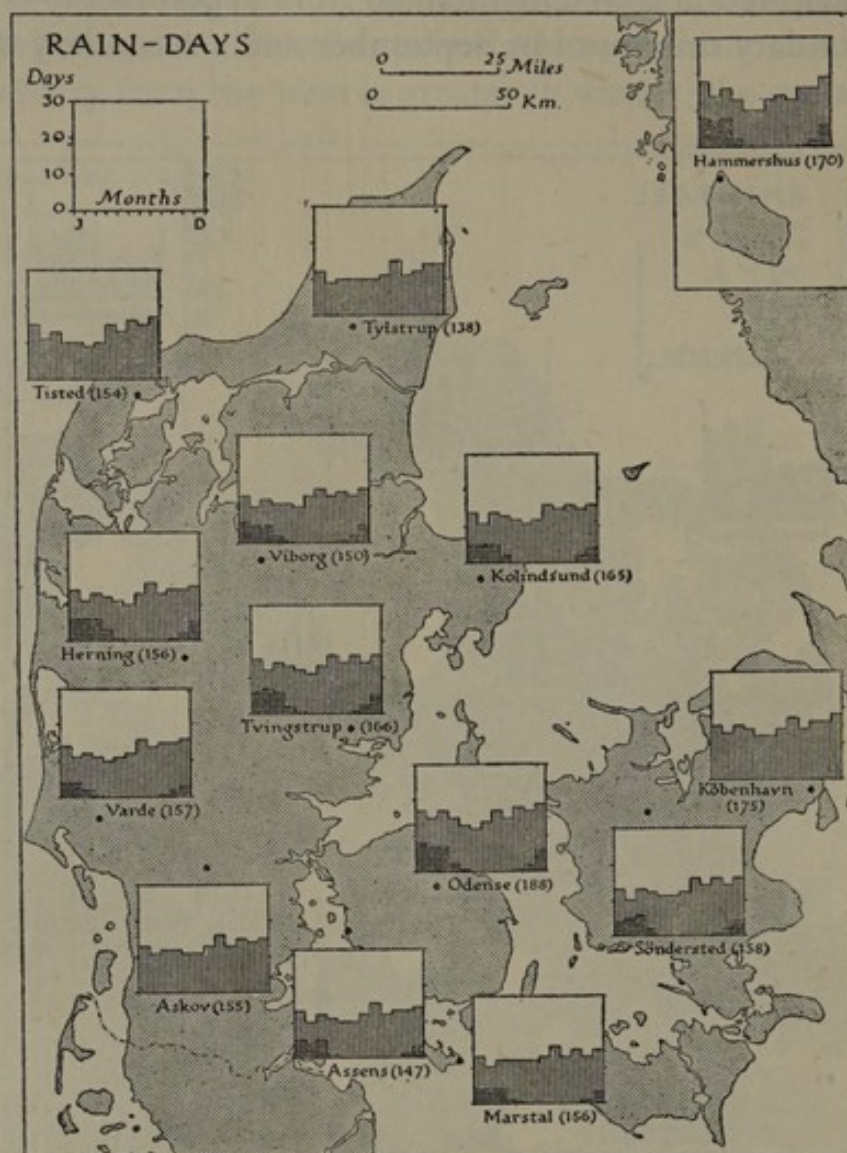


Fig. 25. Mean number of rain-days and snow-days, by months
Based on data in *Danmarks Klima*, pp. 195-6, 198 (København, 1933).

A rain-day is one during which more than 0.1 mm. of rain falls. The cross-hatched sections indicate the number of snow-days, which are days during which enough snow falls to produce 0.1 mm. of water in a rain gauge. The absence of any indication of snow for some stations is due to lack of records and not to absence of snow. The figures in brackets give the mean annual number of rain-days for each station. The values are averages over periods of 20-40 years.

For comparison the number of rain days at some British stations are:

Shoeburyness	149	Manchester	194
Cambridge	163	Falmouth	207
Portsmouth	163	Aberdeen	214
Kew	167	Fort William	240

Fig. 25, which shows the average number of rain days in each month at different stations, correlates closely with that showing mean monthly rainfall. The August maximum is retained but the difference between the number of rain days in this month and the numbers in October, November and December is less than the discrepancies in the amounts of rainfall during these months. The February minimum of precipitation is also reflected in the low number of rain days in this month, but the number is usually as low, and is sometimes lower, in May and June in spite of the smaller numbers of calendar days in February. The difference between the number of rain days in the first and second halves of the year is also less than the difference in the amount of precipitation. This greater relative frequency of rainy days in the winter months is due to the fact that the summer rainfall comes in heavy showers, whereas in winter cyclonic rain is gentler but more persistent. Between August and January some rain falls on an average of one day in two, while from February to July the chances of rain are on approximately one day in three. The monthly details for particular stations can be read from Fig. 25.

Seasonal Distribution of Rainfall

The chief facts of seasonal distribution can be briefly summarized. In April and May the rainfall is fairly equally distributed over the country. In winter the precipitation is cyclonic and is brought mainly by westerly winds. It is consequently heaviest in Jylland, where it is greatest in a belt behind the west coast; it decreases eastwards. In summer, on the other hand, convectional rain is important and consequently the maximum rainfall is in the interior of Jylland and the larger islands, where most thunderstorms develop, while the west coast of Jylland is an area of low rainfall.

Fig. 26 shows the distribution of rainfall in February and August, the months of minimum and maximum falls respectively, and also in May and November. The distribution in January and March is similar to that for February except that in January the amounts are about 10 mm. greater. In April and June the distribution is, in general, similar to that for May. During July the greater volume of summer rainfall makes itself apparent; most of the country receives 60–70 mm. except for strips along the west and north-east coasts of Jylland, the north of Fyn and west Sjælland. In September the distribution is similar to that for August except that the amounts are about 20 mm. less everywhere. In October the precipitation is 10–15 mm. above the September amounts in most parts of the country.

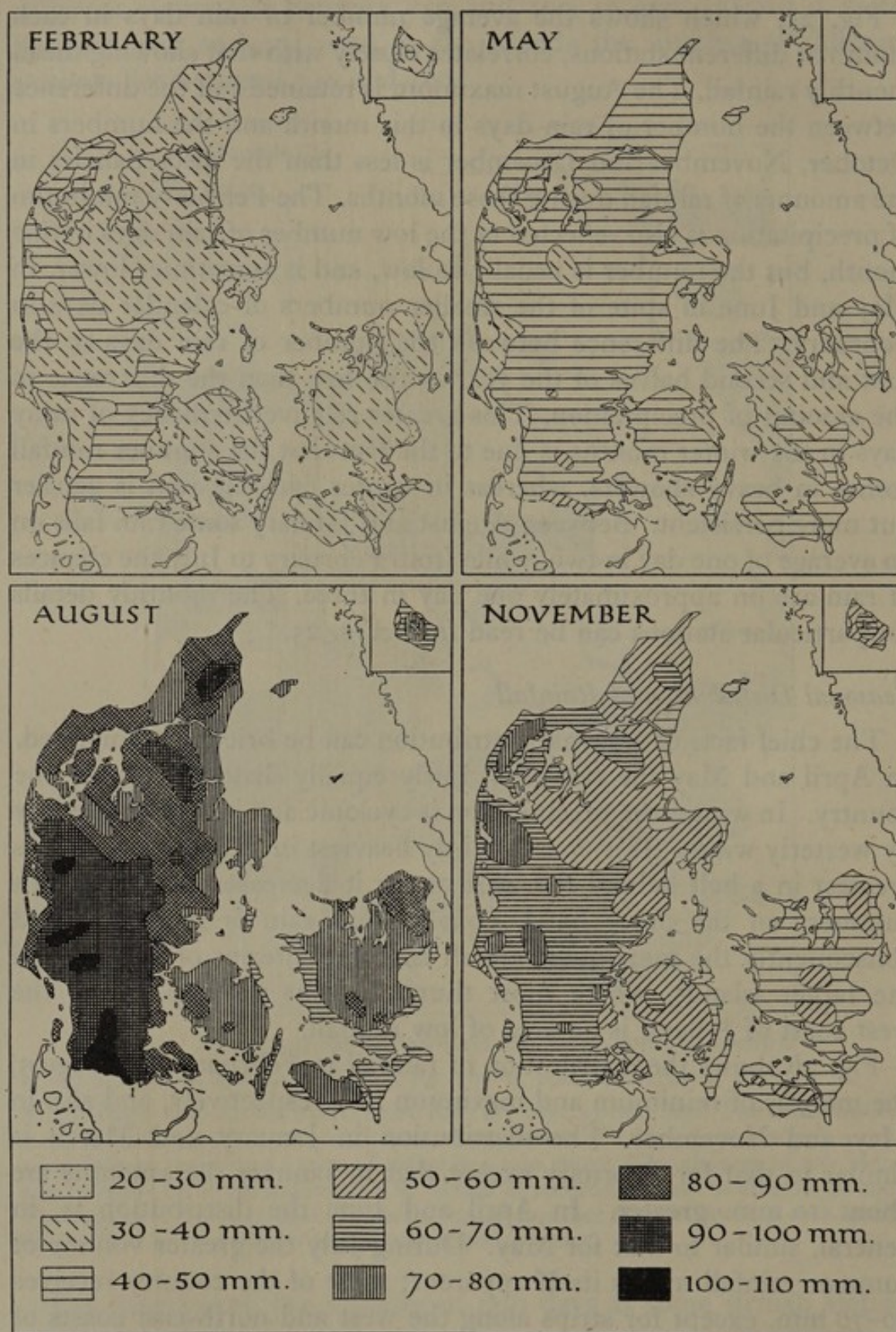


Fig. 26. Mean monthly distribution of rainfall

Based on *Danmarks Klima*, plates 29, 32, 35 and 38 (København, 1933).

February and August are the months of minimum and maximum rainfall respectively.

A broad belt across the west half of Jylland receives 80–90 mm., central and north-east Jylland receive mainly 60–70 mm. and south-east Jylland receives 70–80 mm. of precipitation. In the islands the precipitation is mainly 60–70 mm. except that most of Sjælland receives 50–60 mm. The decrease in precipitation from west to east, which is characteristic of the autumn, is still apparent in November. In December regional differences are less marked. Jylland receives 60–70 mm. over most of its southern half and 50–60 mm. over its northern half, but along the west coast and over most of the neck of the peninsula the precipitation reaches 70–80 mm. On the coastland of the islands the precipitation is 40–50 mm., but it increases inland to 60–70 mm. on the higher ground.

Humidity

The relative humidity of the air is high at all seasons, and shows no significant regional variation. In November, December and January the average relative humidity is about 90 %. It falls gradually to a minimum of about 75 % in May and June and rises again progressively from July onwards.

Snow

The occurrence of snow requires little comment. The average annual number of days with snow varies between 20 and 40 in different parts of the country. This is a higher frequency than is experienced in England (Buxton 38, Kew 13) but is not very different from many Scottish stations (e.g. Aberdeen 34, Braemar 47). But it should be remembered that the Danish meteorological service records as a snow day one on which enough snow falls to produce 0.1 mm. of water in a rain gauge. This gives a slightly smaller number than that obtained by British methods according to which a snow day is one on which snow and sleet have been observed to fall. Snow is appreciable only during December, January and February, although it may fall at any time from October to May. Snowfalls are most frequent from January to March, when they usually occur on 6–9 days a month. They occur rather less frequently in April, November and December (see Fig. 25). It rarely lies long before December, and in some winters it does not lie for more than a few days.

Hail

Hail may fall during any month. It occurs most frequently between October and May, in association with the cold fronts of depressions.

On the average, hail falls on only about 6 days a year. It is rather more frequent in west Jylland than elsewhere and is least frequent in inland areas. Thunderstorms occur, on the average, on 11 days a year, which is approximately the same frequency as is experienced in eastern England. Of these 11 days, 8 occur between May and October. During storms in summer, hailstones of 1–2 cm. diameter fall occasionally, and very exceptionally their diameter may reach 3 cm.

Fog

The main facts concerning the incidence and distribution of fog can be read from Fig. 27. The number of days with fog is greatest in winter when the maximum may occur in December, January or February; it is least during the summer months, usually in June. Fog is most frequent along the west coast of Jylland where it occurs on an average of about 1 day in 3 between December and March, while between June and September the chances of fog are small since there are, on the average, only 2 or 3 days with fog during each of these months. The incidence of fog decreases eastwards. In east Jylland and the Kattegat fog occurs on an average of 1 day in 4 or 5 during the winter, and is rare in summer. Along the Great Belt and the Sound it is slightly more frequent and usually occurs on about 1 day in 4 in winter. These figures include persistent fogs which may last for several days. For example, at Vestervig near the western end of Limfjord, foggy weather lasted from 23 January to 8 February in 1918, and a fog persisted continuously for 7 days 17 hr.

CLOUDINESS

It will be seen from Fig. 28 that the degree of cloudiness shows little regional variation. Cloudiness is generally less, especially in summer, in eastern Jylland and Fyn than in west Jylland and Sjælland. It is naturally greatest in winter when cyclonic activity is most vigorous and temperatures are low. During this season 70–80% of the sky is, on the average, clouded. Cloudiness decreases regularly to a minimum in May when the sky is, on the average, half-covered. Slight increases occur during the summer months and are followed at all stations by a secondary minimum in September, after when cloudiness increases gradually to the winter maximum which is usually in December, but may occur in November or in January. In April, May and June there are, on the average, 6 clear days per month in contrast with only 1 in

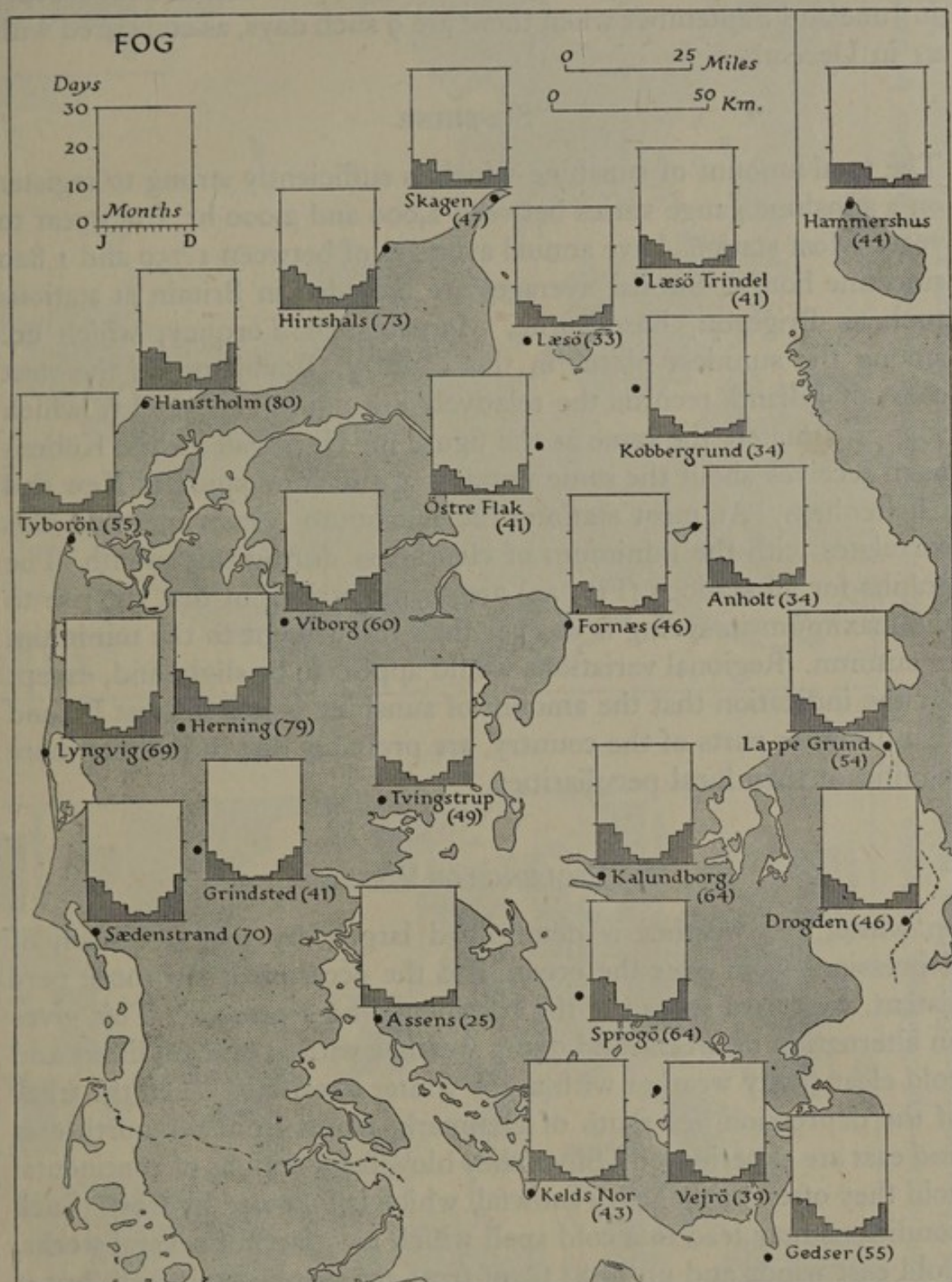


Fig. 27. Mean monthly incidence of fog, by stations

Based on data in *Danmarks Klima*, pp. 200, 202-3 (København, 1933).

The figures in brackets give the mean annual number of days with fog for each station. The values are averages over periods of 20-40 years.

November and December. The lowest number of overcast days occurs in June and September when there are 9 such days, as compared with 21 in December.

SUNSHINE

The total amount of sunshine which is sufficiently strong to register on a sunshine gauge varies between 1,000 and 2,000 hr. from year to year. Most stations have annual averages of between 1,750 and 1,820 sunshine hours. Similar averages are recorded in Britain at stations such as Brighton, Eastbourne, Margate and Torquay, which are among the sunniest places in this country. Bovbjerg, on the west coast of Jylland, records the relatively low figure of 1,346 hr., which is approximately the same as the figure for Harrogate, while Köbenhavn receives about the same number of sunshine hours as Kew and Cheltenham. At most stations the maximum occurs in May: this correlates with the minimum of cloudiness during this month. The graphs for all stations (Fig. 29) are asymmetrical, in that the rise to the maximum in spring is steeper than the descent to the minimum in autumn. Regional variations would appear to be slight and, except for the indication that the amount of sunshine is less in west Jylland than in other parts of the country, are probably due to nothing more significant than local peculiarities.

THE SEQUENCE OF WEATHER

In winter the weather is determined largely by the succession of depressions from over the ocean, and the occasional, but more persistent, westward spread of the continental high pressure. This gives an alternation between mild damp weather with great cloudiness and cold clear frosty weather with much winter sunshine. When the track of the depression lies south of Denmark, winds from the north-east and east are experienced. Since they blow from regions of continental cold they often bring heavy snowfall which is followed by frost. Such conditions may lead to a cold spell which may last for several weeks. Cold east winds and up to 8° C. of frost are then experienced, but if the high pressure continues to spread south so as to cover the country completely, the winds drop and calm weather with sharp frosts, especially at night, occur. If such weather persists long enough, parts of the Belts, especially inshore, may become frozen over. Usually, however, cold spells are well interspersed between spells of mild cyclonic weather.

Spring weather is usually mild and damp but is characterized by considerable diurnal fluctuations in temperature. This is due to the relatively small amount of cloud at this season with the result that insolation gives quite high day temperatures, but rapid radiation at night may bring frost. Dry east and north-east winds may interrupt the sequence of depressions and bring bitter cold weather. In spring and early summer long dry periods occur occasionally and sometimes last for 5 or 6 weeks.

In summer, depressions from the ocean or from over the continent bring rain, but when, as often happens, the sub-tropical belt of high pressure extends north over Denmark a long spell of 'high summer' weather, fair and dry, may result. Such a dry spell may be broken up by thunder accompanied by torrential rain. Thunderstorms often herald a long spell of uncertain rainy weather, during which the passing of a string of depressions brings a recurrent sequence of mild rainy weather, squalls and short fair periods. Rainy spells, of about 10 days or more, occur not infrequently in summer and autumn; occasionally they may last for over a month.

The temperature lag which is characteristic of the maritime climates of north-west Europe may cause summer weather to last well into September, when, if anticyclones develop, long spells of fine weather may occur. In September, comparative cloudlessness and low humidity in the upper air leads to rapid loss of heat by radiation at night. The result is that the lowest air layers quickly reach dew point and give rise to mist which is sometimes called 'Mosekonens Bryg' (The Bogwoman's Brew).

Autumn weather is characterized by increasing cyclonic activity with mild weather and, often, wind and rain. Nightly cooling leads progressively to frosts, but the retained heat of the sea confines them to the interior of the country, and, as in temperate maritime areas generally, autumn is on the whole warmer than spring.

Chapter IV

NATURAL VEGETATION

The Forests and Forested Areas: The Dune Areas: The Marshes and Bogs:
The Heaths

Temperate lands of long-established civilization are characterized by widespread replacement of natural vegetation by cultivated crops. In Denmark, where agriculture is the leading occupation and where, on account of low altitude and the general occurrence of deep glacial soils, there are few eventual obstacles to tillage, this process has been carried almost to its extreme limits. Three-quarters of the area of the country is used directly for agriculture, and more than four-fifths of this land comes under the plough. Denmark has few slopes that are too steep for tillage, and no land that is too high to bear crops. In addition, forests were widely cut down after the thirteenth century to provide fuel for smelting bog-iron ore and for obtaining salt by evaporation of brine along the west coast of Jylland.

The remaining natural vegetation consists mainly of (a) residual forests, (b) the plant growth of the areas of accumulation such as sand dunes, marshlands and bogs, and (c) the secondary growth of heath and moor which replaced cleared forests on lands which were by nature too poor to support a farming economy until improvements in agriculture made possible their gradual reclamation. In these last areas man has been forced to repair his former depredations by planting belts of woodland to serve as shelter for the reclaimed lands. The dunes, the undrained bogs and the heathlands are all best represented in Jylland. The Danish archipelago has few sandhills comparable to those of western and northern Jylland, or heaths as well developed as those of the centre of the peninsula, while peat bogs in the islands are small and scattered. The vegetation of the islands is very closely controlled by cultivation, as is that of east Jylland.

In 1929, the latest date for which figures are available, there were in Denmark some 390,000 ha. of forest, 51,000 ha. of peat bogs and 295,000 ha. of heath and dunes. About 40% of the forest is deciduous, of which some 70% is beech and 10% is oak. Pines and firs account for 68% of the coniferous forest. Jylland contains 65% of the forest, 80% of the peat bogs (60% in west and north Jylland) and 97% of the heaths of which 57% are in west Jylland.

THE FORESTS AND FORESTED AREAS

It is only relatively recently that the primary vegetation cover, the forest, has been controlled by man and to a great extent replaced by grass and arable land. Throughout prehistoric and early Christian times, Denmark, like those countries which adjoin it, was practically entirely forest-covered except in the windswept coastal zones, in the sandy outwash plains and in the marshy areas. On the withdrawal of the ice sheets, a scrub vegetation similar to that of the present-day Arctic tundra prevailed. As the climate became milder, the land was gradually colonized by deciduous trees and smaller plants, many of them marsh-loving. The oak and beech, which dominate the residual forests of Denmark, were well established in the Bronze Age during a period of warm summers known as the Sub-Boreal, when the rainfall was low as compared with the present total, and Denmark's land area was increased by the contracting of the straits separating the Kattegat from the Baltic. Toward the end of Sub-Boreal times, viz. about 1000-800 B.C., increasing humidity gave great impetus to the spread of the beech and the fir, which grow under similar conditions of soil and climate. After about 700 B.C. damp, cold conditions were established, and in spite of a slight amelioration of climate about three centuries before the beginning of our era the beech maintained its supremacy. The Danish beech forests are, with the exception of those of southern Sweden, nearest to the north-east limit of the area within which the beech will grow; the limiting line runs through south Sweden and Königsberg in East Prussia.

Deciduous Forests

The ascendancy of the beech has, then, been a feature of Denmark's forests since the late Bronze Age. Its timber is used for tools, but it was used for smelting only if oak was not available, and so partly escaped some of the medieval destruction of the forest cover. The altitudinal limits for beech growth, or indeed for successful establishment of any temperate trees, are not reached in Denmark where the highest point is 172 m. Winds prohibit its growth in most of west Jylland, and even in the more sheltered areas there the high winds reduce it to a shrub of 6 ft. or so. This is an indication of the great strength of the onshore winds because the beech, in its prime, has a high degree of wind resistance among deciduous trees. Regeneration is difficult in the areas exposed to salt winds from the North Sea, as these dry up the young shoots. The morainic clays of east Jylland,

Sjælland, Fyn and Lolland, which often contain a good proportion of lime, support the finest beech forests, just as English beeches are best developed on chalky clays on the Chilterns and the scarps of the Downs. The chalky sub-soils of the Baltic areas of Denmark are ideal for beech growth, and its absence from certain areas at the present day is usually due to felling for cultivation or to a high-water table in the lowlying coastlands, e.g. southern Lolland, and lake margins such as those of the deeper 'kettle-hole' lakes of Sjælland. Under human control pure stands of beech develop, and in these conditions they do not regenerate naturally.

Many fine stands of timber have been preserved in the lake country for which Silkeborg is the centre. The lake margins here, like those of the islands, carry alder thickets. Some of the finest Danish beech forests are found in this area, though coniferous planting is increasing. Rold Skov is a deciduous forest which has been preserved in the heath belt of Jylland. It is mainly of beech, with some fine oaks. These forests, like the other residual types, are developed in pure stands. Until the beeches grow old and gaps begin to appear in the forest, there is very little undergrowth, saplings do not survive in the shade, and the trees do not regenerate naturally. The plantations also lack undergrowth owing to the care lavished upon them by Danish forestry experts.

Coniferous Plantations

The coniferous plantations behind the dunes of west Jylland and north Sjælland form a fair proportion of the increasing area of this type of forest. Speaking generally, spruce is planted, but only the hardy *Pinus montana* is suited to the dune areas. Coniferous trees, apart from the juniper and yew, are not native to Denmark, and the extensive stands of timber are a feature of the past 200 years. They are known as *Plantage*, as opposed to *Skov*, which denotes the old-established deciduous forests which are remnants of the original forest cover of most of the country. Extensive plantations in the dune belt occur north of Frederiksværk, by Roskilde Fjord—an old-established case associated with Asserbo castle—and behind the dunes on the western sides of Roskilde Fjord and Isefjord, but western Jylland is the main area of planting owing to the greater urgency for controlling the great dune belt. Except for the hinterlands of the narrow haffs they are commonly present behind the dune front. They are best developed in Ty and between the south end of Ringköbing Fjord and the Skalling peninsula.

Denmark's largest plantations are developed in the heath belt of central Jylland, and include the Kronhede-Klosterhede plantation south of Lemvig, the Kompedal and Gludsted plantations north-west and south-west respectively of Silkeborg, and the Högildgaard Plantage south of Herning. The timber is mainly silver fir (*Abies pectinata*), spruce (*Picea Abies*), Scots pine (*Pinus sylvestris*), Douglas fir (*Pseudotsuga taxifolia*), and (in the more exposed positions) mountain pine (*Pinus montana*). Juniper grows wild in Jylland and is fairly common in the hill-island country. It is this extensive planting of the Jylland heath which has so increased the proportion of forested land in the peninsula which now has over three-fifths of the area under forest in Denmark. Fifty years ago this proportion applied to the islands and Jylland had two-fifths only. In the islands only a quarter of the timber is coniferous.

The Distribution of Forest

Eastern Jylland and the islands are almost entirely covered by cultivated areas, but the higher land and steeper slopes still carry a good deal of forest. The well-wooded and well-drained agricultural lands are on the morainic clays which lie behind the east coast of Jylland from Randers southwards to the German frontier. This belt has the least severe climate in Jylland and is its richest and best settled area. Immediately south of Randers the belt is about 60 km. wide across the broad peninsula east of Randers, but it narrows to about 30 km. southwards except that west of Horsens it pushes the heath westward and is some 40 km. wide. It narrows to a few kilometres at Aabenraa and is about 10 km. wide at the German frontier. Other subsidiary better-drained areas carrying little natural vegetation in Jylland are: a small area near Lemvig, the peninsula north of Skive, the island of Mors in Limfjord, eastern Ty and Tyholm and the east and central areas of the northernmost part of Jylland.

In the islands there are two large areas where woodland is almost absent. A triangle of intensive cultivation with its apices at Bogease, Ringe and Kerteminde occupies the morainic plain of north Fyn. In Sjælland a triangle of similar land lies between København, Roskilde and Køge. Around these nuclei stretch wooded areas. The islands are wooded in much the same proportion as the better cultivated area of eastern Jutland, but three areas of more densely forested land occur. These are the roughly rectangular area of north-east Sjælland between Helsingør, Helsingør, Frederikssund and Klampenborg, which is an area of royal parks and castles where much fine beechwood is pre-

served; a smaller area east of Slagelse; and east-central Sjælland where a belt of well-wooded country runs from the southern end of Roskilde Fjord and, widening southward, comes to the southern coasts along the shores of Storström, Ulvsund and Fakse Bugt. The forests of this area include some spruce, but beech is again



Fig. 30. Distribution of heath and woodland

Based on distributions given on the *Geodætisk Institut's* 1 : 520,000 map (København, 1937).

dominant. The blunt peninsula of Stevns, between Køge Bugt and Fakse Bugt, is not well wooded, because, being underlain by calcareous rocks, it tends to develop downland, as do parts of Mön. The well-wooded district of north-east Jylland includes, as a strip along the east coast, the so-called 'Danish Riviera'. There is no basis for this term on the grounds of the introduction of plants native to the Riviera proper, as there is to a certain extent in the Cornish Riviera. The term, as used in Denmark, denotes rather a popular residential area which derives benefit from its sheltered position. The coastal road here is well wooded and there are fine gardens and vegetable cultivation, but sand and its flora from the beaches readily transgress on to the cultivable land especially at the northern and southern ends.

The better wooded parts of Fyn are in the hill country of the south, which includes the *Fynske Alper*. Mixed woods occur, with beech dominant. In Lolland it is the north and east of the island which has the richer forests; the south of the island consists of low marshy land, some of which lies below sea level and has been reclaimed by dyke building. The coast of Falster, along Guldborg Sund, is also well wooded. The beech is dominant in Lolland and there is very little spruce or other coniferous timber.

Downland relief and vegetation occur at their best on the chalk of Mön. The bare grass-covered downs here are reminiscent of south-east England, although they are on a much smaller scale. Beech woods occur on the moraines, especially in south-west and south-east Mön. The chalk cliffs on the south-east are 102 m. high at their summit (Sommerspiret), and where streams fall down them a type of shrub vegetation develops which is not usually found in association in Denmark. Willows line the streams, while sea buckthorn, honeysuckle, hawthorn, a little juniper, and other shrubs clothe the gulleys. Where the cliffs have a more gentle slope the scrub and woodland of small beeches reaches sea level. As the Baltic is almost tideless within the Belts and Sound, the shore below the cliffs does not demonstrate a zoning of vegetation resulting from periodic exposure of the beach.

THE DUNE AREAS

Along the west coast of Jylland, a belt of sandhills stretches from the Skalling peninsula to the Skaw and is unbroken except for sea inlets or lagoon outlets and, in the north, by occasional headlands. The drifting sands and strong sea winds of the 'Iron Coast' limit the growth of natural vegetation, and concern for the regions to landward

has brought into being the most directly unproductive cultivation in Denmark, namely, the planting of the dunes with binding grass and the hardy mountain pine (*Pinus montana*), which holds its own with difficulty against the high winds.

The lesser sand-dune regions of Denmark are to be found along the shores of Aalbæk Bugt, where the western belt of dunes is continued southward from the Skaw, and along the north-west coast of Sjælland between the northern entrances to the Great Belt and the Sound. The dune belts are in fact situated along windward shores on the tidal coasts of Denmark where the maximum extent of sandy shore is open to wind erosion at low tide. The irregularities of coast produced in a land of 'soft' texture exposed to these phenomena give rise to coastal currents which further influence dune formation and coastal vegetation.

Vegetation zones in the dune country are aligned parallel to the shore. The wet sand-worn flats exposed at low tide pass into the dunes proper which are followed on the landward side by marshes. The permanent dunes carry a scanty cover of creeping willows, low-growing leguminous creepers or shrubs, sea buckthorn, sweet briar and small, non-woody plants such as heartsease (*Viola tricolor*). These are limited mainly to the landward face and the sheltered hollows where the water table is nearer the sand surface. The wild binding grass found most commonly is *Calamagrostis*, a coarse spreading variety, now supplemented, especially on the seaward side of the dunes, by such widely used types as marram grass (*Psamma arenaria*). Within the dune belt the larger, dry, dune hollows are frequently enclosed and are tended in summer for meagre crops of coarse hay by fishermen's wives. The hay is used as winter fodder for cattle and, to a lesser degree, sheep. In these hollows and on the marshy meadows fringing the dunes, sea kale, scurvy grass, and some sedges supplement, in the areas affected by brackish water, the shrubs of the dune proper. Farther inland, the salt-marsh meadows, which in their natural state carry fescue pasture with sage bush or wormwood, sea lavender (*Statice*) and sedges, have largely been reclaimed for grazing and cultivation.

THE MARSHES AND BOGS

Marshlands are found mainly in Jylland. They are situated along the wide glacial valleys which now carry small streams, and along and behind the coasts mainly where outwash plains reach the shore, especially

around Limfjord, Isefjord, and lesser inlets of this type. South-west Jylland has marshes developed on a large scale. Most of the peninsula from the latitude of Esbjerg southward is made up of this ill-drained land, the tongue of marshes increasing in breadth as one nears the German frontier. The dune barrier in this stretch has been broken, so that the polders or reclaimed water meadows reach the sea. They are also present in the east of Fanö and Römö, whose western shores carry the remnants of the dune littoral. Although the coast of south-west Jylland has experienced steady emergence for the past millennium, there have been many difficulties in the way of adequate drainage and protection from marine inundation, not the least of which is the lack of local stone for dyke building in the deposits which were laid down in the Littorina sea. The coast is dyked so that polders are found immediately behind the sea wall. The polders carry lush grass for the most part, and tidal mud vegetation is developed mainly along the rivers, e.g. round Ribe and its silted inlet. A small heath area comes to the coast between Ballum and Emmerlev in the south.

The shores of the central and eastern sections of Limfjord carry marshland to a greater extent than those of the western end. It continues south along the east coast of Jylland to Randers and is well marked along Randers Fjord and along the Nørreå almost to Viborg. South of this latter east-west line, eastern Jylland is characterized by better drainage until southern Jylland is reached. Water meadows and marshes are not extensive in Fyn, Langeland, Samsö, Ærö, Mön, Anholt and Læsö. Lolland and Falster are marshy in their southern sections, round Rødby and Gedser respectively. The Rødby marshes are relatively large, and this area, like that around Ribe, has been subjected to devastating sea transgressions. The marshes of Sjælland occur in the west of the island: firstly, around Lammefjord, a western branch of the Isefjord, and southward to Lövenborg; secondly, around the ill-drained shores of Tissö and eastward from it; and thirdly, along the coastlands behind Knudshoved Odde and north-west of Vordingborg.

The above-mentioned areas, though damp, are subject to close human control, and many of them form rich pastures. The marshes with reeds and sedges on the lowlands are fairly readily adapted for this purpose. Two areas not yet fully reclaimed and not included under the above categories are the great peat bogs of north Jylland, the Store Vildmose, north of Limfjord, in the Aalborg neighbourhood, and the Lille Vildmose behind the east coast, immediately south of Limfjord. The acid peat of these bogs carries sphagnum moss in the



Plate 26. Sandy heath

In the foreground is unreclaimed heath; in the background the heath has been improved and settled.



Plate 27. A mere on Randbøl heath, near Vejle

Depressions in the heathland are sometimes filled with shallow meres. These ultimately become filled by plant growth and develop into bog (see Plate 28).



Plate 28. A cotton grass moor

Cotton grass (*Eriophorum angustifolium*) plays a part second only to sphagnum in peat formation. Cotton grass continues the process of peat formation in the later stages of the growth of the bog, when conditions are too dry for sphagnum.



Plate 29. Peat-stacking on a west Jylland (Jutland) bog

In this case the bog has become much drier, either through natural causes or through artificial drainage. At this stage the peat is cut and left to dry in stacks before it is used for fuel.

wettest parts around standing pools, where sedges also abound. Sweet gale (*Myrica gale*) is common, as it is on bogs at low altitudes around British mountains. Cotton grasses are another plant group which Denmark shares with the peat bogs of this country. Ling is found on the drier fringes of the bogs. These remnants of two desolate peat bogs are exceptional in a country where even the heathland is gradually being reclaimed for cultivation. Their vegetation run-off and acidity are such that only extensive drainage, burning and levelling, followed by dressings with lime, clay, calcareous marl, potash and phosphates, would make cultivation possible. The acreage of peat bogs in Denmark was 700 sq. km. about 1900. It has since been reduced to about 500 sq. km.

THE HEATHS

The heathlands of central Jylland are characteristic of the hill islands and outwash plains, away from the river courses (see Chapter 1). They have been greatly altered in character and reduced in area, since the loss of part of Slesvig to Germany in 1864 gave an impetus to the improvement of the more unproductive parts of Jylland. The Danish Heath Society was formed (see p. 227), and under its direction still more of the natural vegetation of Denmark became replaced by cultivated areas.

In Jylland patches of heath extend in a relatively narrow belt along the east coast from the Skaw to the neighbourhood of Hals on Limfjord. From this coastal strip a branch reaches north-eastward toward Hjörning. South of Limfjord the coast belt of heath is very narrow and is broken by the Lille Vildmose, but it persists as far south as Mariager Fjord where marshlands reach the coast. Small patches of heath occur on the broad peninsula east of Randers. Farther south in east Jylland heaths are rare and local in distribution, but the island of Læsö is almost entirely heathland, and Anholt has heath in the interior.

The main heath belt in Jylland develops about 5 km. south of Aalborg on Limfjord and runs in a broken belt, about 35 km. wide, to Mariager Fjord where the inner shores are firm and heath-covered. At Hobro the heathland belt divides and a blunt tongue continues the north-south line to Randers Fjord where marsh replaces heath. A narrower western belt runs west to the southern coast of Limfjord. The marshes fringing the Skals Aa impinge upon this latter belt in the south, but south of Viborg lies the sandy hill-island country on which heath is widespread. Although modified to-day in many

places, the heath area stretches southward in a belt as much as about 70 km. wide at the latitude of Silkeborg. It reaches from the marshy lagoon shores of western Jylland to the intensively cultivated morainic hills of east Jylland. The heathland narrows, as the peninsula itself narrows, south of Blaavands Huk, and near Brörup it dies out. Much reclamation has been undertaken in this southern section.

In this major area of heaths wide variations and transitional types may be observed, especially in the intrusion of cultivated stretches, but, speaking generally, heaths and coarse grass may be found above the valleys which may be marshy and carry water meadows and natural woodland, especially oak scrub. This applies especially to the marshy valleys round Herning, and west of Silkeborg, which are deep and sheltered as compared with the sandy hill sides. Here the establishment of wind belts is often necessary to the setting up of farms.

The heaths now cover some 2,000 sq. km. as compared with 6,000 sq. km. in 1865 before the Danish Heath Society began its work. Prior to this latter date, heath had been increasing in the drier areas of Jylland, especially since much natural timber was cleared in the medieval period for smelting the bog iron ore found in pockets there.

The untouched heath is dominated by ling (*Calluna*), bilberry, and dwarf willows in the drier parts. English gorse (*Ulex europaeus*) grows only where planted, and the heaths, where least altered, have in late summer the rich tints of the upland moors of Britain, but at other times are dark in colour and unrelieved by the spring flowering of *U. europaeus*, or the autumn gold of the low growing *U. minor*. Where the soil is impermeable, mosses and cross-leaved heath (*Erica Tetralix*) begin to appear and suggest a transition to peat-bog vegetation which appears in the ill-drained areas, and which produces cotton grass, sedges, and the associated plants already mentioned.

Chapter V

THE PEOPLE

Physical Characteristics: Language: Religion: Social and Economic Organization

PHYSICAL CHARACTERISTICS

The small size of Denmark and the uniformity of its relief do not lend themselves to wide differences in the physical characteristics of regional populations. But although there are no obstacles to intermixture of different stocks, intermarriage has not produced uniformity of physical type among Danes, any more than it has among other European nations. In Denmark, as elsewhere, the population consists of a number of physical types living side by side with, in this case, a strong sense of social solidarity and a warm sentiment of nationality which have grown against a background of social emancipation, democratic expression, free institutions, and an enlightened education. Similarity of historical development and experience, common traditions, and affinities of culture and milieu, not physical attributes and genetic composition, are the germs from which nationality is born, and social features such as language, religion, literature and education are the sustenance on which it draws for life. Biological differences, such as variations in stature, colouring, face and head form, and physique, which are forms of growth arising from diversities of physical inheritance, are of small consequence in European nationality compared with social and cultural incompatibilities. The so-called 'racial' minorities in any country are cultural and linguistic entities and are rarely, if ever, distinct biological groups which approximate to a particular pattern of physical form.

The Danes are predominantly fair in colouring, moderate in stature and thick-set in build. True blond colouring is not so common as in Sweden, and flaxen hair combined with blue or grey eyes does not occur in more than about one-sixth of the adult population, but light brown hair, which would be termed fair in Britain, and medium brown hair are very common in association with blue or grey eyes. This fair colouring is by no means always associated with the tall stature, and the long narrow head, face and nose which usually go together in the so-called 'Nordic' type. Fair colouring is a widespread feature in the northern lands and has probably arisen through an

early loss of pigment in this region of cloudy skies. In Denmark, as also in north Europe generally, fair colouring occurs in association with long-headedness and broad-headedness, and with tall and short stature alike. Tall, fair, narrow-faced long-heads are not so common as in Norway and Sweden, or even in certain parts of Germany, especially Slesvig, Oldenburg and East Prussia, but they occur everywhere and are most common in Jylland and Fyn and among the upper classes in the other islands. They are generally less tall, less blond and less long-headed and narrow-featured in Denmark than in Norway and Sweden where the type occurs in its purest form.

In the eastern regions of the country fair colouring occurs in association with broad heads, squarish faces with concave noses, medium to short stature, and heavy thick-set build. Such an association of physical characteristics is widely distributed in the lands to the east of the Baltic and is therefore often referred to as the East Baltic type; it occurs commonly in western Russia and the Baltic states and enters considerably into the composition of the population of the eastern part of the North German plain.

A widespread element in the Danish population is a broad-headed type with strong bony development which expresses itself in broad cheekbones, strong heavy jaws, prominent brow ridges, with fine foreheads and high-pitched heads, robust big-boned physique and stature which is usually above the average. Light brown hair is more common than blond tints, and the eyes may carry some pigment to give greenish or hazel shades. The above skeletal features are known from burials dating from the Bronze Age and containing, among other grave finds, pots known to archaeologists as Beakers. For this reason the type is sometimes known as the Beaker type, but perhaps a more appropriate name in Denmark is the Borreby type, often so-called from a type-site at Borreby in Sjælland. These robust, big-headed men are also common in eastern England, from Yorkshire to the Thames, where they have provided the pattern for the conventional drawings of John Bull.

Although fair types predominate, dark-haired, brown-eyed and even swarthy-skinned people are by no means absent. Denmark differs from Britain in that dark colouring occurs probably more frequently in association with broad-headedness than with long-headedness in Denmark. One element is similar to that found along the coasts of south-west Norway. It combines with dark colouring, a broad head and face, square jaw, heavy build and medium to tall stature. Such people are well known in small populations, often

widely separated, along the west coasts of Europe from the Mediterranean through north-west Spain, Brittany, western Britain, the Orkneys and Shetlands to Norway, and are probably the results of a spread by sea during the Bronze Age.

Another element, less dark in colouring, is the short, bullet-headed round-faced, snub-nosed type which, from its wide distribution in the mountain belt of central Europe, is usually referred to as the Alpine type. These peoples have spread northward from their meagre mountainous homeland to the more spacious northern lands since early times, usually as a peasant stock, and their bony morphology has often become associated with fair colouring.

Slim, small-boned, fine-featured, swarthy long-heads, of both short and tall stature, and belonging to the so-called 'Mediterranean' type also occur, but they are markedly less prominent than in Britain.

Immigration of foreigners in historic times, such as that of charcoal burners from the Ardennes to the forests of north Sjælland in the twelfth century or the settlement of Huguenots in Fredericia in 1720, has not left any distinct traces in the appearance of the population, and even the Dutch families which Christian II brought to Amager retain their historical associations by the survival of their native costume rather than by differences in physique. The Jews, who have long found asylum in the country, especially in Köbenhavn, are too few in number to be a physically distinctive element, especially since Jews everywhere comprise several physical types.

LANGUAGE

The Danish language is the medium of conversation, education, worship, journalism and business throughout the country with the exception of the southern part of Jylland, where there is a small but very vocal German element. In this area German is in common use side by side with Danish (see Appendix II).

The Danish language belongs to the northern branch of the Germanic group of the Indo-European languages. The North Germanic languages included all the languages of Scandinavia, and they became differentiated early from the East Germanic languages, now extinct, and from the West Germanic group from which English, Frisian, Dutch, Flemish, Low German and High German developed. The North Germanic branch, in turn, became divided into West Norse, from which the Norwegian and Icelandic tongues have arisen, and East Norse which developed into Danish and Swedish. But, during the

period when Norway was united with Denmark under a common king (1397-1814), Danish was the official and literary language of the country, and it became modified in pronunciation, spelling, vocabulary and idiom to become the Norse Riksmål, which has remained the literary language of Norway although it has recently been in competition with Norse Landsmål which was formed by a synthesis of rural dialects of West Norse stock during the nineteenth century. Thus the languages of Norway, Sweden and Denmark possess a broad substratum of common characteristics and are mutually intelligible in their written forms and, with slightly greater difficulty, in their spoken forms, so that Danes, Norwegians, and Swedes can carry on conversation, and, less easily, even discussion, with each group speaking its own language. In medieval times Danish, like the other Scandinavian languages, assimilated into its vocabulary a large number of German words as a result of the commercial activities of the Hansa which established depots in the ports. These borrowings were mainly from Low German, but more recently the literature and culture of Germany has introduced many High German elements so that modern Danish has many verbal similarities with both Dutch and German. Although the literary language is uniform throughout the country, Jylland and several of the islands, especially Bornholm, have their own dialects.

German and English are taught as accessory languages in the middle and high schools and are widely understood and often spoken adequately, if not always easily, by a considerable proportion of young and middle-aged Danes, not only in Köbenhavn but also in the towns and rural areas.

RELIGION

The Reformation triumphed in Denmark twenty-one years after Luther had nailed his 'nineteen propositions' on the door of the cathedral at Wittenberg. Lutheran ideas spread easily from Germany and gained strength, especially in the towns. Religious issues became bound up with the accession to the throne and led to the Count's War (see pp. 112-14). Two years after the accession of Christian III in 1534 the Catholic bishops were deposed by the king and his Council, their estates were confiscated, and the Lutheran Church became the established church of Denmark; there was no counter-Reformation. During the next three hundred years Danish subjects had to profess the Lutheran faith, although Catholics, Reformists and Jews were



Plate 30. Roskilde cathedral

Until the Reformation, Roskilde was the seat of the Bishops of Sjælland; its cathedral has remained the most famous in Denmark, and here most of the Danish kings have been buried. The cathedral was founded early in the twelfth century, rebuilt after a fire in 1282, and restored frequently. The building is of red brick, but the brick of the interior walls is partly covered with white plaster.



Plate 31. Ribe cathedral

The small town of Ribe, which was a port of some significance in medieval times, was built on low ground above the marshes. The site is dominated by the splendid Romanesque cathedral which dates from the first half of the twelfth century.



Plate 32. Viborg cathedral

The cathedral dates from the twelfth century but was rebuilt in granite during 1864-76. The interior contains huge frescoes, by Joakim Skovgaard, of biblical subjects.



Plate 33. A typical village church

granted the right to live in certain towns. The constitution of 1849 introduced religious liberty, civil marriage and burial, but it also laid down that the Evangelical Lutheran Church should be the established church and that it should be supported by the state. In 1868 voluntary congregations were permitted without secession from the church, so that congregations may choose and support their own clergymen and still hold the right to use the buildings of the established church. Free congregations may also be formed outside the established church and they possess full freedom of conscience and public worship.

Denmark is far less divided into religious denominations than many other countries. Religious movements have seldom become sectarian, and the great majority of the population are members of the Evangelical Lutheran Church. The following table gives the number of adherents to the several religious sects at the enumeration of 1921:

Evangelical Lutheran	3,200,372	Methodists	4,858
Roman Catholic	22,137	Irvingites	3,459
Baptists	6,989	Adventists	2,622
Jews	5,947	Reformists	1,164

The country is divided into nine dioceses, namely, Aalborg, Viborg, Aarhus, Ribe and Haderslev in Jylland, and Köbenhavn, Roskilde, Lolland-Falster and Fyn in the islands. There are not so many ecclesiastical ranks as in England. The 9 bishops and the 94 deans supervise the parish clergy who number about thirteen hundred. The church members over 25 years of age in each parish elect every four years a congregational council of 6-15 members which administers the church property in the parish and has much influence in the arrangement of services and in the allocation of clerical appointments. The clergymen are paid a fixed annual salary, partly out of the voluntary contributions of the parishioners and partly out of a central fund.

Laws affecting the church are passed by the Crown and Parliament in the same way as other laws, and the appointments to clerical offices are in the hands of the state which administers them through the Ministry of Ecclesiastical Affairs.

The Danes are not deeply committed to organized religion. There is a great deal of agnosticism and freethought. The state Church is liberal in doctrine and practice, but the sect known as the Home Mission (*Indre Mission*), while remaining within the Church, has a much more rigid theology and represents puritan tendencies.

SOCIAL AND ECONOMIC ORGANIZATION

Danish society is largely free from class barriers based on either family descent or wealth. Feudal survivals are few and faint and the members of the nobility who claim their titles are small in number: no new titles have been created for over a century. Although some two hundred families still hold noble rank, they enjoy no privileges and the Court plays a far less important part in social life than it does in England. The middle class, unlike the upper class, is both numerous and influential, and it includes professional men, artisans and business men, farmers and many smallholders. The labourers in both agri-

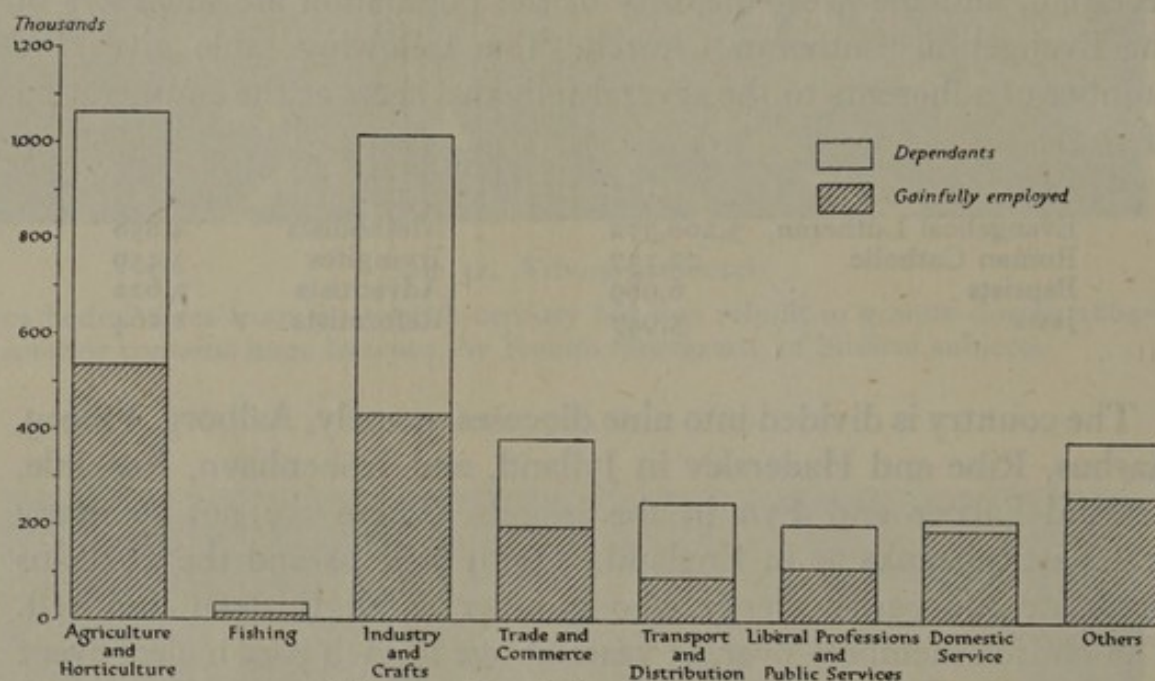


Fig. 31. Population by occupation

Based on data in *Statistisk Aarbog*, 1939, pp. 16-21 (Köbenhavn, 1939).

culture and industry come very near to the middle class in their standard of living. The level of income and of wealth is remarkably uniform and, if there are few large fortunes, cases of poverty and destitution are still fewer. The Danes have achieved, in large measure, Grundtvig's ambition of a nation in which few should have too much and fewer still too little. East Jylland and the islands have many manor houses set among broad acres, but even in Köbenhavn there are no slum quarters, and hovels can be found only by searching; beggars are absent. The state has undertaken the provision of public relief with dignity, and as a responsibility rather than as a charity.

According to the census of 1930, which provides the most recent details, the number of people engaged in different occupations was

about 1.8 million, and these supported a slightly smaller number of dependants. The proportions engaged in the various occupation groups are shown in Fig. 31.

The Farming Community

The half-million people actually engaged in agriculture support an approximately equal number of dependants. Some 194,000 of the active workers are farmers, peasant proprietors and smallholders; only about 35,000 are agricultural labourers. Among the farming population, five categories can be distinguished, namely, the large estate owners, the 'proprietors', the farmers, the smallholders, and the agricultural labourers. These categories are not separated by wide social gulfs, and the divisions between them are often barely perceptible, so that class feeling has not developed. On the contrary, there is a strong sense of fellowship and of community of interests.

The owners of large estates are mainly members of the aristocracy who work their estates with tenants and hired labour. Since, however, land is taxed according to its market value and not by its production, it is not easy to farm by proxy and live on rents. The second group, the 'proprietors', consists of diverse elements. Some are farmers who have acquired wealth and property by their own labours, others are tradesfolk, industrialists and bankers who have invested their fortunes in land, and others have acquired their estates by inheritance. These two classes number less than 2,000.

The farmers and smallholders form the mass of the farming population. They usually own their farms in title, although often they have acquired this title only by borrowing capital from the lending societies against mortgages on their property (see p. 336). This, however, gives them a sense of ownership and full control over their land. They pay rent in the form of interest on mortgages. They and their families largely till their land and employ little hired labour.

The farmers, or *Gaarmænd*, numbered some 95,000 in 1930 and supported a further 194,000 people. Their holdings range from about 10 to 100 ha. The farmhouse is sometimes in the village, but more often nowadays it is set amid the fields to which it has been moved out within the last hundred years. The house is usually well built; it is rarely very old. In the living room the farmer and his servants, if he has any, have their meals together at a long trestle table with wooden benches. Books are usually numerous, and the farmer often has a desk or special table at which he works at his accounts and

correspondence; he may have a special office. A telephone and radio receiver are usual. The parlour is the formal room where visitors are received and entertained. The outhouses are generally modern and well built, including well-appointed dairies, byres, and pig-styes, and there is usually a garage for the family car. The outbuildings, like the house, are commonly lighted by electricity from the public supply, but it is less usual for water to be laid on. Water is mostly drawn from wells by pumps. The pumps are sometimes operated by windmills and feed storage tanks. In such cases water is piped to the house and outbuildings, and sometimes to troughs in the nearer fields. The outhouses contain a much greater variety of machinery than would be found in farms of equal size in this country.

The farmer is usually well-read and deeply interested in politics, economics and social welfare, about which he is well-informed. He may have attended a Folk High School as a young man, perhaps also an agricultural school. He is accustomed to asking for, and taking, expert advice from agricultural specialists, and regards scientific research and its results as matters of practical interest and use rather than as the suspected hobbies of academic personnel. He keeps up-to-date in world affairs and is conscious of their close influence on his sales and purchases.

Since the farm is run as a family farm, home life is well developed and includes the servants with whom the members of the family work on equal footing. The womenfolk do not, as a rule, engage in field work except at lighter tasks during harvest time. Their work deals with the house and its cleaning, the preparation of meals and work in the dairy. Only on the large farms are the hours of work strictly defined. Work starts early, between 4 and 5 a.m., because the morning's milk must be at the dairy usually by 6.30 a.m. Dinner is generally at 12.30 or 1 p.m. Work begins again about 2 p.m. and continues until dusk.

The smallholder, or *Husmænd*, owns a cottage and a plot of land, usually less than 10 ha. in extent, which he has acquired with the assistance of the state and with capital borrowed from credit and mortgage associations. He and his family work the holding through long hours and with little help from machinery. On these small properties the women take a large part in outdoor work. The cottages are well-built, colour-washed, and roofed with tiles or thatched. But, if the smallholder's acres are few, the range of his outlook and interests is not limited by the boundaries of his fields. He takes the same interest as the farmer in world affairs, and shares with him the



Plate 34. Egeskov castle in Fyn (Fünen)

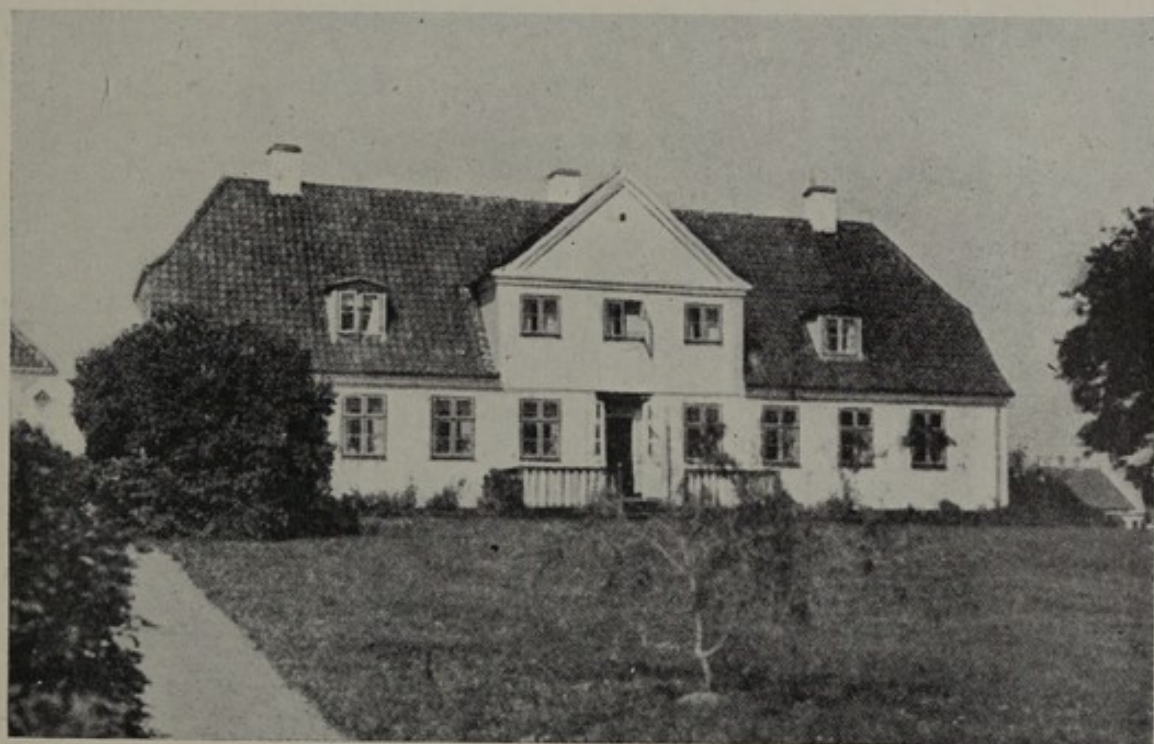


Plate 35. A modern peasant farm

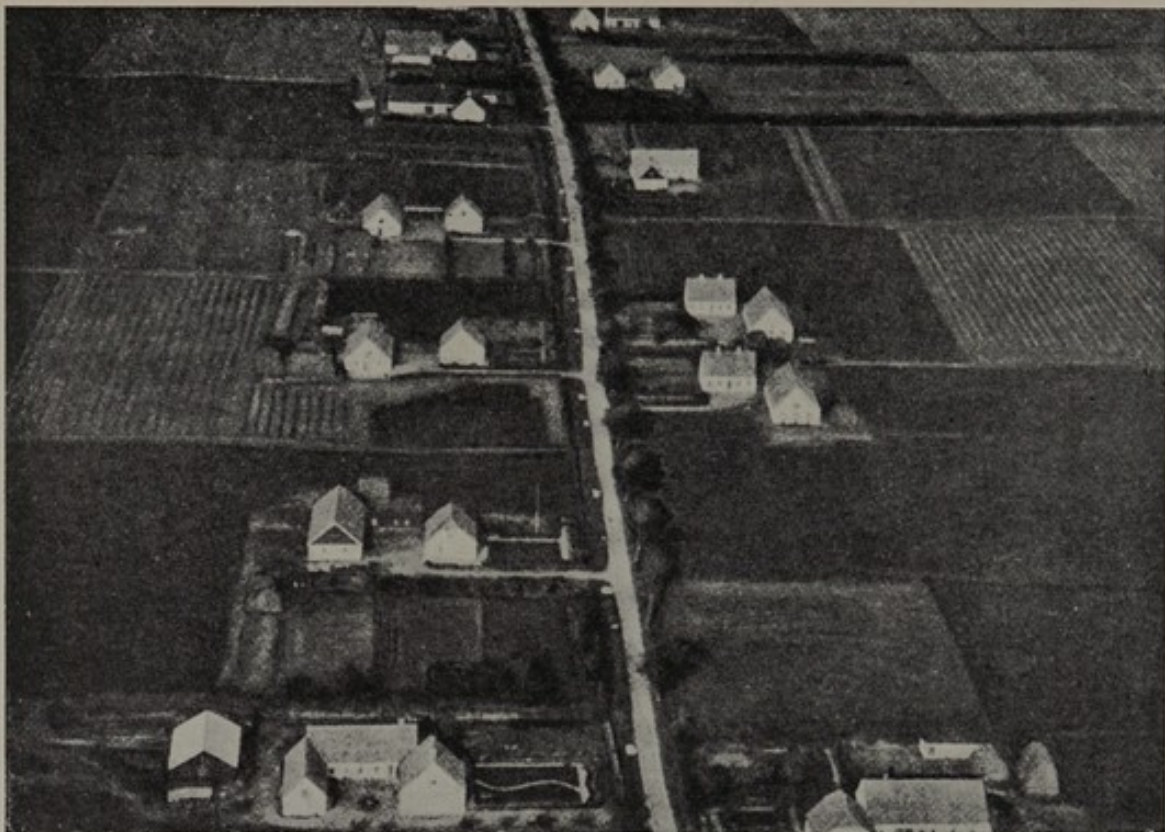


Plate 36. Small holdings established, by state aid, on land parcelled out from a large estate



Plate 37. A suburban summer-house

A large proportion of the population of Köbenhavn (Copenhagen) lives in flats but many own plots in the outskirts where they till their gardens and spend weekends and holidays.

advantages of co-operative buying and selling. His small property does not debar him from taking a prominent part in village affairs, and he may find his seat not only on village committees but also in parliament. The smallholders numbered 96,000 in 1930 and supported a further 210,000. Tenant farmers form only about 5% of the agricultural holders and are found mainly on estates. More than a half of them are lease-holders with leases usually for six, seven or eight years, but there are also many life leases.

Farm servants numbered about 183,000 in 1934. If single, they live usually as members of the family for which they work; if married, they occupy a cottage, on the farm if it is a large one, but more often in the village. While the labourer whose luggage consisted mainly of books is not universal he is more characteristic than the rustic. Many farm servants are the sons of peasant farmers who work on farms for experience before assuming the responsibilities of their own holdings. Others will work until they have saved sufficient money to set themselves up, with loans, as smallholders. The ladder of advancement from labourer to peasant farmer and even to estate owner is unbroken.

Although the homesteads have now been largely moved out from the villages, these are still the centres of rural life. The village clusters around the village church with its white-washed walls and red-tiled roofs with step gables. The houses are usually detached and stand back from the road. The village hall is the centre for folk-dancing, discussion groups and lectures. Water supply is from pumps and village sewage schemes are rare.

Earnings and Wages. The total family earnings for the years 1936-8, and also a long period average, are given in the following table. These figures show the value of average net earnings after costs of production, including interest on loans, had been met and they include salary for management of the properties.

Size of farm acres	Average total family earnings per property		Normal average earnings	No. of holdings in whole country
	1936-7	1937-8		1935
Under 25	£ s. 45 9	£ s. 59 0	£ s. 85 0	104,600
25-125	48 8	97 13	144 0	91,140
Over 125	—	86 5	233 0	9,124

Source: W. H. Pedley, 'Social Life in Rural Denmark', *Journ. Roy. Agric. Soc.* vol. c, p. 29 (London, 1940).

Earnings in 1936-8 were well below average and, while neither figure is large, close comparisons of amounts with those in England are dangerous since costs of living differ. On the whole the incomes are lower than those derived from holdings of similar size in England, but in Denmark the money goes further. Generally the farmers (*Gaarmænd*) live comfortably. Their needs are not great, the cost of their food, coming as it does mainly from the farms, is low and the availability of credit, loans and a comprehensive system of social insurance and pensions gives them a considerable measure of security against bad seasons, sickness and old age. The lot of the smallholder is harder and his earnings, despite longer hours and more hand labour, are smaller. His food, while wholesome, is more monotonous and consists largely of porridge, rye bread, margarine, cheese, pork, vegetables, milk and coffee. A motor car is beyond his means, and even a motor cycle is a luxury.

The standard of living of the married labourer is not unlike that of the smallholder, but the unmarried labourer is usually better off. While his wages are not large, his immediate needs of food and shelter are provided by his employer. He may spend £6 or £7 a year on clothes, and his weekly spendings are usually between 3s. 6d. and 7s. 6d.

The wages of agricultural labourers in 1936-9 were:

	Men		Foremen	Females	
	17-21	Over 21		Under 18	Over 18
	kr.	kr.	kr.	kr.	kr.
1938-9:					
Summer and autumn	493	578	638	241	304
Winter	300	355	389	206	267
1937-8:					
Summer and autumn	448	533	585	226	287
Winter	270	325	356	195	248
1936-7:					
Summer and autumn	401	475	519	214	273
Winter	246	288	315	184	231

Source: *Statistisk Aarbog*, 1939, p. 148 (Köbenhavn, 1939).

Wages of day labourers in 1938-9 ranged from 4.40 kroner a day in winter to 6 kroner in autumn if fed by the farmer, and from 5.76 to 7.21 kroner if they provided their own food.

Unemployment insurance for agricultural workers is a voluntary scheme organized through approved societies, but only a small number contribute to it since unemployment in agriculture is small. The hours of work in agriculture have been laid down as 10 hr. a day from April

to October, $8\frac{1}{2}$ – $9\frac{1}{2}$ hr. in November and March, and 8 hr. from December to February. These regulations, however, apply only to day labourers, since the farm servants work, as they live, with the family. In 1939 a scheme of holidays with pay was instituted, in which farm workers and labourers were included if they had worked 25 weeks of the year on one farm. In that year they received a six-day holiday which was to be extended to twelve days in, and after, 1940.

The Industrial Population

Industry and crafts occupied some 430,000 people and supported a further 585,000 in 1930. Many of these industries arise directly from agriculture. For example, dairies and food industries employed 48,508 people and supported a further 67,098 people. The largest single group of industrial workers was formed by those engaged in metal industries which employed some 76,000 people. The timber and furniture industry employed 72,000 and the textile and clothing industries employed 52,000 people. The chief other groups were the leather and shoe industry with 14,000 employees, the stone, clay and glass industries with 13,000 people, and the paper and book trades with 15,000 people.

One-third of the population employed and supported by industry live in København and its suburbs, although their total population forms rather less than a quarter of the total population of the country. One-half of the industrial population lives in the provincial towns and larger villages, mainly in the chief centres such as Aarhus and Odense, Aalborg–Nørre-Sundby, Randers and Vejle.

In Denmark the industrial and farming populations are not widely divorced in character, origin or interests. Industry is not segregated in large industrial regions within the country or in vast industrial quarters in the towns. In most of the towns the industries are hardly conspicuous, and the industrial population is in close contact with the farming community both because the country lies around them everywhere and because their activities are often closely interdependent. Many of the industrial workers are sons and daughters of farmers, and the link with the soil is never very distant. There is the inevitable clash of interests which arises from the wish of the industrial workers for a greater measure of protection for their industries from foreign competition, and the desire and need of the farming population for as large a measure of free trade as possible to increase their sales abroad and to encourage industrial purchases from the buyers of their farm produce. Subsidies for agricultural

exports, which are sometimes financed in part by a charge on home sales, is another topic of disagreement, but behind the arguments there is usually a wide measure of understanding that the industrial sales, at home and abroad, depend largely on the prosperity of agriculture.

Industrial concerns are usually small, and the relations between employers and employees are generally good and intimate. Denmark, like France, has many family businesses which have been handed from father to son, and in which the employer knows his employees personally.

Earnings and Wages. Wages in industry are not very different from those earned by workers in similar trades in Britain. The average wages per hour in different trades in 1938 were:

	Öre per hour			Öre per hour	
	Köben- havn	Pro- vinces		Köben- havn	Pro- vinces
Artisans:			Workers in:		
Masons	251	163	Sugar industry	161	136
Carpenters	217	152	Cement industry	—	159
Painters	206	161	Oil industry	156	158
Joiners	200	149	Brewing industry	155	144
Lithographers	197	167	Textile industry	150	131
Saddlers and Up- holsterers	196	153	Iron and Steel	148	134
Tin workers	195	147	Ceramic industry	147	136
Ships' carpenters	189	162	Paper industry	138	137
Ceramic workers	187	149	Printing industry	137	128
Bookbinders	187	143	Wood working in- dustry	134	116
Smiths	183	154	Female workers in:		
Printers	181	166	Tobacco industry	127	126
Electricians	177	155	Ceramic industry	112	80
Boot and Shoe workers	169	126	Bookbinding industry	103	82
Mechanics	168	132	Textile industry	101	89
Gold, Silver and Electroplate workers	167	145	Boot and Shoe industry	98	80
Brass workers	161	145	Paper industry	94	86
Bakers	158	130	Printing industry	94	76
Millers	150	134	Chocolate industry	79	70
			Laundry industry	79	73

Source: *Statistisk Aarbog*, 1939, p. 147 (Köbenhavn, 1939).

Wages in industry, even in unskilled trades, are considerably higher than those paid to farm servants and labourers, hours are shorter, amusements and amenities are more numerous.

An eight-hour day has been in force since 1919 for trades with regular day and night shifts, but although the eight-hour day is usual in industry generally, there is no specific legislation to enforce it.

Work on Church holidays is forbidden. Children under 14 years of age may not be employed in handicrafts, industry or transport, and those between 14 and 18 years of age may not work between 7 p.m. and 6 a.m. but night work is not prohibited for women in industry.

Occupational diseases and industrial accidents are covered by an insurance scheme, which is financed by employers as a charge on production (see p. 179). Unemployment insurance is organized in trades through trade unions which compel all their members to contribute to the unemployment fund of their particular trade. The state and the communes make contributions to these funds according

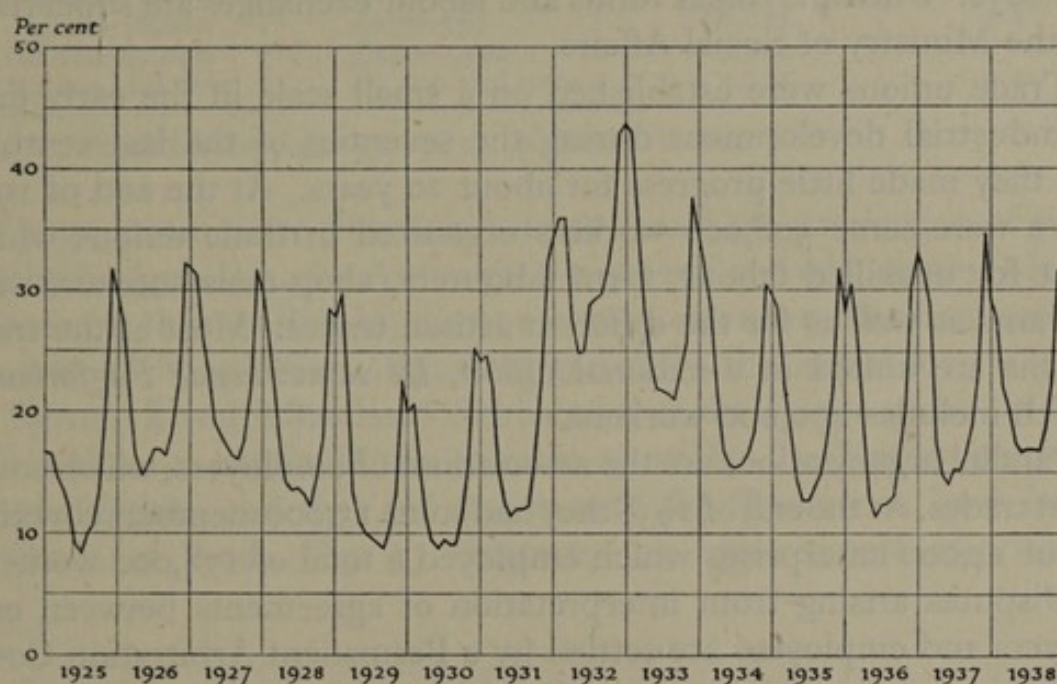


Fig. 32. Percentage of unemployment among insured workers in all trades

Based on data in *Statistiske Meddelelser* (København, 1926-39).

The figures are plotted by months and bring out the influence of seasonal occupations.

to the average income of the members of the trade. The state pays 15% of the members' contributions where earnings are 4,000 kr. or more, increasing to 90% where they are 2,000 kr. or less. The local authorities contribute one-third of the state's share. To receive benefits, workers must have been members of the fund for 12 months and have been employed for 26 weeks in three years or 52 weeks in five years. No benefits are paid during strikes and lock-outs or during unemployment due to voluntary leaving, dismissal for misconduct or refusal of suitable work. The maximum benefits were 3 kroner a day for persons without dependants and 4 kroner a day for persons with dependants, but the total benefit might not exceed two-thirds of the

average earnings in the claimant's occupation. Partial benefits were paid if the hours of work had been reduced by more than one-third. Such payments were made at rates which made it more advantageous to obtain employment than benefit. Persons incapacitated for work or not employed, at the time of application, in the occupation for which the fund is established, are excluded from membership, as are also those owning property valued at between 8,000 and 18,000 kr., varying with marital status and the type of property owned. Benefits are payable for not less than 90 days in a year, and a continuation benefit, financed by reserve funds, may be paid for not more than 140 days. Unemployment funds and labour exchanges are supervised by the Ministry of Social Affairs.

Trade unions were established on a small scale in the early days of industrial development during the seventies of the last century, but they made little progress for about 20 years. At the end of 1938 there were some 508,000 workers organized in trade unions which exist for unskilled labour, farm labourers, shop assistants and civil servants as well as for the different artisan trades. Most of the trade unions are united in a national union, *De samvirkende Fagforbund*, which includes 470,000 workers.

Parallel organizations are the associations of employers, which cover most trades. At the end of 1938 they had some 15,000 members covering about 14,000 enterprises which employed a total of 178,000 workers.

Disputes arising from interpretation of agreements between employers and employees are settled by a Permanent Arbitration Court consisting of six members, appointed in equal numbers by the chief trade unions and employers' associations and presided over by a jurist chosen usually by the six ordinary members. There is also a public Conciliation Board which mediates between parties to avoid stoppage of work on the expiration of agreements. During the ten years before the outbreak of war strikes and lock-outs were few, owing largely to the effectiveness of the machinery for conciliation and arbitration. The largest stoppage was in 1936, when nearly three million working days were lost, mainly in lock-outs which affected nearly a million workers. In 1937 and 1938 the number of working days lost were 21,000 and 90,000 respectively and the corresponding numbers of workers involved were 1,372 and 3,650 respectively.

Standard of Living

The level of incomes in Denmark is, by comparison with Britain, markedly uniform. The latest data relating to incomes are for 1930

which, although unsatisfactory in that they relate to a time when the depression was beginning to settle over the country, are adequate to indicate the general features in spite of the changes in economic conditions and in the value of money which occurred after the depression. In 1930 the number of incomes at different levels were:

Annual income kr.	Sterling at prevailing rate of exchange (18.16 kr. = £1)	No. of incomes	% of population with declared income
Under 3,000	Under £165	956,232	76.8
3,000—5,000	£165—275	203,746	16.3
5,000—10,000	£275—550	66,811	5.4
10,000—20,000	£550—1,100	13,792	1.1
20,000 and over	£1,100 and over	5,231	0.4

Source: *Statistisk Aarbog*, 1939, p. 22 (Köbenhavn, 1939).

Large incomes are therefore very few, and the proportion of small family budgets is high. Although the general run of incomes is lower in amount than in Britain, direct comparisons are misleading because the cost of living differs. Speaking generally, the cost of food is lower in Denmark and it has been estimated that the Danes spend on food about three-quarters of the amount spent by the British per head of population, and that for this money the Danes can have larger amounts of food. Fig. 33 illustrates an approximate comparison

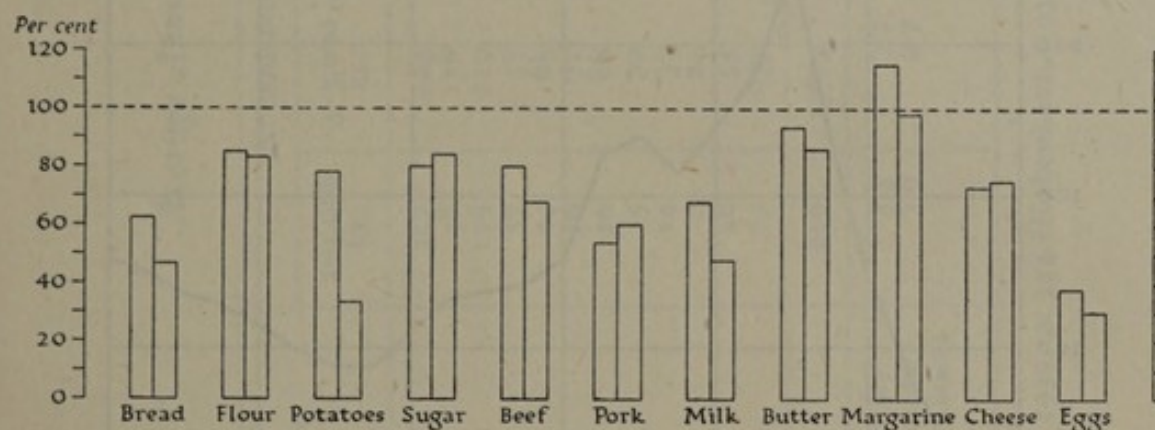


Fig. 33. The retail prices of food in Denmark as compared with those in Britain

Based on a diagram in P. L. Yates, *Food Production in Western Europe*, p. 96 (London, 1940).

The broken horizontal line at 100 indicates the average price of each commodity in Britain, and the columns indicate by what proportion the Danish price is below or above it. The left-hand column, for each commodity, refers to prices in 1927-9, and the right-hand column refers to prices in 1936-8. The prices for bread refer to wheaten bread in England and to rye bread in Denmark, since the latter is the usual food in Denmark. The diagram gives an approximate comparison, since quality varies.

between the principal articles of food in the two countries and shows how most foods are substantially cheaper than in Britain.

On the whole the Danes live well. The consumption of some of the chief foods per head per annum is given in the following table:

Average 1935-8		Average 1935-8	
Butter	8.7 kg.	Tea	0.16 kg.
Bacon	28.7 "	Margarine	21.1 "
Meat	26.3 "	Spirits	1.1 litres
Rye flour	42.66 "	Strong beer	36.8 "
Wheat flour	46.2 "	Weak ale	19.7 "
Barley	1.5 "	Cigars	118
Oats	2.7 "	Cigarillos	106
Sugar	50.1 "	Cigarettes	390
Coffee	7.5 "	Pipe tobacco	0.66 kg.

Source: *Statistisk Aarbog*, 1939, p. 113 (Köbenhavn, 1939).

A study of 484 family budgets in 1931 gave the details of expenditure shown on p. 99.

The cost of living index has moved as shown in Fig. 34 since 1914. Real wages, as distinct from monetary wages, rose between 1929 and 1933, but since then they have fallen as a result of the rise in prices after the slump. The cost of living increased by about 18% between 1933 and 1938 as compared with about 6% in Britain.

Index Number

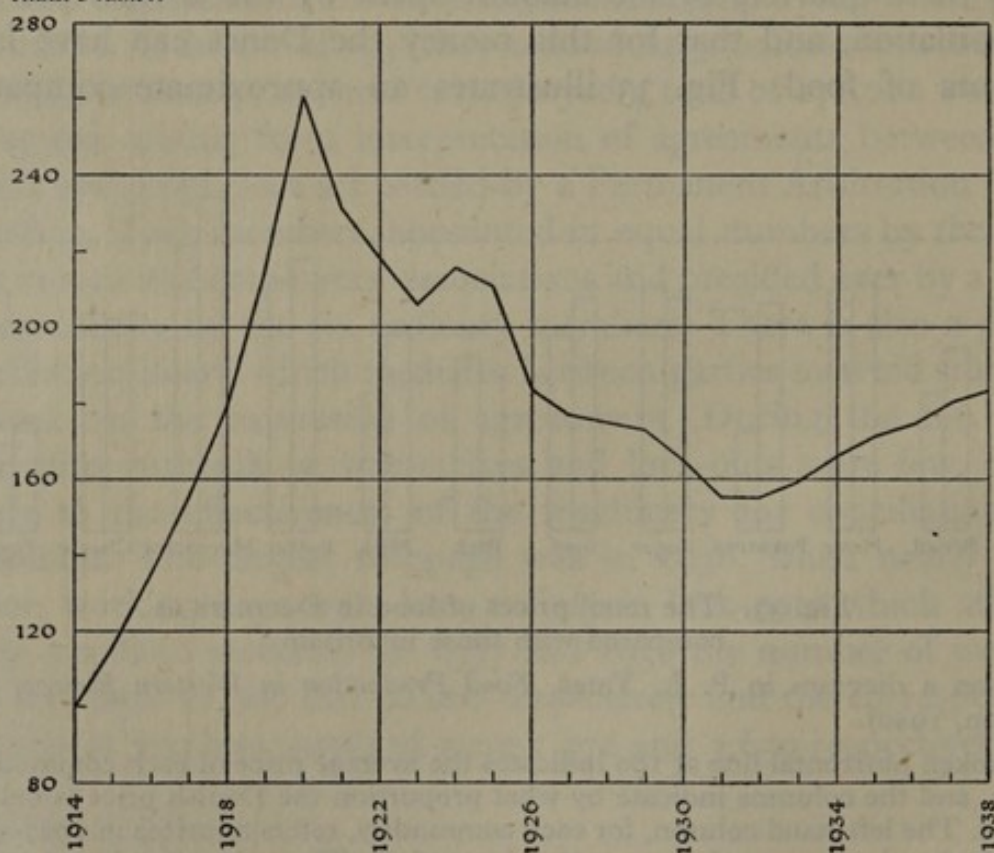


Fig. 34. Movement of the cost of living index, 1914-38 (1914=100)

Based on data in *Statistisk Aarbog*, 1939, p. 116 (Köbenhavn, 1939).

Average Annual Expenditure per Adult Male

Annual expenditure of family	Köbenhavn			Provincial towns			Rural communes		
	2-3,000 kr.	3-5,000 kr.	Over 5,000 kr.	1-3,000 kr.	3-5,000 kr.	Over 5,000 kr.	1-2,000 kr.	2-3,000 kr.	Over 3,000 kr.
Food	347	484	508	331	372	355	245	287	332
Clothing	48	158	164	92	146	157	67	80	121
Housing	178	219	206	142	170	171	85	98	138
Heat and light	37	57	53	58	65	54	46	48	60
Personal taxes	24	65	64	36	67	84	9	16	41
Spirits and tobacco	16	71	79	30	43	42	23	28	32
Furniture	20	88	87	31	52	78	24	27	54
Subscriptions	5	20	16	11	14	15	5	7	9
Books, papers, etc.	14	39	40	20	29	33	13	16	22
Amusements	2	24	28	11	21	28	8	13	20
Transport	42	55	55	25	32	37	22	24	36
Other expenses	73	233	216	141	205	207	93	114	160
Total	806	1,513	1,516	928	1,216	1,261	640	758	1,025
No. of persons per family	3.5	3.3	4.5	3.6	4.0	5.2	3.6	4.5	4.3
No. of consumption units (in equivalent adult males) per family	3.0	2.7	3.8	2.8	3.2	4.4	2.6	3.3	3.4

Source: *Statistisk Aarbog*, 1939, p. 114 (Köbenhavn, 1939).

Chapter VI

HISTORICAL OUTLINE

Denmark and Europe, 800-1157: The Medieval Kingdom: Attempts at Scandinavian Union: The Reformation in Denmark: The Struggle with Sweden, 1563-1720: Denmark during the Eighteenth Century: Denmark during the Age of Napoleon: The Slesvig-Holstein Question, 1839-1920: Denmark from 1864 to 1920: Denmark after 1920

The history of Denmark has always been conditioned by the small numbers of the Danish people. Neither their lands nor their coastal waters were naturally rich, and migration southwards was denied to the Danes by peoples stronger than themselves. They might make conquests overseas, but they could not hold the conquered provinces for long, and the time came when Swedes and Germans took from them ancient provinces within their frontiers. Until modern scientific discovery opened a new prospect to the smaller peoples, Denmark was to shrink from the stature reached by her in the Middle Ages.

To the English, their Danish neighbours, though twice their conquerors, long seemed unimportant and remote. Of Canute and Hamlet, Thorwaldsen and Hans Andersen, they were fully conscious, while scholars suspected that East Anglia and Northumbria at least were incalculably indebted to the Danes. The Protestant royal houses of the two nations intermarried, and if in 1772 a Danish queen from England brought them near to war, a century later a king's daughter from Denmark won the hearts of the British people. Copenhagen became for ever linked with the name of Nelson, as did Slesvig-Holstein with the dawn of the German menace under Bismarck. Yet in 1902 an English author could complain that, compared with Norway and Sweden, Denmark was to us a virgin land, less known than Egypt, the Sudan or regions far more remote. She claimed small attention in the wider world after her dismemberment in 1864 and the first world war did not unveil for Denmark the fate which the second has revealed.

Among the Scandinavians, the most southerly tribes were the Jutes and the Danes. The Danes occupied the eastern regions of the territory which in the eighth century came to be known as Denmark. They, rather than the Jutes, took the lead in war: theirs was the common dynasty and its seat was at Lejre in the heart of Zealand.

When the ninth century dawned, their realm of villages and nascent market towns comprised Jutland, the islands as far east as Bornholm, and, on the main Scandinavian peninsula, the coastal provinces of Halland, Scania and Blekyng. Its boundaries were the sea-shore, which on the west of Jutland was an inhospitable strand, and the heaths, marshes and forests which shielded the Jutes against Slavs and Saxons in the south, and the Danes beyond the Sound against Goths and Swedes.

DENMARK AND EUROPE, 800-1157

The Vikings

Between *c.* 800 and *c.* 1050, the history of Denmark records a new and twofold contact between the inchoate northern state and Europe. The continent endured the onslaught of the Vikings and in return dispatched to them the ministers of Christ. Small as was still the Danish population, it increased beyond the number that their backward agriculture could maintain, while warlike ambition and the love of plunder impelled Scandinavian seamen to turn pirate. Hence, from Russia and Iceland to the northern shores of the Mediterranean, ferocious Northmen terrorized the Europeans. The heathen Danes established the 'Danelaw' in eastern and northern England, ruling, as Christians, the whole country from 1013 to 1042. They crept up the rivers, especially in Frisia, invaded Ireland, southern France and the Mediterranean coasts, menaced Paris and conquered their fief of Normandy. But it was as Anglicized Christians that they first ruled in England, and as Christian Frenchmen that they achieved the Norman Conquest of 1066.

The colonization which the Danes effected in England, in France, and from France again in England, may well be the greatest of their contributions to history. The settlers, whose presence is attested by a thousand *-thorpes* and *-bys* and is credited with the rise of the jury system, added to the enterprise, the tenacity and the virility of the population which they temporarily subdued.

The Empire of Canute

Sweyn Forkbeard, who ruled from about 985 to 1014, sought renown by attacking England, and Ethelred the Unready paid him danegeld in vain. The murder of the intruders likewise increased the Danish menace, and Sweyn died as lord of England. Denmark he bequeathed to his eldest son; England, to his second son Canute.

From 1018 to 1035 Canute the Great ruled Denmark, England and much of the Wendish coast of northern Germany. After proving himself superior to the Swedes he conquered Norway in 1028. England, his chief abode, had to thank him for domestic peace under a strong monarchy and for the fusion of intruding Danes and English. With his death, however, the mighty empire dissolved into its constituent parts, leaving Denmark an imperfectly integrated state with many aspirants to rule and many jealous foes.

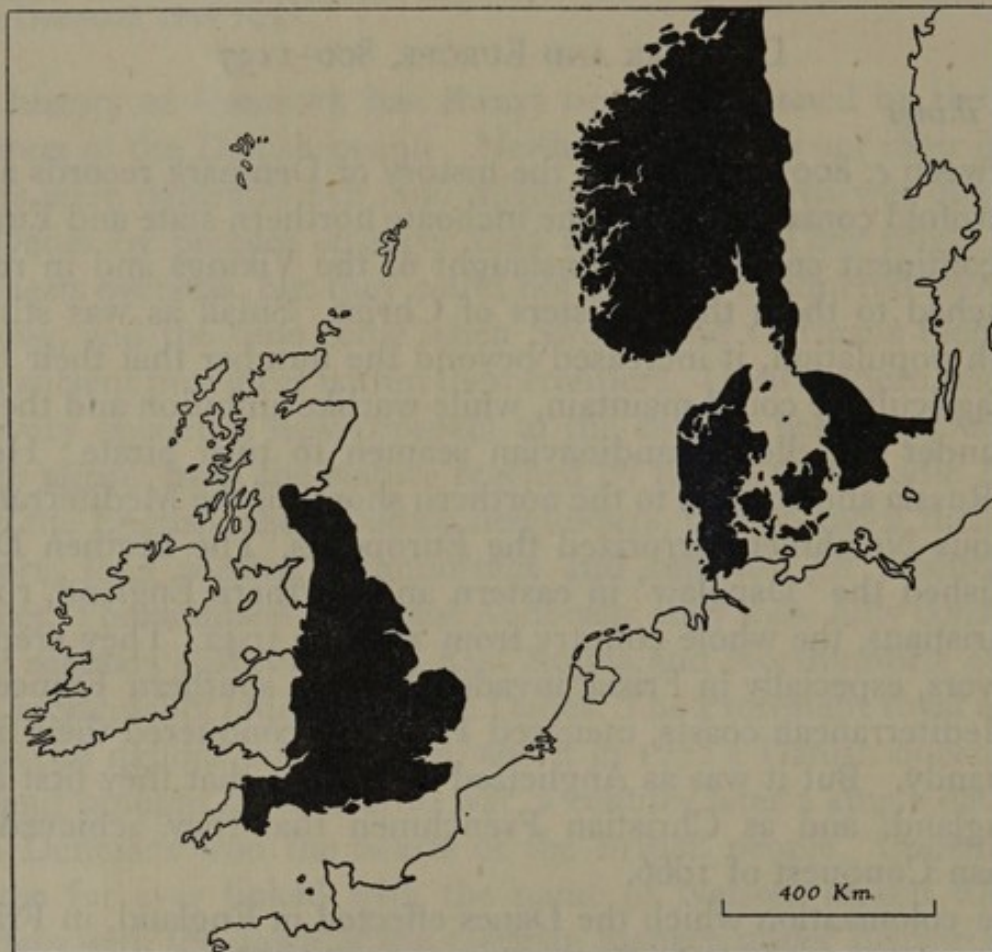


Fig. 35. The Empire of Canute (A.D. 1014-35)

Based on W. R. Shepherd, *Historical Atlas*, p. 64 (3rd ed., London, 1924).

The Coming of Christianity

At the same time, that Christianity which Denmark received from Europe on the eve of her thousand years of struggle with the Germans proved the greatest cultural factor in her life. Soon after war between pagan Denmark and Charles the Great had caused her to fortify her southern frontier with the *Danevirke*, Harold, a claimant to the Danish throne, purchased the Emperor's patronage by accepting baptism. This brought to Denmark Ansgar, a monk from northern

France, who laboured chiefly in Bremen and was canonized as the Apostle of the North. Before his death in 865 he had sowed seeds which in a century produced a Christian Denmark. King Harold Bluetooth (c. 940-c. 985) effected the final conversion which ended the estrangement of his country from western and southern culture.

At the same time, in the face of far greater geographical difficulties, Norway was being moulded into an ill-compacted Kingdom. 'Harried into Christianity' by King Olav, the land was involved by his aristocratic opponents in a disastrous conflict with the Danish Canute the Great. Olav's death at the hands of his peasant rebels in 1030 was quickly followed by his canonization, and the architect of Norwegian national unity and Christianity became the miracle-working saint of Nidaros (Trondheim). The Christian Church taught the people to revere Christ, the Virgin and the Saints, especially St Olav, while in their eyes the old gods became evil spirits. The priests were at first chiefly foreigners, the bishops were often nominated by the king, and the whole organism was ill-paid and ill-established. It was certain that the Danish Church would strive after a better position in the Danish state.

For a full century after the dissolution of Canute's empire in 1047, Denmark suffered from the lack of assured civil rights, including that of succession to the throne, and from the vagaries of many of its rulers. In this age of confusion, the Church, however, with the goodwill of several kings, achieved a firm organization and a connexion with the papacy which guarded it against subservience to the German archbishops. In 1103 an archbishopric was established at Lund for the three Scandinavian kingdoms. The monarchy, on the other hand, became absorbed in factions and murders, until in 1157 chance set Valdemar the Great upon the throne.

THE MEDIEVAL KINGDOM

The Consolidation of the Kingdom, 1157-1241

For nearly a century, until 1241, Valdemar, his son, and his younger son Valdemar the Victorious, showed what a settled monarchy could do for Denmark. The title 'Great' was deserved rather by the king's friend and foster-brother Absalon, bishop of Roskilde, the Danish Westminster, and founder of Copenhagen. This 'father of the Danish people' rallied the nation against the heathen Wends, who were avenging upon the ill-led Danes their own defeats by the Saxons.

Absalon's rejoinder took the form of Christian Viking forays against the Wends, Slavonic tribes in occupation of the Baltic coasts, while Copenhagen became one of several fortresses to defend the coasts of Denmark. Under his vigorous leadership, the Emperor's claim to be Denmark's overlord was rejected, the Wendish lands, Mecklenburg and Pomerania, were conquered, and the title 'King of the Wends' (*Rex Sclavorum*) was assumed by the Danish king.

Between 1202 and 1241 Valdemar the Victorious showed the complexity of Denmark's politics and the ill-based structure of her power. As duke of Southern Jutland he had suppressed a treacherous bishop who was allied with the Emperor, Norway, Sweden and several north German princes. In the struggle he conquered Holstein, and in 1214 the Emperor purchased his favour with the cession of imperial rights over all lands north of the Elbe. Five years later, Valdemar led a crusade to the eastern Baltic, both to check the heathen pirates and to support the German Knights of the Sword against the pirates and the Christian Russians. The sacred standard of the Dannebrog, it was said, brought victory from heaven, and Reval, a Danish city with a bishop of its own, rose in commemoration. Besides Estonia, Holstein, Lauenburg, Rügen, Mecklenburg, Pomerania and parts of Prussia owned Valdemar's sway. For a moment his Denmark rivalled that of Canute in fame, but in 1227 the German princes forced him to renounce all conquests except Pomerania, Rügen and Estonia. Lübeck was irretrievably cut off. The Wendish lands now became German, and the unshakable basis of German northern trade. From the thirteenth century until the close of the Middle Ages the Hanseatic League constituted a powerful threat to Danish hegemony in the northern seas.

By the middle of the thirteenth century Denmark, though always somewhat remote from the main stream of European history, had formed a progressive Christian state. Her king was relatively powerful and wealthy, with a growing tax-roll, high judicial and legislative power and a steadily developing army. Slavery had almost vanished, the great class of cultivators being divided into richer and poorer peasants. It is estimated that the arable area was twice as great as it was four centuries later. Market towns, aiming at self-government, grew slowly, Slesvig, Copenhagen and Ribe leading. The land was at the same time being covered with a network of churches and ecclesiastical institutions. The Church and the rising noble class, both ambitious and exempt from taxes, soon became the rivals of the monarchy for power and independence.

Disintegration and Recovery, 1241-1397

The century and a half that followed Valdemar's death in 1241 saw Denmark exposed to the most violent changes of fortune. The keynote was struck by Eric (1241-50), surnamed from a tax 'Plough-penny'; only a crusade in Estonia relieved a chronicle of strife against German princes and his brothers, one of whom, after his murder, took his throne. A few years later a long struggle between the crown and the archbishop of Lund set in. The archbishop carried his claims to clerical immunities from taxation and arrest as far as to impose an interdict on Zealand and Scania, when he was himself arrested. Civil war followed, and the king's death was ascribed to poisoning by a dean. His successor reigned in constant strife with churchmen, grandees and his own family, until in 1286 he fell to an assassin. His son filled the throne for 33 years, with hardly better fortune save against the weakened Germans. The Emperor once more renounced the lands beyond the Elbe, but the ambitious king became hopelessly bankrupt. After his death in 1319, the Danish monarchy seemed to be following the road to aristocratic anarchy that is for ever associated with the name of Poland. The late king's brother was installed by the magnates at the price of a capitulation which reduced his power to a shadow. Civil war followed, and Holstein intervened with overwhelming force. From 1332 to 1340 Denmark was partitioned by Swedes and Germans, the new Hanseatic League among them. The Jutlanders, however, struck hard at the invaders, and the Hansards found that anarchy impeded trade. They recalled to a fraction of Jutland Valdemar, a royal prince, whose reconstruction of the monarchy earned him the title of 'the Restorer'.

Valdemar 'Atterdag' ('again the day' for Denmark) reigned in alternate storm and sun from 1340 to 1375. His task was by slow degrees to rescue essential Denmark from ambitious nobles and foreign mortgagees and to concentrate her force on self-preservation. To this end Scania was left in the hands of Sweden, and Estonia sold to the Teutonic Knights. A decade of toil gave him an ordered Zealand, while in Jutland the royal power continued to expand. The Swedish king became his client; the Norwegian king became his son-in-law. After twenty years upon the throne he had regained Scania and all the Danish islands. He dreamed of reconquering England with the aid of France, and in 1361 he actually became master of the Swedish island of Gottland, together with Visby its majestic capital. Visby was the great emporium which had been

established by the Hanseatic League, a vast and growing trading corporation consisting of some 80 towns scattered from the Low Countries to Livonia.

Valdemar's conspicuous aggression doomed him to unprofitable strife during his closing years. The Danish king had challenged the



Fig. 36. Denmark in the Middle Ages

Based on W. R. Shepherd, *Historical Atlas*, p. 88 (3rd edition, London, 1924).

The medieval kingdom included all the land adjacent to the channels which connect the Baltic and the North Seas. The possession of Scania, which later became part of Sweden, was a vital interest, since it gave the Danes control of the Sound, through which most of the maritime traffic passed, and enabled her to exact dues from shipping.

powers of commerce, of capital, and of established order. Henceforward Sweden under a new sovereign became his foe and the Hanse towns bound themselves to avenge the loss of Visby. Sweden, Holstein and Mecklenburg became the Hansards' allies, and Southern

Jutland, where a German element was increasing, contributed to the hostile coalition. While Valdemar spent four years in diplomatic warfare in Germany, the Hansards sailed up the Sound and in 1370 forced his Council of State to make peace with them at Stralsund. Great trading privileges and even a voice in the creation of a Danish king were thus acquired by the Hanse Towns. But the coalition against Denmark dissolved, and only his death in 1375 prevented Valdemar from absorbing Southern Jutland.

Valdemar's elected successor, a child of five, was the offspring of his daughter Margaret and of Haakon VI of Norway, himself the son of a king of Sweden. Margaret proved herself a vigorous regent. Though compelled to relax Valdemar's hold over the nobles, she regained the Scanian castles, put down piracy and made the Holsteiners in Southern Jutland her vassals. Hence in 1387, when her young son died, her regency over Denmark and Norway was confirmed. Next year the Swedish nobles, in revolt against their new and oppressive German dynasty, undertook to make her regent also of Sweden. In 1389, near Falköping, the army of the three Scandinavian countries shattered the German force, and many Holstein and Mecklenburg nobles became prisoners. Alike for Danes, Swedes and Norwegians a new and somewhat less complex epoch in history began.

ATTEMPTS AT SCANDINAVIAN UNION

The Union of Kalmar, 1397

The so-called Union of Kalmar of 1397, which placed the 'Three Crowns' upon the head of Margaret's nephew, Eric of Pomerania, owed its origin to the vigour and moderation of the young queen. When Stockholm was held by its own German burghers and the terrible German pirates known as the Victual Brethren, she joined with the Hansards and the Teutonic Knights to conquer Baltic peace. For its preservation, her prescription was union under a common king, at first her Danish nephew guided by her own wisdom and strengthened by the devotion which she aroused in the Danish Church. The Union of Kalmar, where Eric awaited coronation, fell somewhat short of her designs, for, on paper at least, it was agreed that the three realms should be permanently allied but never united, and that, if a king left sons, his successor should be chosen from among them. Before her death in 1412, however, she had done much to curb the nobles, to regain from them the crown estates, and to free

Scandinavia from foreign influence. Eric, her pupil, then continued her work until 1439, when he ceased to reign.

Under Eric of Pomerania, Denmark comprised about one-half of the scanty population, estimated at some 1,500,000, which was all that his vast dominions could then support. Although the Danish monarchy lacked the wealth, the strength and the transport facilities to administer Norway and Sweden, the three peoples were neighbours, united by a common speech and faith, and a common difficulty in securing good government from any other source. The primacy of Denmark was incontestable. The king, however, distracted by war with Holstein, which gained Slesvig in 1432, and forced also to fight the Hansards, could not do justice to his distant dependencies. He developed and defended Copenhagen, but in three fateful years the patriot Engelbrekt, murdered in 1436, inspired a lasting nationalist separatism in the mass of the Swedish people. This challenge, accompanied by a brief revolt in Norway and a far more dangerous attack by his own council upon the royal power, caused the childless Eric to take up his abode in Gottland, whence he made piratical forays against the Swedes.

The Recession of Sweden, 1448-1500

In 1439 the Danish Council installed Eric's nephew, Christopher of Bavaria, as king. The Norwegians and Swedes concurred, but in each country the royal power declined before that of their councils. Next, the union itself was further shaken by the untimely death of Christopher in 1448. The Swedes chose a great Swedish noble. The Danes, hoping to recover Slesvig, made Christian of Oldenburg their king, binding him to refrain from wars or taxes without the consent of the Council. The Norwegians preferred the Swede, but the Swedish Council renounced Norway to Christian, and the Norwegian Council declared union with Denmark eternal. It was destined to endure for more than 350 years.

The first of the King Christians, whose name has never since failed Denmark for more than a single reign, was associated from his accession with the triple ideal of an aristocratic Denmark recovering Slesvig, acquiring Holstein and dominating Sweden. He had first to endure Swedish attacks upon Scania and Gottland. In 1457, thanks to the Swedish nobles headed by Archbishop John Oxenstierna, he secured the Swedish throne and held it until 1463. After a fluctuating struggle, the arbitrary and indigent Christian was defeated by Sten Sture in 1471, and finally expelled from Sweden. For several decades, Union

gave place to a Swedish popular regency in the Sture family and an opposition to the German monarchy in Denmark in which the Danish Council often joined. Meanwhile, despite his poverty, Christian secured for himself the style and rights of duke of Slesvig and count of Holstein, the first a Danish and the second a German fief. Here again he was favoured by fortune. His uncle, at first count of Holstein, had gained from the Danes the duchy of Slesvig as a hereditary fief. He at once set to work to forge an unbreakable link between Slesvig and Holstein, but died childless in 1459. The two fiefs wished to remain united and the Danes valued Holstein. Christian therefore bought off certain claimants to Holstein and secured his own possession. This brought (in 1460) the sovereignty of Denmark to the gates of Hamburg and of Lübeck. Christian, however, marrying his daughter to the Scottish king, pawned to him the Orkneys and the Shetlands for a dowry which was never paid. Thus within a century of the casual acquisition of Iceland, a valuable asset was flung away.

The monarchy, though German, had once again offered a prospect of greatness to the Danes, but chance had still a great and prolonged part to play. In 1481, Christian I was succeeded by his son Hans, the first king since Valdemar Atterdag to be born in Denmark. Maintenance of the Union and of the royal power remained his foremost problems. To win the Norwegians and the Swedes, the crown, at every vacancy, must make concessions to nobles and Council. In Sweden, none the less, it could only hope to tilt in its favour the balance between those nobles who had estates and connexions in Denmark, and the Sture family with great classes at their back. A renewal of the Kalmar Union was gained by force of arms in 1497. Three years later, however, a crushing defeat of the Slesvig-Holstein nobles by the peasants of Ditmarsch inspired the Swedes to throw off the Danish yoke. Elements in Norway, with Lübeck and other towns, were always ready to attack the Danes, but without first-rate leadership they could not break the Danish hold on Sweden. The death of Hans in 1513 left a new Sten Sture face to face with Christian II.

The single decade of Christian's reign (1513-23) brought his country across the threshold of modern times and transformed its status in Scandinavia. During two generations of Oldenburg rule, Denmark had developed characteristics which marked her for twice as many centuries. A German dynasty, ambitions in the eastern Baltic renounced but those in Scandinavia and northern Germany cherished, full profit sought from mastery of the Sound, ambitious

magnates wresting power from king and people, complex relationships between Slesvig, Holstein and the Danish crown—such was the heritage of Christian II's Denmark. It was to be complicated by the exceptional personality of the new king, by the appearance of a political genius in Sweden, and by the manifold transformation symbolized by Martin Luther.

Christian II and the Rise of Sweden

Powerful in mind and body, a Danish-speaking king who sympathized with the common man, Christian II was at the same time passionate, ambitious, secretive and revengeful. Husband of a sister of Charles V, he slew a great noble on suspicion of poisoning a cherished mistress. The magnates had already restrained him from seeking to make his son his successor: they now deeply resented the slaughter of one whom they had acquitted. Soon, however, Christian led the Danes to an inglorious war against Sweden for the Swedish throne. His army was twice defeated; his ally, the archbishop of Upsala, was deposed while the treacherous abduction of hostages, young Gustavus Vasa among them, brought no advantage.

In 1520, however, the Pope laid the mutinous Swedes under interdict and success crowned Christian's third attack. Sten Sture was killed and fair words gave Christian Stockholm. There he was homaged and crowned, but in November the so-called Bloodbath of Stockholm for ever stained his name. On pretext of heresy, Christian beheaded his suspected opponents, eighty-two in a single day. Many estates were confiscated to the crown. Having thus secured Sweden, he attempted to base a strong hereditary Danish monarchy upon the support of the people, especially the favoured trading class. The judiciary was subordinated to the crown, while a summons to Lutheran preachers showed that Christian was resolved to destroy the independence of the Danish Church.

The storm that Christian's ruthlessness invited broke forthwith. In 1521 Gustavus Vasa roused the Dalesmen to revolt and the Swedish nation followed. Lübeck, which had sheltered the fugitive Gustavus, declared war, and the king's uncle, Frederick of Gottorp, followed by the nobles of Jutland, joined in the struggle. While Christian, with his queen and their son, fled to the Netherlands, Gustavus became firmly established on the throne of Sweden and Frederick (1523-33) on that of Denmark.

During the reign of Frederick I, Danish progress continued to be impeded by the shifting interplay of national and external forces.

Once again a king, to secure the crown, had promised the magnates augmented power, adding pledges against Lutheran heresy. All these undertakings proved inconvenient and were not kept. Frederick,

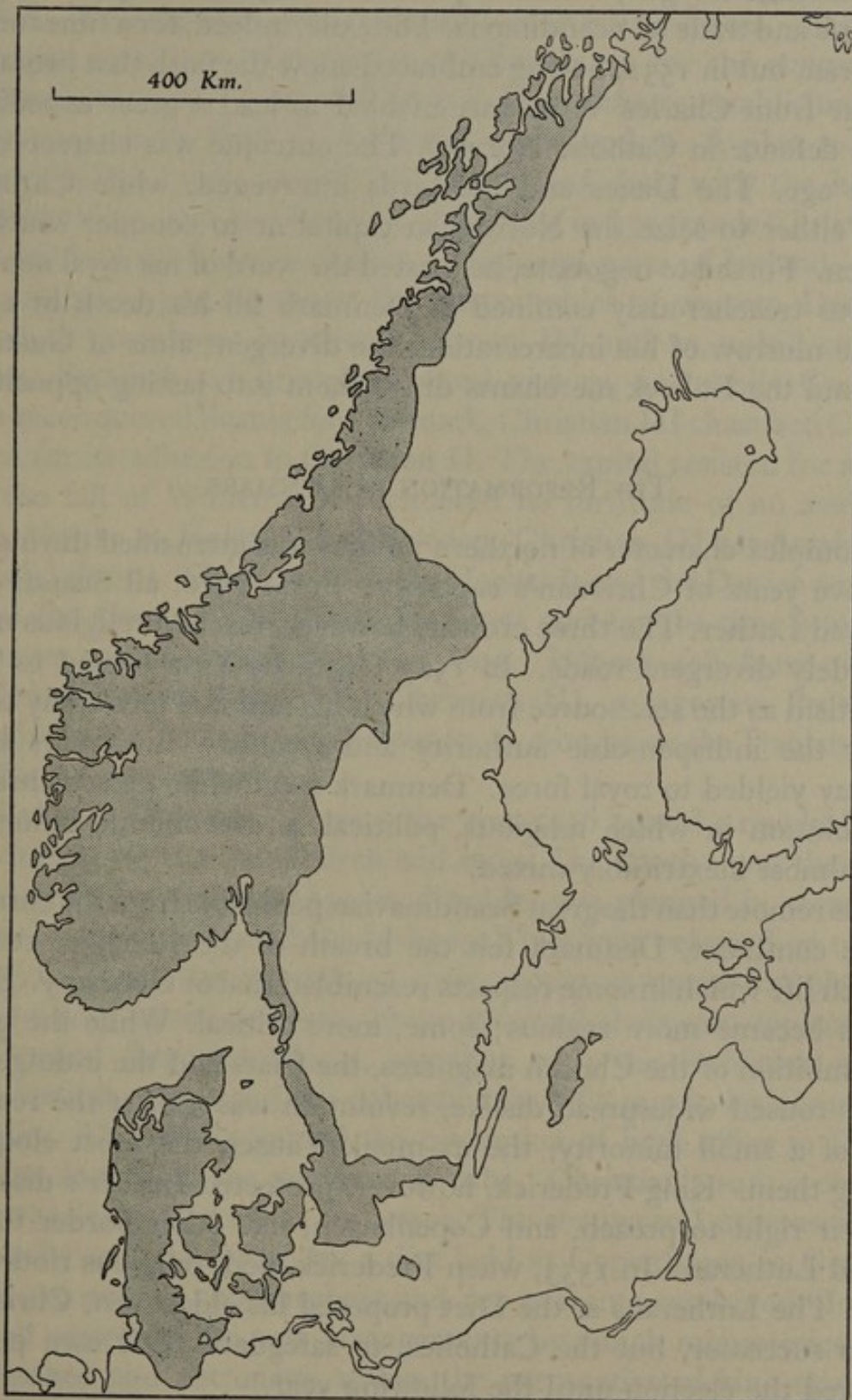


Fig. 37. Denmark in 1520

Based on *The Cambridge Modern History Atlas*, map 17 (2nd ed., Cambridge, 1924).

indeed, a German-speaking prince who ruled from Gottorp, could coerce both Church and Council by threatening to resign in Christian's favour. The return of Christian would have menaced also the Hanseatic League, which he planned to supersede by developing the ports and trade of Scandinavia. The exile, indeed, for a time turned Lutheran, but in 1531, having embraced anew the faith that promised succour from Charles V, he was enabled to lead a great expedition for its defence in Catholic Norway. The outcome was characteristic of the age. The Danes and Hansards intervened, while Christian failed either to seize the Norwegian capital or to conquer southern Sweden. Forced to negotiate, he trusted the word of his royal nephew and was treacherously confined in Denmark till his death in 1559. On the morrow of his incarceration, the divergent aims of Gustavus Vasa and the Lübeck merchants drove them into lasting opposition.

THE REFORMATION IN DENMARK

The complex character of northern politics was intensified during the first five years of Christian's captivity. From 1536, all Scandinavia followed Luther. The three crowns, however, reached religious unity by widely divergent roads. In 1527 Gustavus Vasa turned to Protestantism as the sole source from which his national monarchy could derive the indispensable authority and wealth. Nine years later, Norway yielded to royal force. Denmark meanwhile passed through an evolution in which religious, political, and economic influences were almost inextricably mixed.

Less remote than the great Scandinavian peninsula from the currents of the continent, Denmark felt the breath of the Renaissance in a Church life which in some respects resembled that of Germany. Some Danes became more zealous; some, more critical. While the greed and ambition of the Church magnates, the friars and the indulgence-sellers roused widespread dislike, revolution was at first the remedy only of a small minority, the ex-monk Tausen the most eloquent among them. King Frederick, however, protected Luther's disciples in their right to preach, and Copenhagen, like other border towns, turned Lutheran. In 1533, when Frederick died, religious riots were afoot. The Lutherans at the Diet proposed his eldest son, Christian, as his successor, but the Catholics, to safeguard their own power, deferred the election until the following year.

Meanwhile, the question of Denmark's religious allegiance, in which the captive Christian II now ranked as a Protestant factor, was

complicated by a struggle for her commercial allegiance, whether to the Hansards or to their Low Countries rivals. Lübeck, the ageing queen of the Baltic, ruler of Bornholm whose inhabitants protested they 'would rather obey the Turks', had now an ambitious burgo-master, Wullenweber, and powerful mercenary forces. These he entrusted to Count Christopher of Oldenburg, for the conquest of Denmark, the restoration of Christian II and the re-establishment of Hanse supremacy both in Denmark and Sweden. A plan to make Henry VIII lord of Scandinavia miscarried, but, with the help of peasant risings, the so-called 'Count's War' in 1534 made Christian II nominal lord of Zealand, Scania, Fünen and parts of Jutland.

In August 1534, however, the lesser nobles of western Denmark forced the magnates to elect Christian III and an uphill struggle began. Swedish aid brought a naval victory, and while Gustavus Vasa reconquered Scania for Denmark, Christian III chastized Copenhagen for its adhesion to Christian II. The capital resisted for a year, but the fall of Wullenweber rendered its fortitude of no avail. In 1536, thanks to Holstein and Sweden, Christian III sat firmly on a peaceful throne. The Catholics, the Hansards and the Danish peasants found the Count's War a crushing blow, and for the time being the magnates succumbed before the king. Lübeck fell from power; Wullenweber was beheaded. Christian III, a vigorous Protestant from Holstein, had a rare opportunity to reorganize the Danish state, and he did not let it slip.

Thanks to Christian's vigour, the year 1536 beheld a revolutionary transformation in both Church and state. The attack upon the traditional order by the allied king and nobles was planned in secret and begun by the arrest of all the bishops. They were released on undertaking to follow the example of their secular compeers by pledging acquiescence in the reforms. These involved their own replacement by General Superintendents, together with the forfeiture of the ecclesiastical estates and the subordination of a purely lay Council to the king. The nobles gained the restriction of high office to Danes, and freedom from the payment of tithe. Christian's son, a child of two, was designated as his successor. The change to Lutheran strong monarchy was confirmed by a diet held at Copenhagen in October, when 400 nobles, 200 burghers and 500 peasants combined. Luther himself approved the new arrangements by which monasteries were condemned and patronage, unless the prerogative of king or noble, passed to the congregations. His friend Bugenhagen, though not a bishop, installed the seven non-nobles who first performed such

episcopal functions as survived and were always styled 'bishop' by the people. In the interest of the Reformation, Latin schools were established, the bible translated, and the University of Copenhagen revived.

Royal power and Lutheran doctrine were impressed upon Denmark by a monarch who gave to the new system more than twenty years of vigorous and virtuous supervision. Before Christian's death in 1559, the transition to a married priesthood had been accomplished, education advanced, Norway was made a Lutheran dependency of Denmark, the succession to the crown was secured, the Netherlanders were forced to submit to Denmark in the Sound, and good relations with all neighbouring powers were established. The tangled question of the duchies, though insoluble by any power extant, offered as yet no special threat to Denmark. The Danish king gained wealth and power by sharing with his family in rule over a non-Danish region—such was the Slesvig-Holstein factor in the later days of Christian III.

THE STRUGGLE WITH SWEDEN, 1563–1720

The Northern Seven Years War

Christian III left Denmark at peace with Sweden, where Gustavus Vasa survived him by a single year. Yet in 1563 the two countries were embroiled in the so-called Northern Seven Years War, which poisoned their intercourse for many generations. While Gustavus was succeeded by the unstable Eric XIV, Denmark fell to Frederick II (1559–88), his father's foe and almost as unlike him as Eric was unlike Gustavus. He proclaimed his resolve to be a knightly, not a priestly, king, and dreamed of making a reality of the three crowns which Denmark still bore upon her arms. Heartened by the swift conquest of Ditmarsch, which had defied the Holsteiners for two hundred years, he was soon at issue with the Swedes at a moment when the help of both was needed to repel the Russians from Estonia. The heraldic question, Frederick's hopes of ruling once more over Sweden, maritime rivalry, the clash of interests and ambitions in the eastern Baltic, all impelled the two young kings towards war. More than a year's diplomacy preceded seven years of bitter strife, in which Denmark had Poland and Lübeck as allies, and thousands of trained German mercenaries at her disposal.

The war of 1563–70 proved exhausting, costly and inconclusive. Sweden, handicapped by an unstable and unheroic king, possessed the stronger fleet and bought, at a great price, a treaty with Ivan the

Terrible. Denmark discovered a great general in Daniel Rantzau who captured Elfsborg and gave her victory beyond the Sound. Her resources, however, were soon exhausted, and the acquisition of Ösel was her only compensation. In 1569 Eric was driven from the throne by his brother John, who had already made overtures for peace. Next year this was accomplished at Stettin, Sweden abandoning her claim to Gottland and all else reverting to the pre-war status. During the remaining eighteen years of his reign, Frederick II kept clear of the convulsions of western Europe and strove to make Denmark magnificent. While the sea-powers were struggling with Philip of Spain, the Sound dues were raised at their expense and the salute to Danish warships was exacted. A new and stately Kronborg rose at the gateway of the Sound, and, with the great name of the astronomer Tycho Brahe, symbolized Denmark's progress in the realm of culture. Such achievements were continued by Frederick's son, who succeeded him in 1588 and reigned for sixty years.

Christian IV and Popular Monarchy

Christian IV (1588-1648), who succeeded at eleven, became the 'good Queen Bess' of Danish history. His courage, his sympathy, his energy and his patriotism have indelibly impressed his bright figure upon the consciousness of later generations. Popular in the strictest sense of the word, his paternal intercourse with his subjects formed a precedent which more than one of his successors has wisely followed. His all-embracing energy, seemingly undiminished by his deep carouses, found vent in plans for empire, which involved even the discovery of routes unknown, and in an administration which brought every detail under the royal eye. He would care for Denmark and Norway as for his own estate, conquer Sweden, extend his power into northern Germany, command the Baltic, secure the wealth of Greenland and Iceland and win colonies in the Indies. Of this imposing programme, not a little was actually achieved. Tranquebar became Danish. Trading companies for Iceland, Greenland and the East and West Indies were set on foot. Christian, the sailor-king, built and organized a first-rate fleet. By him Norway was visited and cared for as by no earlier or later Danish king. Suppressing Jesuit propaganda, Christian completed the Norwegian Reformation. He created mines for copper and silver and replaced the Oslo destroyed in the great fire of 1624 by a city which until 1905 bore his name, the greatest among many so distinguished. In Norway, as in Denmark, he liberally promoted education and took thought for the codification

of law. To him Copenhagen still owes several of her most charming buildings, and more than one royal palace attests his taste and extravagance. New factories and a new postal system likewise owed their origin to the untiring Christian, stimulated by the rise in revenue which the influx of gold and silver brought about. As the nobles, both from this cause and from a desire to imitate the king, also turned to travel, learning and fine building, Christian's Denmark gained a Renaissance aspect which never wholly faded.

The Thirty Years War

Christian's foreign ambitions proved less fortunate. From 1611 to 1613 he waged the unprofitable 'War of Kalmar' against Sweden, which renounced her claims on Finmark to an opponent superior both by land and sea, but too poor to conquer a kingdom. Twelve years later, he again prevailed over the reluctance of the Diet to embark on foreign adventure. In its eighth campaign Denmark entered the Thirty Years War as the champion of the menaced Protestants. A sincere Lutheran, who believed that Christ had appeared to him by night, the king counted on securing German bishoprics for his sons at the expense of England and their fellow-Protestants. James I, who in 1589 had married Christian's sister, preferred his terms to those of Gustavus Adolphus, king of Sweden, but failed to secure him due payment. Christian indeed led his armies into Germany, but in the second campaign (1626) Wallenstein inflicted on him the fateful defeat of Lutter. Next year Jutland, which had never desired the war, was ravaged to its northern coast, and only the Danish fleet saved the islands. Fearing Sweden, however, the Catholics granted Christian in 1629 what he rightly styled 'this golden peace' at Lübeck. The conquered lands were all restored in return for his promise to meddle in Germany no more.

From 1629 to 1643 Christian looked on, while Gustavus Adolphus of Sweden dazzled Europe and his successors conquered those German lands which had tempted Denmark to intervene. Arming by land and sea, but always hampered by lack of funds, the king tried to persuade his subjects to consent to increased taxation. The outcome was a conflict between the privileged nobles and the other classes. Maritime taxes upon foreigners, however, could be levied at the king's pleasure, and in 1638 Christian doubled the tariff upon merchandise passing through his territorial waters. The familiar Sound dues were supplemented by similar exactions in the Elbe. By such exactions, by an unwise treaty with Spain, and by undisguised

hostility to Sweden, Christian alienated many neighbouring nations, notably the Dutch, and gained no friends.

Wars with Sweden, 1643-60

In 1643 the storm broke over Denmark. Without warning, a Swedish army marched northward from Moravia, joined forces with the duke of Gottorp, and conquered Jutland. While a Dutch fleet sailed to join them, another Swedish force invaded Scania. Christian was in the later sixties, but in 1644 he vanquished both the Dutch and Swedish fleets. Later, however, the hostile powers united, and in October the Danish superiority at sea was ended. Christian by his valour had won the heart of the nation, but the peace of Brömsebro of 1645 marked the novel supremacy of Sweden. She secured Ösel and Gottland from Denmark, two mountain provinces from Norway, Halland for thirty years and exemption from dues in the Sound. Three years later, Christian gave place to his younger son Frederick III (1648-70).

The accident, his weakling elder brother's death, that brought Frederick to the throne proved fateful in the history of Denmark. The Council accepted him only after months of strife and at the price of a capitulation which confirmed their lately augmented power. But the quiet, abstemious, connoisseur whom they had elected was at heart an autocrat with a vigorous and ambitious princess of Brunswick-Luneburg as his queen. For some six years after the great peace of Westphalia (1648), Sweden under Queen Christina ceased to be formidable, and Frederick could gain an alliance with the Dutch and quietly prepare to regain his German provinces. Then, in 1654, Christina placed Charles X upon her throne, and next year that warrior king invaded Poland, the rival Vasa kingdom. His queen was a princess of Holstein, Denmark's enemy, while in Brandenburg the Great Elector, Frederick's kinsman, pursued his enigmatic career.

In 1657 the Danish king, counting on the Dutch, the Great Elector and the Poles, persuaded his Council to make war on Sweden. His motive was sheer revenge, and never can such an immoral action have been more swiftly and more signally punished. Charles X, who had begun his reign with a triumphant progress to the Carpathians, now led his host from the Vistula to the Little Belt and took the fortress of Frederiksdodde (Fredericia) by storm. His fleet was blockaded in Wismar, but he crossed the Belts upon the ice, and in February 1658 forced Frederick to make peace at Roskilde. Bornholm and the Danish provinces upon the great Scandinavian peninsula were ceded,

with the adjacent coastal province of Norway and even Trondheim. All goods on board Swedish ships might be carried through the Sound duty free. The duke of Gottorp profited by the good fortune of his ally, and ceased to be a vassal of the Danish crown.

The Scandinavian concord of 1658, however, was short-lived. To resume his conquests farther east, this time with the Great Elector as a foe, Charles X must have a completely subjugated Denmark in his rear. The Dutch had looked with favour upon a territorial change which placed the two shores of the Sound in different hands. Aggressive Sweden, threatening lordship of the Baltic, now became their natural enemy and they championed Danish independence. To cut every knot with the sword, Charles sent troops to conquer Kronborg and to invade Norway, while he led his own force from Kiel against Copenhagen. By declaring, like Job, that he would die in his own nest, Frederick went far towards saving his capital and transforming the constitution of his country.

Through the autumn of 1658 the men and women of Copenhagen offered a desperate resistance to the Swedes. In October the Dutch fleet defeated the Swedish, and brought the Danes reinforcements and supplies. In February 1659, they foiled the furious effort of Charles to storm the city. Swedish conquests, indeed, continued, but Norwegian resistance grew, Poland and the Great Elector invaded the mainland, and the Swedes suffered more than one defeat. Meanwhile, the sea-powers laboured to negotiate a peace. The sudden death of Charles X in February 1660, relieved both nations. By the peace of Copenhagen, Denmark recovered Bornholm, and Trondheim was restored to the Norwegians. The reign of the infant Charles XI began with general peace. His empire embraced the northern Baltic coast as far as Riga, together with important stretches in the south. Sweden was therefore the natural ally of the Gottorp line against Denmark, but the natural enemy of powers desirous of averting any dangerous predominance within the Baltic Sea. Soon, moreover, Scandinavian politics were to assume a new complexion through the rise of Louis XIV to a new leadership of Europe.

Denmark in 1660 had to face a fresh and painful situation. Her own half million people had suffered deeply in the war, both from the enemy and from their own allies. In Scania she had lost her most outstanding province. Many farms were derelict, especially in Jutland. A far-reaching reconstruction was obviously needed, but who could undertake it? The burghers of Copenhagen had proved themselves heroes, but they were too few and too poor to lead the nation.

The king had won many hearts by his heroism, but his powers were limited by the capitulations. The nobles, on the other hand, numbering about 150 families, owned half the soil and monopolized the administration. Themselves enjoying wide freedom from taxation, they disposed of the peasants as serfs, and that without rendering the military service which had caused the system to arise. The changes dictated by the situation were hastened by the kingdom's shrunken size.

The Constitutional Revolution of 1660: the Kongelov

In September 1660, the Estates, without the peasants, met at Copenhagen. Their duty was to raise funds. The nobles, standing on their chartered rights, at first insisted on exemption. Inspired by the mayor and bishop, the Copenhageners brought about a *coup d'état* which made Frederick III hereditary king, and absolute. The king, who had secretly inspired the movement, was commissioned to draw up the *Kongelov* or Royal Law, setting forth the new autocracy. Within a few years a document, at first kept secret, came into being and remained the constitution of Denmark and Norway until their separation. Based on the works of Hobbes, it made the king the most absolute sovereign in Europe. 'He cannot', declared the *Kongelov*, 'be bound by his subjects through any oath or obligation.'

The real author of the *Kongelov* was one of the most conspicuous examples of what its working could produce. The son of a rich wine merchant of Copenhagen, educated abroad, he became secretary to Frederick III, and steadily gained in power. Ennobled by Frederick's son, he is known to history as Count Griffenfeld, and his career showed how the power of the new monarchy could be wielded from behind the throne. The Danes in 1660 had desired a patriarchal rule, that of their trusted king surrounded by the citizens, his 'children'. They soon found themselves governed by five 'Colleges' or Boards—of Admiralty, War, Finance, Commerce and Foreign Affairs—whose presidents formed a Privy Council. Besides this standing advisory body, the king might turn to the private secretaries in his 'cabinet', a dualism which promised to increase the freedom of a real autocrat, but to imperil the country, if a misguided weakling reigned. Among the firstfruits of the new monarchy, however, two ranked as excellent. A new supreme tribunal for Denmark, Norway and her former colonies of Iceland and the Faroes was set up, and Frederick's illegitimate son, Ulric Frederick Gyldenlöve ('Golden Lion'), became the able and popular viceroy of Norway.

War with Sweden, 1675-79

Frederick's later years were marked by vacillation in foreign policy and extravagance at home. The heady influence of Louis XIV was beginning to influence the north, and the Danish queen was a spend-thrift. To the new autocracy may be ascribed the failure of Frederick and his successors to establish an adequate constitutional connexion between Denmark and Slesvig-Holstein. Was it not sufficient that both should obey the same master? A king of Denmark should rather regain the provinces lost to Sweden, and with them his exclusive rights over the Sound. Vengeance on Sweden and the subjugation of Gottorp were the dreams of the new monarchy for sixty years.

After a decade of Frederick's absolutism, his young son Christian V (1670-99) placed on his own head a new and costly crown, while a bishop, bowing as to a divine revelation, recited the *Kongelov*, which remained unpublished until a decade after Christian's death. With more varnish from foreign travel, but less tenacity and depth, the new and popular king seemed a second Christian IV. His mother, his half-brother Ulric, and Griffenfeld, now Chancellor, influenced the forward policy of his earlier years, when Louis XIV and the Regency in Sweden attacked the Dutch and the Great Elector. In 1675, at Fehrbellin near Berlin, the Swedish cavalry was put to flight and Sweden had to fight for its province in Pomerania. With young Charles XI and his French patron thus deeply engaged, Christian seized his opportunity. The Danish army occupied the Gottorp lands and seized Swedish possessions in Germany. In 1676 the Danes took Gottland, defeated, with Dutch help, the Swedish fleet, and regained Scania and the lost Norwegian provinces. Acclaimed by the liberated regions, Christian might congratulate himself on a timely and well-aimed stroke.

At this crisis, however, the personal superiority of Charles XI to his opponent turned the scales. While Christian rashly seized a command for which he was unfit, Charles's invincible obstinacy won a decisive battle. Declining to let any slaughter drive him from the stricken field of Lund, in December he made Scania once more his own. Neither the Danish guerillas, the combined fleets' mastery of the sea, nor successes in Norway and in Swedish Pomerania could enable the Danes to overcome the Swedes, supported as they were by Louis XIV. The peace of Lund (1679) restored the pre-war position both in Sweden and in Gottorp. As a pledge of pan-Scandinavian

friendship, Charles married Christian's sister, the mother of the future Charles XII.

Denmark at the end of the Seventeenth Century

During the twenty remaining years of Christian's reign, the peace remained unbroken. The Denmark of the *Kongelov* had therefore time to assume the character which, in the main, it bore until the revolution of 1849. Small, centralized and poor—such, apart from Norway, the duchies and the distant islands, was the realm of Christian V. The Lutheran faith, the fixed succession and the territorial integrity of the monarchy—these were sacred, even against the king. All else could in theory alter, but in practice kindly tradition made 'old Denmark' a somewhat patriarchal country. Taxes were high, agriculture was backward, and industry and commerce were small. The new bureaucracy appointed by the king, the new royal army and the new grandees whom the king ennobled included many German elements, and it was the so-called 'German Chancery' that managed foreign affairs. An English observer declared that the Danish kings chose their placemen from low-born foreigners, who would serve them without scruple, and whom they could fleece or make scapegoats without mercy. Culture came largely from the Dutch, who remained in some degree 'the University of the civilized world'. Thus a few Danes were impelled towards natural science. In the University of Copenhagen, however, theology reigned supreme and all lectures were in Latin. Given peace, the Danes might well have shone in learning, but for the first two decades of the eighteenth century their destiny was bitter war.

The Northern War, 1700-21

The great Northern War owed its origin and conduct to the 'Snow-King' Charles XII. Jealousy between the Swedish noble and non-noble Estates thrust autocracy into the hands of a wild and headstrong lad of fifteen, whose father, Charles XI, had followed a path of caution which suggested weakness and fear. Hence the suicidal policy of the Estates unleashed all Sweden's former victims, each governed in 1700 by a young ambitious king. Peter the Great, Augustus the Strong of Saxony and Poland, Christian V—all had been secretly marshalled by a Livonian noble who resented Sweden's oppression of his class. Frederick IV (1699-1730), a pious though far from stainless monarch, who might have made a fair constitutional ruler, was the first of the confederates to move. In 1700 he attacked

Gottorp, but provoked an unexpected storm. William of Orange, hoping for a great league against Louis XIV, sent a fleet to check the Danes, and Charles XII was transformed in a moment into the hero who never again saw Stockholm. With English aid, he struck at Copenhagen, and Frederick hastened to renounce the Gottorp adventure.

For nine years, while Charles XII was making the name at which the world turned pale, Frederick IV looked on inert and hired his troops to the anti-French alliance. In 1709, Peter the Great's victory at Poltava revived the coalition. Augustus regained the crown of Poland and Frederick invaded Scania. Vanquished at Helsingborg, the Danes were destined never again to cross the Sound against Sweden. Despite the plague which devastated Copenhagen, they joined the Russians in successful warfare on the continent. Driven thence by the allies, with the aid of the Danish fleet, Charles spent his last years in attempting to conquer Norway. The name of Tordenskjold commemorates both Norwegian heroism by sea and land and the strengthening of the bonds which linked both his peoples with their Danish king. In 1718 the death of Charles XII before a Norwegian fortress heralded peace and the downfall of the Swedish empire. At Frederiksborg in 1720 the Swedes, besides paying an indemnity, renounced the Gottorp alliance and their immunity from the payment of Sound dues. Thus the Danish king acquired the Gottorp lands in Slesvig, while the threat from Sweden was replaced by the remoter but more deadly perils from the rise of Russia and of Prussia.

DENMARK DURING THE EIGHTEENTH CENTURY

Internal Affairs, 1720-46

During the last decade of his reign, Frederick, alienated by his domestic irregularities from the unimpressive precisian who was his heir, resumed that struggle for revenue which formed the unending task of Danish kings. He sold the lands not only of the crown but of the Church, and that in an age when the current of Pietism was sweeping over Germany and Denmark. To posterity, this was rather the age of Holberg, whose masterly comedies were checked both by the great fire of Copenhagen in 1728 and by the advent of a monarch who deemed play-acting sinful. From 1730 to 1746 Denmark was subjected by the *Kongelov* to the autocracy of Christian VI, perhaps the most un-Danish of her kings. Unduly magnifying his office, and

swayed by his German queen, who scorned the Danes, he imported German counsellors and lavished money on superfluous German buildings. A policy of sumptuary laws based on division into numerous ranks, of enforced sobriety and of compulsory church-going was developed, while protection against imported goods propped up the factories established by the crown. While popular education was promoted, the Danish peasant was plunged deeper into serfdom.

The passive acceptance of Christian's vexatious laws, like the endurance of all the vagaries of three mediocre autocrats, showed that the king might choose his foreign policy at will, without risk of a rebellion. Denmark, however, had become a small and exposed power needing financial help, and no power wished for her alliance on equal terms. At the same time the rise of Frederick of Prussia and, in Russia, of Elizabeth, with the growing antagonism between France and Britain, made it extremely hard for Christian to find his way. The election of his crown prince to the vacant throne of Sweden, which the Swedish peasants desired, would have reunited the three crowns and safeguarded the Danish monarchy in Gottorp, but it was not to be. Elizabeth, victorious against the Swedes in Finland, decreed that Adolphus Frederick of Holstein-Gottorp should be king, and in 1743 he became the elected heir. Although Christian VI escaped a war, he faced anew the danger of a struggle with Sweden and Gottorp.

This danger vanished by sheer good fortune. When Christian died in 1746, he was succeeded by a son utterly unlike himself, Frederick V, who reigned for twenty years. Young, jovial and popular, he revived the merriment of Copenhagen, and the age of Holberg bloomed once more. Until her untimely death, his queen, a daughter of George II, also charmed the people. Frederick left business to his ministers, and it chanced that among them was J. H. E. Bernstorff, a Hanoverian noble of the highest character and skill. 'Denmark', said Frederick the Great, 'has her fleet and her Bernstorff', and a Danish historian finely observed that it is ethically strengthening to have to do with him. While the king, now married to Juliana, a severe Brunswick princess, sank into debauchery, Bernstorff with unrivalled courtesy managed both home and foreign affairs.

The Bernstorff Régime, 1751-70

Although in Copenhagen Bernstorff's character, attainments and courtesy could not fail of their effect, he was no born financier or man of business. His own peasants he made freeholders but left those of

others in serfdom; Denmark's protectionist policy went on. More magnificent buildings and charitable institutions rose, and crown lands had to be sold to pay for them. In foreign affairs, on the other hand, his skill and judgement proved outstanding. While from 1756 the Seven Years War embroiled all Denmark's neighbours, she remained unharmed until in the first days of 1762 Elizabeth's death placed a headstrong Holstein fanatic upon the Russian throne. The new Tsar, Peter III, was the slave of two passions, reverence for Frederick the Great and hatred for the Danes who had absorbed his Gottorp heritage. His autocracy was strong enough to transfer Russia from the Austrian to the Prussian side, and Frederick, thus saved from destruction, could not forcibly oppose his saviour's attack on Denmark. Braving financial ruin, the Danes assembled an army of 70,000 and a strong fleet, but they were in dire straits when in July Catherine deposed her husband. Thenceforward, to solve the Duchies question by a treaty of exchange with the rulers of Russia became the dominant aim of Bernstorff.

The years 1762-73, indeed, showed what vicissitudes the Denmark of the *Kongelov* might endure. The throne passed from a drunkard to a lunatic; the administration, from an eminent German statesman to a hated German adventurer, who was removed only by a royal *coup d'état*. Twice the state faced ruin at the hands of a great power. Through all the danger, the people looked on inert, to be rewarded with a quarter of a century of unbroken peace and progress.

The Struensee Régime, 1770-72

In 1766 the throne of Denmark was ascended, like that of Britain, by a grandson of George II. The new king, Christian VII, remained until 1808 the nominal ruler of Denmark, and by him some of the ceremonial duties of royalty were always performed. Succeeding at seventeen, he submitted to espouse Caroline, sister of George III, while his own sisters linked him with the rulers of Sweden and of Hesse-Cassel. He begot a son, the future Frederick VI, and paid a notable visit to Holland, France and England, where Vauxhall and Newmarket aroused his special interest. Yet from the first this debauched and pallid weakling was fundamentally insane, and after the first five years of his reign he became almost a cipher.

The royal journey of 1768, however, had paved the way for one of the strangest revolutions in the history of any country. Among Christian's attendants was a young German physician, Struensee, son of a high ecclesiastic and brother of a future Prussian statesman. By

studying the king's malady, Struensee gained a complete influence over him and was retained at court. There he became the lover of the queen and the ally of high-placed Danes who resented the ascendancy of Bernstorff. In 1770, to the outspoken indignation of Catherine of Russia, Bernstorff was dismissed, but the real authorship of the change remained a secret. Next year, however, Struensee, now a count, was forced by Christian's growing insanity into the open. A typical eighteenth-century 'philosopher', he was raining doctrinaire reforms upon Denmark 'as though legislating for the inhabitants of Jupiter or Saturn'. Freedom of the press, man's legal right to be vicious, rule by Cabinet orders, reforms of the tribunals, purges of the administration, rural emancipation—many of these might be welcomed from a Danish king, but hardly from a foreign upstart who had seduced the queen and enslaved his royal master. Christian's signature to edicts, however, could not always be procured, and the substitution of that of Struensee violated the *Kongelov*.

After sixteen months of benevolent despotism, Struensee found himself with only one sincere supporter, Caroline. His crowning blunder was to affront the army. In January 1772, the queen dowager and her son, his tutor Guldberg, and Count Rantzau, an earlier patron of Struensee, carried through a counter-revolution. Christian screened by his participation the attack upon his consort and minister, as he had screened their liaison by recognizing Struensee's daughter as his own. Britain vetoed violence against the queen, who was divorced and transferred to Hanover. Struensee and a noble confederate were hewn in pieces before a shuddering crowd. Guldberg then became for twelve years the inspiration of a conservative *régime* whose motto was 'Denmark for the Danes'. In court and official life, and in army words of command, Danish replaced German. Danes alone became eligible for office, and the Norwegians were bluntly told that they were Danish.

The Guldberg Régime, 1772–84

The Guldberg government was confronted with a new danger from the restless ambition of Gustavus III of Sweden. His monarchical *coup d'état* of 1771 might well be the prelude to an attack on Norway. But the danger to both powers from Sweden drew Russia closer to Denmark, and in 1773, when Paul, duke of Holstein and heir to Russia, was of age, Catherine ratified the Treaty of Exchange which embodied the patriotic plan of Bernstorff. By ceding Oldenburg to Holstein, Denmark gained Paul's recognition of her incorporation of

Slesvig and his cession of the Gottorp lands in Holstein. Thenceforth Christian reigned without question over Denmark and the Duchies alike.

Guldberg's deficiencies in foreign affairs were in part made good by the employment of Count A. P. Bernstorff, the upright and virile nephew of the great minister who had died on the morrow of the *coup d'état*. As a Hanoverian, a Danish statesman and a man of sense, he steered clear of affront either to Sweden or to Britain, which was soon engaged in her North American War. This for a time brought great profit to sea-faring Denmark, but its inevitable accompaniment was friction with the belligerents, especially with Britain. The foremost sea-power claimed a sterner maritime law than neutrals could accept. The British would seize the goods of their enemy if found upon the high seas in neutral vessels. The neutrals, led by Russia, in 1780 formed an armed neutrality to uphold their doctrine of free ships and free goods, save only contraband of war or violators of blockade. Sweden and Denmark joined the league, but Bernstorff's negotiation with Britain of a separate agreement regarding contraband offended Catherine. His opposition to the continued 'Cabinet government' in Denmark caused Queen Juliana to seize the occasion for his dismissal.

Four years later, when the war had ended, the queen and Guldberg were themselves dismissed. The Crown Prince Frederick, the mad king's somewhat wooden son, adroitly used the *Kongelov* to gain a regent's power. In April 1784, being sixteen years of age and a Lutheran duly confirmed, he attended the Council and requested his father to sign a document. This, as it proved, decreed the replacement of the existing Council by four progressive ministers, of whom Bernstorff was the first. The irresistible authority of the king thus empowered his son and a group of liberal aristocrats to mould anew the rural population. In the great year 1786, which also saw the dynasty secured by the marriage of Struensee's daughter to the duke of Augustenburg, sixteen high officials or great landowners met to reform the Danish countryside.

Agrarian and Social Reform

Led by enlightened men and supported by the government, the great Commission swiftly abolished the worst of the old abuses. Within a few years Denmark was changed from a land half-filled by downtrodden serfs into a land in which the best contemporary agriculture was pursued by freemen. By the turn of the century, serfdom

had disappeared, landlords could no longer chastise their tenants, more than half the peasants had bought their holdings, and both wealth and man-power were increasing. Thanks to Bernstorff, the Duchies shared in the advance.

Denmark's small size and accessibility, indeed, enabled her to profit swiftly by what was best in the age of Rousseau, Svedenborg and Arthur Young. She could claim to lead the world in negro and in Jewish emancipation. Within a generation of Struensee's death many of his innovations were accepted. The press became free; education, widespread; protection, much reduced. Steered by Bernstorff, the Danes, delivered from the Russo-Swedish War of 1788, could evade the wars of the Revolution, while profiting immensely from the absence of many competitors by sea. New writers, scientists and artists, Thorwaldsen the most renowned among them, commemorate this as Denmark's golden age. Her increased national consciousness challenged Norway to follow her example, and strengthened the anti-German feeling visible when Struensee fell.

DENMARK DURING THE AGE OF NAPOLEON

The Second Armed Neutrality and the Battle of Copenhagen, 1800-1

In 1797, however, the death of Bernstorff, whose sons and successors were not his equals, robbed Denmark of her pilot when she was most gravely threatened by the gathering storm. One ruler of doubtful sanity had replaced Catherine the Great; another succeeded Gustavus III. While Britain suffered little from the madness of George III, the autocracies became unaccountable, and Napoleon soon menaced Europe. In these conditions, Denmark joined Russia and Sweden in a second armed neutrality. Britain stood stoutly by her claim to search neutral ships for goods in transit to or from the enemy. The Danes then attempted to protect their trade by convoy, but one convoying frigate was herself brought into port for judgement. The outcome of the armed neutrality proved in April 1801 to be a hard-fought battle off Copenhagen, when Nelson's resourcefulness brought the Crown Prince Frederick to give way. The Danes could be justly proud that they had faced a renowned and powerful enemy without flinching, and that his losses were comparable with their own. So strong was the fleet in which Nelson, the hero of Aboukir, was only second in command, that its destination was surmised as Russia. Modern research and judgement cannot disapprove Frederick's surrender to an ultimatum which he was in no strength

to decline. The simultaneous murder of the Tsar dissolved the league, and Denmark, abandoning her claim, secured six years' prosperity.

The Bombardment of Copenhagen, 1807

Napoleon's triumph at Jena, however, warned the Danes that they might soon be forced to choose between France and Britain. To the detriment of their finances and administration, the crown prince made Kiel his headquarters, and guarded the southern frontier with an army. With Napoleon at Berlin, the two combatants outlawed each other by proclamation, and at Tilsit Alexander of Russia joined the French. To the Danes Britain seemed the more formidable power, for she could crush their trade, invade their coasts, and sever them from Norway. As an ally, moreover, she could make the Danish isles and Norway secure against Napoleon. Britain, however, suspected that the Emperor would gain the Danish fleet, and sent an irresistible force to demand its custody. Three days of pitiless bombardment forced Copenhagen to surrender, and the great fleet was carried off (September 1807). But it flung Denmark into a seven years' war with Britain, and next year into a war with Sweden, Britain's momentary ally. These wars impoverished the Danish state and threatened it with dissolution. Until Napoleon was finally overthrown, the future of Denmark was transformed year by year.

In 1808, the British fleet frustrated an attack from Denmark upon Sweden, and Norway defended herself against the Swedes. Christian VII at last gave place to Frederick VI, who might hope that the Swedes also would elect him, after deposing their madman king. Next year, the horoscope favoured a partition of Sweden between the Russians and the Danes. The Swedes, indeed, deposed their autocrat and abolished autocracy, but made an insignificant royal uncle king. For a moment it seemed that the popular Augustenburger who had governed Norway would unite that country with his future Swedish realm, but his sudden death compelled a second choice. By a strange chance the Swedes, deprived by Russia of Finland, turned towards Napoleon for compensation, and chose his marshal, Bernadotte, as their crown prince (1810). As cautious in statecraft as he was bold in battle, the newly-named Crown Prince Charles John in 1812 joined Russia and Britain against France. His steadfast aim was to gain Norway, which could be held against the Danes, in compensation for Finland, which would always be at the mercy of the Russians. After the Leipzig campaign he entered Holstein, and in January 1814 Frederick VI made peace at Kiel. Sweden thereby gained Norway

in personal union and ceded her Pomeranian lands to Denmark. To end the kaleidoscopic evolution, Frederick joined the allies, accepted Lauenburg in place of Swedish Pomerania, shared in the occupation of France, and ceded Heligoland to Britain.

Denmark after 1815

Post-war Denmark, where Frederick reigned for four-and-twenty years, was in many respects a new realm in new surroundings. The kingdom and duchies formed a fairly compact country of some 22,000 square miles, with the Faroes, Iceland, part of Greenland and a few tropical possessions as wreckage from its former empire. In the population of continental Denmark, Danes stood to Germans roughly as two to one, with a great majority in the capital, the government and the kingdom, but a minority in the duchies, especially in Holstein and Lauenburg. These last gave the king a seat in the new German Confederation. But the rising tide of German racial feeling, strengthened by poets and by the War of Liberation, already threatened the foundations of the Danish state. In 1810 the brothers Bernstorff had resigned their offices—to the detriment both of the new administration by Colleges and Councils, and of the old collaboration between the Danish and the German subjects of the crown. Meanwhile, the pride and the renown of the Danish people were growing, as the names of Grundtvig, Ørsted, Thorwaldsen and Andersen suggest. The national debt, which in 1813 had compelled a drastic repudiation, lost its disturbing power in time of peace, and progressive Danes began to contemplate a constitution. Frederick VI, an autocrat by conviction, gained in popularity as his reign grew longer, but the fall of the Bourbons in 1830 awoke an echo in Denmark. Four years later, on a narrow franchise and with only a consultative voice, four provincial assemblies were created. The islands elected 70 representatives; Jutland, 51; Slesvig, 44; and Holstein, 48; Lauenburg retaining its old constitutional Diet. Thus tempered, the Danish autocracy faced the growing danger from the Slesvig-Holstein question.

THE SLESVIG-HOLSTEIN QUESTION, 1839-1920

The Status of the Duchies

In the later years of Frederick VI (1834-9) the Slesvig-Holstein question was compounded of two main elements—dynastic rights and popular ambitions. The Denmark of the *Kongelov* had been an aggregate of provinces with the common duty of obeying their common

king. So long as the crown passed from father to son, no question of division could arise. But since Frederick VI had no sons and had failed to introduce the *Kongelov* practice into Holstein, that province should pass to the duke of Augustenburg while all else fell to the king's nephew.

A severance from Holstein would of course wound the feelings of the king's successor and of ambitious Danes. Year by year, moreover, it became increasingly distasteful to Germans in both duchies. Men of the same blood, faith and speech, dwelling on a plain that stretched to Hamburg and lay remote from Copenhagen, they might well prefer great Germany to narrow half-alien Denmark. The duke of Augustenburg, who had hoped that as son-in-law of Christian VII he would inherit both kingdom and duchies, was ready to maintain that no later legislation could override the king's promise of 1460 that Slesvig and Holstein should be eternally united. In support of this more than dubious thesis he could marshal pregnant facts. The duchies were governed through a separate Chancery and mainly by German officials. They had a common Viceroy; their churches, a common General Superintendent; and their troops, a common commander. The customs frontier was so drawn as to place them rather in Germany than in Denmark. Throughout Holstein and much of Slesvig, the language of the church and schools was German, and the cultural influence of the German university of Kiel prevailed. The aristocrats of both duchies worked in common for their claim to govern.

A century later, these facts would have powerfully influenced any body charged with the division of the Jutland peninsula into states. In an age when hereditary and prescriptive right ranked foremost, they were far from decisive. Whatever the political notions of the inhabitants, moreover, it could not be gainsaid that Slesvig was immemorially Danish, that its northern and middle zones used Danish in the home, and that the northern zone also worshipped and was taught in Danish. As Germany and Denmark became more conscious of their nationality, a question never completely soluble grew ever more dangerous to peace. When, in 1839, Frederick VI was succeeded by his cousin Christian VIII, the problem of Slesvig and Holstein was inflaming the educated youth of both Denmark and Germany.

Attempts to find a Settlement

Christian VIII proved incapable of a firm or brilliant policy in troubled times. After making Danish the language of government over part of Slesvig, he allowed its use in the assembly only when a

representative could not speak German. Meanwhile he had attempted to propitiate or to undermine his Augustenburg rival by appointing his younger brother to represent the king and to command the army both in Slesvig and in Holstein. But the nationalists of Copenhagen marshalled the Slesvig peasants to demonstrate for Denmark, while the childlessness of the crown prince, Queen Victoria's 'wretched king', threatened to renew the separation question in the not distant future. Throughout the reign, the growing well-being of the Danes in the age of railways and rising corn prices and under a *régime* of peaceful progress had given rise to new parties and new demands. The peasants claimed full equality with other classes. National Liberals advocated the severance of Slesvig from Holstein and a common constitution for the kingdom and Slesvig—'Denmark to the River Eider'. Intellectuals dreamed of a reunited Scandinavia of the three crowns. Orla Lehmann, a heady orator, fired great crowds with enthusiasm for a northern brotherhood in arms.

Pestered from all sides, Christian turned first to a commission of inquiry and then to a temporizing decree. His 'Open Letter' of 1846 declared that, in Slesvig, as in Denmark, the *Kongelov* determined the succession, but that in Holstein the question was not free from doubt. He would, however, do his best to arrange that there also the female line might inherit. At this all German elements protested. Of the threatened representatives of the male royal line all save Christian's nephew by marriage, the later Christian IX, made formal protests. The prince who ruled the duchies resigned his offices, and the assemblies dissolved themselves. The German Diet at Frankfurt voiced its sympathy. The king replied by filling vacancies with trusty men, but in January 1848 he died.

Christian VIII's son, Frederick VII, whose forte was affability, succeeded at the age of 39. Thanks to his father's labours, eight days later he produced a draft constitution which virtually abolished the autocracy. The 1,300,000 inhabitants of the kingdom and the 800,000 of the duchies were to have equal representation in a joint Diet with sovereign power—a solution which could please neither Germans nor Danes. The former were doomed to perpetual Danish rule; the latter, in the kingdom, to mere equality with the duchies, where their kinsfolk had little shelter against the German majority. For some six weeks the mutual intolerance grew. Then the overthrow of the French monarchy produced a ferment which spread from Germany to her northern neighbour, and the revolutionary movement known as 'The Days of March' began. First the Germans of the duchies claimed

Slesvig for the German Diet. At Copenhagen, Orla Lehmann and the masses demanded that Slesvig should remain Danish, with a provincial Diet of its own, and that new ministers should be appointed. Frederick had in fact already dismissed the old. Compounding with difficulty a national ministry from old and new, he declared himself henceforward a constitutional king. Thus it was the ministry that replied to the German claim, adding to the incorporation of Slesvig the promise of a democratic constitution for Holstein.

The War of 1848-9

The victory of the 'Eider Danes' at Copenhagen and of the forces of revolution at Berlin stirred the Germans of the duchies to take up arms. Claiming to be the deliverers of their duke, Frederick, from the revolutionaries of Copenhagen, they formed a provisional government under an Augustenburger. The hostility of the Slesvig Danes to the revolt, however, was strong enough to drive his family from Augustenburg to a place of safety. The Danes of the kingdom flocked to the colours and pan-Scandinavian sympathy brought volunteers from Norway and from Sweden.

A few months of combat sufficed to show that on land the Danes were stronger than the Slesvig-Holstein Germans, but unable to make head against the Prussians, who quickly intervened. They could, however, blockade the Prussian ports, while Prussia found her intervention condemned by Britain, Russia and Sweden. A truce between the combatants proved that neither Frederick nor his Danish subjects could tolerate concession, and in 1849 the war began anew. It was marked by German superiority but increasing lukewarmness on the part of Prussia, by a heroic Danish victory at Fredericia, and by a deepening cleavage between the Slesvig Danes and Germans.

In July 1849, a truce with Prussia was established. As the German revolution waned and Russian autocracy became predominant, this hardened into a permanent peace, Frederick undertaking that he would rule Slesvig himself and that it should never be incorporated in the kingdom. The Germans of the duchies and German volunteers fought on, but Austria and Prussia intervened to end a hopeless struggle on the terms of Frederick's undertaking. The quickened racial feeling which dictated the Eider frontier had suffered a veiled defeat. In 1850 Slesvig was permanently differentiated both from its northern and its southern neighbour. How its jarring Danes and Germans could be satisfied, time alone could determine.

The June Constitution, 1849

Meanwhile Denmark had been feeling her way towards transformation into a constitutional state. Amid much excitement and debate, 150 Danes had been formed into a constitutional Convention. Of these one-fourth were nominated by the king and the rest chosen by general suffrage of men past thirty. In June 1849, the Convention produced a new Fundamental Law (*Grundlov*), by which the *Kongelov* was superseded. Every independent male of thirty gained a vote in the election of two chambers, distinguished by the age and wealth of their membership, which were to form the Diet (*Rigsdag*). This shared with the hereditary monarchy the powers of legislation, taxation and conscription. Freedom of the press, of creed and of assembly were pronounced fundamental rights, and many social and political reforms were designated for future realization.

The end of the war, therefore, left the kingdom a democracy and the duchies two distinct entities under an autocratic king. Frederick VII was childless, and the female line could succeed only in the kingdom. He appointed an active Dane as his viceroy in Slesvig, but Holstein remained in Austrian and Prussian occupation, and constitutionally neither duchy might be drawn nearer to Denmark. While, therefore, the Danes were inclining towards a unified state, comprising both kingdom and duchies, their new Fundamental Law must be confined to the kingdom alone. By a series of agreements, they had by 1852 conceded to the German powers that Slesvig and Holstein should be equal as against the crown and kingdom and that no constitution should be imposed upon them without their consent. It remained to provide the three constituents of Denmark with a common succession and a common constitution.

London Conference, 1850

Meanwhile, in the interests of European peace, the five Great Powers and the Scandinavian states had met in conference in London. It was there arranged that the duke of Augustenburg should receive pecuniary compensation and that the whole succession should pass to the Glücksburg male line. Christian, the king's nephew, thus became crown prince. Frederick then conferred upon the duchies limited and aristocratic constitutions. Many statesmen, however, could not abandon the hope of a common constitution for the whole, and a stormy period of politics culminated in an edict of 2 October 1855, in this sense. The Crimean War, in which Britain and France,

with Austrian sympathy, combated reactionary Russia, favoured the Liberal Danes, and the edict roused the implacable opposition of the Holstein leaders. These received Austrian and Prussian support, and in 1858 the Danish ministry gave way. They fell back upon the Eider policy, only to be met with German claims that Slesvig must keep in line with Holstein.

To sacrifice their hopes of progress, when Russia was engaged in Liberal reform and Italy in national union, seemed to the Danish nationalists intolerable. Their German opponents, indeed, found support in Prussia, but Prussia had played a sorry part during and after the Crimean War. In March 1863, the Danes, who in 1857 had accepted some \$400,000 to abolish the Sound dues, announced that they would give Holstein and Lauenburg a separate and almost independent constitution. Prussia and Austria protested; the Slesvig Diet broke up; but on 13 November the Danish ministry voted for Liberal institutions to the Eider. Two days later Frederick VII died. On the 18th, Christian IX signed the November Constitution.

The November Constitution, 1863

The Danes thus defied the Germans at a moment when the European situation was full of peril, with Bismarck eager to manipulate it against them. The Polish rising of 1863 brought an *entente* between Russia and Prussia, while it also revealed the latent antagonism between France and Britain. No power, not even Sweden, proved able and willing to help the Danes. They offered to withdraw the new Constitution, but would admit no German occupation as a guarantee. An Augustenburg prince claimed and roused the duchies and the Danes could not hold them against Austrians and Prussians combined. The *Danevirke*, however, ranked as impregnable.

The War of 1864

In December 1863, the forces of the German Confederation established the Augustenburg claimant in Holstein. The Danes had withdrawn to the *Danevirke*, but in February 1864 they were forced by the Austrians and Prussians to give it up. In May all Jutland was in German hands, despite hard fighting by the Danish troops on land and a moderate superiority by sea. Meanwhile, Great Powers and Scandinavians had met in London and proposed that Denmark should cede Holstein and a part of Slesvig as the price of peace. The Danish ministers offered the *Danevirke* line but declined the German minimum and a plebiscite. Hostilities were resumed, but soon after mid-

summer the Danes lost heart, and three months' negotiation resulted in a disastrous peace. Slesvig, Holstein and Lauenburg were abandoned to the Austrians and Prussians.



Fig. 38. Slesvig-Holstein, 1864

Based on *The Cambridge Modern History Atlas*, map 116 (2nd ed., Cambridge, 1924).

The northern portion of Slesvig was returned to Denmark on the results of the plebiscite of 1920 (see Fig. 130).

More than half a century passed by before, in 1920, a plebiscite heralded the return of northern Slesvig to Denmark. Of this the first six years were full of expectations unfulfilled. Bismarck's successive triumphs proved so many disasters for the Danes. First seizing Kiel,

he rejected the Augustenburg pretensions. In 1866, outwitting Napoleon III, he crushed the Austrian army. Napoleon, indeed, abridged the campaign and shaped the peace treaty at Prague to include a Prussian undertaking that a free vote in northern Slesvig should determine its allegiance. The overthrow of France in 1870, however, robbed the undertaking of its value, and in 1878 Prussia and Austria denounced it. No outside power interfered. Christian IX was called 'father' by many sovereigns, but towards Russia and Britain, the chief of them, Bismarck directed his most watchful care. By 1890, when he fell, Denmark had become a tiny state lying on the doorstep of the mighty *Reich*, which was preparing to complete her fetters by means of Heligoland (1890) and the Kiel Canal (1895).

DENMARK FROM 1864 TO 1920

The years 1864-1914 transformed the Danes into a people hardly surpassed in civilization but almost negligible in the race for power. They might well be proud of the constancy with which the north Slesvig Danes clung to their fatherland, in spite of all the blandishments and coercion of their German governors. Should they exercise their right to retain their Danish nationality or, at the price of military service, acquire the rights of Prussian citizens? Their answer, different at different times, was determined by the apparent interest of Denmark, and when at long last the day of voting came, their Danish sympathy was overwhelming (see p. 519).

Domestic Affairs

Meanwhile, the mutilated state plunged into keen party strife—the prelude to a time when economics and culture should fill the horizon while foreign politics shrank to almost nothing. As the National Liberals had brought Denmark into a disastrous war, the Conservative landowners united with the peasants to alter the Constitution to the advantage of the landed interest, high income giving the advantage in elections to the second chamber (1866). When 1870 brought the Franco-Prussian War, Denmark clung to neutrality. The collapse of France condemned Danish arms to impotence, and the Danes wisely turned to hasten the development of their agriculture, industry and culture (see Chapters VIII, XI and XIII). This none the less involved a keen political struggle between Right and Left, with national defence a burning question, and, in the eighties, Social Democracy a growing force.

When the twentieth century began, the Left, now split into several groups, united to form a ministry. Its fruits were a defence commission, more socialistic taxation and education, and greater autonomy for Iceland. In 1905, at the moment when Norway broke off from Sweden, and chose a king from Denmark, the Danish Radical Left drew up a programme which suggested the trend of the following generation. Denmark, they agreed, should declare herself permanently neutral, and Copenhagen an open city. The fleet and army must be reduced to what was necessary to perform the duties of neutrality. In commune and nation alike, perfect democracy should prevail; adults, without regard to sex, calling or poor relief, having equal votes by ballot. Communal self-government, they held, should be enlarged, and ranks and titles done away. Taxation, especially death duties, and 'a systematic social legislation', should aim at reducing economic and other inequalities. Free trade should be promoted and the community guarded against legal or actual monopolies. A Ministry of trade, navigation, handiwork and industry must be established. The state should create a mass of small holdings and a wide plan of social insurance and inspection. Church courts should disappear, and justice be modernized. In civil legislation, the northern nations should keep in step. Learning should be accessible to all; and culture, directed to 'develop the national sympathy with our countrymen outside Denmark'. Schools should become secular and democratic.

The Rise of Social Democracy

Soon this Radical programme was supplemented, and in some degree displaced, by that of the Social Democrats, who in the next generation gained a majority in every Scandinavian kingdom. As the Church and aristocracy lost in power, and foreign violence was assumed to have been charmed away by the spell of arbitration, the public enemy was discerned in private capital. The means of production must therefore be controlled by the community, while class-conscious socialist Labour seized wealth and power. Tempered by history, by national stolidity and good nature, and, from 1912, by the popular monarchy of Christian X, Social Democracy has progressed in Denmark without convulsion. In co-operative agricultural production, in several branches of industry and in the wide diffusion of education and social decency, the little kingdom of less than four million souls ranks among the foremost in the world. Science, learning and the arts comprise Danish names in numbers out of all proportion to the population. The fact that few Danes quit their tiny fatherland,

which, at least in harvest-time, 'the progress of agriculture has turned into a country of immigration', is eloquent.

Denmark during the War of 1914-18

The last half-century, none the less, has given conclusive proof that Denmark is too accessible and too weak for safety. The Kiel Canal and the new German fleet, the invention of motor transport, submarines and aircraft, all tightened the grip upon her of her mighty neighbour. The gateway of the Baltic was seized by the state which possessed the Kiel Canal and dominated the Belts and Sound. It has been powerfully contended that in the early years of the twentieth century, and particularly in August 1914, Denmark became the cats-paw of the Hun, making preparations solely against his enemies. In the war of 1914 it served the German interest to shield his northern flank with neutral Holland and Scandinavia. By agreement the Danish food surplus was divided between Britain and Germany. All this encouraged the Social Democrats to disarm, and to rely upon an *entente* between the northern states and upon the League of Nations. When, in the spring of 1940, the interests of Germany dictated the subjugation of Denmark, she was powerless to resist and none could save her.

In 1915, after ample and evidently sincere promises to Germany in no case to join her foes, Denmark achieved an almost uncontested reform of her constitution. The changes pointed to the expectation of prolonged domestic peace. The life of the revised arrangement was prolonged from 25 to 100 years, and the chief changes were the addition of new constituencies and the grant of votes to women. Next year, after a commission and plebiscite, the Danes complied with the urgent wish of the United States by selling the Danish West Indies for 25 million dollars. In return, the United States conceded a free hand in Greenland. Despite the mounting difficulties of a prolonged and intensified world war by sea, the elections of April 1918 showed a nation whose equilibrium was undisturbed. The Left or Liberal Democrats held 45 seats; the Conservatives, 22; the Radicals, 33; and the Social Democrats, 39. The government coalition must thus set a small majority in the Lower House (*Folketing*) against a minority (28-44) in the Upper House (*Landsting*), but in the Lower House they received a vote of confidence by 70 against 62.

The North Slesvig Plebiscite

The Armistice of 1918 was immediately followed by that disarmament of Copenhagen which the government in 1909 had fixed

for 1922. At the same time the sufferings of the north Slesvig Danes claimed attention. Called to arms from 17 to 50, the menfolk had suffered heavily, while births fell and deaths increased by many thousands. As soon as Germany collapsed, the Danes dared to speak out, and, particularly to frustrate the germanization of Flensburg, more and more of them demanded the frontier of the Eider. The Danish spokesman at the Peace Conference, however, showed that, beyond the border of northern Slesvig, and particularly in Flensburg, his government wished for no acquisitions unless with the manifest consent of the population. Meanwhile, a Flensburg newspaper collected 116,000 signatures to a petition for the *Danewirke* frontier. A Peace Conference Commission, indeed, held that a 'third zone' should also vote, but the reluctant Danish government secured the veto of the Council of Four. At midsummer 1919, H. P. Hanssen, long the Radical hero of Slesvig, became minister for 'the southern Jutish regions', and in 1920 the plebiscite took place. In the northern zone three-quarters of the voters favoured Denmark; in the southern, only one-fifth. By midsummer, northern Slesvig had substantially returned to the rule of the Danish crown. On Sunday, 11 July, in the presence of Christian X, and his government, the stricken field of Dybbøl witnessed a mighty gathering of 100,000 triumphant people. Denmark, whose Diet had voted unanimously for joining the League of Nations, was entering the new age with some 15,000 of her adults under German rule, and with some 25,000 Germans under her own.

DENMARK AFTER 1920

Internal Politics, 1920-33

In the autumn of 1920, the elections to the *Rigsdag* gave the Left 52 members; the Social Democrats, 48; the Conservatives, 27; and the Radicals, 18—a grouping roughly followed by those for the *Landsting*. The Ministry of the Left lasted half-way through its fourth year, but party cleavages and economic fluctuations proved most violent. A small army was retained, though the Social Democrats wished for none, and the Radicals favoured only a tiny fleet and army to satisfy the League of Nations. The descent from high prices to low, and the collapse of the currency, shook the voters. In 1924 the Social Democrats came in, having with Radical support a majority of two. Two years later they restored the currency only to suffer a rapid fall in prices. From 1926 to 1929, the Left, with precarious

Conservative support, struggled with unemployment, debt repayment, banking difficulties and the restriction of social subsidies. An increase in the military budget overthrew them. In April 1929, the Social Democrats rose to 61, with the Left numbering 44, the Conservatives 24 and the Radicals 16. Th. Stauning, cigar worker, leading trade unionist and premier, from 1924 to 1926, then formed a coalition ministry of Social Democrats and Radicals, himself exchanging the Ministry of Navigation and Fisheries for that of National Defence.

With Stauning as a skilful pilot, the Danes have since been steered along the line of greatest comfort and of least resistance. The army was soon reduced in size and improved in organization and equipment. The navy discarded heavy ships and built light. Thus a burning question was temporarily disposed of, and the nation saved more than 20% on the military estimates. Capital punishment ceased, criminal justice was improved, social security developed, and great public works undertaken.

The Economic Crisis, 1930-33

When the world financial crisis came, Denmark, at first helped by the fall in fodder prices, found in the early thirties her exports failing, her farms becoming a burden, her workless more than doubled, and her currency going down. Government fought the dangers by many regulations and, fearing a British prohibition of imports from Denmark, promoted purchases from Britain. In September 1932, an election to the *Landsting* showed that the country did not resent their efforts. Two months later, Stauning survived a general election with undiminished power. In 1935 the Social Democrats, thanks to trades unionism, rose from 62 to 68, while the Radicals, largely representing the smallholders, again numbered 14. Next year the verdict of the electors to the *Landsting* proved similar.

Meanwhile, in 1933, three questions critical for Denmark had been solved:

(1) Prior to the Ottawa Conference of 1932, she had been perilously dependent upon Britain. Of her bacon exports 99% went to this market, with 85% of her eggs and 72% of her butter. British colonial preference threatened this vital trade, and an offer to fix a total import quota, of which Denmark should have a great fraction, at first led to disappointment. In place of a weekly contingent of 125,000 Danish pigs supplied to Britain there were to be only 108,000. In 1933, however, Britain agreed to keep her import duties low, with none on bacon, and to take 62% of her non-Empire imports from Denmark.

Excepting fish, this promised almost to maintain the former rate of trade. Reciprocally, Danish customs dues were to favour coal and many other British exports. These agreements, it was hoped, would remedy the low prices, currency depreciation, unemployment and fall in exports which had driven even Burmeister and Wain to virtual bankruptcy.

(2) To ease the impossible industrial situation, the law of January 1933 prolonged all wages contracts for a year, forbidding strikes and lockouts in the meantime. Such legislation was the outcome of a crisis in which the Danish currency, linked with the paper pound, might fall to half its normal gold value, while Denmark struggled to outwit her rival, New Zealand. It was followed by energetic and far-reaching legislation designed to guide and to protect Danish agriculture in all its aspects, and to ease taxation by contracting loans. Social well-being was also sought by the extension of insurance and of education (see pp. 178, 158). It was protected against the infection of Hitlerism by a law prohibiting political uniforms, which was carried against Conservative and Communist opposition. When legislation proved inadequate to cope with the world storm, funds were raised by taxing imported corn and cheap butter and margarine produced at home, and thus increasing the provision of state help for the poor and workless.

(3) While the foreign policy of Denmark was directed to the maintenance of peace, which she sought by treaties of arbitration and of commerce, by support of the League of Nations and by a scrupulously fair treatment of her German subjects, friction with Norway arose through conflicting claims in Greenland. While the Danes had long exercised sovereignty in the west of the island, the Norwegians insisted that the east had been a no-man's-land and that they themselves had seized it. After long and vain negotiations, the question was submitted to the Hague Tribunal and, in April 1933, Denmark gained an almost unanimous award.

The Clouds of War, 1933-40

Between 1933 and 1939 the forces gathered strength which in April 1940 submerged historic Denmark. Viewed superficially, indeed, she remained the active and prosperous country that had understood how to turn from unprofitable corn-growing to remunerative farming and to steer clear of the first world war. Her king, her prime minister and, in the main, her parties remained unchanged. In its ratio to population, her foreign trade was the second highest among continental

countries, and its profits were by no means spent on armaments. Her good relations with six neighbours like herself were embodied in the periodic meetings of the so-called Oslo states. Yet in 1939 an observant writer could describe her, without injustice, as fast asleep on a volcano.

The ground for this indictment lay in the fact that Denmark had made no attempt to cope with a novel but obvious situation. From the victory of Hitler in 1933 it became year by year more certain that the German peril was reviving. In June 1935, the Anglo-German naval agreement placed the Danish Baltic coasts at the mercy of their mighty neighbour, while the growth of the German air fleet added a new and terrible danger to the whole land. Next year the triumph of aggression against Abyssinia showed the impotence of Britain and the League of Nations to protect small countries against military powers. At the same time the Danes, dependent on their trade with Germany and Britain, were struggling to comply with the British demand that it should be less one-sided. Within a few years, indeed, they doubled their imports from this country (see Fig. 70). Such was the internal friction from economic causes that in July 1935, some 50,000 farmers marched on Copenhagen and vainly appealed to Christian X. All that the government could do was to conclude with Germany a commercial treaty (January 1936) which pledged them to great sterling payments in return for German goods, including many which were quite unnecessary.

Defenceless against Germany and in no small degree dependent upon Germany—such were the characteristics of Denmark on the eve of the second world war. Hitler's victory in 1933, moreover, was followed by a wave of Nazi irredentist agitation both within and without northern Slesvig. For some years the relations between Berlin and the Nazis in Slesvig-Holstein and Denmark remained obscure, while the subservience of the Danish government towards Germany was denounced, especially in Scandinavia. But in 1937 the Germans could claim to have prevented Denmark from entering a Nordic defensive alliance, while Danish registry offices were forbidden to marry non-Aryan aliens to persons of pure German blood. Political refugees from Germany could not count on an asylum in Denmark, and critics were amazed at the docility shown by the Danish press in discussing German questions.

On the eve of the second world war, Denmark was still treading the path which, she hoped, would lead to a neutrality no less profitable than her escape in 1914. While enjoying unprecedented prosperity,

she continued to perfect her own democracy and at all costs to please the Germans. In May 1939, only some 12,000 more votes proved necessary for the national approval of a law abolishing the second chamber, while the Danes, alone among Scandinavians, accepted a peace pact with Hitler. The government continued its social reforms by decreeing holidays for workers. Before Christmas, however, war had undermined Danish prosperity, except in shipping, and they had again proclaimed their neutrality in the Russo-Finnish struggle. They warned their fellow-Scandinavians that their policy was all-embracing neutrality. In April 1940 the bubble burst. With unconscious irony, when Britain had brought herself to the slightest possible infraction of Norwegian neutrality, Hitler seized both Norway and Denmark on the pretext of British invasion plans.

Chapter VII

GOVERNMENT AND ADMINISTRATION

The Central Government: Local Administration: Administration of Justice: Relations with Iceland, Greenland and the Faroe Islands

The present constitution of Denmark is based on the Law of 5 June 1915, which was amended on 10 September 1920. These amendments were of a minor character and were made necessary by the inclusion in Denmark of part of Slesvig after the plebiscite of 1920. The Constitution of 1915 marked a return to the principles of the Constitution of June 1849 after the attempts which were made between 1855 and 1866 to devise a constitution that would provide a working arrangement to include Slesvig and Holstein (see pp. 133-4).

THE CENTRAL GOVERNMENT

The kingdom of Denmark is a constitutional monarchy in which legislative authority is shared by the Crown and a parliament, the *Rigsdag*, which consists of two chambers composed of the elected representatives of the people. Executive powers are vested in the King, who exercises them through his ministers. The highest executive body is the Council of State which consists of the King, the Crown Prince and all the Ministers. Judicial authority lies with the law courts.

Bills passed by the *Rigsdag* cannot become law until they have been signed by the King. On the other hand, the King may make provisional laws, in cases of urgency, when the *Rigsdag* is not in session or when it has been dissolved and a new *Rigsdag* has not been elected. But such provisional laws must be submitted to the *Rigsdag* when it assembles, and if they are not approved they cease to be in force. Normally, however, the King may not make laws without the collaboration of the *Rigsdag*.

The Rigsdag

The *Rigsdag* consists of an upper chamber, the *Landsting*, and a lower chamber, the *Folketing*. All Danish nationals over 25 years of age and permanently resident in Denmark hold the franchise for

the lower chamber except those who have been sentenced for 'dishonourable offences'; those who are, or have been, in receipt of Poor Relief and have not repaid the money they received; those who are undischarged bankrupts and those who have been declared incapable of managing their own affairs. The lower chamber consists of 149 members, although according to the Constitutional Law the number may be increased to 152. Of the 149 members, 118 are elected by direct and secret ballot. Nominally the election system is that of single-seat constituencies, but in practice it is a proportional system.

For purposes of election the country is divided into twenty-three electoral divisions (*Storkredse* and *Amtskredse*) of different size. These are further divided into constituencies (*Opstillingskredse*), and each division elects, by proportional representation, as many members to the *Folketing* as the number of constituencies which it contains. In this way 117 members of the *Folketing* are elected in Denmark including Bornholm, and one is elected by the people of the Faroe Islands. A further thirty-one seats are distributed among the parties according to the proportion of votes cast for each party in the whole country. At the same time as members of the *Folketing* are elected, substitutes who will take the place of members who may die or resign are also elected. There are, therefore, no by-elections. Members of the lower chamber are elected for four years.

The franchise for the upper chamber is more restricted. It is held by all Danish nationals who are over 35 years of age and permanently resident in a particular constituency. The *Landsting* consists of seventy-six members, but according to the Constitutional Law the number may be increased to seventy-eight. Nineteen of these members are elected by proportional representation by an electoral college composed of members of the retiring *Landsting*, one is elected in the Faroe Islands, and the other members are elected by indirect ballot in six electoral divisions (*Landstingskredse*). The number of members elected by each of these divisions is determined according to the number of inhabitants. The largest division is Köbenhavn, which elects ten members; the smallest is Bornholm which elects one member. Members of the *Rigsdag* receive an annual salary of 4,000 kroner if they are resident in Köbenhavn and of 5,200 kroner if they live outside the capital. This basic salary is supplemented by a small grant which varies with the cost-of-living index.

The method of election is that voters in the *Folketing* electoral divisions vote for representatives by secret ballot. These representa-

tives are elected by proportional representation, and those within each of the six *Landsting* electoral divisions in turn elect the number of members which the division is entitled to send to the *Landsting*. Members hold office for eight years, and the elections are so arranged that half the members resign, and new representatives are elected, every four years.

All who hold the franchise for the respective chambers are eligible for election to that chamber. The two chambers possess equal status except that all financial measures must be initiated in the lower chamber and, whereas the King can dissolve the lower chamber at any time, the upper chamber can be dissolved only under certain circumstances of disagreement between the *Landsting* and the *Folketing*. Both chambers must be dissolved and new elections held before any changes in the Constitution can be made.

Normally the King convenes the *Rigsdag* once a year. It assembles for its ordinary session on the first Tuesday in October and sits for six or seven months. If the King failed to summon the *Rigsdag*, it would assemble of its own accord on the above date.

Legislation may be initiated by the Crown, acting through its ministers, and by the *Rigsdag*. In an ordinary session the first measure presented is the budget for the following year. Most bills must receive three readings before they can become law. The more important bills, including the budget, are referred to specially elected committees which may propose amendments.

All bills, except those concerned directly with finance, may be submitted first to either chamber. A bill can be accepted by a chamber only if half its members have voted on it, and when it has been passed it is submitted to the other chamber. If this chamber rejects it, the bill is abandoned; but if the chamber makes alterations in the bill, it must be submitted again to the chamber which passed it originally. This chamber may then reject it, or may propose new alterations in which case it is again passed between the chambers. If the two chambers cannot agree over a bill, it may be referred to a committee composed of members of both chambers who try to revise the bill in such a way that it becomes acceptable to the two chambers.

When a bill has been passed after three readings by both chambers, it is submitted to the King for his assent. The King usually discusses the bills with his Cabinet, and although he has absolute power of veto he normally gives his consent to all bills passed by the *Rigsdag*.

Plans to Reform the Electoral System

In 1938 the *Rigsdag* considered plans for reform of the electoral system so as to make it simpler and more democratic. The proposals were submitted by the Prime Minister on behalf of the Government. It was proposed that the *Landsting* should be abolished and that the new *Rigsdag* should consist of 210 members which should be elected simultaneously by the same electorate. Of these members, 176 were to be elected direct, by the system of proportional representation, in electoral divisions; the other thirty-four members would be elected under the system of Additional Mandates based on party lists. These thirty-four members were to be members of a chamber known as the *Ringsting* to which the 176 members elected in the electoral divisions would add another thirty-five members chosen from among themselves. The 141 members remaining from those elected in the electoral divisions were to constitute the *Folketing*.

These proposals were carried by a large majority in the *Folketing* and by a smaller majority in the *Landsting* in March 1939. But under the terms of the Constitutional Law, proposals for altering the Constitution must be referred to the electorate of the *Folketing* and 45 % of the total electorate must approve the proposed changes. Of the votes cast, 90.7 % approved the changes, but since only 49 % of the electorate voted, this represented only 44.4 % of the total number of the total electorate and therefore the bill was rejected.

The King and his Ministers

The King is above the law but he cannot declare war, make peace, conclude alliances and commercial treaties, or cede any part of the country without the approval of the *Rigsdag*. The Evangelical Lutheran Church is the established church and to it the King must belong. If the King goes abroad or is unable to discharge his duties he appoints a Regent who has exactly the same duties and privileges as the King.

The King exercises his authority through his ministers who carry the responsibility for government and can be impeached by the King or by the *Folketing*. Impeachments are heard before a special political court (*Rigsretten*) in which the Supreme Court and the *Landsting* are equally represented. The King appoints and dismisses ministers but the Constitutional Law does not specify how ministers shall be chosen. In practice they are chosen from the strongest political party in the *Folketing* or the party which has, at least, the support of the *Folketing*. The King does not usually appoint individual ministers but only a Prime Minister whom he orders to form a ministry, which

he does usually from among his own political party and parties which support it. The list is submitted to the King for his approval. In political crises the King sometimes appoints a Ministry composed of men of various political parties and of those who do not pay allegiance to any party. Ministers are usually, but not necessarily, members of the *Rigsdag*, and each is usually in charge of an administrative department. The number of Ministries and the division of ministerial posts is determined by the King.

Political Parties

There are four main political parties in Denmark. The Conservative party draws support mainly from among the propertied and commercial classes in the towns, while the Liberal Left party is supported chiefly by the propertied rural classes. The Radical Left party has its following among the smaller landed property owners and some of the urban intelligensia, and the Social Democrats find their supporters among the artisans and trade-union members. There are some five smaller parties. The Free Peoples party represents extreme agrarian interests. The Justice Union consists chiefly of those who advocate the single-tax ideas of Henry George, and there is a small Communist party. A Slesvig party represents the German minority in Northern Slesvig, and there is a very small National-Socialist party. The seats gained by the respective parties at the latest elections were:

	Folketing				Landsting			
	3. iv. 39	22. x. 35	16. xi. 32	24. iv. 29	11. iv. 39	1. x. 36	1. x. 32	1. x. 28
Social Democrat	64	68	62	61	35	31	27	27
Conservative	26	26	27	24	13	15	13	12
Liberal Left	30	28	38	43	18	22	28	28
Radical Left	14	14	14	16	8	7	7	9
Communist	3	2	2	0	0	0	0	0
Free Peoples Party	4	5	—	—	1	—	—	—
Justice Union	3	4	4	3	0	0	0	0
National Socialists	3	0	0	—	0	0	0	—
Slesvig Party	1	1	1	1	0	0	0	0
Independent (elected in Faroes)	1	1	1	1	1	1	1	0

LOCAL ADMINISTRATION

Before the nineteenth century local government was naturally left largely to the landowners to whose estates the peasantry were bound in villeinage and later in serfdom, while the nobility acted as lords-

lieutenant over large areas. They held their own courts, and collected taxes and imposed services, on their own account in feudal days and, later, on behalf of the King. The emancipation of the peasantry towards the end of the eighteenth century made control by the local squirearchy more remote and a measure of local self-government grew naturally from the election of poor law commissioners which were set up under an Act of 1803. An organized system of local government was set up under the Constitution of 1849. Municipal self-government was set up in the provincial towns in 1857 when citizens were given the right to elect representatives to the municipal councils.

The country (excluding the Faroe Islands) is divided into twenty-one counties (*Amter*), each of which is administered by a state official, the *Amtmand*, who holds a position which is similar to that of the prefect in France. He is appointed by the Crown, is the representative of the State, and acts as the link between the central and local governments. He supervises the working of the law, superintends subordinate officials, acts as chairman and executive authority of the county council, and superintends the work of the parish councils. He has the power to suspend any of the decisions of the parish councils if he considers that they are against the law or detrimental to the interest of the community. He presides over various county bodies such as the committees on agriculture, local trade, taxation and epidemic control. He also possesses certain judicial powers such as the right to settle disputes between parishes regarding Poor Law cases and to issue orders for maintenance contributions.

Apart from the general supervision exercised by this State official, local government rests in the hands of county councils, municipal authorities and parish councils. Each of the twenty-one counties contains a number of parishes (*Sognekommune*) and municipalities or market towns (*Köbstad*); in the whole of Denmark there are 1,297 parishes and eighty-eight market towns. The parish councils (*Sogneraad*) are elected by all citizens over 25 years of age who pay local taxes and who have been resident in the parish since the beginning of the preceding financial year. The council is elected on a proportional system for a period of four years, and always consists of an odd number of members which is rarely more than nine or less than five. The members elect their own chairman who may receive a small honorarium, but otherwise the members are not paid. The parish councils manage the local roads and schools, poor relief, sanitation, water supply, drainage, hospitals and health services,

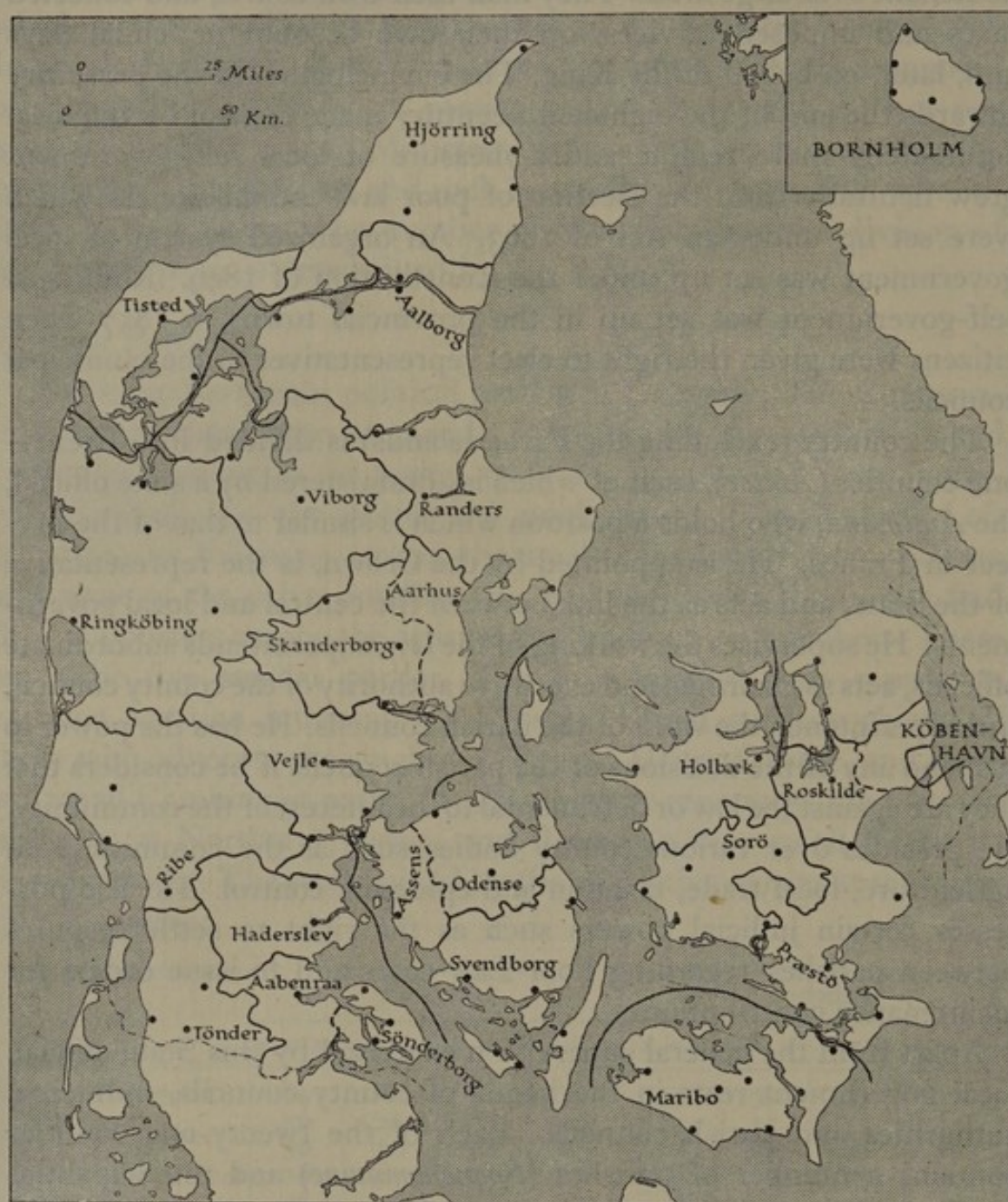


Fig. 39. The counties (*Amter*) and municipalities (*Købstæder*)

The boundaries of the counties have been taken from the *Geodætisk Institut's* 1 : 520,000 map.

The municipality named is, in each case, that which gives its name to the county. The county in north-east Sjælland (Zealand) is named after the royal castle of Frederiksborg, near Hillerød. Most of the *Købstæder* are the Danish equivalent of the English county borough in that they are not part of the administrative county. The exceptions are those in Bornholm. Marstal, on the island of Ærø, is a *Handelsplads* (trading place). The *Flækker*, or unincorporated towns, of South Jylland (Jutland), Augustenborg, Christiansfeld, Höjer, Løgumkloster and Nordborg are also shown.

and they are responsible for assessing and collecting the income and property taxes imposed by the State.

The county councils (*Amtsraad*) are elected indirectly by an electoral body chosen by the parish councils, each of which nominates three electors and also an elector for every 600 voters over and above the first 600 voters in the parish. Denmark is one of the few countries where a system of indirect election to a local authority is in force. The county council must contain an uneven number of members and must not be fewer than nine, or more than fifteen. They hold office for six years and all retire at the same time. The authority of the county councils covers the care and maintenance of the chief rural roads, the supervision of certain branches of the public health administration, and measures for dealing with contagious diseases in animals; they issue licences to public-houses and help in supervising the execution and observance of rural by-laws regarding public works and fire services. They supervise the work of the parish councils over which they have similar authority to that exercised by the Ministry of Home Affairs over the town councils (see next section). Four of the counties (Köbenhavn, Odense, Aarhus and Aabenraa-Sönderborg) are subdivided into two districts each, for administrative purposes; each of these districts has its own council.

The Municipalities

The municipalities are administered by town councils (*Byraad*) which are elected in the same way, and for the same period of office, as the parish councils, but the number of councillors may be between seven and twenty-five. The council elects its own chairman who is known as the *Borgmester* and is also a state official for some purposes such as the celebration of civil marriages. The *Borgmester* is the executive authority, but in some towns he is assisted by a small group known as the *Magistrat* which consists of two, three or four members of the town council who are appointed for this purpose by that body. The town councils also appoint, from among their members, standing committees to deal independently with particular affairs, as well as other committees the personnel of which are not necessarily limited to members of the town council. The consent of the Ministry of Home Affairs is necessary for any large increase in rates, raising of loans and acquisition of real estate.

Köbenhavn is administered by a city council of fifty-five elected members who elect their own chairman. The High Bailiff of Köbenhavn is a state official who is appointed by the King and holds

office for four years. The administration of the city is divided into five departments each of which is in charge of a *Borgmester* who is assisted by a deputy. The five *Borgmesters* and five deputies form the *Magistrat* or executive council over which the High Bailiff presides. The *Borgmesters* and their deputies are elected by the city council for a period of eight years. They, like the city councillors, receive an annual salary. The mayors of towns and the High Bailiff of Köbenhavn may nullify the decisions of their council pending reference to the Ministry of Home Affairs.

The administration of the police was transferred to the state in 1938. Previously the local police had been a purely communal service, maintained by the counties, except that the chiefs of the sixty-five police districts were state officials.

ADMINISTRATION OF JUSTICE

The Constitution contains stipulations to ensure that the law courts shall be independent of executive and administrative authorities. Judges may not be dismissed, except by legal process, nor can they be transferred from one court to another against their will. According to a law of 1919, on which the judicial system is based, judicial authority has three instances.

The highest authority is the Supreme Court (*Højesteret*), which consists of a president and twelve judges and sits in Köbenhavn. Next in authority are the two provincial courts, *Landsretter*. One sits in Köbenhavn, has jurisdiction over the islands and consists of a president and 23 judges: the other consists of a president and 14 judges, has jurisdiction over Jylland, and sits in Viborg. These courts hold assizes in various centres within the areas of their jurisdiction. Finally, there are ninety-eight Lower Courts, each of which functions within a judicial district. Most of these courts have only one stipendiary magistrate (*Dommer*), but some of the larger districts may have two or three who tend to specialize in criminal or in civil actions. Minor actions are heard in the Lower Courts from which there is appeal to the *Landsret*. More serious offences are referred in the first instance to the *Landsret* from which there is appeal to the Supreme Court. There is no appeal against the Supreme Court. Apart from certain specified exceptions, all civil cases must be first submitted to a Tribunal of Conciliation (*Forligskommission*) consisting of two members elected for six years by the local authority. Such tribunals are organized in

140 districts and they usually settle about a half of the cases submitted to them.

Trials are usually held in public. In the Lower Courts, cases are dealt with by a magistrate sitting without a jury. But a large category of serious criminal actions and cases of alleged political offences must be heard before a jury who return verdicts and may make recommendations. All such jury cases are tried in the *Landsret*.

Special Courts. The Maritime and Commercial Court (*Sö-og Handelsretten*) which sits in Köbenhavn deals with actions arising from shipping and commerce. The court consists of a president and a vice-president, who are lawyers, and a number of assessors who are experts in the fields concerned. In the provinces, maritime and commercial actions may be heard before the Lower Courts to which two experts are appointed for the purpose. Alternatively, cases may be brought before the court in Köbenhavn. The Permanent Arbitration Court deals with labour disputes (see p. 96). Ecclesiastical offences are dealt with by ecclesiastical courts.

The Danish legal code is based entirely on statutes; there is no case law. A new civil penal code came into force in 1933. It is based on modern views of the purposes and methods of punishment and it abolished the death penalty. Although this penalty is retained in the military code, it has not been exacted for several decades.

Every citizen is equal before the law. The Constitution lays down that there shall be liberty of speech and of the press, but authors, publishers and printers are responsible to the law courts for their productions. Societies may be formed and maintained provided that their object is not illegal. People may assemble unarmed and hold meetings in public places but the police may prohibit such gatherings if it is considered that they endanger the public peace.

RELATIONS WITH ICELAND, GREENLAND AND THE FAROE ISLANDS

Iceland

Iceland is a sovereign state united with Denmark by a personal union through King Christian X of Denmark, who is also King of Iceland and shares legislative authority with the Icelandic *Alþingi* or parliament. But the Act of Union of 30 November 1918, while establishing the independence and sovereignty of the two states, forged links which united them beyond the bond of the King's person. The order of succession to the Crown might not be altered

without the assent of both states. Danish nationals in Iceland enjoyed equal rights with Icelanders and, reciprocally, Icelanders in Denmark enjoyed equal rights with Danes, but the nationals of either of the states were exempt from military service in the other. Denmark was to act for Iceland in foreign affairs in accordance with Iceland's wishes, but special Icelandic attachés might be appointed to Danish embassies and consulates if Iceland so desired. After 31 December 1940, either the Danish *Rigsdag* or the Icelandic *Alþingi* could demand revision of the Act of Union. If no agreement were reached within three years after such a demand, either the *Rigsdag* or the *Alþingi* could pass a resolution to abolish the Act of Union. Such a resolution must be passed by two-thirds of either the *Rigsdag* or the *Alþingi* and then submitted to a referendum in the country which initiated the resolution. In the referendum three-quarters of the poll or of the electorate, whichever is the larger, must approve the resolution for it to become effective. On the day following the German occupation of Denmark the *Alþingi* transferred the powers of the King to the Icelandic Government and undertook the conduct of Iceland's foreign affairs. On 17 May 1941, the *Alþingi* passed resolutions proclaiming Iceland's right to abrogate the union with Denmark and, while expressing the intention to establish an Icelandic republic at the end of the war, it stated that the time was then not suitable to conclude a formal separation.

Fuller treatment of the relations between Denmark and Iceland and of events since the outbreak of war are to be found in the *N.I.D. Geographical Handbook on Iceland* (B.R. 504), pp. 202-10.

The Faroe Islands

The Faroe Islands are part of the kingdom of Denmark and have representation in both chambers of the Danish *Rigsdag*. The local administration of the islands is carried on by a Governor (*Amtmann*) and a 'parliament' consisting of nineteen members and known as the *Lagting*. The position is similar in some respects to that of the Isle of Man in the United Kingdom. The islands are represented by one member in each of the two chambers of the Danish *Rigsdag*. The *Lagting* elects the representative to the Danish *Landsting* but the member to the *Folketing* is elected by the people on a simple majority.

Greenland

Since 1916, Greenland has been Denmark's only colony. At home, in Köbenhavn, control is centred in the *Grönlands Styrelse* (Green-

land Administration) headed by a Director with advisors in commerce, navigation, etc., and subject, except in regard to the church and the schools, to the Ministry of Home Affairs. In Greenland, the country is administered in three provinces, North Greenland, South Greenland and East Greenland.

North Greenland and South Greenland, the two main provinces, dating from 1782, are each controlled by a Danish *Landsfoged* (Inspector or Chief Commissioner), who supervises the administration, judiciary and the trade. One is stationed at Gotthaab and the other at Godhavn. He presides over the *Landsraad* (provincial council). Each of the two provinces is subdivided into *sysler* (communes or districts), each under the control of a Danish *Sysselmand* or *Kolonibysterer* (factory manager or trader) who supervises the district's courts and presides over the *Sysselraad* (district council) which deals with education, sanitation and public welfare. There are five districts in South Greenland and seven, excluding Thule, in North Greenland.

The *sysler* are further subdivided into communes or outposts consisting of a *boplads* (village) or a number of small settlements. The inhabitants in each commune have their local affairs dealt with by a *Kommuneraad* (communal or municipal council) of three to five members.

The third of the provinces, East Greenland, is in a different position and is administered by the heads of the trading stations at Angmagssalik, and, since 1925, at Scoresby Sound. They are each directly responsible to the *Grönlands Styrelse* in Köbenhavn.

This system, confirmed by legislation in 1925 and 1926, in which administration and trade are linked together, has been a matter of controversy, but on the whole has been favourably regarded. Those who opposed the system claimed that the social and economic interests of Greenlanders were subordinated to trade interests. On the other hand, it was pointed out that the separation of administration and trade functions was not practicable since the trade was a state monopoly and was not conducted according to commercial principles but by arbitrary fixing of prices.

Chapter VIII

EDUCATION

Growth of School Education: Modern Organization of Schools: Institutions for Higher Education: Technical and Vocational Schools: The Folk High Schools: Youth Associations: Libraries: Foundations for Art and Scientific Research

In few countries has education permeated national life and character to the extent that it has in Denmark. Danish education possesses, to a special degree, its own characteristics. These are derived largely from the democratic nature of the school system, its relative freedom from strict state control, and, above all, from the development of adult education which played such an important part in the rapid social and economic progress of the peasantry during the nineteenth century. Danish education is not characterized by public schools of great antiquity and long tradition, or by rapid expansion of university centres in modern times. While Denmark has produced outstanding scholars in many disciplines, yet it is the general education of its farming population to an appreciation of social opportunity, responsibility and service that forms the dominant feature. It is the fond boast of the Danish farmer that he works more with his brain than with his hands, and it is his ability to read and think for himself, and to translate his thoughts into action, in co-operation with his neighbour, that has given him a leading place among the peasantries of Europe.

GROWTH OF SCHOOL EDUCATION

Education by tradition and custom handed on from parent to child became supplemented by formal education during the Middle Ages in Denmark. There, as elsewhere, scholastic instruction lay in the hands of the Church and was primarily religious education imparted in Latin. Schools were established in monasteries and chapters and around cathedrals in the larger towns. During the later Middle Ages the expansion of trade led to the formation of a Danish middle class, and schools were established to teach arithmetic and the reading and writing of Danish. The Protestant Reformation led to the triumph of the Lutheran Church in Denmark, and in 1536 it was ordered that

a school should be established in every town. Although the Reformation introduced the use of Danish in church services, these schools taught Latin only, because their aim was to educate for the priesthood, but local authorities were to provide 'writing schools' for children unable to learn Latin. Little was heard of the 'writing schools', but in the larger towns many private schools were established in spite of the fact that they were prohibited by a law of 1536. There was no provision for education in rural areas. The clerk of the parish taught the children the Lutheran catechism on Sundays, and a few villages had schools, but these were exceptional. In the early part of the eighteenth century, Pietism spread to Denmark from Germany, and the followers of this movement established schools in association with every church in Köbenhavn and so laid the foundations of the elementary school system in that city. Frederick IV followed this lead and built 240 schools on his estates in different parts of the country. In 1739 his successor, Christian VI, ordered that the necessary number of schools be built throughout the land. The country was too poor to put this decree into effect, but a number of schools were founded. These schools taught reading and religious knowledge, but on payment of a small fee by the parents, writing and arithmetic were also taught.

The period of social and economic reforms at the end of the eighteenth century marked the beginning of a new phase in the history of education in Denmark. Many landowners followed the example of Christian and Ludvig Reventlow and established schools on their estates. In 1789 the government set up a Commission to examine the question of school education and to make suggestions for its improvement. The Commission completed its work in 1814. Its findings prompted the Act of 29 July of that year. Although this Act could not be put into effect for many years owing to the impoverishment of the country after the Napoleonic wars and the separation from Norway, it did, nevertheless, lay down the lines along which development should take place, and its provisions are the foundation on which the Danish school system has been built. The Act declared that the number of schools should be such that one would be available within 2 km. of every home. Education was made compulsory for children between the ages of 7 and 14 years. The number of subjects to be taught was increased and included compulsory physical education. Colleges were to be established for the training of teachers who should replace the fortuitous assemblage of pensioned civil servants, parish clerks, and discharged petty officers

into whose hands the instruction of the children has so often been allowed to fall. The control of schools was allowed to remain in the hands of the clergy. The old Latin-teaching schools had already been reformed by an Act of 1809 which abolished the church duties that had been incumbent upon their pupils, and modern languages and science were introduced into the curriculum. In this way, the Latin schools began to develop gradually into the secondary schools or high schools (*Gymnasieskoler*) of to-day. During the nineteenth century there was little legislation which affected the educational system, but much was done to improve school buildings, enhance the social position of teachers, enlarge the number and scope of the subjects of instruction, and improve the methods of teaching. The turn of the century brought a number of legislative measures which improved the educational system further. An Act of 1899 introduced new subjects into the curriculum, reduced the number of children in each class, and raised the salaries of teachers. In 1903 an Act was passed to establish the middle school as a link between the elementary school and the high school and so gave an unbroken progression throughout the school system.

During the period after the war of 1914-18, Danish school education advanced further. By an Act of 20 March 1918 most of the private schools were taken over by the state or by municipalities; hitherto most of the higher schools had been in private hands. Between 1919 and 1923 a Commission investigated Danish education and a number of Acts were passed during the ensuing period. The most important of these were the Act of 1930 which extended the period of training of teachers, an Act of 1933 concerning the management and inspection of council schools and the supervision of private schools, and the Elementary Schools Act of 1937. By the Act of 1933 the Church lost its last semblance of control over elementary schools. Hitherto, rectors of parishes had been *ex officio* chairmen of the local education committees, but the Act ruled that the committees should be free to elect their own chairmen and the rectors were left with only supervision of religious instruction. The Act of 1937 increased the number of hours of instruction from 18 to 24 a week, enlarged the range of subjects, and laid down that every school attended by children over 12 years of age must provide a gymnasium with dressing rooms and bathing facilities, as well as a sports ground.

MODERN ORGANIZATION OF SCHOOLS

The School System

The present-day school system in Denmark consists of three grades:

(a) The elementary school (*Folkeskole*) is attended usually for 4 years by children between the ages of 7 and 11 years. From the elementary school the pupils pass to the middle school, but those who do not wish to do so, or are not fitted to proceed to a higher grade, continue in the elementary school until they are 14 years old. The subjects taught are Danish, religious knowledge, hand-writing, arithmetic, history, geography, physics, natural history, gymnastics, drawing and handwork.

(b) The middle (or intermediate) school (*Mellemskole*) is attended for 4 years by children between the ages of 11 and 15 years. At the age of 15 they may take the school examination (*Mellemskole-eksamen*). After a further one-year course (the *Realklasse*) they may take the *Realeksamen*, success in which qualifies for apprenticeships in the railway, postal, telegraph and customs branches of the Civil Service and gains admission to the high school. In the business world the status of this examination is similar to that held by the School Certificate in England. It also gains admission to the High School of Commerce, the College of Dentistry, and the Royal Veterinary and Agricultural College, provided that the candidates pass an additional examination. The middle schools teach English, German, mathematics, physics, drawing and Latin, in addition to the subjects taught in the elementary schools.

(c) The high school (*Gymnasieskole*) is attended usually for 3 years by pupils of 15-18 years of age. The course culminates in the *Studentereksamen*, which qualifies for admission to the University and to the State College of Engineering. The high schools have three 'sides', namely classical languages, modern languages, mathematics and natural science. All pupils study Danish, religious knowledge, history, French, geology, biology and physiology. The classical side specializes in Greek and Latin, the science side in mathematics, physics and chemistry, and the modern language side in English and German.

The three school-leaving examinations are mainly oral, but in the higher examinations written answers are also required to questions which are the same for all schools. The examinations are conducted

by the school teachers, but at the *Realeksamen* and *Studentereksamen* referees appointed by the Ministry of Education must also be present. Parents are allowed to attend all examinations. The standard of instruction and attainment in the schools is considered by outside observers to be very high.

Education is compulsory for children between the ages of 7 and 14 years. Instruction may be given by tutors in the home provided that it is similar in amount and quality to that given by the schools. Education is free in the elementary schools and also in some of the middle schools and high schools, but in some towns fees are charged. These fees are sometimes graded according to the income of the parents, those of low income paying nothing. The highest fee payable in Köbenhavn was 16 kroner a month. Schools are co-educational except for some in the towns. Instruction is in Danish, but by an Act of 1923, schools must provide instruction in a foreign language in those areas near the border where the population speaks a language other than Danish; thus in the minority schools in south Jylland instruction is in German (see p. 523).

Administration of Schools

The Ministry of Education is the central educational authority, but in Denmark there has long been a struggle between centralization and local control. The administration of elementary schools is left to the local authorities, that is, the county councils and the municipalities, which also meet all expenditure apart from grants from the state. The local authorities decide the extent of instruction in various subjects, the scope of examinations and other details within the broad framework laid down by the state, which concerns itself mainly with the opening and closing down of schools, fixing of salaries and dismissal of teachers. Each county council appoints an education committee which arranges for the inspection of schools and for the appointment of teachers, and sends annual reports to the Ministry. Each county comprises a number of parishes, and the parish councils, which are elected by popular vote, deal with the economic administration of the schools within their jurisdiction, erect school buildings when necessary, control funds and nominate teachers for appointment or dismissal. The parish council elects local school committees which attend to the daily management of the schools. It should be noted that the parish council (*Sogneraad*) is a civil authority. In the towns the town councils attend to the economic administration of the schools

and appoint an education committee which attends to educational administration.

In addition to the public elementary schools there are small private elementary schools which may or may not be subsidized by the state. These private schools are subject to supervision by the local authorities, and the children take tests at intervals of six months or a year. The middle schools are either municipal schools or private schools. If they are municipal schools, they are controlled in the same way as the elementary schools and are usually run in conjunction; they are very rarely housed in separate buildings.

The high schools are managed either by local authorities or by the state, but there are still a few private high schools which were not taken over by the state under the Act of 1918. These latter receive grants from the state which amount to half the sum paid for every child attending state or municipal high schools. They receive these grants only if their standard of education is equal to that at the state and municipal schools, if they submit to state inspection and economic control, and if they do not favour any particular social class. The state high schools are owned by the state and are controlled entirely by the Ministry of Education which appoints all teachers in such schools. The high school teachers are university graduates.

There were 4,472 elementary, middle and high schools in Denmark in 1938. Of these 34 were state schools, 3,886 were municipal schools (including 15 *gymnasieskoler*) attended by 427,068 pupils, and 552 were private schools (including 10 *gymnasieskoler*) attended by 40,788 pupils.

About 95 % of the children between the ages of 7 and 14 years attend elementary schools and about 16 % of those between 14 and 18 years of age attend secondary schools. Comparisons with other countries are given in the following table:

School children per 10,000 of total population

	Primary schools	Post-primary schools	Higher schools
Denmark (1936-7)	1256	355	20
Sweden	1001	509	14
Norway (1935-6)	1280	235	19
Finland	1062	391	23
Germany (1935-6)	1291	326	13
France (1936-7)	1368	209	19
Netherlands (1936-7)	1598	374	14
Belgium	1229	403	12

Source: *Year Book of Education*, 1939, p. 96 (London, 1940).

INSTITUTIONS FOR HIGHER EDUCATION

Denmark has two universities, one at Köbenhavn and the other at Aarhus. The *University of Köbenhavn* was founded in 1479 and is under the direction of the Ministry of Education, although it is largely self-governed through a council of its professors and lecturers. It offers degrees in arts, science, medicine, law, political economy and theology. University education is free except for a registration fee of 22 kroner and smaller fees for examinations; lectures may be attended by members of the public as well as by all students. Candidates may submit themselves for examination for a degree when they consider themselves sufficiently well-equipped, which is usually after a period of 5-7 years. The University of Köbenhavn had some 5,200 students in 1938. The *University of Aarhus* was founded in 1928 and opened in September 1933. It is an independent corporation and had some 500 students in 1938.

The *Polytechnic Institution* in Köbenhavn is a state college of engineering which ranks as a university and confers the diploma of *candidatus polytechnices* (*cand. polyt.*). The college was founded in 1829 and offers courses in chemical, mechanical, civil, and electrical engineering. The courses extend over $4\frac{1}{2}$ - $5\frac{3}{4}$ years but may take longer. The college had about 1,100 students in 1938.

The *Royal Veterinary and Agricultural College*, which was established in Köbenhavn in 1858, grew out of one of the first veterinary schools in Europe which was opened in that city in 1773. While it is necessary for students to have passed the *Studentereksamen* before they can enter on courses in veterinary surgery, surveying and forestry, it is required only that students shall have had some practical training for them to gain admission to the courses in farming, horticulture and dairying. The courses in veterinary surgery, surveying and forestry occupy a minimum of $4\frac{3}{4}$ -5 years, according to the subject taken, but the courses in farming, horticulture and dairying are completed in 2- $2\frac{1}{2}$ years. This college is the centre of Danish agricultural science, but there are also, in different parts of the country, twenty agricultural schools which have courses varying from five to twelve months in duration. These courses are intended for young farmers and cover general, as well as agricultural, subjects. Most of them have been established by old students of the Folk High Schools (pp. 164-8) with which they work in close co-operation. They were attended by about 2,000 pupils in 1938.

In Köbenhavn there are a College of Pharmacy with about 100

students in 1938, a School for Dentistry with about 190 students in 1938, and a Royal Academy of Arts with about 330 students in 1938. Important centres for scientific research are the Institute of Theoretical Physics, the Institute of Physiology, the Carlsberg Laboratory, the Institute of Bio-Chemistry, the Finsen Institute for Cancer Research, the State Serum Institute and the State Veterinary Serum Laboratory.

Eighteen *training colleges* provide courses for teachers. Seven of these are state establishments and eleven are private concerns. The course extends over 4 years, and graduates of the colleges are qualified to teach in elementary and secondary schools. About 1,800 students were attending courses at these colleges in 1938. The final examinations at these colleges are controlled by the Ministry of Education.

TECHNICAL AND VOCATIONAL SCHOOLS

Denmark has also the accessory educational institutions which are found in most countries of western Europe. There are some 300 technical schools attended by about 43,000 pupils, mostly in evening classes. These schools are usually owned and managed by local associations, but nearly all of them receive grants from the state and the municipalities, and they are under state inspection. By an Act of 1921 employers are required to induce their apprentices to attend courses at such schools outside their working hours, but the Act did not impose compulsion. The employers are also required to pay the cost of such courses. In much the same way, commercial schools are run by associations of merchants and receive financial help from the state. There are about 100 commercial schools and these are attended by about 18,000 pupils. The Industrial School for Artisans and Employers in Smaller Industries, in Köbenhavn, arranges short technical courses which are given by professional artisans and has an advisory service. It also organizes provincial courses which are given by instructors who visit different centres and help artisans who cannot leave their work to attend courses in Köbenhavn. Nineteen special schools provide training in domestic economy; the course lasts two years and the schools had about 1,600 pupils a year. Some training in domestic economy is also given by other schools. Evening continuation schools offer opportunities to those who cannot attend technical schools, and there are residential day continuation schools, usually with separate winter and summer courses for children between 14 and 18 years of age, in rural areas.

These educational institutions are but the Danish forms of scholastic equipment which is to a large measure common to most of the well-organized nation states of Europe. For example, the Danish elementary, middle and high schools may be regarded as the counterparts of the elementary, central and county schools of Britain, and further parallels can be easily drawn, for while the details of organization and management may differ the general plans possess many common features. But the most characteristic feature of Danish education is the development of adult education which is typified in the Folk High Schools. No account of education in Denmark would be adequate without some description of the growth of this movement which reflects so many of the essential features of Danish life and social outlook.

THE FOLK HIGH SCHOOLS

The idea of the Folk High Schools arose in the mind of N. F. S. Grundtvig (1783-1872), a clergyman and poet who was inspired by the desire to help the peasantry of his country to a fuller life. When Grundtvig was a young man the Danish peasantry had but recently been emancipated, and a generation of freedom had not effaced the effects of centuries of serfdom. Three visits to England during the summers of 1829, 1830 and 1831 served to impress on his mind the progressive character and creative activity of the English people who were vigorously engaged in implementing the new industry and new agriculture and in fighting for parliamentary reform and for alleviation of the social consequences of the factory system. Although he deplored a system which made men accessories of machines and caused rural depopulation, Grundtvig saw these developments in contrast to the backward and somewhat apathetic condition of the Danish peasantry who were still suffering from the impoverishment that followed on the Napoleonic wars. He interpreted the contrast as arising from the civil, religious and personal liberty of the English people, and he returned to Denmark fired with an even greater desire to improve the life of his fellow-countrymen. He believed that this could best be done by educating the Danish people to a fuller realization of the opportunities of social life. To this end he conceived the idea of establishing Folk High Schools which should not be institutions for acquiring book-learning but should instruct the people in the richness of their national heritage and educate them for life. He expressed his aims thus: 'It is my highest wish as a citizen

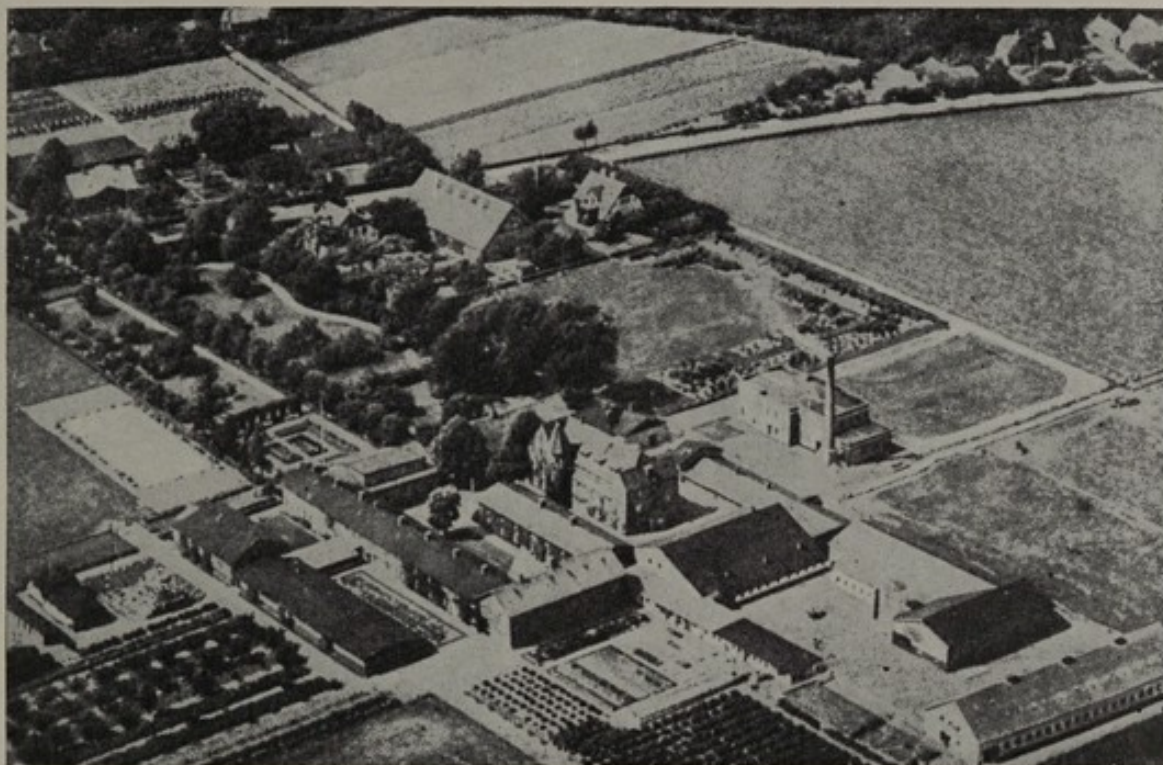


Plate 38. The agricultural school at Dalum, near Odense



Plate 39. Niels Bukh's Folk High School at Ollerup, near Svendborg

This school specialises in gymnastics and is one of the best known in the world. Part of the gymnasium appears on the left of the photograph.



Plate 40. A Folk High School



Plate 41. The International People's College at Helsingör (Elsinore)

The photograph shows the original building which was adapted from a farm house; later, new buildings were added.

that soon there may be opened a Danish High School accessible to young people all over the land where they may become better acquainted with themselves in particular and where they will receive guidance in all civic duties and relationships, getting to know their country's real needs. Their love of their country shall be nourished by the mother tongue, their nation's history, and by Danish song.'

Grundtvig's conception of the Folk High Schools was that they should be institutions where young men and women might acquire inspiration and understanding rather than knowledge, and where they should be educated for life and citizenship and not for a particular vocation. He claimed that the years of youth, between 18 and 25 years of age, was the best time, since then pupils would have some knowledge of life, and he intended that after their stay at the Folk High School they should return to their customary work which he believed they would do better for their schooling. He was confident that the school would give them the ability and the desire to go on educating themselves after they had left. The method of instruction was to be largely oral—'the living word', as he put it, which meant more than the spoken word, since the teacher should aim at imparting something of his own personality and enthusiasm rather than his learning. Grundtvig discouraged learning from books on the grounds that they led to repetition without understanding, and he maintained that the history, literature and song of their country were the best media of teaching, since these were in harmony with the life and experience of the people, and learning, he maintained, should always follow life. History he described as experience of life on a large scale. He deplored examinations in which 'the old people torment the young with questions which they cannot possibly answer out of their own experience of life and can only answer by repeating the words of others', and he asked for no high academic qualifications from teachers. He set greater store by natural gifts than by certificates, and he demanded that they should be inspired by their mission. Such was Cristen Kold, the son of a shoemaker from Tisted in north-west Jylland, and while the conception of the Folk High School came from Grundtvig, it was Kold who put his ideas into practise. Kold also started the 'Free Schools' or private schools in Denmark and introduced a summer course for women in the Folk High Schools. After Kold's death in 1870 Ludvig Schröder became the leader of the Folk High School movement.

The first Folk High School was set up in Rødding, north Slesvig, in 1844. The beginning of the movement in north Slesvig is signi-

ficant in itself, since it flourished as a means for keeping Danish language, history and literature alive among a people that were exposed to the penetration of German *Kultur*. In 1851, Kold opened a small Folk High School at Ryslinge in Fyn and a few years later he moved it to Dalby in north-east Fyn. In 1862 he opened a much larger school at Salum near Odense. Other Folk High Schools were established in the meantime, but the movement did not flourish until after 1864.

The defeat of Denmark by Germany in the war of 1864 had widespread repercussions which touched on almost every aspect of Danish life. It led to an inward orientation of national life and to a campaign to 'win at home what was lost abroad'. In the work of national reconstruction the disciples of Grundtvig played a prominent part, and thirty-nine Folk High Schools were built in different parts of the country between 1861 and 1871. Before the end of the century there were seventy Folk High Schools in Denmark, and the number of pupils soon numbered many thousands yearly.

More recently the Folk High School movement has become less prominent, perhaps because the schools did their work of educating the peasantry so well that the need for them is now less pressing. Also, in times of economic difficulty and competition for employment, technical education is sought more ardently than cultural development. Between 1912 and 1921, twenty-seven schools closed down during the unrest which accompanied the war of 1914-18. In 1938, there were fifty-seven Folk High Schools which were attended by about 5,800 pupils. The majority of these schools are of the Grundtvig type but a few, especially the 'Home Mission' High Schools, have a religious bias and a few specialize in gymnastics, nursing, etc. Niels Bukh's High School for Gymnastics at Ollerup in Fyn is a famous centre not only for Danish youths but is attended by large numbers of foreign students.

The ideas of Grundtvig and Kold are still embodied in the aims and methods of the Folk High Schools of to-day, although there is now more objective instruction. These schools are private schools in that they are usually owned by the principal or by a group of local supporters, but they are subsidized by the state which gives an annual grant to each school and to pupils who cannot afford to pay the whole of their expenses, but it insists that every student shall pay part of the fees. In 1938-9 the state grants to the schools amounted to 582,678 kroner and those to pupils amounted to 832,400 kroner. The schools are entirely free to choose their own curricula, there are

no examinations and each school is autonomous. The pupils, who attend on their own initiative, are boarded at the schools; two to four usually share a room. The average age of the pupils is 20-21 years; few are younger than 18 years of age. The inclusive fees are approximately 70-85 kroner a month. The men attend the winter term from 1 November to 1 April, and the women attend a 3-months course from 1 May until 1 August. Usually three lectures are given daily to the whole school, and more recently the practice of study groups has been spreading, especially in the larger schools. The subjects taught often cover a considerable range and gymnastics have gained a prominent place: the schools are free to teach any religious or political doctrine. The purpose of the schools is not primarily to impart knowledge but to develop the interests and intellectual life of the pupils and to educate them in responsibility and self-development. Anyone may open a Folk High School, and provided he can attract the necessary number of pupils for two years, and that more-or-less the accepted subjects are taught, the school will receive a grant from the state. Since 1844 a hundred and sixty Folk High Schools have been opened, but over a hundred of them have not survived. The principal of the school is free to appoint whomsoever he pleases as teachers, whatever their academic qualifications may be. The Folk High Schools are essentially rural institutions and their pupils are drawn almost entirely from among the farming population; only about 10 % of the pupils are from the towns. It was Grundtvig's ambition to have Folk High Schools for all parts of the country and all classes of society, but the schools have not gained a hold in the larger towns. Borup's non-residential Folk High School in København is an exception, and there is a residential Folk High School near Esbjerg which has close contacts with the Workers' Educational Association. These schools, as well as the Folk High School at Roskilde, are attended chiefly by workers from the towns.

Out of the idea of the Folk High Schools grew the International People's College which was founded by Peter Manniche at Helsingör in 1921. The aim of this college is to foster international fellowship and peace by providing opportunities for young people of different nationalities to meet and discuss matters of common interest and to pursue studies which will help towards international understanding. The college had normally about a hundred students a year drawn chiefly from Norway, Sweden, Britain, Germany and America, but the majority were Danes.

The Folk High School movement spread early to the other Scandinavian countries. Norway founded its first Folk High School in 1864, Sweden established three such schools four years later, and Finland followed the lead in 1889. Danish emigrants carried the idea to America, where the first school was opened at Elk-Horn, Iowa, in 1878. The first attempt to adapt the Danish model to industrial conditions in Britain was made in 1908 when the Fircroft Adult School was founded near Birmingham. In 1919 the Adult Education Committee of the Ministry of Reconstruction recommended the establishment of residential continuation schools, with 3-months courses, in rural areas. Such an institution has been founded at Avoncroft near Evesham. Coleg Harlech, in Merionethshire, has many points of resemblances with the Danish Folk High Schools. The movement has also been actively pursued in Switzerland, Czechoslovakia and Germany.

The ideas of Grundtvig and Kold have also influenced deeply the private schools of Denmark, for although most of these schools were taken over by the municipalities or the state in 1918 they have retained most of their original characteristics, and some are still largely independent of public authorities. In such schools the practical principles of Kold are in force and the pupils are taught to acquire, rather than absorb, knowledge. A school for training teachers for these 'Free Schools' exists near Horsens, and a Danish Free Schools Association has been formed.

YOUTH ASSOCIATIONS

There are many associations for young people. The Boys Voluntary League is in close association with the Church and is modelled on the Church Boys' Brigade in England. The Youth Sports League is a comparable organization run by the Social Democratic Party and is affiliated to the International Socialist League for Education. The Danish Boy Scouts Corps and the Danish Girl Guides Corps are modelled on the British organizations and are affiliated to the international movement. The Y.M.C.A. and the Y.W.C.A. are similarly the Danish equivalents of these institutions in other countries. The Danish Young Peoples' Associations represent the Grundtvigian movement among young people and arose from the Folk High Schools. Such associations exist in different centres and meet periodically, usually in village halls, for lectures, play-reading and folk-dancing. They publish their own periodical called *Danish Youth*. Political associations for young people exist in association with the several

political parties of which the Liberal, Conservative, Radical and Socialist parties are the most important. These associations offer opportunities for reading, discussion, study and debate on political topics. There is also a branch of the international agricultural organization which encourages agricultural work among young people. The Workers' Educational Association was established in 1923 and is financed by the chief labour organizations in Denmark such as the Social Democratic Party, the Trades Unions Association, the Co-operative Union and the Union of Social Democratic Youth. Since most of the individual trades unions are also members, almost every organized worker in Denmark is a member of the Workers' Educational Association. The Association organizes lectures, study circles, educational visits to works, museums, etc., and courses in evening schools, as well as summer courses for members of municipal councils and for leaders of study circles.

As in all the Scandinavian countries, physical education occupies a prominent position. The Danish Athletic Union promotes athletic events and lays out playing grounds. An important branch of this union is the Danish Gymnastic Association which has four branches—in Köbenhavn, Sjælland, north Jylland and south Jylland. It still adheres to the German agility exercises on special apparatus. Most of the youth organizations also give gymnastics a prominent place in their activities. Many sports, such as swimming, rowing, skating, hockey, cycling and boxing, are organized in national unions and clubs.

LIBRARIES

Although public libraries were established in Denmark towards the end of the eighteenth century, these were mostly in rural areas and served the peasants' desire to read. The library movement did not make much progress until the beginning of the twentieth century. Vigorous propaganda for libraries was carried out during the first decade of the century, and it prepared the way for the building of numerous libraries throughout the land during the next two decades. The public libraries are established and managed by local communities which receive state grants. Scientific libraries are supported entirely by the state. There are some 950 public libraries of which 860 are in rural districts; they include together over 2 $\frac{3}{4}$ million books.

The Royal Library in Köbenhavn was founded by Frederick III (1648–70) and is the national library of Denmark and the largest library in Scandinavia. It comprises nearly a million books and about

30,000 manuscripts, which include unique collections of Icelandic and some Oriental manuscripts. The University Library has nearly half a million books and about 7,000 manuscripts including important Norse-Icelandic and Persian manuscripts. The State Library in Aarhus serves as a library for the university in that town and has a large collection of Danish newspapers and special collections dealing with Slesvig (Regensburg Collection) and with missionary work. It is the third largest library in Denmark and is the only large one outside Köbenhavn. These three libraries receive copies of all works published in Denmark under a copyright act. The National Record Office in Köbenhavn contains all the state archives dating from before 1559 and all the archives of the central administration. There are three provincial Record Offices, at Köbenhavn, Odense and Viborg, and there is a Record Depot at Aabenraa. These contain the archives of the local authorities, including church records up to the end of the nineteenth century.

FOUNDATIONS FOR ART AND SCIENTIFIC RESEARCH

Endowments for the support of art, handicrafts and scientific research are numerous, but four great funds stand out. These are the Carlsberg Foundation, the New Carlsberg Foundation, the Rask-Örsted Foundation and the Tuborg Foundation.

The Carlsberg Foundation was established in 1876 by Jacob Christian Jacobsen, founder of the Carlsberg brewery. The interest on a capital sum of one million kroner was placed at the disposal of the Carlsberg laboratory for the investigation of the chemical and physiological processes of the fermenting industries; the surplus money was to be used for the promotion of academic research in arts and science. Two years later Jacobsen bought Frederiksborg castle and established there a Museum of National History which was to be maintained by the Foundation. In 1881 the capital of the fund was doubled, and on Jacobsen's death the brewery was bequeathed to the Foundation. The Carlsberg Foundation thus has three main interests, the laboratory, the museum, and the support of scholarly research. The brewery is run as a business concern which has no shareholders and the profits of which go to support the museum and research. The Foundation is administered by a board of five members elected by the Royal Danish Academy of Science and Letters from its members. The laboratory publishes reports on its researches. Grants for academic research are made by the board on consideration

of applications. Among the scientific undertakings financed by the Foundation were the Amdrup expedition to north-east Greenland (1898-1900), and the Dana expedition which went round the world to carry out researches in oceanography and biology. In 1931-2 the Foundation built the Carlsberg Foundation Biological Institute, to which the Rockefeller Foundation donated one million kroner, the interest on which is to pay running expenses. The capital of the Foundation is estimated at about 50 million kroner.

J. C. Jacobsen's son, Carl, followed his father's lead. His interest in art resulted in a large private collection of sculptures which he presented to the Danish nation in 1888-90. This collection became the nucleus of the *Ny Carlsberg Glyptothek* in Köbenhavn. In 1902 the new brewery which he had built was entrusted to a new Foundation and its profits were to be used for the promotion of the fine arts. A few years later the old and new Carlsberg breweries were amalgamated and the profits are divided about equally between the two Carlsberg Foundations. The New Carlsberg Foundation continues to expand the art collections at the Glyptothek, it presents ancient and modern works of art to state collections, provincial museums and open-air sites, makes grants to artists, and supports the Museum of Applied Art. The assets of the Foundation are over 10 million kroner, and the profits of the brewery are usually well over a million kroner a year.

The Rask-Örsted Foundation was established in 1919 by Act of Parliament. Its main purpose is the endowment of scientific research carried out by Danes in co-operation with scientists from other countries. It also helps to finance international scientific meetings and makes grants to Danish scientists for work in other countries and to foreign scientists for study in Denmark. It assists the publication of results in languages other than Danish. The Foundation is administered by a board which is appointed partly by Parliament and partly by academic institutions. The capital of the Foundation is in government stock and the minimum annual revenue is 250,000 kroner.

In 1931 the United Breweries established the Tuborg Foundation. This Foundation is more utilitarian in its interests. It aims at promoting the social welfare, trade and industries of Denmark, and while the other Foundations are primarily concerned with supporting pure science, the Tuborg Foundation is interested mainly in applied science. Among the enterprises financed by the Foundation have been researches into vitamins, pollination of red clover and improvement of heathland. The capital of the Foundation is over a million kroner in the form of shares in the United Breweries.

Chapter IX

PUBLIC HEALTH

The Growth of Public Health Services: The Organization of Public Health Services: National Insurance: Child Welfare: Vital Statistics: Causes of Death: Some Important Diseases

THE GROWTH OF PUBLIC HEALTH SERVICES

The period of social and economic reform at the end of the eighteenth century was also the time when the organization of public health began in Denmark. In 1782 the first Act for combating epidemics was passed. In 1790 notification and treatment of venereal diseases were made compulsory and measures were put into force for free treatment of such patients. The first Quarantine Act was passed in 1805, and five years later compulsory vaccination against smallpox replaced the partially compulsory system which had previously obtained. The hospital system comprised a few hospitals which were used mainly as centres for isolation and for the treatment of venereal diseases. In 1806 a Royal Decree commanded the county authorities to provide an adequate number of general hospitals for the needs of the population within their boundaries, and the number of hospitals in Denmark grew from 15 in 1800 to 25 in 1825, and 40 in 1850, but it was not until the end of the nineteenth century, when surgical technique improved, that the hospital system expanded markedly; until then, the advantages of hospital treatment as compared with home treatment were less evident. An Act of 1858 made the issue of health by-laws compulsory in the towns and gave local authorities the right to issue such by-laws for rural areas.

During this period health legislation was concerned mainly with measures to prevent the spread of infection, but during the latter half of the nineteenth century treatment of the sick acquired greater importance as knowledge of surgery and medicine advanced. The number of hospitals grew from 40 in 1850 to 93 in 1875 and to 109 in 1900. Greater facilities for the treatment of patients led to health insurance legislation. Health insurance societies began as private organizations during the nineteenth century and, like the co-operative movement, spread rapidly throughout the country. By the Health

Insurance Societies Act of 1892 the state gave financial support to these societies which, in return, had to submit to supervision and approval of their rules by the state. The health insurance legislation also laid down that members of health insurance societies must be admitted to hospitals at reduced charges which should not exceed half the normal rate.

During the first quarter of the present century the number of hospitals further increased from 109 in 1900 to 155 in 1939, while the number of beds increased from 5,568 to 17,038, representing an increase from 2.3 to 6.3 beds per thousand of the population between the same dates. The hospitals already established were extended, reorganized and re-equipped, especially to keep pace with the advances in surgery. The great advances in medicine and radiology during the last ten or twenty years made necessary further reorganization and the establishment of special departments with elaborate technical equipment. In 1930 the National Health Board put forward a general plan which advocated, for each county, one or two central hospitals with medical, surgical and radiological departments, and to which special departments for diseases of the eye, ear, nose and throat might be added in due course; each county should have, in addition, a number of general medico-surgical hospitals, each with not fewer than 50 beds. Several county councils have adopted this plan and there were, in 1939, central hospitals in more than a half of the counties, while in others reorganization was in progress.

More than forty laws affecting social insurance and public relief have been passed during the last 50 years, and the system set up by these laws has served as a pattern for social legislation in many countries including Britain, which based its old-age pensions scheme on that of Denmark. In 1933 the old laws were replaced by four new Acts affecting public relief and insurance.

THE ORGANIZATION OF PUBLIC HEALTH SERVICES

The public health services in Denmark are now administered almost entirely by public bodies and are financed by public grants. The legislation that controls these services applies uniformly to the whole country and to urban and rural areas alike. Local health by-laws are administered by local Health Committees composed mainly of representatives of the county and municipal councils. Local authorities also control the work of nurses.

Central Administration

Three central offices control health and insurance affairs, the National Health Board, the Social Insurance Board, and the Invalidity Insurance Board. The National Health Board, under the Minister of Home Affairs, is presided over by the Chief Medical Officer. It is composed of expert advisers and supervises the public health services of the country, doctors, nurses, midwives, dentists and all medical personnel, hospitals and other medical institutions. It advises the government in all matters pertaining to medicine and the public health, and makes recommendations for appointments to leading medical posts in hospitals and in the public services. A special council under the direction of the President of the National Health Board controls the sale of drugs and supervises pharmacies and their personnel. Administrative work is done by the office of the Board under the direction of the Chief Medical Officer. The office has an expert legal adviser, a statistician and a physicist concerned with the X-ray installations of hospitals. A special council, quite independent of the Health Board, advises the Courts of Justice in medico-legal cases. The State Serum Institute in Köbenhavn is under the supervision of the National Health Board and its director is the bacteriological and epidemiological adviser of the Board.

Local Administration

There are 70 district medical officers of whom 23 act also as county medical officers. All these medical officers are controlled by the National Health Board and they are appointed by the king on the recommendation of the Chief Medical Officer. District medical officers are part-time officials; they advise district councils on all health matters and treat gratuitously all cases of venereal diseases. County medical officers supervise the work of district medical officers, hold annual conferences with midwives, and advise the County Epidemic Committees. All cases of epidemic diseases are notified by doctors to their district medical officers who submit weekly and monthly returns to the county medical officer and monthly returns to the National Health Board. The more serious epidemic diseases are reported immediately direct to the Board. District medical officers receive monthly returns of births and deaths from parish priests. They exercise strict supervision of the work of midwives in their district, and exercise control over the pharmacies and certain public health aspects of the doctors' work.

All local councils are required to make provision for the medical care of the poor. In Köbenhavn and a few of the larger towns special doctors are appointed for this work but more commonly arrangements are made between the councils and local practitioners. As so large a proportion of the population is covered by sickness insurance the work is light.

Hospitals

The general hospitals are, with a few exceptions, owned by the local authorities, and are managed by representatives of the local population. The mental hospitals have been taken over entirely by the state and are managed by a directorate under the Ministry of Home Affairs; the only exception is that the city of Köbenhavn manages its own mental hospitals. The hospitals and sanatoria for the treatment of tuberculosis are owned and administered partly by local authorities and partly by the National Society for the Combating of Tuberculosis, but the state makes large grants towards the building and maintenance of such institutions. Nearly all the hospitals for infectious diseases are run as separate sections of general hospitals and the state makes grants to cover most of their expenses. The state also pays for the hospital treatment of venereal diseases. Private hospitals are few and relatively unimportant.

Hospital charges are fixed by the boards of the different hospitals, but are subject to the approval of the Ministry of Home Affairs. Members of sickness benefit societies, who form about 80% of the population over 15 years of age, are charged at only half the normal rate and this is paid by the society.

At the end of 1939 there were 155 public hospitals with a total of about 24,000 beds, while sanatoria, and lunatic asylums and homes for mentally deficient people had accommodation for about 4,447 patients, and 22,000 patients respectively. These represent 6, 1 and 5‰ of the total population respectively. The distribution and size of hospitals and sanatoria are summarized in the accompanying maps (Figs. 40, 41). The distribution of hospitals is such that no place is beyond a radius of 20 km. from a hospital, and for the great majority of the population the distance is much less.

The physicians at the hospitals are full-time workers and only the leading men are allowed to have a consulting practice. Hospital doctors alone are allowed to treat patients at the hospital. The chief physicians hold permanent appointments, but the assistant physicians are appointed for specific periods.

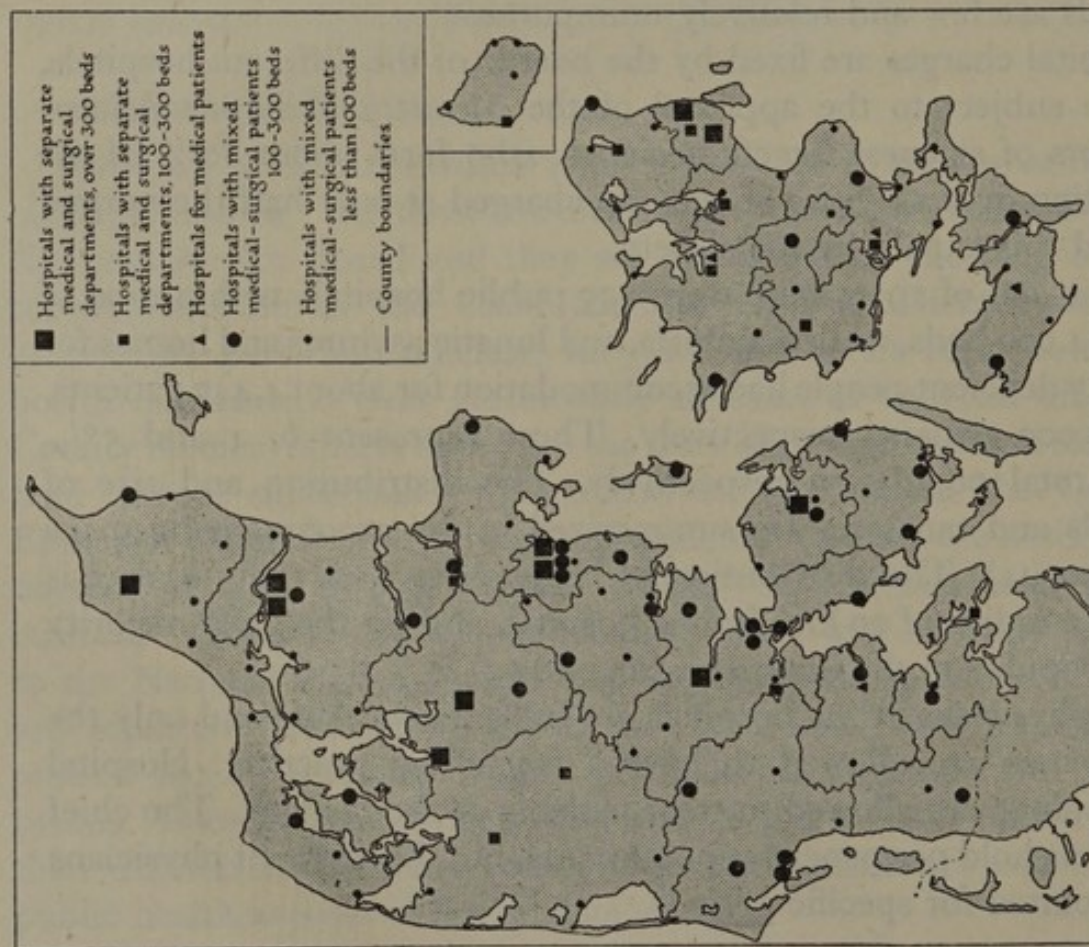


Fig. 40. Distribution of hospitals

Based on a map printed in the monograph on *Denmark* prepared for the European Conference on Rural Life, League of Nations official no. 113, M. 68 (Geneva, 1939).

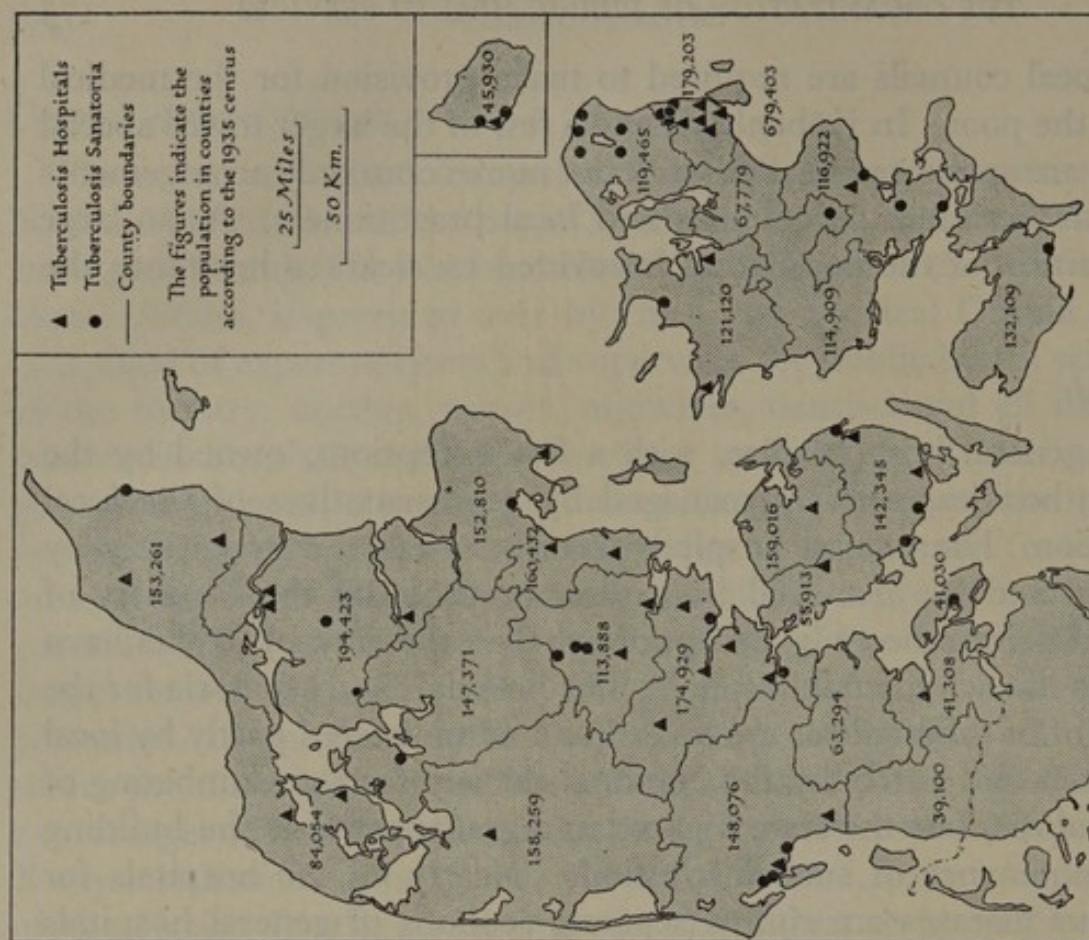


Fig. 41. Distribution of tuberculosis hospitals and sanatoria
Based on a map in *Denmark* 1937 published by the Royal Danish Ministry for Foreign Affairs and the Danish Statistical Department, p. 227 (Köbenhavn, 1937).

Personnel

Doctors are given authority to practise by the National Board of Health. They all receive their training at the University of Köbenhavn and the course extends over seven years. After qualifying they are required to serve a year as assistant at an approved hospital. No doctor may set himself up as a specialist without the authority of the National Health Board, which grants such authorization only if the doctor has received special training. The National Health Board also authorizes dentists to practise and requires that they shall have passed the qualifying examination of the Köbenhavn School of Dentistry.

The practice of normal midwifery in Denmark is almost entirely in the hands of qualified midwives. The doctor's intervention is confined to complicated cases and the administering of an anaesthetic. The practice of midwifery by unqualified women is prohibited. The course of training, which extends over two years, is concentrated in a state school. Local councils are required to appoint official midwives in numbers sufficient for the needs of their districts with due regard to the number of private practitioner midwives in the area. The official midwife is provided with a house and a salary of from 700 to 1,000 kroner and receives fees for cases attended, according to a fixed scale which is graduated in accordance with the financial situation of the patient. The midwife does her own antenatal work but must call in a doctor if any abnormality is discovered. Most births occur at home. Complicated cases are treated in hospitals. There are a few nursing homes which receive maternity cases, and the *Rigshospital* provides for unmarried women. The official midwife is pensionable; the retiring age is 70.

Nursing is not restricted to those who have been specially trained, but only nurses who have received a three-years' training at a hospital approved by the National Health Board may occupy a public post.

At the end of 1937 the personnel of the health services at the disposal of the population of the country, excluding Köbenhavn, was:

One doctor per	1,583 people.
One dentist per	5,650 people.
One chemist per	10,998 people.
One nurse per	690 people.
One masseuse per	3,832 people
One midwife per	902 women between 15 and 50 years of age.

Pharmacies

Pharmacies in Denmark are licensed and not all qualified pharmacists may be licensed as proprietors of pharmacies. The number of licences is controlled and applicants for a vacant licence, which is advertised, are considered by a special council and by the National Health Board and on these reports the Ministry of Home Affairs issues licences. Licensed pharmacists pay into the Pharmacy fund a fee which is calculated on the turn-over and nett profits of the business. This fund pays pensions to retired pharmacists and pharmaceutical assistants.

The Pharmacopoeia Committee keeps the Danish pharmacopoeia up-to-date, but inspection of pharmacies and analysis of dispensed and of patent medicines are carried out by officials appointed and maintained by the National Health Board. All patent medicines must be approved, both in prescription and in price, by the National Health Board before they can be placed on the market.

NATIONAL INSURANCE

Insurance against sickness, invalidity and old age are combined into a single system in Denmark. The National Insurance Act of 1933 made the whole population over 21 years of age contributing members of health insurance organizations, and introduced compulsory insurance against invalidity for those between 21 and 60 years of age. It also decreed that no one could receive an old-age pension without having been a member of these organizations. Only those people who are classed as 'unpropertied' may derive benefits from the health insurance scheme in the ordinary way, and this category is revised every three years and adjusted annually in accordance with average wages; it also differs for different parts of the country. Generally the highest level of income under which persons may derive full benefit from the insurance scheme corresponds to the annual wages of a fully employed skilled worker. In 1938 the limits were 4,100 kroner a year in Köbenhavn and its suburbs, 3,600 kroner in the provincial towns and 2,800 kroner in the remainder of the country. The members whose incomes are above these limits pay only small contributions and do not derive benefits from the societies, but they may do so at any time if their incomes fall below the prescribed levels and if they pay the larger contributions which are about 40 kroner a year as compared with 9.60 kroner paid by ordinary members.

The insurance society defrays the expenses of medical and hospital treatment and pays a maternity benefit, and a daily allowance for any period of illness up to 26 weeks. Pensions for invalidity are paid only if the person's earning capacity has been reduced by at least one-third. The pension is normally the same amount as an old-age pension (see below), but supplementary payments are made in special cases.

There are some 1,600 approved health insurance societies with a total membership of over two million unpropertied persons qualified to draw full benefits. The state makes an annual grant of 2 kroner for each unpropertied member to the health insurance societies and also pays a quarter of the cost of medical attendance, treatment outside the home, sick pay, maternity benefit, dental treatment and treatment at convalescent homes. The state and local authorities make grants for chronic invalids.

Occupational diseases and industrial accidents are regarded as trade risks which must be covered as a charge on production costs. These risks are met by a system of insurance which covers the injury disability and death of all employees. The premiums (8.40 kroner a year) are paid wholly by the employers and the cost of workmen's compensation does not devolve on the worker or the taxpayer. All minor accidents and disability for periods of less than 13 weeks are, however, treated as sickness, and compensation is paid by the sickness insurance societies.

Old-age pensions are paid wholly by the state and the municipalities in a proportion of 4:3 and are graduated according to income. When both husband and wife are eligible for old-age pensions the annual basic sum paid is 1,086 kroner in Köbenhavn, 912 kroner in provincial towns, and 702 kroner for the remainder of the country. For others the basic figures are 732, 606 and 468 kroner respectively for men, and 678, 564 and 432 kroner respectively for women. Supplementary payments, which vary with the cost-of-living index, are paid over and above the basic sum, but on the other hand the basic sum is reduced if the person's income is over 40% of the basic pension amount. The pension is reduced by 60% of the first 500 kroner of income in excess of that exempted, and additional income is deducted in full. If the pension becomes reduced to less than one-twelfth of the full amount it is cancelled. The pension becomes payable at the age of sixty but if it is not claimed until some years after the person has reached this age the basic sum is increased proportionately.

CHILD WELFARE

Child welfare is similarly organized for the country as a whole. Before the outbreak of war in 1939 Denmark was engaged in appointing public health nurses in all parts of the country. These nurses were to visit and instruct mothers in the care of very young children and the University of Aarhus had opened a school for the training of district nurses who had to be fully trained and certificated sick-nurses before they could be admitted to this training school. These district nurses are paid by the local authorities who receive grants from the state to cover up to half the cost. Medical inspection at schools by school doctors does not exist in all rural areas, but a Commission has reported on the provision of a general system for the whole country.

Institutions for the care of neglected and difficult children were first established as charities during the thirties of the last century and it was not until the end of the century that legislation in this matter became active. Provisions were made for the supervision of foster children and for paternal maintenance of illegitimate children in which the local authorities acted as guarantors of the alimony. At the same time there was a movement to make the state grant financial support to homes for children and to institutions for the education of young delinquents. In 1905 Boards of Guardians for different parts of the country, and also a General Council of Guardians for the country as a whole, were set up. The Boards of Guardians have powers of admonition, transference of children to homes, schools or similar institutions, and nomination of guardians. An Act of 1922 replaced that of 1905 and decentralized the organization for Child Welfare. Towns of over 10,000 inhabitants have their own regulations as to membership of Boards of Guardians, while in small towns or in rural areas the Boards are elected by the local councils. A number of mothers' clinics, children's homes, nurseries, and infant schools have been established by private charity and in 1919 the state began to make grants to cover half the running expenses of these institutions.

Deaf and dumb children are required by law to attend schools from their sixth to sixteenth years. They receive elementary instruction at an institute in Köbenhavn and are then sent to institutions either at Fredericia or at Nyborg. Lip-reading and speech are taught, and those who are incapable of mastering these arts are taught the

hand alphabet and writing. There is also a state institute for the instruction and improvement of those suffering from impediments of speech.

Education of blind children was made compulsory only as late as 1926. All blind children must be educated from their eighth to their eighteenth years. They attend special schools for elementary instruction until they are 11 or 12 years of age. The more backward children remain at these schools and specialize in manual work while the more gifted children go to a school in Köbenhavn to receive a more advanced general education. Private education of the blind is permitted under state inspection. The state also provides free professional training for blind people up to the age of 22 years. Since 1927 nearly all blind people have been regarded as partial invalids and receive the normal invalid grant of 800 kroner a year to compensate them for their reduced opportunities for employment. Homes, clinics, sanatoria, trade schools and elementary schools are maintained for cripples.

VITAL STATISTICS

The relatively high standards of health prevailing in Denmark are reflected in its vital statistics. The crude death-rate for the decade 1931-40 averaged 10.7 per thousand. The crude and standard death-rates of certain European countries in recent years are set out in the following table. The standard death-rate is the death-rate that would have been observed if the various national specific death-rates for the different age and sex groups of the population referred to populations with identical age and sex distribution. The standard population used is that of England and Wales as revealed by the census of 1901:

	Standard death-rate per 1,000	Crude death-rate per 1,000
Netherlands (1938)	7.0	8.5
Norway (1937-8)	7.3	10.2
Denmark (1937-9)	7.9	10.4
Sweden (1937)	8.1	12.0
England and Wales (1936-7)	9.2	12.2
Germany (1936)	9.4	11.8
France (1935-6)	10.9	15.7

Source: *League of Nations Annual Epidemiological Report*, 1938, pp. 65-7 (Geneva, 1941).

The mean expectation of life at birth also compares favourably with other European countries:

	Males	Females
Netherlands (1931-5)	65.1	66.4
Sweden (1931-5)	63.2	65.3
Denmark (1931-5)	62.0	63.8
Norway (1921-31)	61.0	63.8
England and Wales (1933-5)	59.6	63.6
Germany (1932-4)	59.9	62.8
France (1928-33)	54.3	59.0

Source: *Statistisk Aarbog* 1939, p. 247 (Köbenhavn, 1939).

Infant Mortality

The downward trend of the infant mortality rate, which has characterized the vital statistics of all western European countries during the present century, has lagged somewhat in Denmark in comparison with some adjacent countries. The following table gives some comparative figures:

Deaths of Infants under One Year per 1,000 Live Births

	1911-13	1935-9
Netherlands	105	38
Norway	65	40
Sweden	71	43
England and Wales	111	55
Denmark	98	64
Germany	164	64
France	125	66
Finland	112	68
Belgium	139	75

Source: *League of Nations Annual Epidemiological Report*, 1938, p. 63 (Geneva, 1941).

The Danish rates are higher than the high health, economic and social standards lead one to expect.

The infant mortality rate in Köbenhavn and Frederiksberg is always much below the rate for Denmark as a whole. For the four years 1935-8 the Köbenhavn rates were 56, 50, 40 and 40, as compared with 71, 67, 66 and 59 for the remainder of the country. In England and Wales urban infant mortality rates are nearly always higher than rural rates. The disadvantage of Danish rural infants as

compared with Köbenhavn infants is most in evidence during the second and third months of existence. During the second year of life rural children have the advantage. These facts are illustrated in the following table which gives the death-rates per 1,000 living in each age group for the years 1931-3:

Age	Köbenhavn and Frederiksberg	Remainder of the country	Percentage of rural excess
Under 1 month	25.5	29.5	15.7
2-3 months	7.1	15.1	112.7
4-12 months	25.3	32.5	28.5
Under 1 year	57.8	77.0	33.2
1-2 years	9.8	7.9	-19.4

Source: K. Stouman, 'The Perilous Threshold of Life', *Quarterly Bulletin of the Health Organization, League of Nations*, 1934, vol. III, no. 4, p. 600 (Geneva, 1934).

The more vigorous prosecution of public health and social welfare work in the capital than in other parts of the country is reflected in the saving of infant life, more especially among the 2-3 months age group, and shows what might be and will be done in smaller towns and rural areas.

CAUSES OF DEATH

The number of deaths attributed to each of the 43 causes of death in the international abridged nomenclature, and the rates per 100,000 inhabitants, are given in the table on p. 184. It will be seen that the most common causes of death are not widely different from those which obtain in England and Wales. The most marked differences are that the number of deaths due to bronchitis and diseases of the heart are, in proportion to the population, about half the rates which obtain in England and Wales. The rates for tuberculosis, cancer, bronchitis, cerebral haemorrhage, embolism and thrombosis are also lower in Denmark than in England and Wales, but it may be that some of the apparent diversities are due to differences in classification. For example, while the rate of deaths from cancer are lower in Denmark the incidence in deaths from non-malignant and unspecified tumours is lower in England and Wales, and while deaths from bronchitis and nephritis are more common in England and Wales the opposite is the case to a similar degree for pneumonia and un-

Mortality by Cause (rates per 100,000 inhabitants)

Causes of death	Denmark				1937 England and Wales	
	1936		1937		Deaths	Rate
	Deaths	Rate	Deaths	Rate		
Typhoid and paratyphoid fever ...	12	0.3	14	0.4	206	0.5
Typhus fever ...	0	0	0	0	0	0
Smallpox ...	0	0	0	0	0	0
Measles ...	17	0.5	14	0.4	1,051	2.6
Scarlet fever ...	54	1.5	38	1.0	349	0.8
Whooping cough ...	300	8.1	87	2.3	1,750	4.3
Diphtheria ...	111	3.0	75	2.0	2,963	7.2
Influenza ...	727	19.5	765	20.4	18,635	45.4
Plague ...	0	0	0	0	0	0
Tuberculosis of the respiratory system ...	1,359	36.5	1,319	35.2	23,970	58.4
Other forms of tuberculosis ...	377	10.1	345	9.2	4,559	11.1
Syphilis ...	76	2.0	68	1.8	1,243	3.0
Malaria ...	0	0	0	0	21	0.0
Other infectious or parasitic diseases ...	483	13.0	536	14.3	3,249	7.9
Cancer and other malignant tumours ...	5,612	150.8	5,497	146.6	66,991	163.3
Tumours, non-malignant, or of which nature not specified ...	396	10.6	503	13.4	2,568	6.3
Chronic rheumatism and gout ...	83	2.2	90	2.4	3,735	9.1
Diabetes mellitus ...	799	21.5	773	20.6	7,296	17.8
Alcoholism (acute or chronic) ...	37	1.0	54	1.4	102	0.2
Other general diseases and chronic poison- ings ...	764	20.5	729	19.4	8,395	20.5
Progressive locomotor ataxia and general paralysis of the insane ...	81	2.2	78	2.1	1,436	3.5
Cerebral haemorrhage, cerebral embolism and thrombosis ...	1,440	38.7	1,497	39.9	27,301	66.5
Other diseases of the nervous system and of the organs of special sense ...	1,815	48.8	1,788	47.7	11,168	27.2
Diseases of the heart ...	5,927	159.2	6,121	163.3	128,713	313.7
Other diseases of circulatory system ...	3,226	86.7	3,269	87.2	28,526	69.5
Bronchitis ...	669	18.0	617	16.5	17,882	43.6
Pneumonias ...	3,615	97.1	3,530	94.2	29,532	72.0
Other diseases of respiratory system (tuber- culosis excepted) ...	570	15.3	524	14.0	4,832	11.8
Diarrhoea and enteritis ...	560	15.0	533	14.2	4,925	12.0
Appendicitis ...	372	10.0	350	9.3	2,821	6.9
Diseases of liver and biliary passages ...	495	13.3	471	12.6	3,745	9.1
Other diseases of digestive system ...	1,006	27.0	1,010	26.9	13,018	31.7
Nephritis ...	533	14.3	509	13.6	15,065	36.7
Other diseases of genito-urinary system ...	1,279	34.4	1,305	34.8	8,326	20.3
Puerperal septicaemia* ...	85	1.3	72	1.1	596	1.0
Other diseases of pregnancy, childbirth and the puerperal state* ...	172	2.6	165	2.4	1,392	2.3
Diseases of the skin and cellular tissue and of bones and organs of locomotion ...	445	12.0	355	9.5	2,732	6.7
Congenital debility and malformations, pre- mature birth and other diseases of early infancy* ...	1,975	29.7	2,018	29.9	19,463	31.9
Senility ...	2,786	74.9	2,621	69.9	16,975	41.4
Suicide ...	644	17.3	785	20.9	5,165	12.6
Homicide ...	22	0.6	20	0.5	173	0.4
Violent and accidental deaths (suicide and homicide excepted) ...	1,237	33.2	1,170	31.2	17,458	42.5
Causes of death not specified or ill defined	758	20.4	727	19.4	1,237	3.0
Total ...	40,919	1099.4	40,442	1078.7	509,574	1241.9

* Rates per 1,000 live births.

Source: *League of Nations Annual Epidemiological Report*, 1938, pp. 68 and 70 (Geneva, 1941).

specified diseases of the genito-urinary system. The proportion of deaths from causes which were unspecified or ill-defined is higher in Denmark than in England and Wales.

SOME IMPORTANT DISEASES

Tuberculosis

There has been a remarkable decline in tuberculosis mortality in recent years. This has been due, in very large measure, to direct attack on the disease. The fall in tuberculosis death-rates has been much more marked than the fall in the death-rate from all causes. Up to the outbreak of the war New Zealand alone had lower tuberculosis death-rates than Denmark. The Netherlands occupied third place:

Tuberculosis Deaths per 100,000

	Denmark	Netherlands
1933	58	60
1934	55	54
1935	51	52
1936	47	50
1937	44	48

Source: *Bulletin of Hygiene*, 1937, p. 633 (London, 1937) and *League of Nations Annual Epidemiological Report*, 1938, pp. 70, 77 (Geneva, 1941).

The fall in tuberculosis incidence has been in evidence in both urban and rural areas, but as in most other countries the town dweller suffers most:

Tuberculosis Mortality per 100,000

	Towns	Rural areas
1930	78	65
1931	77	63
1932	75	63
1933	64	54
1934	60	51
1935	56	48
1936	51	43

Source: 'Tuberculosis in Rural Areas', *Bulletin of the Health Organization, League of Nations*, vol. VIII, nos. 4, 5, p. 554 (Geneva, 1939).

In Köbenhavn and Frederiksberg the male tuberculosis death-rates are higher than the female rates, whereas in provincial towns and rural areas the female rates are always considerably higher than

the male rates. For the five-year period 1931-5 the annual tuberculosis death-rates per 100,000 were:

	Males	Females
Köbenhavn and Frederiksberg	87	71
Provincial towns	58	64
Rural areas	49	63

Source, *Bulletin of Hygiene*, 1939, p. 299 (London, 1939).

The age and sex distribution of deaths from tuberculosis in towns and rural areas in 1935 is set out below:

Tuberculosis Mortality per 100,000 in 1935

Age	Urban		Rural	
	Male	Female	Male	Female
Under 1 year	56	75	78	93
1-4 years	66	42	39	36
5-9 "	12	14	11	21
10-14 "	6	14	9	13
15-19 "	38	65	28	49
20-24 "	90	77	48	93
25-34 "	68	88	51	88
35-44 "	68	47	39	63
45-54 "	88	38	42	48
55-64 "	48	56	64	66
65-74 "	50	60	61	85
75 and over	52	66	35	56
All ages	58	54	39	57

Source: 'Tuberculosis in Rural Areas', *Bulletin of the Health Organization, League of Nations*, vol. III, nos. 4, 5, p. 569 (Geneva, 1939).

A very considerable proportion of tuberculosis infections in Denmark is milk-borne. About a third of the cattle slaughtered show naked-eye lesions of tuberculosis. In 1935 infections with the bovine type of the tubercle bacillus were responsible for 4.9% of 1,814 cases of pulmonary tuberculosis, 49% of 251 cases of tuberculosis of the cervical glands, 18.5% of 567 cases of bone and joint and genito-urinary tuberculosis and for 24.7% of 304 cases of tuberculous meningitis. Bovine infections are most in evidence in west Jylland and least in Bornholm, Sjælland, Lolland-Falster and Fyn.

Every tuberculous patient in Denmark, requiring institutional treatment, can receive it regardless of his ability to pay for it. For poor patients the state pays three-fourths of the cost, the balance being found by the patient, or by a sick-benefit club or by the municipality.

If the bread-winner is in a sanatorium, the municipality supplies the family in cases of need. The state contributes the cost of upkeep of tuberculosis dispensaries. An ever-increasing proportion of tuberculosis patients in the last stages of the disease were being treated in institutions, thus rendering harmless potentially dangerous sources of infection. The Danish National Tuberculosis Association has branches in every county and has contributed much to the campaign.

Venereal Diseases

Systematic attempts to control the prevalence of venereal diseases have been made for 150 years or more; for many years Denmark was far ahead of other countries in this important branch of public health work. All sufferers are entitled to gratuitous treatment whatever their financial position may be, and they can be compelled to undergo treatment. The free treatment of such patients is an important part of the duties of the district medical officers. Due regard is paid to the provision of privacy for the patients. The state defrays the cost. The police regulation of professional prostitution was abolished in 1906 and alternative measures were taken. In that year new cases of syphilis amounted to 3.9 per thousand of the population; in 1933 they numbered but 0.3 per thousand. A large proportion of new cases of syphilis occurs among sailors.

All serological tests for syphilis are carried out at the State Serum Institute at Köbenhavn for all parts of Denmark. No private laboratory is allowed to do such tests. The centralization of this serological work has many advantages. It insures that the requisite skill and experience for carrying out these tests and interpreting the results are available to all medical practitioners in Denmark, and the card index kept at the Institute furnishes an almost complete list of syphilitic infections in the country. The Institute's records show that the notification of primary cases to district medical officers is often very incomplete.

A decline in the number of cases of gonorrhoea notified in Köbenhavn has been apparent since the introduction of the sulphanilamide treatment of that disease. In the first half of 1939, 1,899 new cases of gonorrhoea were notified; the number in the corresponding period of 1936 was 2,488. Further evidence of declining incidence and the shortening of treatment is furnished by the facts that, in 1930, 59% of the beds in the Rudolph Bergh Hospital in Köbenhavn were occupied by venereal diseases patients, whereas in September 1939 only 10% were so occupied.

A certificate of freedom from venereal diseases or a statement to that effect is demanded before marriage.

Other Notifiable Diseases

Cases of disease notified by medical practitioners in Denmark from 1932 to 1938 include:

Cases of Notifiable Diseases reported by Doctors in 1932-8

	1938*	1937	1936	1935	1934	1933	1932
Typhoid fever ...	43	47	47	78	79	74	106
Paratyphoid fever ...	98	198	106	134	122	178	878
Paradysentery ...	367	1,103	617	845	612	604	752
Cerebro-spinal meningitis ...	60	61	61	60	55	63	91
Acute poliomyelitis ...	566	1,243	79	398	4,711	356	73
Epidemic encephalitis	25	41	23	48	73	67	100
Diphtheria ...	870	1,348	2,138	3,807	2,155	2,118	3,037
Scarlet fever ...	8,950	9,519	8,305	7,722	5,580	3,592	2,438
Measles ...	43,978	4,736	3,595	87,839	7,498	9,150	24,192
Whooping cough ...	17,100	12,334	28,971	31,017	15,653	11,663	28,764
Mumps ...	4,673	10,626	7,666	7,164	7,662	5,214	2,123
Erysipelas ...	3,103	2,800	3,163	3,362	3,332	3,178	3,115
Puerperal fever ...	256	194	190	179	187	175	167
Tetanus neonatorum	40	37	53	35	24	23	32
Pemphigus neonatorum	175	139	182	293	202	96	99
Rheumatic fever ...	2,485	2,904	3,009	3,194	3,260	3,054	3,029
Lobar pneumonia ...	3,172	3,133	3,705	3,753	3,224	2,939	3,172
Acute tracheo-bronchitis ...	93,803	100,795	98,823	95,358	81,987	80,408	79,843
Capillary bronchitis and broncho-pneumonia ...	19,175	23,570	24,654	24,255	21,320	21,272	21,403
Influenza ...	95,993	108,134	190,886	112,320	52,620	154,673	167,100
Angina tonsillitis ...	89,971	90,015	82,863	86,239	83,993	73,556	65,985
Acute intestinal catarrh ...	32,259	34,959	32,043	29,978	31,224	30,820	32,463
Epidemic catarrhal jaundice ...	2,257	2,178	2,739	5,347	11,262	11,768	6,908
Gonorrhoea ...	9,275	10,094	10,364	9,953	9,978	10,090	10,410
Venereal ulcer ...	94	82	96	82	107	100	90
Syphilis (acquired) ...	470	641	771	766	805	653	782
Syphilis (congenital)	50	65	64	68	69	69	111
Scabies ...	—	13,696	11,239	9,483	8,521	8,300	8,952
Delirium tremens ...	9	6	18	28	23	21	27
Pulmonary tuberculosis ...	—	3,500	3,370	3,272	3,350	3,455	3,934

* Provisional figures.

Source: *Statistisk Aarbog*, 1939, p. 30 (Köbenhavn, 1939).

No case of plague, cholera or typhus fever has been reported from Denmark for very many years. The last case of smallpox notified was in 1924. The incidence of the common zymotic diseases of childhood

is comparable to that in England. Scarlet fever is somewhat more prevalent in Denmark, and diphtheria less prevalent than in England and Wales. In both countries scarlet fever is a very mild disease, the case mortality rate averaging about 0.5% in Denmark and 0.8% in England and Wales. The diphtheria case mortality rates were 5.8% in Denmark and 4.8% in England and Wales (1936-8).

There were considerable outbreaks of acute poliomyelitis in 1934 and 1937. In the latter year, of 599 patients that developed paralysis, 133 died. It is probable that numerous non-paralytic cases were undiagnosed. The epidemic reached its height in September. The incidence was greatest among children under 7 years of age but 45% of the fatal cases occurred at ages of 15 and over. There was an increase in the number of adult cases late in the epidemic. The rural areas affected were the same in the 1934 and 1937 outbreaks.

Undulant fever caused by the infection of man with *Brucella abortus*, the organism that is responsible for contagious abortion of cows, appears to be more prevalent in Denmark than in other European countries, but its apparently greater incidence may be only a measure of the greater attention paid in that country to the search for cases. The clinical symptoms of the disease are protean and it is rarely, if ever, possible to make a diagnosis without recourse to laboratory investigation. For many years it has been the practice at the State Serum Institute of Denmark to look for the presence of agglutinins to *Br. abortus* in all samples of serum of febrile patients that are sent to the Institute for examination. More than 10% of such serums give positive results and it would appear probable that some 500 cases of undulant fever occur annually in Denmark. Infection is acquired either by contact with diseased cows or by drinking milk from an infected animal. It was estimated that between 4,000 and 5,000 of the 210,000 herds of cattle in Denmark become reinfected with brucellosis each year. The disease is more costly to Danish farmers than is tuberculosis.

Chapter X

DISTRIBUTION AND GROWTH OF POPULATION

General Features

Distribution of Population: West Jylland (Jutland); North Jylland; East Jylland; Fyn (Fünen); Sjælland (Zealand)

Growth of Population: Growth of Population since 1800; Recent Trends

Regional Variations in the Growth of Population

Towns: Number and Distribution of Towns; The Growth of Towns

Rural Settlement

Foreign Population

GENERAL FEATURES

The population of Denmark numbered 3,706,349 in 1935; this is rather less than half the population of Greater London and is slightly larger than the population of Chicago. The density of population for the country as a whole is 86 persons per sq.km. Among European countries Switzerland comes nearest to Denmark both in area and population. There, 4.2 million people live on some 41,000 sq.km. and so represent a general density of 102 per sq.km. in spite of snowy peaks, forests and rocky slopes. The general density in Denmark compares most closely with that of Poland (89 per sq.km.), Portugal (80 per sq.km.), France (76 per sq.km.) and Northern Ireland (92 per sq.km.). It contrasts with England and Wales which have a general density of 272 per sq.km., Germany (territory of 1937) which has 140 per sq.km., and the Netherlands and Belgium which have 254 and 279 per sq.km. respectively. Denmark is the most densely peopled of the Scandinavian countries, for Norway and Finland, with large areas of barren mountains, forests and lakes, have densities of only 9 per sq.km. and Sweden has only 14 per sq.km.

The general density of 86 persons per sq.km. has more meaning in Denmark than in most countries. There are no very marked contrasts, either in density of population or in the nature of settlement. Denmark has no barren, sparsely peopled uplands contrasting with wide, densely peopled valleys or plains, nor has it closely packed industrial conurbations contrasting with the general scattered distribution of rural areas. The differences in distribution are merely

a gentle gradation from the lightly peopled heaths of western Jylland to the more densely peopled morainic hills and plains of eastern Jylland and the islands. Denmark has but one city, Köbenhavn, whose population of 843,168 in 1935 formed 23 % of the total population of the country. This contrasts with Sweden, Norway and Finland, in each of which the capital contains 8-9 % of the total population of the country, with France, Germany and the United States, where the corresponding proportions are 6-7 %, and still more markedly with Poland, Rumania, Italy and Spain for which the figures are 3-4 %. The high proportion of the population living in the capital in Denmark is almost as great as in Austria, where Vienna has 27 % of the total population of the country, and is greater than in Britain and Argentina in both of which the capital contains 18 % of the total population.

The domination of Köbenhavn is accentuated still further by the absence of other cities. Britain has Manchester, Birmingham and Glasgow; Germany has Hamburg, Köln, Munich and Leipzig; Spain has Barcelona; Italy has Milan; and America has Chicago and Philadelphia, in addition to their capitals, and all of which are important national centres. Denmark, on the other hand, has but provincial towns, the largest of which has a population of only 90,898 which is comparable in size with towns such as Ipswich, Northampton, Grimsby and Rochdale. Thus while Denmark has no provincial towns with a population of over 100,000, Britain and Germany each have about 60, France has 16 and even Switzerland has 3 such towns. Denmark has but 9 towns with over 20,000 inhabitants and only 29 towns with over 10,000 inhabitants. The corresponding figures for Sweden are 19 and 47, for Norway 4 and 17, for Switzerland 12 and 24.

Danish statistics classify about 62 % of the population as urban, but include in this category all persons living in villages, many of which have less than 500 inhabitants. This makes comparisons with other countries difficult, since the definition of urban population varies widely. If we class as urban that part of the population which lives in towns with over 20,000 inhabitants (excluding Köbenhavn), 10 % of the total population falls into this class, as compared with 7 % in Sweden, 8 % in Norway, 10 % in Finland and 19 % in Switzerland. If the urban class is extended to include those living in towns with more than 10,000 inhabitants, the proportion is 17 % in Denmark, 23 % in Sweden, 14 % in Norway, and 23 % in Switzerland. By contrast, about 30 % of the population of Britain and about 25 % of the population of Germany live in towns of more than

100,000 inhabitants.* The proportions of the total population living in the different types of settlements are shown in Fig. 42.

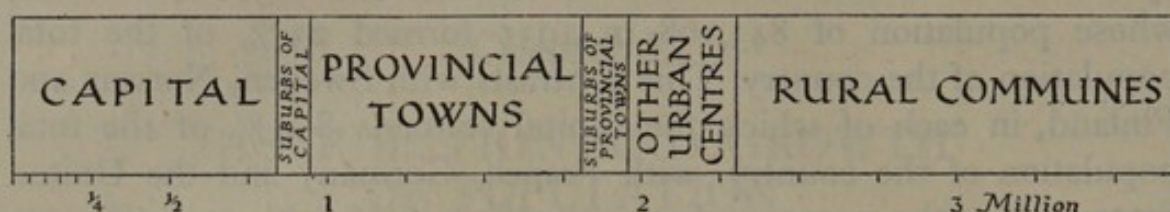


Fig. 42. Proportions of the population living in the main categories of settlements, 1935

Based on census returns, *Statistiske Meddelelser*, 4. Række, 101. Bind, 1. Hæfte (København, 1936).

The provincial towns are the municipalities (*Købstæder*) (see p. 150).

The density of the agricultural population on the farmed land is not high in comparison with that of other countries, but, since there is little land that is unsuitable for farming, the population is well distributed over the whole country.

Density of Agricultural Population

	Density per 100 ha. of			Density per 100 ha. of	
	Culti- vated area	Total agri- cultural area		Culti- vated area	Total agri- cultural area
United Kingdom	26	7	Netherlands	61	28
Denmark	21	17	France	33	22
Sweden	27	21	Germany	46	33
Norway	40	33	Belgium	53	33
Finland	43	32	Poland	54	40

Source: International Institute of Agriculture: *Documentation for the European Conference on Rural Life*, p. 18 (Rome, 1939).

DISTRIBUTION OF POPULATION

The general pattern of the density of population is illustrated in Fig. 43; the main reasons for this distribution emerge from a correlation of this map with Figs. 57 and 58. The main facts can be stated briefly.

In general, the density of population varies directly as the quality of the land and shows a gradation from the sparsely inhabited dunes

* In all cases, these figures do not include the capitals.

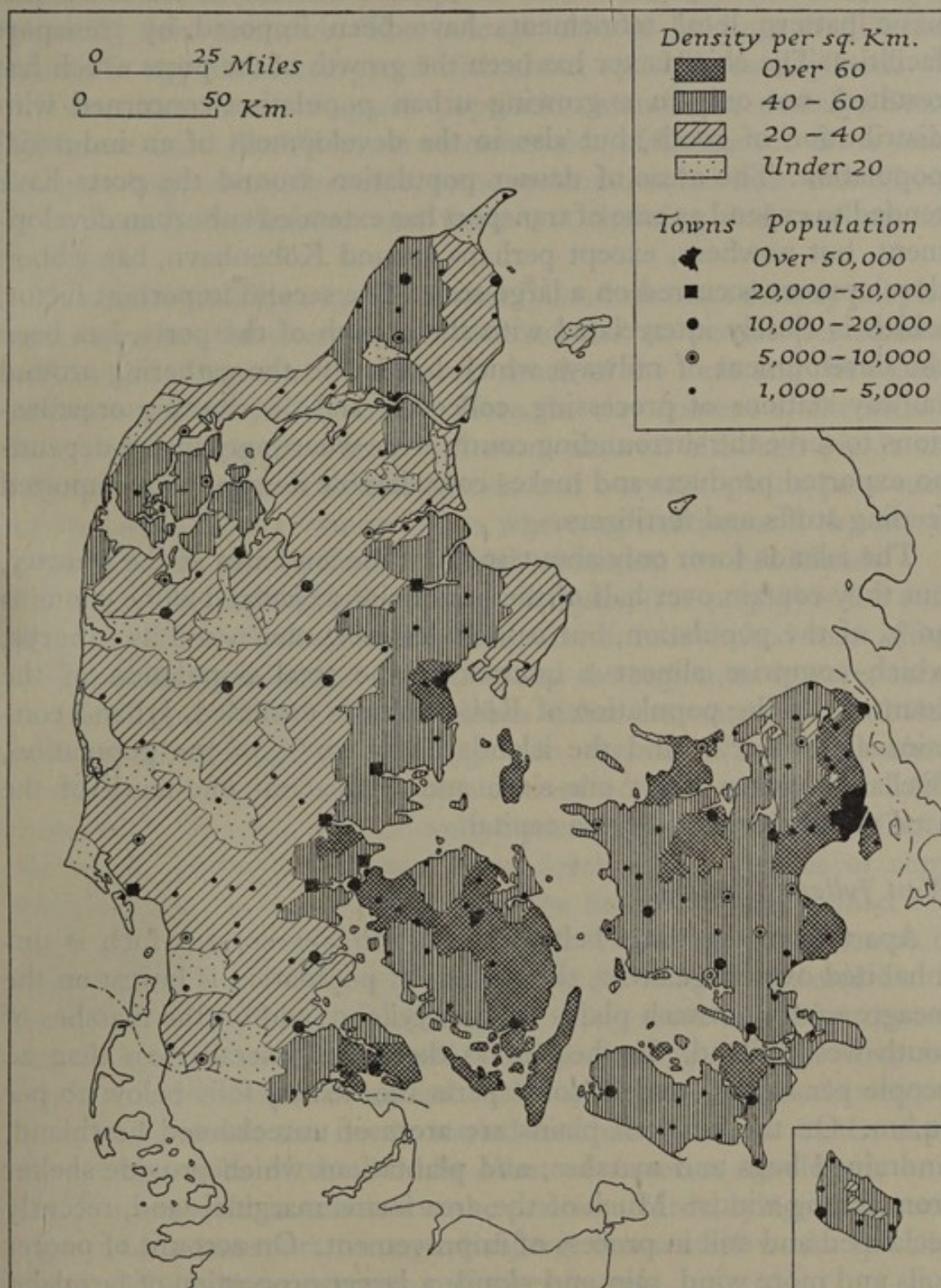


Fig. 43. The distribution of population (see also Fig. 56)

Based on C. C. Christensen and A. M. R. Krogsgaard, *Atlas for Mellem-skole og højere Skoler*, 10th ed., p. 7 (Köbenhavn, 1936).

of the North Sea coast, through the sandy heaths of west Jylland, to closely settled clayey soils of east Jylland and the islands. On this basic pattern local refinements have been imposed by transport facilities. The chief factor has been the growth of the ports which has resulted, not only in a growing urban population concerned with distribution of goods, but also in the development of an industrial population. The areas of denser population around the ports have tended to expand as ease of transport has extended suburban development, but nowhere, except perhaps around Köbenhavn, has ribbon development occurred on a large scale. The second important factor, which is closely interrelated with the growth of the ports, has been the development of railways which has led to the gathering around railway stations of processing, collecting and distributing organizations to serve the surrounding countryside where agriculture depends on exported products and makes considerable demands for imported feeding stuffs and fertilizers.

The islands form only about 30 % of the land area of the country, but they contain over half of the population; Sjælland alone contains 40 % of the population, but it includes Köbenhavn and its suburbs, which comprise almost a quarter of the total population of the country. If the population of Köbenhavn is excluded, Jylland contains about 60 %, and the islands about 40 % of the population, Sjælland having about one-sixth and Fyn about one-tenth of the total population outside the capital.

West Jylland (Jutland)

Apart from the dune belt of the North Sea coast, which is uninhabited over large areas, the density of population is lowest on the meagre sandy outwash plains of west Jylland, and on the marshes of south-west Jylland. In these areas there are generally less than 20 people per sq.km., and in some parts the density falls below 10 per sq.km. On the outwash plains are areas of unreclaimed heathland, undrained bogs and marshes, and plantations which provide shelter from strong winds. Much of the area forms marginal land, recently reclaimed and still in process of improvement. On account of poorer soils and more wind, rain and cloud, a larger proportion of farmland is under grass than in other parts of the country, and poorer crops, such as rye, must be grown. Yields of crops and the density of livestock are relatively low.

In south-west Jylland much of the land is too wet for arable crops. Permanent grassland occupies more land than either cereals or

rotation grassland, while the area under root crops is small. Beef cattle are an important element in farm economy and farming is generally less intensive. The average size of holdings in Tönder county is $25\frac{1}{2}$ ha. as compared with about 17 ha. in east Jylland.

Two other areas of sparse population stand out, namely, Store Vildmose and Lille Vildmose on either side of Limfjord. Both areas are peat-bogs where, however, some reclamation has been carried out by stripping the heather and peat, and draining and marling the sour soil.

The hill islands (pp. 13-14) of west Jylland are more densely peopled and carry, on the average, between 20 and 40 people per sq.km., which is similar to the density over much of the Fens and the coastal plain from Perth to Inverness. Here the clay content of the soils is higher and crops are better and more assured although yields are still below average. The hill islands and outwash plains pass eastwards into a zone of sandy loams where agriculture and density of population are similar to those which obtain on the hill islands.

West Jylland contains few towns. Esbjerg (see p. 385) is the only large centre. The barren lagoon-fringed and dune-locked coast offers few facilities for maritime activities, and the region, as it were, turns its back on the North Sea and looks either eastwards to the Baltic ports or southwards to Esbjerg. On the heathlands Holstebro, Herning and Varde, with populations of 10,658, 12,568 and 6,869 respectively in 1935, are the only centres other than large villages. All are of recent growth and have developed as centres of communication since the reclamation of the heathland was pushed forward on a large scale after about 1870. Holstebro is the centre of communications for the north, Herning for the centre, and Varde for the south, of the heathland region. They serve as market centres and have therefore developed food-processing and packing industries, manufacture of agricultural implements and machinery, to serve and provide the newly settled heathlands, much in the same way as the cities of the Middle West of America developed, on a vastly larger scale, in relation to the prairies. Varde, lying within easy reach of sea transport through Esbjerg, has a steel works (p. 289) which manufactures castings and special steels.

Viborg, on the north-east fringes of the heathland, was the ancient capital of Jylland. It has kept some of its administrative importance and is, for example, not only a county town but also the seat of the *Landsret* for Jylland. It is the centre of communications for north-central Jylland and has the usual agricultural industries.

In the south-west Jylland, Ribe and Tönder, each with a population of about 6,000, are old towns with narrow streets and ancient buildings. Ribe was a port of some importance in medieval times (p. 366), but to-day it, like Tönder, serves as a market town for the marshlands and has a small engineering industry. Tönder is the centre of road and rail communication on the north-west side of the German frontier.

North Jylland (Jutland)

In north Jylland the soil is mainly sandy loam of indifferent or low fertility. The terrain is bare and windswept, and the growing season is shorter than elsewhere, so that the poorer and hardier crops such as oats and rye are most common; yields are little higher than in west Jylland. Much land is under grass and rearing of beef cattle is important. Over most of the area the density of population ranges between 20 and 40 per sq.km., but three regions of greater density stand out. These are: the island of Mors and its adjacent coastlands in Limfjord, the north-west area between Hirtshals and Brønderslev and centring on Hjørring, and finally the area around Aalborg. The area around Aalborg carries a denser population mainly on account of the importance of that town as a port and industrial centre, especially for the manufacture of cement, and as a focus for roads and railways across Limfjord (see p. 373). The other areas are areas of greater soil fertility where clay loams occur; crops are more varied and abundant, and the stock-carrying capacity of the land is great. For example, in Tisted county the average size of farms is 15 ha., while in Aalborg and Hjørring counties as a whole it is about 18 ha. The larger towns in this region are all ports—Struer (5,726), Tisted (8,288), Nykøbing (Mors) (8,177), Skive (10,799), Aalborg—Nørre-Sundby (55,280) and Frederikshavn (10,500) (see Chapters II and XVII)—with the exception of Hjørring and Brønderslev which had populations of 11,714 and 6,272 respectively in 1935. The last two towns are market centres and have the usual industries of food processing and packing, and the manufacture of agricultural machinery.

East Jylland (Jutland)

The zone of clay loams, which extends over an average width of about 30 km. behind the east coast of Jylland south of Randers Fjord, has a general density of between 40 and 60 per sq.km., which is similar to that found over most of East Anglia and Lincolnshire. Only over small areas does the population fall below 40 per sq.km.,

and in the areas around Aarhus, Vejle and Sønderborg it rises to well over 60 per sq.km. This zone contains about a third of the total population of Jylland and most of its larger towns. The soil has a good lime content, clay particles are fine, and the farming is more intensive than in the other parts of the peninsula; crop yields are higher and livestock are more numerous. The important towns are all ports, six of which have populations of over 20,000, while another three have between 10,000 and 20,000 people each. Six of these ports are at the heads of fjords and are centres of communications which lie behind these coastal indentations. They are the main exporting and importing centres for Jylland, except for the quick-transport traffic that passes through Esbjerg, and they possess a considerable variety of industries; their equipment and functions are described in Chapter XVII. The broad peninsula of Djursland, which extends east between Aalborg Bugt and Aarhus Bugt, is a poorer area of sandier soils and more hummocky relief where the density falls below 40 persons per sq.km.

Fyn (Fünen)

Fyn contains some of the most prosperous farming land in Denmark, and the average size of farms (13 ha.) is lower than in any other part of the country. The general density of population is everywhere over 40 per sq.km. except in restricted areas on the higher morainic hills known as *Fynske Alper* where the soil is sandier and less fertile. The density rises to over 60 per sq.km. around Odense (p. 390) and in a belt which invests the lines of communications by road and railway across the island to Sjælland and also to the smaller islands of Langeland and Ærø. Odense, Nyborg and Svendborg are the only large towns and are described in Chapter XVII.

Sjælland (Zealand)

Sjælland, like Fyn, is mostly covered with fertile clay loams which are intensively farmed and support over 40 people per sq.km. The average size of farms is 14–15 ha. The general density does not vary greatly except around København and along the so-called Danish 'riviera' between the capital and Helsingør. Here the land is closely settled with a mixture of fishing villages and the suburban villas of the richer people from the capital. København county has a general density of 189 per sq.km. The hinterland of this coastal zone is a region of sandy soils which carries large areas of forest where the density of population falls very low.

Apart from the ports (see Chapter xvii) the only important towns are Slagelse, Ringsted, Haslev and Hillerød, which have populations of between 5,000 and 8,000 each except Slagelse, which had 15,538 inhabitants, and Roskilde which had 22,944 inhabitants, in 1935. Roskilde has only a very small harbour. Its importance dates from medieval times, when it was the capital of the kingdom and the seat of the archbishop. As elsewhere these are market towns which are centres of road and railway communications for the surrounding districts and they have the usual industries of food processing and packing, and the manufacture of agricultural machinery. Slagelse manufactures stationary steam and heavy-oil engines, dairy machinery and margarine, while Ringsted makes road-building machinery, and Hillerød builds foundry furnaces and narrow-gauge motor locomotives in addition to the more usual industries.

Lolland and Falster have the richest soils but not the densest population. These islands are peripheral areas away from the main lines of communications and consequently their economy is almost purely agricultural. The density of population is mostly between 40 and 60 per sq.km., and the only large towns are the ports of Nakskov and Nykøbing (F) (see pp. 396 and 435).

GROWTH OF POPULATION

Growth of Population since 1800

Denmark experienced the same rapid increase of population during the nineteenth century as did some European countries in which the development of mechanical industries led to the growth of large-scale factory industries and to widespread rural depopulation. But in Denmark rural depopulation was not a feature. On the contrary, the nineteenth century was the period when the rural population became fully emancipated and was settled on the land. Reclamation of heathland and dispersal of settlements were more prominent features than urban expansion. Although there was a constant drain from the rural areas to the towns, this was never so large as the natural increase in the country districts. Thus the proportion of the population living in provincial towns increased only from 10 to 11.7 % between 1801 and 1850, while the proportion living in rural areas decreased from 79.3 to 79.1 % between the same dates. It was not until after 1880 that the towns began to expand, and this expansion followed on the development of communications and the

reorientation of agricultural economy which resulted from better and cheaper transport.

Fig. 44 shows that the birth-rate remained fairly constant, apart from natural oscillations until about 1885, while the death-rate

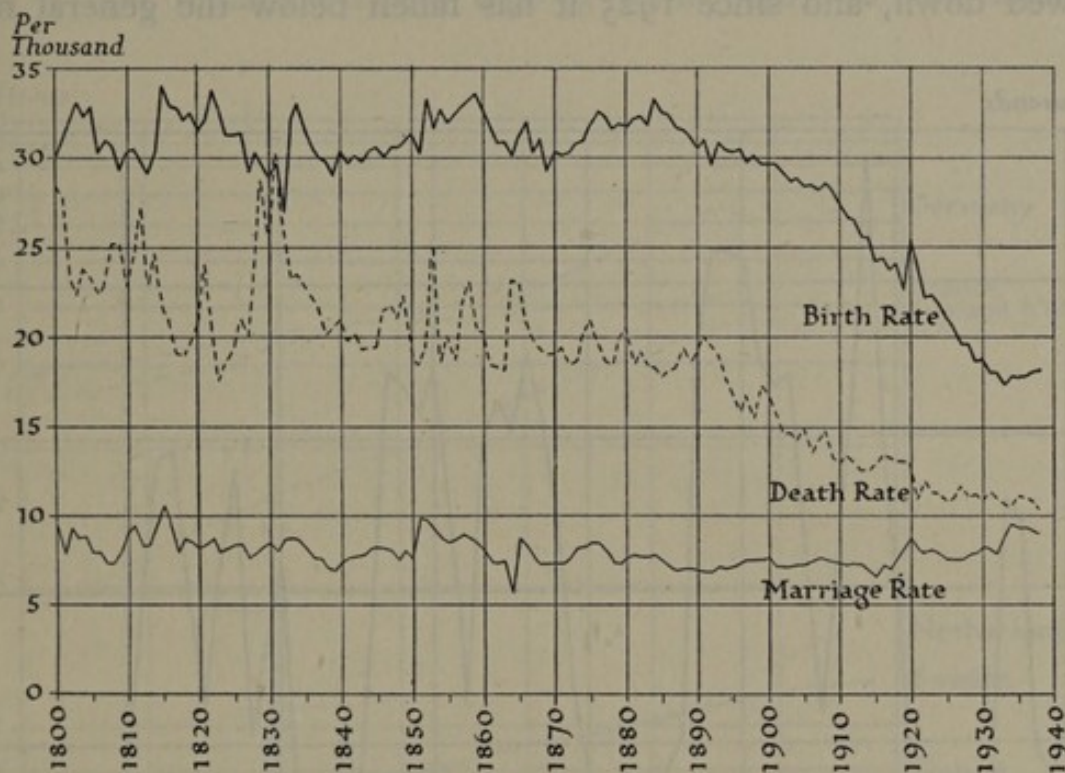


Fig. 44. Variations in the birth-, death- and marriage-rates in Denmark, 1800-1938

Based on data in *Statistisk Tabelværk*, 5. Række, Litra A, Nr. 5 (København, 1905) and *Statistiske Meddelelser*, 1902-36.

The graph expresses the numbers per 1,000 of the total population (crude rates). It will be noticed that the decline in the birth-rate has not been due to fewer marriages, although these have tended to occur at higher ages in recent years.

Growth of Population

	Initial population	Increase by births	Loss by deaths	Excess of births over deaths	Loss by emigration	Increase by immigration	Balance of migration	Total increase	Total population
1801-1840	929,001	1,330,731	974,355	365,376	?	?	+ 3,698	360,074	1,289,075
1840-1860	1,289,075	895,373	585,616	309,757	?	?	+ 9,530	319,287	1,608,362
1860-1870	1,608,362	525,220	339,197	186,023	15,463	—	—	176,379*	1,784,741*
1870-1880	1,784,741	585,012	360,812	224,200	39,902	—	-39,902	184,208	1,969,039
1880-1890	1,969,039	662,396	386,039	276,357	76,975	3,959	-73,016	203,341	2,172,380
1890-1901	2,172,380	760,483	442,659	317,824	61,809	21,145	-40,664	277,160	2,449,540
1901-1911	2,449,540	741,599	369,239	372,360	?	?	-64,824	307,536	2,757,076
1911-1921	2,757,076	725,856	379,152	346,704	51,603	52,032	+ 429	510,755†	3,267,831†
1921-1930	3,267,831	695,136	373,653	321,483	58,516	19,858	-38,658	282,825	3,550,656
1930-1935	3,550,656	322,734	197,211	125,523	42,404	72,574	+30,170	155,693	3,706,349

* Including results of territorial changes in 1864.

† Including 163,622 persons included in Denmark by the return of northern Slesvig to Denmark by the terms of the Treaty of Versailles and the plebiscite of 1920.

Source: 'Befolkningsforholdene i Danmark i det 19. Aarhundrede,' *Statistisk Tabelværk*, 5. Række, Litra A, Nr. 5 (København 1905) and *Statistiske Meddelelser*, 1902-36 (København, 1902-36).

declined after about 1835. After 1885 a persistent decline in the birth-rate set in, but between 1885 and 1910 the death-rate declined still more rapidly, so that between these years the excess of births over deaths continued to increase. After 1911 the rate of natural increase slowed down, and since 1925 it has fallen below the general rate

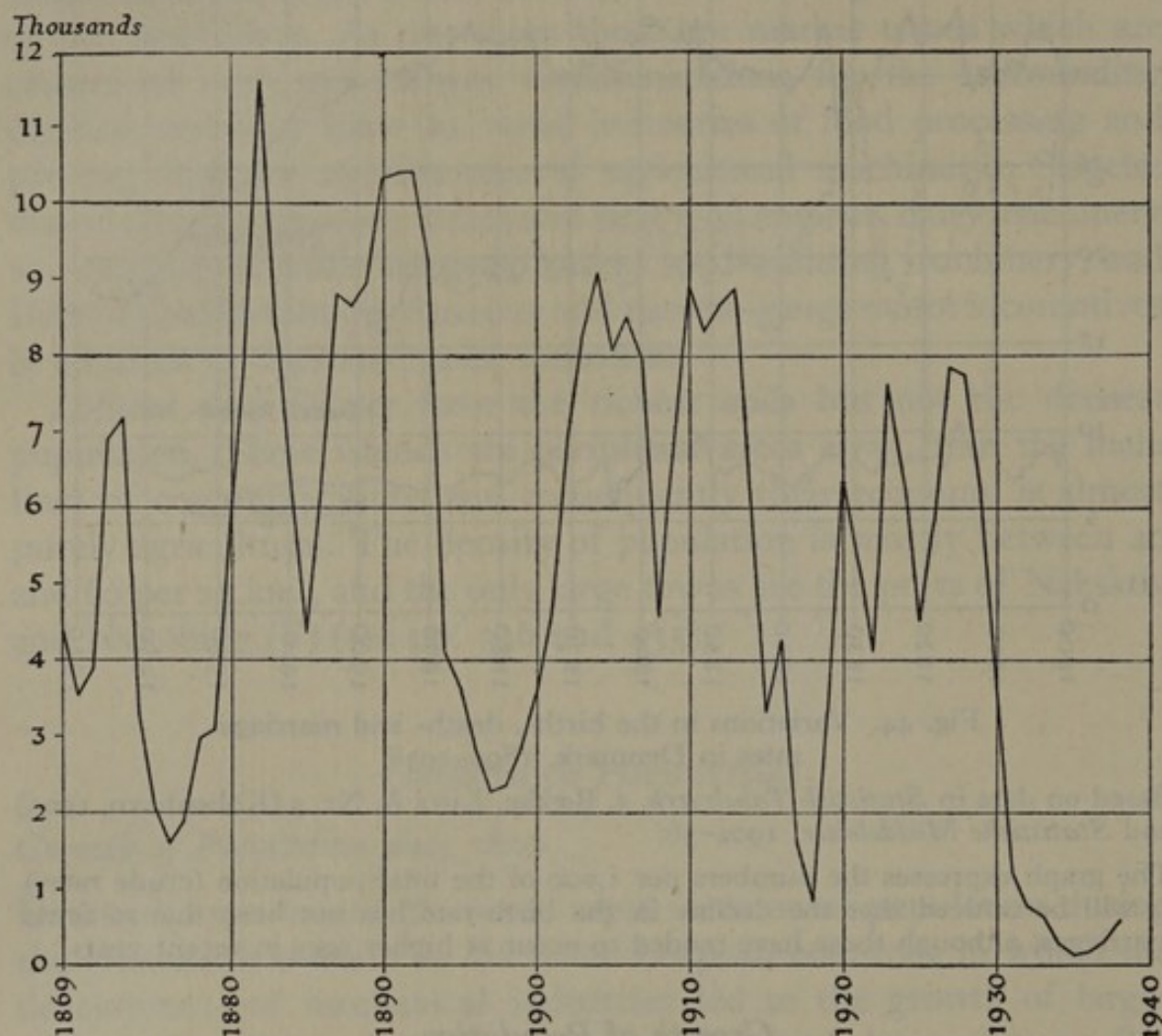


Fig. 45. Overseas emigration from Denmark, 1869-1938

Source: Compiled from 'Befolkningsforholdene i Danmark i det 19. Aarhundrede', *Statistisk Tabelværk*, 5. Række, Litra A, Nr. 5 (København, 1905) and *Statistisk Aarbog*, 1939, p. 23 (København, 1939).

during the first half of the nineteenth century and well below the rate during the years 1850-1910.

The table on p. 199 sets out the general features of the growth of the population. It will be seen that apart from a few exceptional years, Denmark has lost large numbers by migration. During the nineteenth century this loss was due mainly to overseas emigration. Details of numbers are given in Fig. 45.

The rate of increase has been fairly uniform and fluctuated between averages of 0.77 and 1.31 % per annum, during the intercensal periods between 1801 and 1901. It was maintained at between 0.98 and 1.33 % during the years 1901-25. In 1925-6 the rate fell to 0.79 % and remained below 0.70 % until 1930. It rose slightly

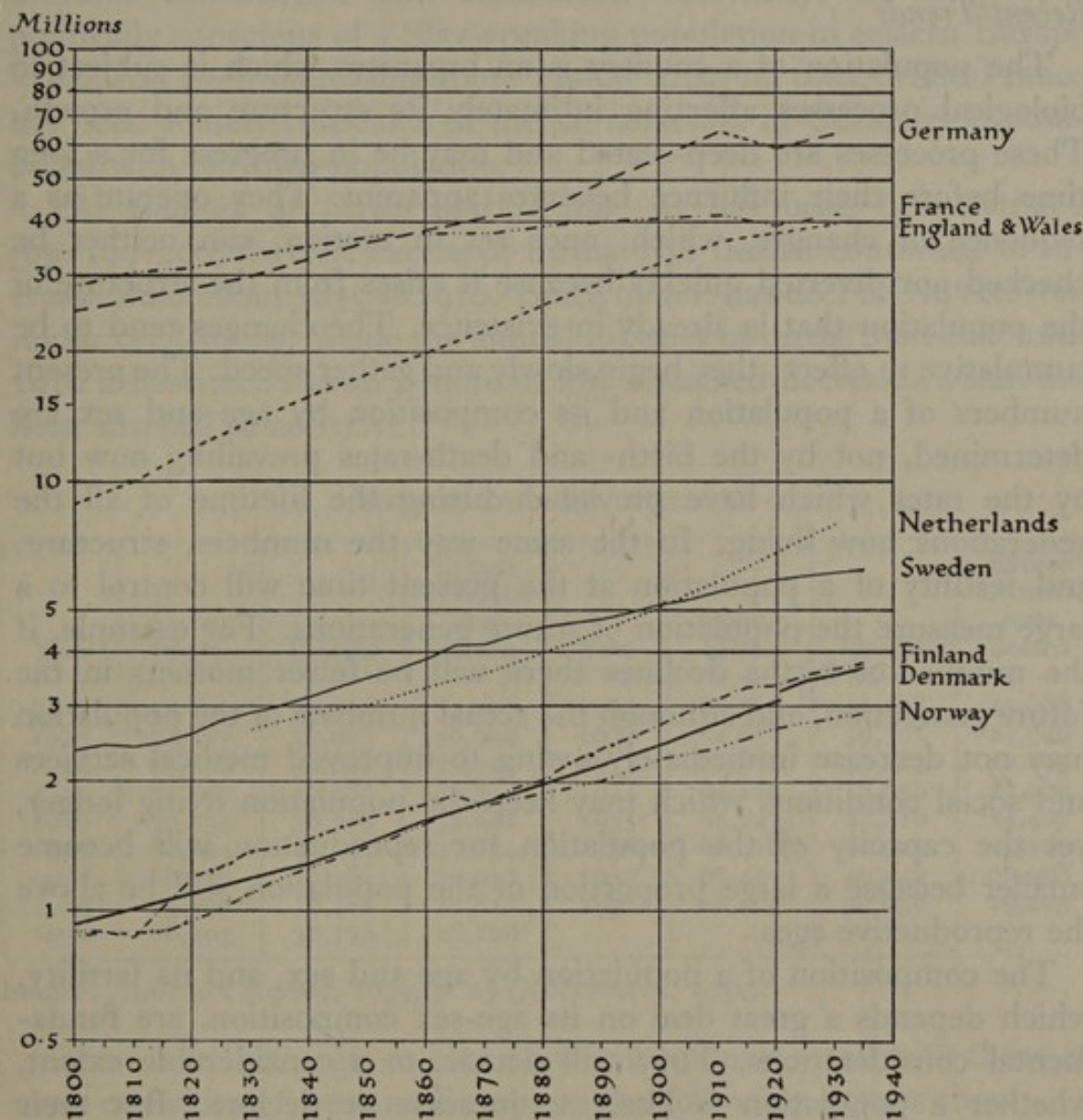


Fig. 46. Growth of population in Denmark and some other European countries, 1800-1935 (logarithmic scale)

Based on the census returns of the several countries.

during the early thirties and reached 0.95 % in 1921-2, but since 1935 it has been between 0.73 and 0.75 %. During the nineteenth century the population of Denmark increased by 164 % as compared with about 266 % in England and Wales, 155 % in Norway, and 130 % in Germany. In Finland the increase was 152 %, but in

Sweden it was only about 120 %. This contrasts with France where the population increased by only 45 %. Between 1801 and 1935 the population of Denmark increased by 299 % as compared with 166 % for Sweden, 226 % for Norway, 355 % for Finland, 349 % for England and Wales (to 1931) and 53 % for France.

Recent Trends

The population of a country is an organism which is subject to biological processes affecting intimately its structure and growth. These processes are deep-seated and may be in progress for a long time before their influence becomes apparent. They operate as a sequence of changes, which, once set in motion, can neither be checked nor diverted quickly because it arises from the structure of the population that is already in existence. The changes tend to be cumulative in effect; they begin slowly and gather speed. The present numbers of a population and its composition by age and sex are determined, not by the birth- and death-rates prevailing now but by the rates which have prevailed during the lifetime of all the generations now living. In the same way the numbers, structure, and fertility of a population at the present time will control to a large measure the population of future generations. For example, if the number of births declines there will be fewer mothers in the future generation, and although the actual numbers of the population may not decrease immediately owing to improved medical services and social conditions which may keep the population living longer, yet the capacity of the population for reproduction will become smaller because a large proportion of the population will be above the reproductive ages.

The composition of a population by age and sex, and its fertility, which depends a great deal on its age-sex composition, are fundamental considerations. They will decide, to a considerable extent, whether a population is likely to increase or decline. But their influence reaches further than considerations of mere numbers, since they affect social issues such as the outlook of the majority of the population and the responsibility of the state in matters such as old-age pensions, especially in relation to the numbers of the active population that has to provide the taxation from which these services are financed. The desirability of a larger or of a smaller population is a question which can be variously argued, but knowledge of the trend of population at home and abroad is essential for modern states, since it lies close to economic and political issues in

international affairs. It will be sufficient to mention, as cases in point, the pressure of population in Japan as contrasted with the small populations of some British dominions which are probably not maintaining their numbers by reproduction, and the increase of population in Britain during the nineteenth century in relation to overseas colonization and settlement. Germany has long been politically conscious of a Slav-speaking population in eastern Europe which has been increasing more rapidly than its own, while France has been acutely conscious of the same factors in Germany as compared with her own population.

The Balance of Births and Deaths. It has been demonstrated (pp. 199-200) that the excess of births over deaths continued to increase from about 1835 to 1910. Since then it has declined apart from minor oscillations. While the annual number of births increased until 1910 it has since shown a more or less sustained decrease, which has been marked since 1921.

Natural Increase, 1922-38

Year	Living births	Deaths	Excess of births over deaths	Year	Living births	Deaths	Excess of births over deaths
1922	73,899	39,452	34,447	1931	64,266	40,578	23,688
1923	74,827	37,903	36,924	1932	64,650	39,701	24,949
1924	73,836	38,091	35,745	1933	62,780	38,287	24,493
1925	71,897	37,083	34,814	1934	65,116	38,050	27,066
1926	70,734	38,093	32,641	1935	65,223	40,816	24,407
1927	68,024	40,190	27,834	1936	66,418	40,919	25,499
1928	68,516	38,484	30,032	1937	67,440	40,442	26,998
1929	65,297	39,486	25,811	1938	68,463	39,058	29,405
1930	66,303	38,174	28,129				

Source: *Statistisk Aarbog*, 1939, p. 23 (Köbenhavn, 1939).

The crude birth-rate in Denmark still compares well with those of most countries of western Europe as the following figures show:

Crude Birth-rates (live births per 1,000 inhabitants).

Annual Averages, 1934-8

Netherlands	20.3	Denmark	17.9	Norway	14.9
Finland	19.8	Belgium	15.5	England and Wales	14.8
Germany	18.9	France	15.2	Sweden	14.2

Source: *Statistical Year-book of the League of Nations*, 1939/40, p. 37 (Geneva, 1940).

The death-rate, which averaged 10.7% annually between 1934 and 1938, is lower than in most European countries, and the expectation

of life at birth is exceeded only in Sweden and the Netherlands (see p. 182).

Fertility and Reproduction. But in Denmark, as in the other countries of western Europe, the decisive factor in population at present is not mortality but fertility. The fertility of a population depends to a considerable degree on its composition by age and sex.

During the latter part of the nineteenth century death was greatly postponed through improved medical and social services, but it is already clear that the rate at which the span of life can be lengthened is slowing down and obviously the extent to which the chances of death can be reduced is limited. The increase in the span of life was accompanied, somewhat later, by a reduction in the size of families as the standard and cost of living rose and as knowledge of birth control spread. The effects of the lengthening of life are seen in the higher average age of the population which is illustrated in the following table: the consequences of the decrease in the size of families will be more apparent in future years when the old people have died and the smaller families have grown up. These smaller families will give fewer, and possibly still smaller, families.

Numbers in Different Age groups per 1,000 Inhabitants

Ages	1880		1935	
	Males	Females	Males	Females
0-4	132	125	83	78
5-9	112	106	86	81
10-19	196	185	181	173
20-29	158	163	176	174
30-39	122	127	149	153
40-49	103	104	119	119
50-59	87	88	96	99
60-69	58	63	65	67
70-79	26	31	33	38
80 and over	6	8	9	11

Source: *Statistisk Tabelværk*, 5. Række, Litra A, Nr. 5 and *Statistiske Meddelelser*, 1936.

The crude birth-rate merely expresses the number of births per thousand of the total population, irrespective of age and sex. Neither it nor the balance between it and the death-rate is a true measure of the capacity of a population for further increase. Even while it is actually increasing in numbers a population may be preparing for decline. This paradox arises from the fact that the capacity of a popula-

tion for increase depends on its fertility and mortality in different age groups. The fertility of a population will obviously depend on the number of women between the ages of 15 and 50 years, which are the effective limits of the period of reproduction. Thus the number of births expressed as a proportion of the number of women of reproductive age is a better measure of fertility than the crude birth-rate. But since the younger women have a higher fertility than

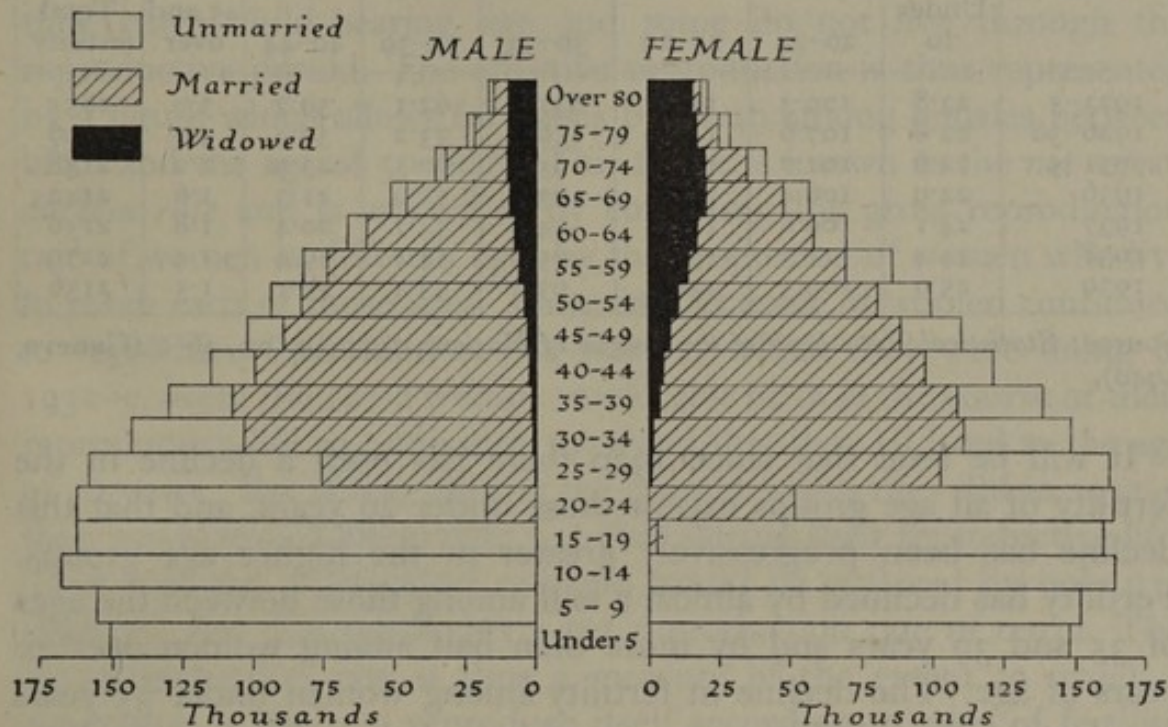


Fig. 47. The composition of the population of Denmark by age, sex, and civil status in 1935

Based on data in *Statistiske Meddelelser*, 4. Række, 101. Bind, 1. Hæfte (København, 1936).

The diagram indicates that the twenties are the most common ages at which women are married, whereas the majority of the men are slightly older when they marry. The preponderance of females over males in the population means that spinsters are more numerous than bachelors at all ages above 35 years, but the bulk of the mature population is, or has been, married. The decline in the birth-rate reflects itself in the smaller proportions at the ages 0-9 years than at the ages of 10-29 years.

older women the composition of the population by age, especially the age of its women, is an important factor. If the average number of children born to every thousand women at every year of age between 15 and 50 years are added, the figure so obtained gives the number of children which would be born to every thousand women during their reproductive life provided that no women died between the ages of 15 and 50 years, and that the current fertility of women at the different ages remained the same as they were for the period for

which the calculation was made. Such a figure expressed the *total fertility* of the population.

The following table shows the fertility rate of Danish women by age groups and also the total fertility in recent years:

*Average Number of Living Births per 1,000 Women
at Each Age in the Respective Age Groups*

	Under 20	20-24	25-29	30-34	35-39	40-44	45 and over	Total fertility
1921-5	23.8	120.3	158.7	131.8	92.1	39.7	3.9	2851
1926-30	22.6	107.6	133.9	110.8	73.2	30.4	3.0	2407
1931-5	22.6	101.7	121.9	95.0	60.5	23.9	2.2	2138
1936	22.9	106.4	126.3	93.9	55.9	21.3	1.6	2142
1937	24.1	109.8	126.7	94.4	54.1	20.4	1.8	2156
1938	24.4	111.3	130.2	95.0	54.1	19.4	1.4	2179
1939	25.9	109.5	129.5	93.3	53.4	18.1	1.5	2156

Source: *Statistical Year-book of the League of Nations*, 1939/40, pp. 46-7 (Geneva, 1940).

It will be seen that since 1920 there has been a decline in the fertility of all age groups except those under 20 years, and that this decline has been progressively greater in the higher age groups. Fertility has declined by almost a half among those between the ages of 35 and 39 years and by more than half among women over 40 years of age. The decline in fertility among women under 35 years of age was followed after 1935 or 1936 by a period of greater fertility. Among women in the higher age groups the decline has been continuous; this is significant because the proportion of women at these ages has been increasing owing to the reduced number of younger women. The total fertility of the Danish population compares with other countries as follows:

Netherlands (1935-7)	2584	France (1934-6)	2078
Finland (1930-2)	2479	England and Wales (1931)	1920
Germany (1936)	2212	Norway (1936-8)	1840
Denmark (1931-5)	2138	Sweden (1931-5)	1755

Source: *Statistical Year-book of the League of Nations*, 1939/40, pp. 46-7 (Geneva, 1940).

The figure for Denmark means that, according to the fertility rates of 1931-5, a thousand Danish women, all living between the ages of 15 and 50 years, would give birth to 2,138 children during their reproductive years, that is, an average of two children each. This, then, is the measure of the fertility of the population. But since the number includes both boys and girls it is not a measure of the extent

to which the population is equipping itself for reproduction. This is expressed by the number of girls born to every woman living through the child-bearing years, since these will be the potential mothers of the future. In Denmark this figure, which is called the *gross reproduction rate*, averaged 1.038 annually for the years 1931-5. That is to say, that at the current rate of reproduction the number of women would just be maintained, provided that all these females live through their childhood and reproductive years. But some of them die before they reach child-bearing age and some do not live through the reproductive period. The effective reproduction is thus represented by a figure which allows for losses by death among females between birth and the age of 50 years. This figure is known as the *net reproduction rate* and is arrived at by correcting the gross reproduction rate of women at different ages by the proportion of women who live to reach each of those ages. Thus, in Denmark, if women continued to reproduce their kind at the rates at which they were doing in 1931-5, every thousand women would give birth in the course of their reproductive life to 1,036 girls provided that they all lived to the age of 50 years. But if they died at the rates at which they did in 1931-5 they would give birth to only 932 girls during their reproductive life. That is to say, a thousand mothers would be replaced by only 932 mothers, and this represents a net reproduction rate of 0.932. The net reproduction rate is thus a measure of the extent to which a generation is likely to reproduce itself according to rates of fertility and mortality of the years for which it is calculated; it does not take account of new trends in fertility and mortality which will almost certainly occur in the future. It measures, for particular years, the extent to which the contemporary population is replacing itself at the current rates of fertility and mortality, and while it indicates whether a population is likely to increase or decrease it does not say when this process will begin. A net reproduction rate of 1.0, if maintained, means that the population is likely to remain constant provided that fertility and mortality do not change. A rate of 1.25 means that the population is eventually likely to increase by a quarter in a generation, while a rate of 0.90 indicates a reduction of 10 % from one generation to another.

Between 1885 and 1910 the net reproduction rate in Denmark was fairly stable at about 1.4 or 1.5, which meant that the population was doubling itself in two generations. It then declined gradually, but until about 1930 the population was more than maintaining itself by reproduction. Between 1931 and 1935 the net reproduction rate

averaged 0.932 and remained at approximately this level up to 1940. The inference is, therefore, that according to the rates of fertility and mortality during the last decade the replacement of females was not occurring at a rate sufficient to maintain the numbers of the total population, and that unless mortality, and especially fertility, change the population of Denmark is likely to decline. This is not due to a sudden change but is the result of a decline in fertility which has been in progress since about 1885. Populations are likely to decline in future in most countries of north and west Europe, and in several of them the rate of decline is likely to be greater than in Denmark as the following table suggests:

Net Reproduction Rates

Poland (1931-2)	1.25	Germany (1933-6)	0.850
Italy (1935-7)	1.131	Norway (1931-5)	0.831
Netherlands (1935-7)	1.131	Belgium (1936)	0.831
Finland (1931-5)	0.956	England and Wales (1931-5)	0.77
Denmark (1931-5)	0.932	Sweden (1931-5)	0.75
France (1928-33)	0.905		

Source: *Statistical Year-book of the League of Nations*, 1939/40, pp. 48-9 (Geneva, 1940).

These figures are merely indications of the trend of population; they are not absolute measures. The population may increase by immigration or the rates of fertility and mortality may change either towards an increase or towards a more rapid decrease. If current fertility and mortality rates persist, the population of Denmark will have begun to decline fairly rapidly by the end of this century.

REGIONAL VARIATIONS IN THE GROWTH OF POPULATION

Conditions since 1800. The increase in population since 1801 has, on the whole, been fairly uniform in all parts of the country. The following table shows that the proportions of the population living in various parts of the country has not changed materially since 1801:

	1801 %	1855 %	1901 %	1921 %	1935 %
Sjælland	36.9	36.0	39.2	38.9	40.4
Fyn	13.9	13.8	11.4	10.0	9.7
Lolland and Falster	5.7	5.6	4.3	3.9	3.6
Bornholm	2.1	1.9	1.7	1.4	1.2
N. Jylland	13.0	13.2	13.0	12.0	11.7
E. Jylland	15.9	17.3	17.6	16.4	16.3
W. Jylland	12.5	12.1	12.8	12.5	12.2
S. Jylland	—	—	—	5.0	5.0

Source: *Statistisk Tabelværk*, 5. Række, Litra A, Nr. 5 and *Statistiske Meddelelser*, 1901-36.

The table reflects the growth of København in Sjælland and of the port towns of eastern Jylland, while predominantly rural areas such as Bornholm, Lolland and Falster have come to contain a relatively smaller proportion of the total population of the country in spite of the fact that Lolland and Falster have the richest soil in the country.

Thus the general density of population in Denmark increased from 23·84 per sq.km. in 1801 to 86·34 per sq.km. in 1935. In the different parts the densities per sq.km. at different periods have been:

	1801	1860	1901	1911	1921	1935
Sjælland	45·6	76·5	128·0	146·4	169·0	199·4
Fyn	37·1	62·5	80·5	87·3	94·0	102·7
Lolland and Falster	29·4	48·4	59·2	64·6	71·7	73·6
Bornholm	33·2	49·8	69·6	73·0	75·6	78·2
N. Jylland	16·0	28·6	42·2	46·5	51·7	57·1
E. Jylland	20·1	39·1	58·8	65·9	73·3	82·1
W. Jylland	10·8	18·3	29·1	34·0	37·8	42·1
S. Jylland	—	37·8	41·5	41·8	41·1	47·6
Denmark	23·8	41·3	62·9	70·7	76·1	86·3

Source: *ibid.*

It will be seen that the increase in population density since 1800 has been greatest in Sjælland and east Jylland, where it has more than doubled. This has been due mainly to the growth of the towns especially the ports, and the establishment and development of industries in them. In west Jylland the increase in density has been greater than in east Jylland and almost as great as in Sjælland. This reflects the vigorous policy of land reclamation, settlement and soil improvement which has been carried out on the heaths here since the middle of the nineteenth century. The increase in population density in south Jylland has been much less than in the other parts of Denmark.

More significant than these general figures are those for densities in the rural areas. The following table gives the figures of population density in the rural districts of the several counties. The outstanding fact is that for each county as a whole the density of the rural population has increased progressively, sometimes rapidly, and that in spite of urban expansion there has been no marked rural depopulation. In some areas the population has done little more than maintain itself since 1880. Everywhere the rate of increase in rural areas has slowed down, especially since 1921, and in some areas the density of working population on the land is decreasing (see p. 263). The absolute increase between 1801 and 1935 has been greatest in the areas around

the towns and in the poorer areas such as the reclaimed heathlands of west Jylland, and north Jylland. This increase in the poorer areas contrasts with Britain where the marginal areas suffered the earliest and most severe depopulation.

Population per sq.km. in Rural Districts, 1801-1935

Counties (<i>Amter</i>)	1801	1840	1880	1901	1911	1921	1935*
	%	%	%	%	%	%	%
København	36 100	49 136	73 202	74 206	94 261	118 328	189 525
Frederiksberg	31 100	46 148	52 168	51 165	55 177	60 194	68 219
Holbæk	27 100	38 141	51 189	52 193	54 200	57 211	57 211
Sorø	27 100	38 141	50 185	49 182	52 192	54 200	53 196
Præstø	30 100	41 137	54 180	52 173	54 180	56 187	57 190
Bornholm	24 100	30 125	40 167	40 167	43 179	45 188	47 196
Maribo	28 100	37 132	46 164	45 161	48 171	51 182	52 186
Svendborg	33 100	46 139	58 176	59 179	63 191	65 197	63 191
Odense	32 100	45 140	56 175	55 172	61 191	66 206	68 212
Vejle	17 100	27 159	37 218	37 218	40 235	44 259	46 270
Aarhus	19 100	28 147	40 210	41 216	46 242	49 258	55 299
Randers	18 100	24 133	35 194	37 206	41 228	42 234	45 250
Aalborg	13 100	17 131	26 200	31 238	35 269	39 300	46 354
Hjørring	15 100	22 147	33 220	36 240	37 247	40 267	42 280
Tisted	16 100	24 150	33 206	34 212	35 219	37 231	38 238
Viborg	13 100	17 131	28 216	31 238	35 269	37 285	40 308
Ringkøbing	8 100	12 150	18 226	22 275	23 288	25 312	26 325
Ribe	11 100	14 127	22 200	24 218	28 254	32 291	35 318
Haderslev	— —	— —	— —	— —	— —	31 —	35 —
Aabenraa	— —	— —	— —	— —	— —	35 —	40 —
Sønderborg	— —	— —	— —	— —	— —	62 —	62 —
Tønder	— —	— —	— —	— —	— —	20 —	24 —

* Provisional figures.

Source: *ibid.*

Recent Tendencies. The changes in the distribution of population between 1925 and 1935 are shown in Fig. 48. Although all counties except Holbæk, Sorø, Svendborg and Sønderborg show an increase in their rural population, the map, which has been compiled by parishes (*Sognekommunerne*), makes it clear that, within the counties, increase in some areas, often of small extent, mark the decreases which have occurred in other areas, often of considerable extent.

The areas of marked increase are almost all near towns, but such increase is not always directly at the expense of rural areas since they are sometimes due to outward movement of urban dwellers to sub-urban locations. A belt of marked increase extends across almost the entire width of Jylland south of Esbjerg. This represents the colonization of the zone of the old frontier which was sparsely populated. The areas of decrease are mainly in the richer parts of the country—Sjælland, Lolland, Falster, Fyn and east Jylland. On the heaths of west Jylland increase has been maintained, and it is only in the poorest areas such as the outwash plains and the marshes of south-west Jylland that decrease has occurred over large areas. This decrease in

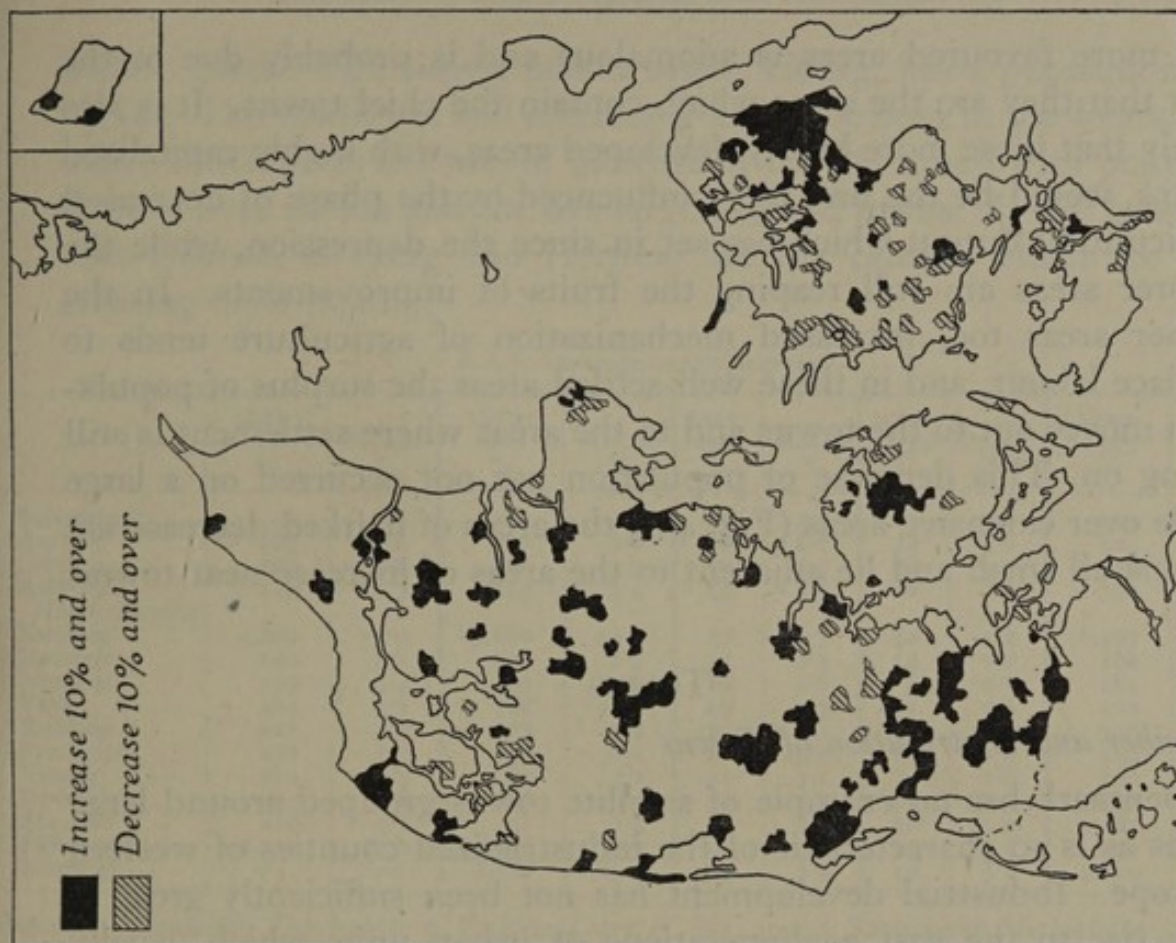
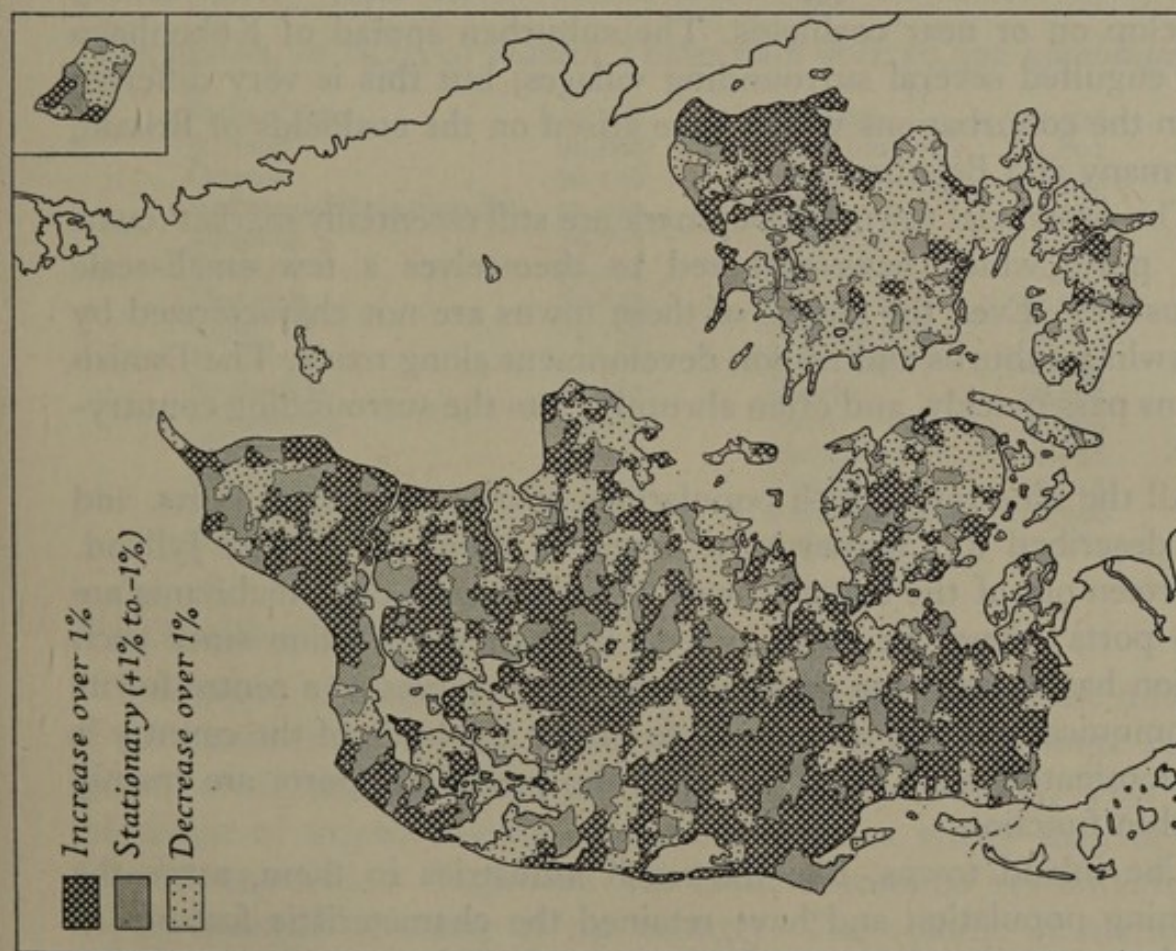


Fig. 48. Changes in the distribution of population, 1925-35
Based on a map in *Statistiske Meddelelser*, 4. Række, 101. Bind, 1. Hæfte, pp. 36-7 (København, 1936).

the more favoured areas is anomalous and is probably due to the fact that they are the areas which contain the chief towns. It is also likely that these more highly developed areas, with highly capitalized farms, would be the first to be influenced by the phase of decreased agricultural output which has set in since the depression, while the poorer areas are still reaping the fruits of improvements. In the richer areas too, increased mechanization of agriculture tends to replace labour, and in these well-settled areas the surplus of population moves out to the towns and to the areas where settlement is still going on. This decrease of population has not occurred on a large scale over extensive areas (Fig. 48); the areas of marked decrease are almost all small and lie adjacent to the areas of increase near towns.

TOWNS

Number and Distribution of Towns

Denmark has no example of satellite towns grouped around large cities as is so characteristic of the industrialized counties of western Europe. Industrial development has not been sufficiently great to give rise to the vast agglomerations of urban units which usually develop on or near coalfields. The suburban spread of Köbenhavn has engulfed several surrounding villages, but this is very different from the conurbations which have arisen on the coalfields of Britain, Germany and Belgium.

The provincial towns of Denmark are still essentially market towns and ports which have gathered to themselves a few small-scale industries. Even the largest of these towns are not characterized by sprawling suburbs and ribbon development along roads. The Danish towns pass quickly, and often abruptly, into the surrounding countryside.

All the nine towns with populations of over 20,000 are ports, and are described in Chapter XVII; seven of them are in east Jylland. Thirteen out of the twenty towns with 10,000–20,000 inhabitants are also ports; these are more general in their distribution since each region has at least one sizeable town which serves as a centre for its communications and economic life. Even the trade of the country is so dominated by Köbenhavn that the provincial ports are mainly local in function.

The inland towns, like the small industries in them, serve the farming population and have retained the characteristic features of market towns equipped with transport facilities to collect and dis-

tribute goods. The largest inland town, Viborg, has a population of 17,344. The towns are still increasing as can be seen in the following table, which gives the rate of increase of the ten towns with populations of over 20,000 and the five largest inland towns. It will be seen that Odense, Esbjerg and Herning are the centres which are increasing most rapidly.

A.A.I. = average annual increase.

	1801- 70 %	A.A.I. %	1870- 1911 %	A.A.I. %	1911- 1921 %	A.A.I. %	1921- 1935 %	A.A.I. %	1870- 1935 %	A.A.I. %
København	94	1.4	182	4.4	25	2.5	20	1.5	325	5.0
Aarhus	265	3.8	311	7.6	20	2.0	22	1.6	524	8.1
Odense	193	2.8	150	3.7	17	1.7	55	3.9	349	5.4
Aalborg - Nørre-Sundby	115	1.7	185	4.5	25	2.5	16	1.1	794	12.2
Esbjerg	2,200	31.9	3,860	94.2	17	1.7	44	3.2	6,577	101.2
Randers	149	2.2	102	2.5	15	1.5	14	1.0	166	2.5
Horsens	339	4.9	127	3.1	16	1.6	8	0.6	184	3.8
Vejle	365	5.3	184	4.5	27	2.7	11	0.8	300	4.6
Kolding	222	3.2	163	4.0	21	2.1	37	2.6	336	5.2
Fredericia	107	1.5	98	2.4	21	2.1	22	1.6	199	3.1
Viborg	170	2.5	69	1.7	31	3.1	22	1.6	170	2.6
Roskilde	195	2.8	86	2.1	32	3.2	35	2.5	232	3.6
Slagelse	216	3.1	91	2.2	28	2.8	16	1.2	183	2.8
Silkeborg	5,214	77.2	276	6.7	24	2.4	23	1.6	473	7.3
Herning	—	—	2,580	63.9	34	3.4	42	3.0	5,010	77.2

Source: *Statistisk Tabelværk*, 5. Række, Litra A, Nr. 5 and *Statistiske Meddelelser*, 1901-36.

Population, in 1935, of Danish Towns with over 10,000 inhabitants

København	843,168	Slagelse	15,538
Aarhus	90,898	Nykøbing (F)	14,801
Odense	76,116	Nakskov	14,522
Aalborg - Nørre-Sundby	55,280	Silkeborg	13,393
Esbjerg	30,714	Herning	12,568
Randers	30,254	Holbæk	12,493
Horsens	29,856	Næstved	12,229
Vejle	24,354	Sønderborg	12,115
Kolding	23,520	Hjørring	11,714
Fredericia	21,463	Rønne	10,898
Svendborg	19,161	Skive	10,799
Viborg	17,344	Holstebro	10,658
Helsingør	17,140	Vordingborg	10,512
Haderslev	16,108	Frederikshavn	10,500
Roskilde	16,104	Aabenraa	10,184

The Growth of Towns

The towns of Denmark showed a gradual growth until the middle of the nineteenth century. After 1850 a phase of much more rapid growth set in and continued until the turn of the century. This was the result of improvements in communications rather than of industrial expansion. Improved sea communications revolutionized the agricultural economy of the country. The volume of maritime traffic swelled as exports of agricultural produce increased and called

for still larger imports of feeding stuffs and fertilizers. Larger and more numerous ports were required. Regular and rapid transport of perishable farm produce called for improved land transport and the web of railways began to grow more complicated. The older towns naturally drew the main lines to them and so increased their importance and their opportunities for employment. They not only became centres for the collection and distribution of goods on a larger scale, but also attracted manufacturing concerns as the industrial life of the country quickened after about 1880. But, in addition, people gathered around rural stations and junctions and set up their co-operative dairies near these transit centres. The station-towns which developed earliest and grew most rapidly, such as Brønderslev, Herning, Haslev and Jyderup, lie almost midway between the older towns. The growth of these mushroom station-towns has been one of the most characteristic features of Danish settlement since the middle of the nineteenth century. For example, Grindsted appears for the first time in the census of 1906 as a village with 307 inhabitants. In 1911 its population was still only 460, but in 1914 it was connected by railway with Vejle; by 1916 its population had grown to 1,060. In 1917 and 1919 it acquired further railway connexions and became a junction for lines in six different directions; in 1921 its population numbered 1,724. Since that date its population has continued to grow and was 2,418 in 1935. In the same way Brande, which had a population of 658 in 1911, became connected by railway to Herning and Vejle in 1914, and by 1916 the population had grown to 1,202. In 1917 the railway between Silkeborg and Bramming was opened and Brande became the junction between these two lines. Its population had grown to 1,989 in 1921 and to 2,301 in 1925. Since then its population has remained almost stationary and was 2,316 in 1935.

The urban growth of Denmark is summarized in the following tables:

Towns with population of	1801 no.	1840 no.	1880 no.	1901 no.	1911 no.	1921 no.	1935 no.
Over 100,000	1	1	1	1	1	1	1
50,000-100,000	0	0	0	1	1	1	3
20,000-50,000	0	0	3	4	4	7	6
10,000-20,000	0	0	3	6	11	16	20
5,000-10,000	3	5	11	13	19	19	17
3,000-5,000	3	7	14	21	20	21	19
2,000-3,000	3	13	14	14	18	17	25
1,000-2,000	27	25	26	13	41	69	75

Source: Compiled from census reports.

	Islands	E. Jylland	N. Jylland	W. Jylland	Denmark
Number of towns: 1801	54	19	14	8	95
1860	61	22	17	9	109
1930	252	176	131	81	627
Urban population 1801	161	34	14	9	218
in thousands: 1860	290	80	32	17	419
1930	1,325	407	219	133	2,084
Urban population 1801	30	13	12	9	21
in % of total 1860	32	19	12	10	24
population: 1930	68	54	41	39	59
Rural population 1801	383	227	99	90	799
in thousands: 1860	618	336	233	149	1,336
1930	602	352	308	204	1,466
Rural population 1801	29	23	10	9	19
per sq.km.: 1860	46	33	24	15	31
1930	45	35	32	21	34
Growth of 1801-1860	61	48	133	66	67
rural popu- 1860-1930	- 3	5	32	37	10
lation:					

Source: M. Vahl, 'The Urban Settlement of Denmark', *Geografisk Tidsskrift*, 36. Bind, p. 11 (Köbenhavn, 1933).

Note. The boundary between east and west Jylland was taken along the line of terminal moraines of the third glaciation (p. 8). The boundary between these areas and north Jylland was taken through Viborg to Mariager Fjord. The towns of south Jylland are not included.

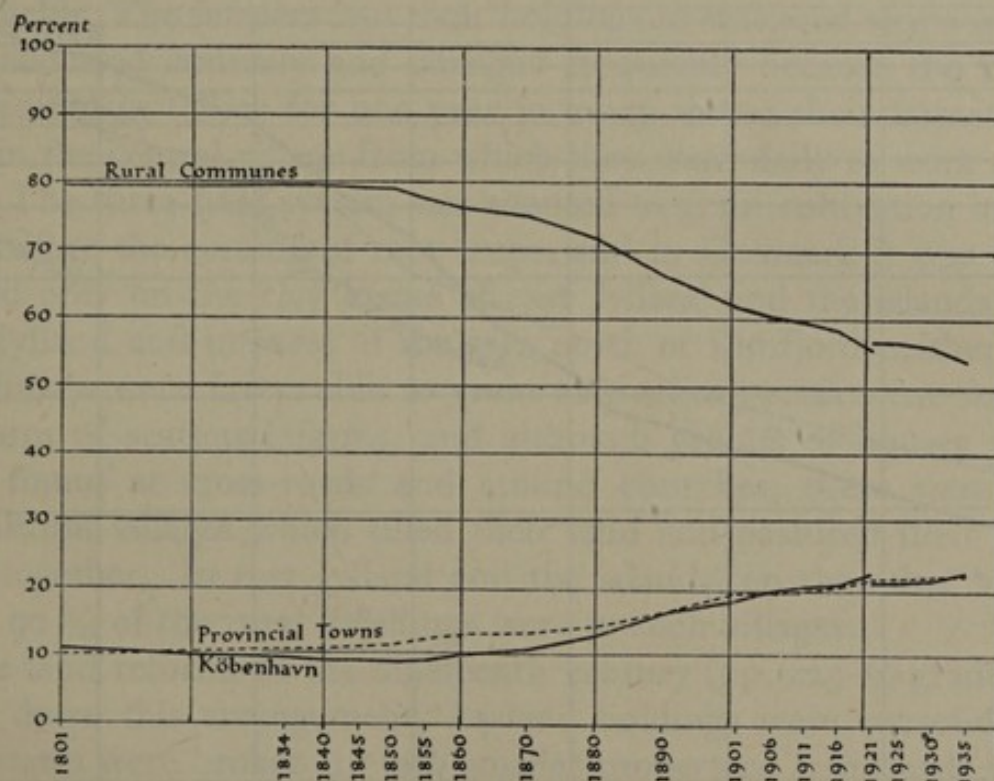


Fig. 49. Proportions of the total population, living in three categories of settlement, 1801-1935

Based on census returns.

The provincial towns are the municipalities (*Købstæder*) (see p. 150).

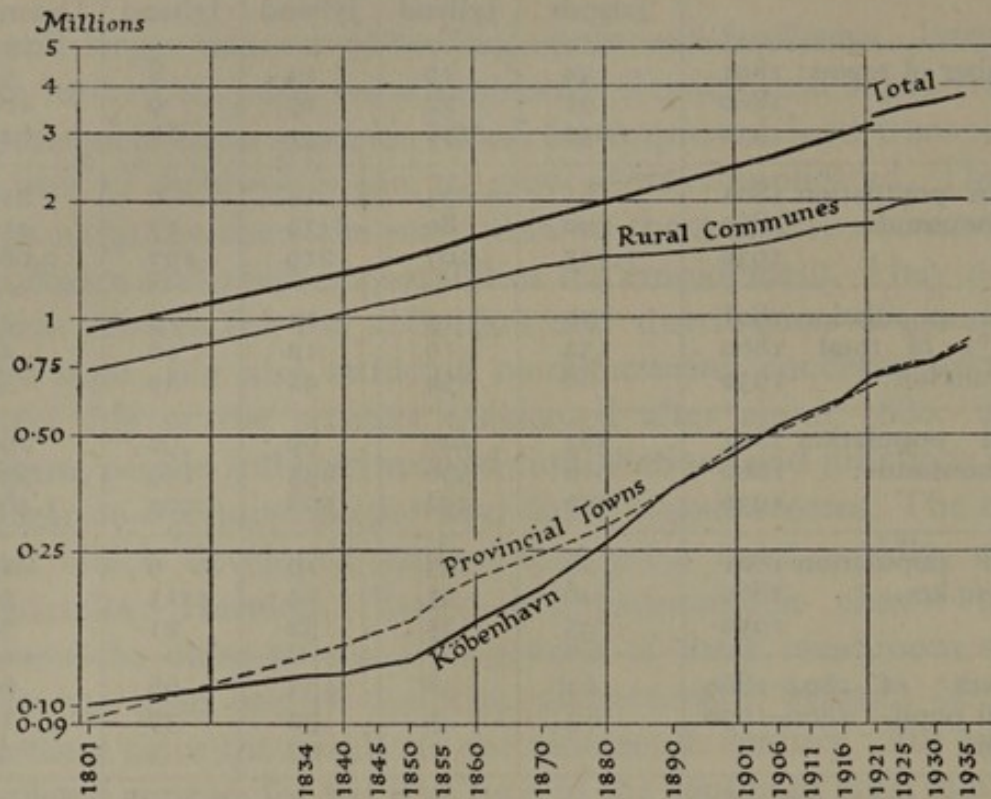


Fig. 50. Growth of population in three categories of settlement by actual numbers, 1801-1935 (logarithmic scale)

Based on census returns.

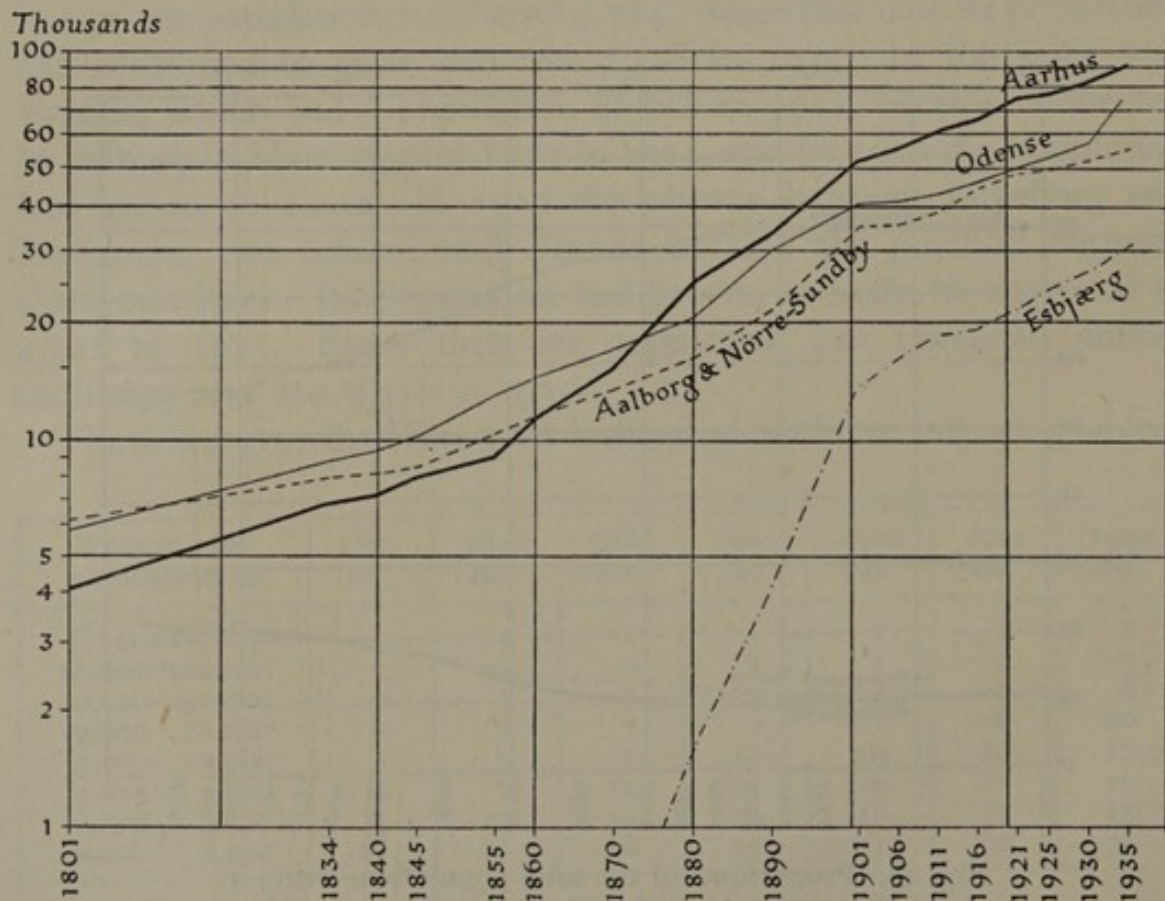


Fig. 51. Growth of population in the four largest Danish towns (logarithmic scale)

Based on census returns.

Vahl calculated the urban and rural populations to have been approximately as shown in the table on p. 215. He counted as towns, only those centres which were mainly engaged in trade and craft; these do not necessarily correspond with municipalities. The towns were considered as units, including suburbs, and not merely as the areas within particular administrative boundaries.

The process of urbanization is illustrated by Figs. 49, 50. It shows that between about 1820 and 1890 the provincial towns grew more rapidly than the capital, and that since the latter date the capital and the provincial towns grew at similar rates in relation to the total population of the country. They also make it clear that although the population living in rural districts has continued to increase in absolute numbers it has formed a persistently declining proportion of the total population since about 1850.

Figs. 50 and 51 illustrate the rapid but steady growth of Köbenhavn and of the three towns with populations of above 50,000 in 1935, and also the remarkable growth of Esbjerg.

RURAL SETTLEMENT

Before the nineteenth century the prevalent form of settlement in Denmark was the nucleated village which organized its land in large open fields. The farmers had their holdings in scattered strips which were allocated annually and changed frequently because the fields recuperated in fallow for one year in every three; their farmsteads were in the central village from which they went daily to work their plots. The three-field system was adapted to grain cultivation in the days before the coming of root crops, and in Denmark it was established only on the clay loams of east Jylland and the islands. In west Jylland and in most of the area north of Limfjord neither soil nor climate were favourable to grain cultivation; settlement was in the form of scattered farms, and although groups of houses were often found at cross-roads and around churches, these were not agricultural villages which tilled their land and pastured their livestock together. In east Jylland and the islands, on the other hand, about 90 % of the rural dwellings were in such villages.

The land reforms of the nineteenth century (pp. 225-6) gradually broke down this arrangement. As land holdings were consolidated and estates were broken up into smaller properties, farmsteads were moved out from the village and set up amidst the fields, since the central village no longer offered advantages. This process went on

slowly because capital expenditures in farm buildings often kept the farmstead in the village until such time as the buildings decayed. The establishment of small holdings hastened the dispersal of settlements; there are now nearly three times as many farms as there were in 1682. The process of dispersion is still going on, but Denmark

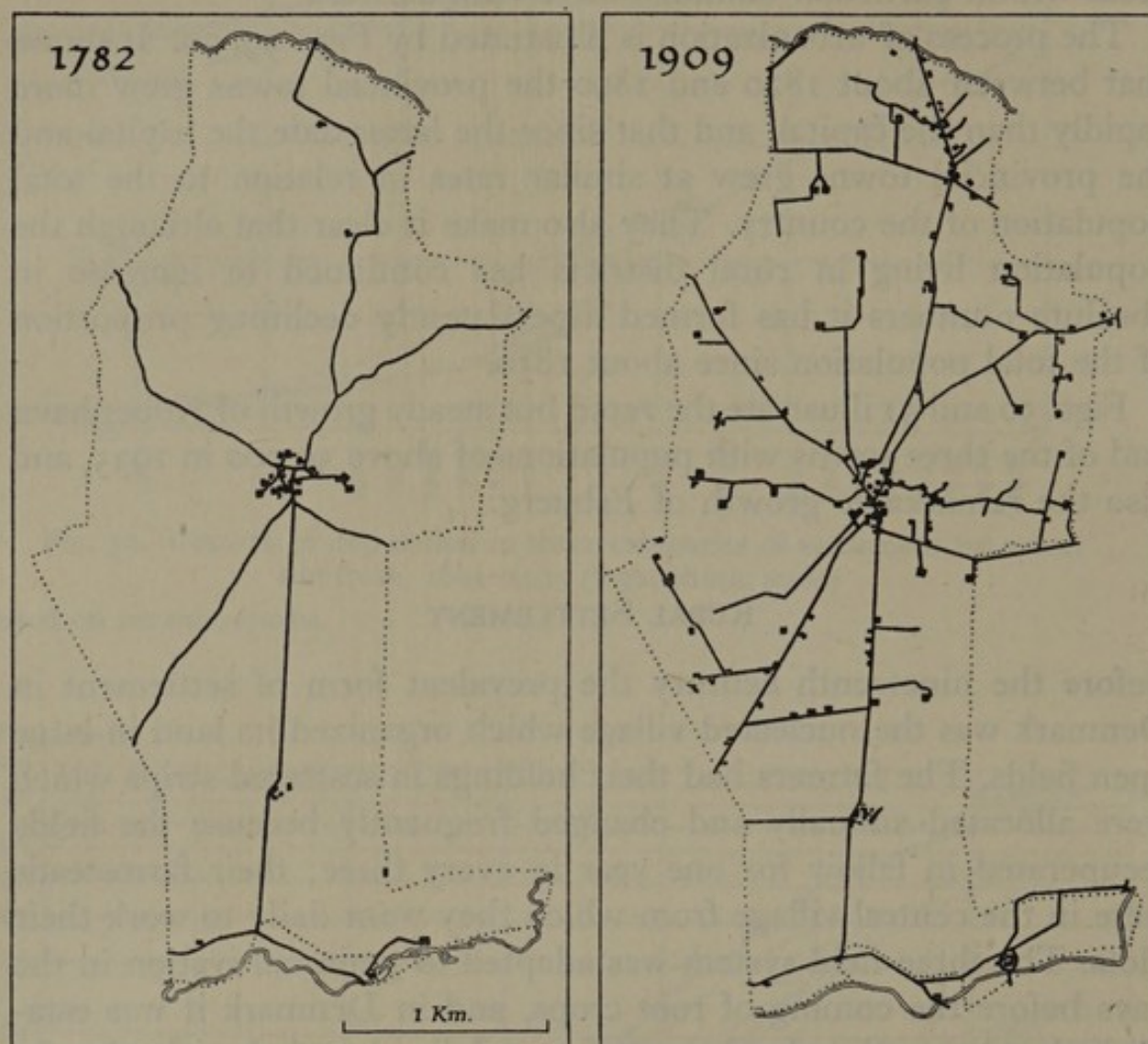


Fig. 52. The village of Solbjærg, near Slagelse, in 1782 and 1909

Based on maps by M. Vahl in *Comptes Rendus du Congrès internationale de Géographie*, Paris, 1931, tome III, pp. 174-5 (Paris, 1934).

The maps illustrate the dispersal of settlements which occurred after the agricultural reforms of the late eighteenth and early nineteenth centuries. Farms and roads are shown within the parish boundary.

has already become a land of scattered farms. Nevertheless, the old village nuclei still remain, but the farming population has to some extent been replaced by artisans, labourers and tradesmen.

Two basic forms of villages can be distinguished. One is the round or oval village in which the buildings are grouped around a central space in much the same way as dwellings are arranged around village

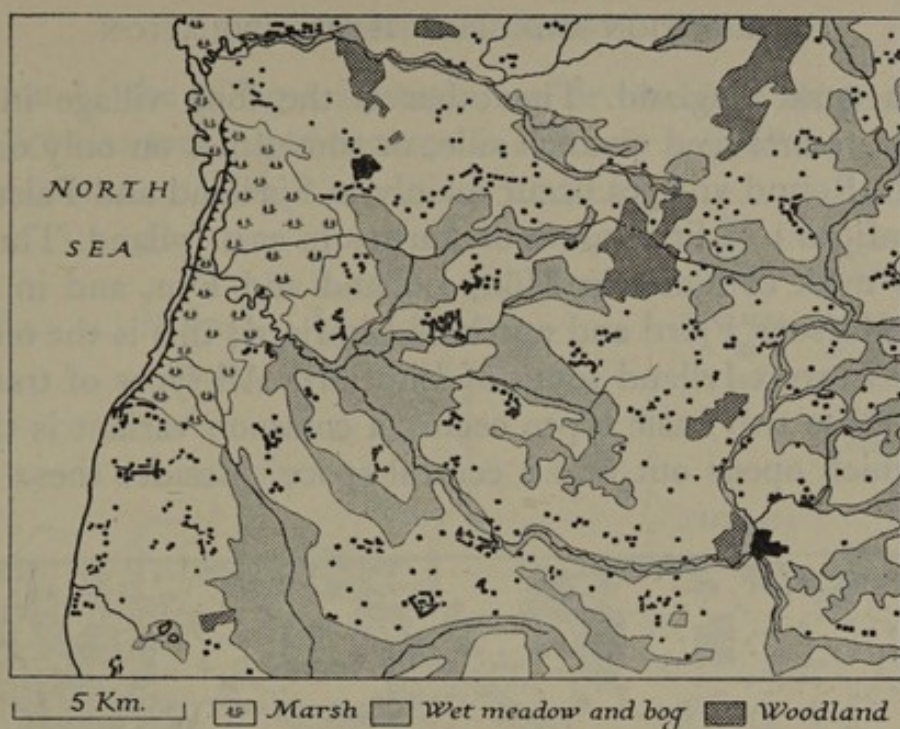


Fig. 53. Settlement in south-west Jylland (Jutland)

Based on the *Geodætisk Institut's* 1 : 100,000 map, sheet 51 (1935).

The wide distribution of marsh, water-meadow and bogland has restricted settlement to the drier areas, which are often small so that the village nuclei have, on the whole, been little dispersed. The two towns marked are Løgumkloster and Skærbæk.



Fig. 54. Settlement on the heathland in central Jylland (Jutland), south of Herning

Based on the *Geodætisk Institut's* 1 : 100,000 map, sheet 27 (1927).

The scattered distribution of settlements is characteristic of the reclaimed heathlands. The unimproved heaths are without settlements. The small hamlets have grown around churches and railway stations; true villages have never been a feature of the heathlands.

greens in rural England. The other is the long village in which buildings are arranged on each side, or sometimes on only one side, of a road. Round villages occur mainly in Sjælland and Falster, and from Limfjord to a little south of Aarhus in east Jylland. The 'long' village is most common in Møn, Lolland and Fyn, and in Jylland south of Horsens Fjord and north of Limfjord; this is the only type of village in west Jylland south of Limfjord. All types of transitions between these two basic types occur; a common variant is the long village which opens out into a central space. Besides these villages



Fig. 55. Settlement near Randers

Based on the *Geodætisk Institut's* 1 : 100,000 map, sheet 19 (1928).

The map shows the old village nuclei from which farms have been moved out so that the region is now one of dispersed settlement (see Fig. 52).

there were isolated farms and small groups of farms in all parts of the country.

The coming of railways gave many old villages a new lease of life, and often resulted in the establishment of new villages where the railway station was placed at some distance from the old village. Thus there is sometimes an old, decaying, agricultural village and a new village, occupied mainly by artisans and tradesmen, which has grown around a nearby railway station. Generally, however, the Danish villages are old, and relatively few have been established since the thirteenth century. Apart from those around railway stations the

population of the villages is stationary or else it is declining. The villages are also tending to become less closely knit, since new houses

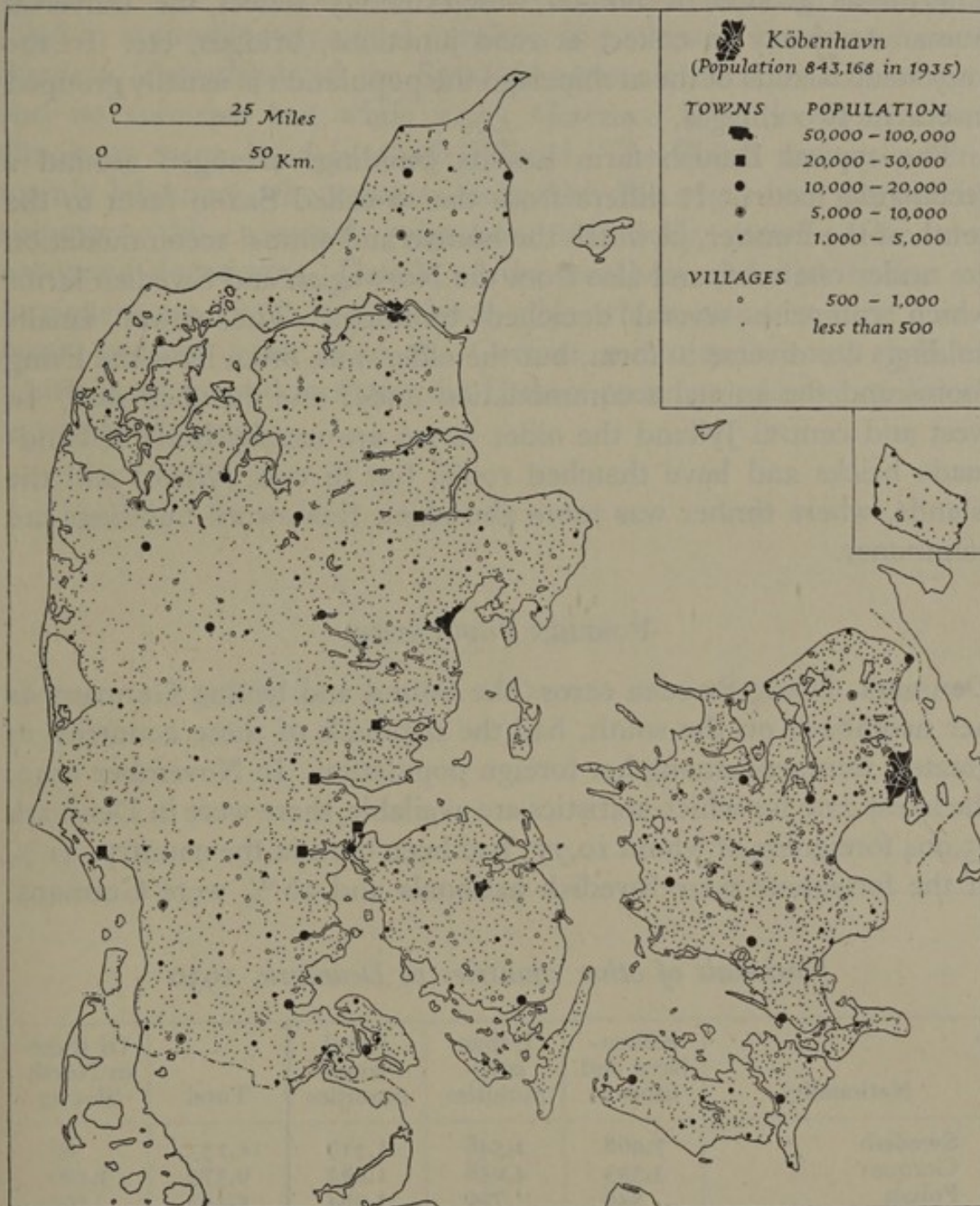


Fig. 56. The distribution of towns and villages

Based on the *Geodætisk Institut's* 1 : 520,000 map (1937) and census returns for 1935 in *Statistiske Meddelelser*, 4. Række, 101. Bind, 1. Hæfte (København, 1936).

are often built along the road which has bus connexion with the nearest town.

Fig. 56 shows how the pattern of village settlement is closer in east Jylland and the islands than in central and west Jylland. This

contrast is more marked than the map suggests, because in west Jylland the villages are usually small and are often no more than amorphous groups of houses which merely reflect the universal human tendency to collect at road junctions, bridges, etc. In the very small islands of the archipelago the population is usually grouped in one or two villages.

The typical Danish farm has its buildings arranged around a rectangular court. It differs from the so-called Saxon farm to the south of the frontier, in which the human and animal accommodation are under one roof, and also from the Norwegian and Swedish farms which comprise several detached buildings. The newer small-holdings are diverse in form, but the older ones often have the living rooms and the animal accommodation under one thatched roof. In west and central Jylland the older farms are usually built of hand-made bricks and have thatched roofs, but in east Jylland and the islands, where timber was more abundant, framework buildings are commoner.

FOREIGN POPULATION

Denmark, facing Sweden across the Sound and having Germany as her neighbour on the south, had the nationals of these countries in greatest numbers among her foreign population. In November 1930, the latest date for which statistics are available, there were in Denmark 35,904 foreigners of whom 10,777 had been born in the country. 31 % of the foreigners were Swedish nationals and 26 % were Germans.

Nationals of other countries in Denmark, 1930

Nationality	Köbenhavn and suburbs	Urban communities	Rural communities	Total	Of these in North Slesvig
Swedish	7,268	2,548	1,317	11,133	66
German	3,333	4,058	1,982	9,373	3,106
Polish	548	720	3,984	5,252	504
Norwegian	1,536	624	171	2,331	15
Russian	669	145	308	1,122	238
British	622	257	49	928	8
Other Europeans	1,943	731	362	3,036	143
American (U.S.A.)	639	449	192	1,280	27
Others	781	454	214	1,449	44
Total	17,339	9,986	8,579	35,904	4,151

Source: *Statistisk Aarbog*, 1939, p. 5 (Köbenhavn, 1939).

Note. The above figures do not include Danish citizens of foreign ancestry.

The only other foreigners present in any numbers were some 5,252 Poles and 2,331 Norwegians. British nationals numbered 928. Nearly a half of the foreigners lived in Köbenhavn and the remainder lived in approximately equal numbers in provincial towns and rural districts. Two-thirds of the Swedish nationals lived in Köbenhavn and its suburbs, but while 3,333 Germans lived in Köbenhavn almost as many lived in south Jylland. The Polish nationals were mainly labourers who came to help with the sugar-beet harvest in summer; this seasonal migration materially ceased after the economic depression. Details of the numbers and distribution of foreigners are given in the above table which requires little comment, because apart from the German minority in south Jylland which are discussed in Appendix II their presence raises no political or economic issues.

Chapter XI

AGRICULTURE

Historical Background: Changes in Land Tenure and Farm Management; Technical Improvements; The Change from Grain Farming to Livestock Farming; The Growth of Co-operative Associations; Increases in Livestock and in Crop Yields

Modern Danish Agriculture: General Features; Soils; Distribution of Crops; Livestock; Rotation of Crops; Volume of Production; Farm Management and Labour; Use of Machinery; Co-operative Associations; The Vulnerability of Danish Agriculture

Agriculture is, and has been from very early times, the chief occupation of the people of Denmark. Apart from her merchant navy and her minor industries, the economy of the country rests entirely on the produce of the soil. About one-third of the population is engaged directly in agriculture, and the great majority of these are peasant farmers who till their own farms which are very rarely large. This proportion is similar to that for France and Sweden, is rather larger than that for Germany and Norway, and contrasts with Britain where only about 6% are directly employed in agriculture. In Denmark most of those engaged in commerce, distribution and marketing are concerned with serving the predominantly agricultural economy of the country, and even of the 23% of the population engaged in manufacturing many are concerned with agricultural industries which provide machinery, implements and other equipment for farming, and which process agricultural products. It is estimated that about 70% of the active population is employed in agriculture and in the industries, transport and commerce directly connected with it.

Human effort, not richness of natural endowment, is the dominant feature in Danish agriculture. The country has neither rich soil nor particularly favourable climate, but greater poverty of mineral, timber and power resources has precluded any large-scale industrial development and has forced Denmark to develop her agricultural resources to their fullest extent to keep her place in modern world economy. Thus while her neighbours developed factory industries during the nineteenth century and sometimes, as in the case of Britain, allowed agriculture to decline and rural depopulation to proceed at an alarming

rate, Denmark marshalled her agricultural resources and organized them as her chief industry. Thus she has become what might be called an industrialized agricultural state producing primarily for export and incidentally for sustenance, while she imports much of her agricultural raw materials in the form of chemical fertilizers for the soil and feeding stuffs for livestock. The economy of the country has been planned as carefully and with as much forethought as the mechanical-industrial economy of any country, and the demands of public taste in her markets, the high and uniform quality of her products, as well as the rise and fall in prices and consumption of her commodities, are watched and responded to equally carefully. The building up of agriculture as the chief industry of the country has meant that the population has been kept on the land and has, in contrast with Ireland for example, been largely prevented from migrating to industrial centres outside the country by raising the standard of living of the farming population. This has been effected, not by making it possible for the farmers to accumulate large bank balances, but by building up social assets in the form of good and comfortable farmsteads, reasonable security of markets and prices over long periods, easy access to capital and monetary credit through loans at low rates of interest, by good education for children and adults, by avoidance of most of the social evils and problems that industry so often brings, and by the creation of a sense of social solidarity and public welfare brought about by the practice of co-operation and by adult education which have made possible much of the economic prosperity which they possess. As much attention has been given to the social, as to the economic, returns of farming as a mode of life.

HISTORICAL BACKGROUND

CHANGES IN LAND TENURE AND FARM MANAGEMENT

To understand the nature and organization of Danish agriculture it is necessary to trace briefly its history from the end of the eighteenth century when the modern phase of Danish economy began. Until then, Danish agriculture remained essentially medieval in character. The land was largely unenclosed, holdings were unconsolidated and arranged in scattered strips and plots. The agricultural system was one of mixed farming which aimed at a more or less self-sufficient economy and was worked partly by peasants who owned their farms

and partly by landowners or squires who had tenants and villeins working their large estates.

During the eighteenth and early nineteenth centuries the Danish government, under an autocratic monarchy, not only abolished villenage, common fields and strip cultivation but also took measures to endow the emancipated peasants with holdings to which they should have a secure title. Legislation prohibited the merging of peasant holdings into larger farms and also forbade the subdivision of farms into holdings which could not support a family. Leases had to be for a minimum of 50 years or for life, so that tenure was secure and the fruits of improvements were assured. Rents could be increased only under stipulated conditions. Freehold ownership was encouraged by means of state loans which provided money at 2% interest per annum and permitted repayment of capital over a period of 25 years. This process was encouraged by a period of rising prices between 1760 and 1818, so that farm values appreciated while debts remained fixed and peasants were therefore eager to buy their farms. The landlords needed money and were ready to sell parts of their estates, and, since in Denmark there was no industrial development to earn large fortunes and create an aristocracy of wealth, who were eager to acquire parks and broad acres from those older landowners who had become impoverished, the benefit fell to the peasants who could, through state support, extract their small holdings from the shrinking larger properties. Half the common land had been enclosed by about 1800, and the process was virtually completed by about 1830, which was earlier than in any other European country. By 1850 less than half the farmers were tenants, and by 1885 the proportion had fallen to one-ninth.

Enclosure of fields was thus carried out primarily in the interests of, and for, smaller farmers. The tenant was given protection against dispossession by landlords, and Denmark avoided the rise of a class of landless proletarians. Cottagers who had held rights of common pasture were compensated for the loss of these rights by receiving grants of 4-6 acres of land, and they became a class of agricultural labourers who still had a stake in the soil. During this period of change the peasantry were virtually prevented by law from leaving their villages and so were kept on the land until economic conditions became more settled. In this way, Denmark became a land of mainly small peasant proprietors on the very eve of the period of agricultural reforms which spread through north-western Europe during the nineteenth century.

TECHNICAL IMPROVEMENTS

These reforms in land-holding, farm management and labour were but one phase in the reorganization of agricultural life. They prepared the way for the coming of the new agriculture in which increased knowledge of the natural sciences was applied to agriculture and brought improvements in crops and their rotation, in yields, in livestock and in the technique of tillage and grassland management. These improvements took place earlier in Denmark than in most continental countries and occurred not much later than in England. The process of enclosure had broken down the old economic arrangement of village communities farming scattered plots and dwelling in nucleated settlements. Now that holdings were consolidated, the homesteads were set up amidst the fields. The emancipation of the peasantry and their desire for farms led to the reclamation of much uncultivated land chiefly on the heathlands of west Jylland where over 5,700 sq. km. was barren ground. Royal Decrees of 1723 and 1751 had sought to encourage reclamation of heathland by offering freedom from military service and from taxes to such as would undertake the work, but this attempt, as well as the importation of German colonists in 1760, brought little success. In 1788 the state began laying out plantations for shelter from the westerly winds and gales, but settlement on the heath remained on a small scale until after the middle of the nineteenth century when knowledge of biochemistry had advanced and improvements in transport made available cheap fertilizers which were necessary for extending the frontiers of settlement in these areas. Colonel Dalgas founded the Danish Heath Society in 1866, and under its leadership heathland was widely planted with trees and hedged for shelter, drainage schemes were undertaken, while roads and light railways were built to carry marl on which the improvement of the soil largely depended. Much marling was done between 1850 and 1880, while the area of drained land increased from 2,005 to 5,085 sq.km. between 1871 and 1881.

Improvements in the implements of tillage kept pace with improvements in the quality and management of land. The larger farms and manors led the way with improvements which spread to the smaller holdings only gradually. Improved ploughs were exhibited and introduced during the latter part of the eighteenth century, and by the middle of the nineteenth century the swing plough was in general use. Threshing machines came into use on the larger farms and estates during the first half of the nineteenth century, and soon after-

wards they became widely adopted. Broadcast seeding machines became common on the larger farms after the middle of the century, but seed drills did not become common, even on the larger farms, until the end of the nineteenth century. Reapers were widely used by larger farms after about 1870. Livestock farming was similarly improved. In 1843 the first Shorthorn bull was introduced into Slesvig, and this breed gradually spread northwards through western Jylland, while in the islands farmers undertook seriously the task of improving the local breeds of cattle.

THE CHANGE FROM GRAIN FARMING TO LIVESTOCK FARMING

In spite of a considerable export of live cattle Denmark concentrated during this period on grain production for sale and export. Economic conditions in western Europe were then favourable for cereal farming. The economic crisis following the Napoleonic wars advanced the price of wheat. Industry was expanding and population was increasing in Britain and Germany particularly, while at the same time the proportion of the population engaged in the direct production of food was decreasing. Expanding markets were further enlarged when Britain repealed the Corn Laws in 1846. The common rotation in Denmark was the so-called Holstein Kobbel system whereby a number of grain crops were grown in succession on the same land and were followed by clover and grass for a number of years, and then a period of bare fallow during which the land might recuperate after this exhausting cropping. Denmark's export of grain reached its peak of some 300,000 tons* a year in the middle sixties.

This phase of economy proved to be short-lived. The industrial expansion which had brought prosperity to the cereal farmer in Denmark served in the long run to bring about the downfall of the system of grain production for export and sale. The Industrial Revolution made possible, in due course, the application of steam power to the propulsion of both land and sea transport, while the mechanization of tillage made possible extensive farming for cereals on lands which could be rented cheaply owing to sparsity of population in the newly settled lands, especially of America. These facts meant, not only that railway construction linked these lands with ocean ports for export of their produce, but also that the coming of iron ships, which could be built much larger than wooden vessels and

* For measurements of weight metric tons are employed and are referred to as 'tons'.

which steamed independently of winds, made profitable the export of bulky agricultural produce which could be sold cheaply to the industrial populations of western Europe. Furthermore, the growth of financial organizations made possible the use of European capital for the development of the newly settled lands overseas. These developments affected not only grain crops but also beef cattle which could be reared cheaply on the wide ranges of North America, Argentina and Australia and transported to Europe, especially after 1880, when refrigerator ships became an accepted success although frozen meat was exported from Argentina as early as 1877. Thus mechanized grain farming and large-scale stock-rearing became established in these new lands, where land was cheap and labour was dear, while western Europe, where land was dear and labour cheaper, turned to increased dairy farming which involved more human labour.

The importation of cheap American wheat into European countries developed on a large scale during the seventies of the last century. The result was that the price of grain fell markedly, while the price of dairy products, which had not expanded in proportion to the increased demand for it, appreciated relatively to grain. In Denmark the average Köbenhavn price of wheat fell from 20.14 kroner per 100 kg. and of barley from 14.78 kroner per 100 kg. in 1871-80 to 11.94 kroner and 10.25 kroner per 100 kg. respectively in 1896-1900. During the same period the price of rye fell from 14.60 to 9.72 and that of oats from 14.05 to 10.59 kroner per 100 kg. This represented a fall in prices of approximately 40% in the case of wheat, 30% in the case of barley, 33% for rye and 25% for oats, while during the same period ordinary farm butter improved in quality and its price increased by about 10% from 1.70 kroner to 1.88 kroner per kg. Moreover, the continuous grain growing of the Holstein Kobbelt rotation was proving exhausting to the soil and yields were falling off. Livestock farming had already been growing during the sixties and seventies, and in 1874 the value of exports of livestock and dairy products was twice that of grain exports. This marked fall in the price of grain precipitated an agricultural crisis which was met in all European countries, except Denmark, Britain and Holland, by the erection of tariff barriers against imported grain or by prohibition of imports. In Denmark the immediate crisis was no less acute, but with foresight and characteristic adaptability Denmark immediately took steps to reorientate her national economy, and this reorientation was already under way before the slump in grain prices occurred.

The erection of tariff walls to keep out foreign wheat would have been of little avail, since the agricultural prosperity of the country depended on the sale of her grain abroad and not at home where the nation was composed mainly of largely self-sufficing farmers. It was more profitable to turn grain into dairy produce by feeding it to livestock, and Danish farmers saw in cheap American grain an opportunity for expanding their livestock industry, laying emphasis on dairy produce and bacon, which could find a ready and growing market in the industrial centres of Germany and especially of Britain with which regular steamship connexion had been started in 1865. To this end Danish economy was reorganized during the eighties of last century. This declared policy of economic change was, in Denmark, truly an agricultural revolution, as distinct from the period of agricultural reform which had preceded it. It was at this time that the modern agricultural economy of Denmark started on its progress.

The change from grain farming to livestock farming did not, in Denmark, lead to reduction in arable farming and to laying down of land to permanent pasture and hay. There has been little change in the total area under cereals, and the amount of land under permanent pasture has been kept at a minimum. The changes took place in the allocation of land to different crops as the following table shows:

	Wheat	Rye	Barley	Oats	Mixed corn	Pulse	Buck-wheat	Total cereals
1888	49	281	298	426	93	17	23	1,187
1938	134	147	404	381	307	—	—	1,373
Of this in south Jylland in 1938	12	14	32	43	21	—	—	—

Figures are in thousands of hectares.

Source: E. Jensen, *Danish Agriculture*, p. 389a (Copenhagen, 1937) and *Statistisk Aarbog*, 1939, p. 46 (Köbenhavn, 1939).

The relatively low rainfall of Denmark makes arable crops successful, and it was more profitable to feed animals on these crops than to sell cereals and raise livestock on natural pastures. The recent introduction of root crops and clover had been a fortunate and necessary development. It made possible a fuller rotation; it rendered productive, land which had previously been allowed to recuperate in fallow; and it provided a supply of substantial winter feed, which was important for maintaining a uniform output of milk and butter throughout the year, as was necessary to a country whose economy depended on supplying other countries with food. The marked

extension of the acreage under root crops has been the outstanding feature of arable cultivation. They have grown to equal the grain crop in food value although they occupy less than 40% of the area under cereals.

Percentage Distribution of Land Area under Crops

	1881	1912	1933	1938
Corn crops	45.3	44.5	49.9	42.2
Roots and potatoes	2.6	13.8	19.8	16.3
Grass and green crops	38.7	32.7	27.4	39.2

Source: *ibid.*

Grain crops were now grown for fodder and to provide straw for bedding, which became converted into manure to increase further the yields of ploughed land. The cheap imported grain which had made this reorganization necessary was admitted freely to be used as feeding stuffs and was supplemented by imported oil cakes. The change took place quickly, for while Denmark exported 200,000–300,000 tons of grain annually about 1870, she was already importing about 90,000 tons of grain in 1885.

Denmark now set out to intensify production by increasing both the numbers of livestock and the yields of animal and land produce alike. Reclamation of waste land and improvement of the soil by drainage, marling and manuring were again pushed forward vigorously. Movable rail tracks were laid down to carry marl from the pits to the districts where soil improvement was being carried out, and the state granted financial support to these undertakings. It was estimated that about a half of the arable land was marled by the end of the century. Dykes were built to reclaim land from the sea, especially in south-west Jylland, while drainage by clay pipes was widely carried out. Towards the end of the century the use of chemical fertilizers to supplement farmyard manure had become general. Seed drills and mechanical harvesters were introduced and their use spread slowly from larger to smaller farms. A Society for the Improvement of Cultivated Plants was founded in 1876 and carried out experimental work until 1893 when this work was taken over by the state, while in 1871 an institution for seed control was established and was later adopted by the state. The work of these organizations and of the Royal Agricultural Society of Denmark has done a great deal through research, breeding of improved strains and distribution of high-quality seed, to improve the yield of crops. Parallel progress was

made in the improvement of livestock breeding through the keeping of herd books and through the establishment of bull clubs which increased rapidly between 1884 and 1909, and were aided by state grants which, until 1912, averaged about 150 kroner annually for each bull.

THE GROWTH OF CO-OPERATIVE ASSOCIATIONS

Attention was not confined to the improvement of the land and livestock. Equal regard was given to the quality and marketing of dairy produce. In 1878 a Danish engineer invented the first non-intermittent centrifugal cream separator. This meant that cream could be drawn from milk rapidly and consistently without waiting for it to rise to the surface for skimming, so that whole milk could be dealt with immediately after transport. In short, it meant that dairy work could be done on a large scale in factories and with all the speed and uniformity of mechanical-industrial processes. This was a specially important development, because the Danish farms were generally too small to be efficient independent producers of dairy products.

The rise of the dairying industry in Denmark was closely associated with the development of the co-operative system which was carried through by the farmers themselves without guidance or support from outside. A small co-operative dairy was established at Hjedding in south-west Jylland in 1882, nearly 40 years later than the Rochdale cotton-workers' pioneer co-operative venture in England. It was the beginning of the co-operative movement which was to become the pivot of Danish agricultural economy. Co-operation progressed rapidly, especially in the dairy industry. Between 1885 and 1890 a total of 511 co-operative dairies were built, and of the co-operative dairies now in existence 70% were erected before 1900. The skimmed milk returned by the dairies to the farmers was used for feeding pigs, and the relation between the growth of the dairy industry and that of the pig industry is eloquently illustrated by the fact that the next branch of agriculture to apply the co-operative principle was the slaughter-house business which established a bacon factory at Horsens in 1887. In the same year Germany prohibited the import of live pigs from Denmark and the Danish farmers turned their attention to producing bacon for the British market. The principle of co-operation was soon applied to other farming activities. Before the end of the century co-operative associations for butter export, for cattle export, for egg collection and export, and for the purchase of feeding stuffs,

were formed, while in 1901 a co-operative association for the purchase and import of artificial manures was established. Co-operation has brought many advantages to the Danish farmer, whose holding is usually small and whose capital and credit are limited. It has provided an organization which supervised the quality and uniformity of produce, and organized distribution and marketing to the best advantage. It obtained the highest prices procurable and made possible wholesale purchase of raw materials. Since the control of the affairs of the co-operative society rests in the hands of its members, each of whom has one vote irrespective of the volume and value of their output, the small farmers, who form the majority in Denmark, have an equal interest and responsibility in, and derive the same benefits from, collective bargaining and large-scale organization as do the owners of large holdings.

Co-operation has flourished in Denmark largely as a result of the particular social qualities of its people. Large private interests are few, and the bulk of the nation is composed of farmers and small-holders who found their economic status and social responsibility at the same time and who had, of necessity, to pull together. The co-operative organizations were, and are, financed not by selling of stocks but by borrowing capital, and the members are, as a rule, jointly liable for the obligations of the co-operative venture; few ventures have failed. It so happened in Denmark that the period of agricultural reorganization and economic change was also a time of social awakening which expressed itself especially in the Folk High Schools (see pp. 164-8) and which spread rapidly after the loss of Slesvig in 1864. It is generally admitted that the success of co-operation has been due in no small measure to the influence of the Folk High Schools.

INCREASES IN LIVESTOCK AND IN CROP YIELDS

Against this background of democracy, co-operation and popular adult education the economic prosperity of Denmark has grown rapidly. Although the framework of agricultural economy, and especially of co-operative effort, was largely set up before the end of the nineteenth century, there has been continuous improvement in technique, equipment, quality and yield of output, and organization of agricultural economy. The numbers of milch cows increased from 808,000 to 1,627,000 between 1871 and 1938, and of young cattle, bulls and oxen from 431,000 to 1,612,000, and of pigs from 442,000

to 2,885,000, while the number of sheep fell from 1,842,000 to 187,000 between the same dates. The quality and yield of the animals improved as the numbers increased. The total production of milk increased from 1,100 million kg. in 1870 to 5,400 million kg. in 1934, and during the same period the average annual yield of milk per cow advanced from 1,350 to 3,200 kg. Crop yields showed similar improvements. During the quinquennial period 1880-4 the annual yield of the harvests was nearly 43 million crop units,* by 1900-4 this had increased to an annual average of 59 million crop units, and it had advanced further to 72 million crop units by 1920-4 and to 110 million crop units annually during 1935-8. The increase in yield during the 35 years up to 1938 was thus greater than the total annual yield during the years 1880-4. The average yield of individual crops has increased as shown in the accompanying table.

Average Yields in hundreds of kg. per hectare

	1875-9	1894-8	1934-8
Wheat	21	27	30.4
Barley	16	18	29.8
Oats	13	16	26.8
Mixed grain	15	17	23.9
Rye	16	17	17.8
Potatoes	58	107	171
Mangolds	344	453	588
Swedes	—	421	580

Source: *Denmark: Agriculture*, p. 35 (Copenhagen, 1935) and *Statistisk Aarbog*, 1939, p. 48 (Köbenhavn, 1939).

The increased output found increased markets, especially among the industrial population of Britain. The export of butter increased from about 4,000-5,000 tons annually in the late sixties of the last century to over 12,000 tons in 1881, over 61,000 tons in 1900, about 102,000 tons in 1915 and reached a peak of about 172,000 tons in 1931. When the dairy industry expanded in the seventies, the Danish pig industry was concerned chiefly with the export of live pigs to Germany, and this export rose from about 2,000 in 1860 to 25,000 in 1870, over 250,000 in 1880 and nearly 375,000 in 1883. In 1887 Germany prohibited the import of live pigs and Denmark turned to

* The crop unit is the official measure of harvest yields. One crop unit equals: 100 kg. of barley, or of rye, or of wheat, or 120 kg. of oats, or 110 kg. of mixed grain, or 100 kg. of dry matter in sugar-beet or potatoes, or 110 kg. of dry matter in roots, or 250 kg. of hay or 500 kg. of straw.

the production of fresh pork for export, but when Germany extended her prohibition to pork Denmark turned, with the aid of co-operation, to the production of bacon for the British market. Between 1886 and 1890 the annual export of bacon and ham averaged 24,000 tons annually, it rose to 62,000 tons in 1900, to 147,000 tons in 1914, to 197,000 tons in 1924 and reached a peak of about 390,000 tons in 1932, nearly all of which was sold on the British market. The export of eggs was some 2 million score about 1880; it rose to about 17 million score annually at the turn of the century. Until 1920 the annual export was maintained at over 20 million score annually, but after that year it increased markedly and rose to 78 million score in 1938.

This expansion in agricultural output was effected partly through increased production of fodder at home which was made possible by large-scale importation of chemical fertilizers and partly through the importation of feeding stuffs from abroad. The import of unground cereals and pulses rose from 140,000 tons about 1880 to roughly 600,000 tons in 1900, and 1,400,000 tons in 1930. The import of oil-cake and oil-cake meal, to provide proteins in the feed, increased from 17,000 tons annually about 1880 to roughly 200,000 tons at the end of the century, and to 926,000 tons in 1938, while the production of oil-cake manufactured in Denmark from imported seeds and kernels rose from 57,000 tons in 1913 to 282,000 tons in 1933. The imports of nitrogen fertilizers, phosphoric acid fertilizers and potash fertilizers rose respectively from 6,000, 43,000 and 11,000 tons in 1900 to 219,000, 228,000 and 106,000 tons in 1938, while the increased use of oil-cakes for feeding has greatly increased the quality of the farmyard manure.

In this work of agricultural improvement the co-operative associations took a leading part, as did also the agricultural societies which organized themselves into associations in Jylland, Sjælland, Fyn, and Lolland-Falster between 1872 and 1897, and later joined to form a Federation of Danish Agricultural Societies. Small-holders' societies followed a similar course of development. These societies improved the quality of livestock and agricultural produce by organizing shows. In 1919 the initiative of the agricultural and co-operative societies led to the formation of an Agricultural Council which is the keystone of the structure of Danish agricultural organization and which acts in close collaboration with the government for the improvement of Danish agricultural economy and for the protection of agricultural interests in relation to other industries.

MODERN DANISH AGRICULTURE

GENERAL FEATURES

The historical aspects have been dwelt upon at some length because it is only against this background that the modern agricultural economy of Denmark can be understood. Denmark has become a land of modest peasant farms and small-holdings. Of the 203,500 agricultural holdings in Denmark less than 1 % of the holdings and about 10 % of the area are held in estates 120 ha. or more, as compared with 3 and 22 % respectively in England. Farms between 60 and 120 ha. in area form about 2 % of the holdings and about 10 % of the area, compared with 9 and 29 % in England. Nearly half the farms are between 10 and 60 ha. in area and occupy two-thirds of the total agricultural area of the country, while in England about two-fifths of the farms and of the farmed area are in holdings of this size. In Denmark about 100,000 are small-holdings of 0.55 to 10 ha. in extent. These small-holdings occupy only about one-fifth of the total area of agricultural land, but they accommodate approximately a half of the rural population. In England such small properties form nearly a half of the total number of holdings but account for little over 5 % of the total farmed area. Over 90 % of the farms are freehold, copyhold is virtually extinct, while tenancy is commonest on the large farms.

Since Denmark shows but relatively slight differences in elevation and in climate, and the soil is almost everywhere of glacial origin, since holdings are overwhelmingly in the nature of peasant farms and the orientation of effort is towards animal and dairy produce for export, it is perhaps inevitable that Danish agriculture should show a remarkable degree of uniformity over the whole country. Throughout the land much the same crops are grown, although proportions may differ, and the nature of farm management is broadly similar. The aim of farming is to produce as much fodder for livestock as possible, and by increasing yields through careful seed selection and liberal use of fertilizers, and by economizing labour through the use of a great deal of machinery on small farms, they have made fodder production at home profitable in spite of the cheapness of imported grain from 'new' lands overseas.

Of the total land area of Denmark, 77 % is agricultural land. Of this, 83 % is arable land in rotation as compared with 27 % in Britain (or 41 % if rough grazings are not included in the total of agricultural

land); the proportion of arable to grassland is higher than in any country in Europe. On the arable land the crop ratio is approximately 50% cereals, 20% root crops, and 30% rotation grasses. Of the acreage under cereals the proportions under different crops in 1938 were: oats 27.7%, barley 29.4%, mixed cereals 22.3%, rye 10.7%, and wheat 9.7%.

Summary of Agricultural Statistics, 1938

	Area in hundreds of hectares	Production in thousands of tons
Cereals:		
Barley	4,044	1,384
Oats	3,809	1,164
Mixed cereals	3,067	808
Wheat	1,340	470
Rye	1,470	288
Rootcrops:		
Swedes	1,910	11,624
Mangolds	1,504	9,205
Potatoes	806	1,456
Sugar beets: For sugar	393	1,410
For fodder	215	859
Fodder beet	303	1,545
Turnips	143	652
Carrots	44	133
Other crops:		
Seeds	347	
Garden crops	71	
Other crops	63	
Fallow	332	
Rotation grassland	7,336	
Permanent grassland	5,487	
Total area of farmland	3,268	
Livestock:	Numbers in hundreds	
Milch cows	16,270	
Heifers (1 year old and over)	6,195	
Calves (under 1 year old)	8,453	
Other cattle	1,468	
Pigs	28,846	
Horses	5,645	
Sheep	1,870	

Source: *Statistiske Meddelelser*, 4. Række, 108. Bind, Nr. 5 (Köbenhavn, 1939).

SOILS

The soils of Denmark, being of glacial origin, bear a close relationship to the relief of the country. Since glacial deposits cover the underlying rocks almost everywhere, and since the climate of Denmark is

fairly uniform over the country, it follows that differences in soil composition and texture arise from variations in the nature of the



Fig. 57. The distribution of soil types

Based on a map in E. Jensen, *Danish Agriculture*, p. 72 (Copenhagen, 1937); drawn from maps by C. F. A. Tuxen.

glacial deposits and from differences in drainage. The poorest soils are in western Jylland and lie west and south of the line marking the farthest sustained advance of the ice sheets during the last glacial

period.* On the surfaces of the hill islands are deposits of morainic sand which have been much eroded and leached and have a clay content of less than 20%, giving rather meagre sandy loams of low fertility but not so poor as the sandy soils of the outwash plains. The outwash plains that surround the hill islands are built of glacial sands which were washed out from the surface and margins of the ice sheets, and they form barren lime-deficient soil which carried little better than heath in its natural state. Where these glacial sands are well aerated and freely drained they weather deeply to form yellowish or brownish soils out of which the lime has been washed. Where, on the other hand, dense heather growth checks aeration, and where sun and wind make the soil too dry for earthworms to live and help to aerate the soil, peat beds are formed from which humic acids percolate to dissolve all soluble material (the sesquioxides and alkalis) in the underlying sand, and deposit them in a hard pan of cemented sand and iron compounds leaving the upper layers as barren grey quartz sand. The reclamation of parts of these heathlands by marling during the last hundred years has improved them greatly, but the soils are still light and hungry and there still remains much unimproved land which is barren and poorly drained and resembles the sandy heaths of Norfolk and Surrey. Dry summers often render grain crops precarious on these unretentive soils. East of the line marking the stationary margin of the ice sheets of the last glacial period, and in Jylland north of the line of Mariager Fjord and Limfjord, morainic sand is again widespread and forms soil of indifferent quality. Eastwards this belt passes into areas of loamy glacial clay which covers most of the islands and east Jylland south of Mariager Fjord. The clay, which was laid down as ground moraine under the ice sheets, is usually blue-grey in colour and has a clay content of between 15 and 35%, but it may occasionally rise to as much as 60%. The content of calcium carbonate varies greatly; it is usually between 10 and 30%, but may be higher, especially in the east, while in Jylland the lime content in the soil decreases inland from the east coast; the remainder is composed mainly of sand. Through weathering the iron compounds in the clays become oxidized to give them a reddish colour, but weathering does not proceed so deeply as in the glacial sands. These clay loams are the best soils in Denmark, and although they are the heaviest soils in the country they are very much lighter than the heavy clays of Britain and form, by comparison, lightish loams which are easily worked. The best soils occur in Lolland and

* See Chapter I, pp. 12-23 and Fig. 3.

Falster, while generally the lime content of the soil is higher, and the clay particles are finer, in the southward- and eastward-facing coastal areas of the islands and in eastern Jylland.

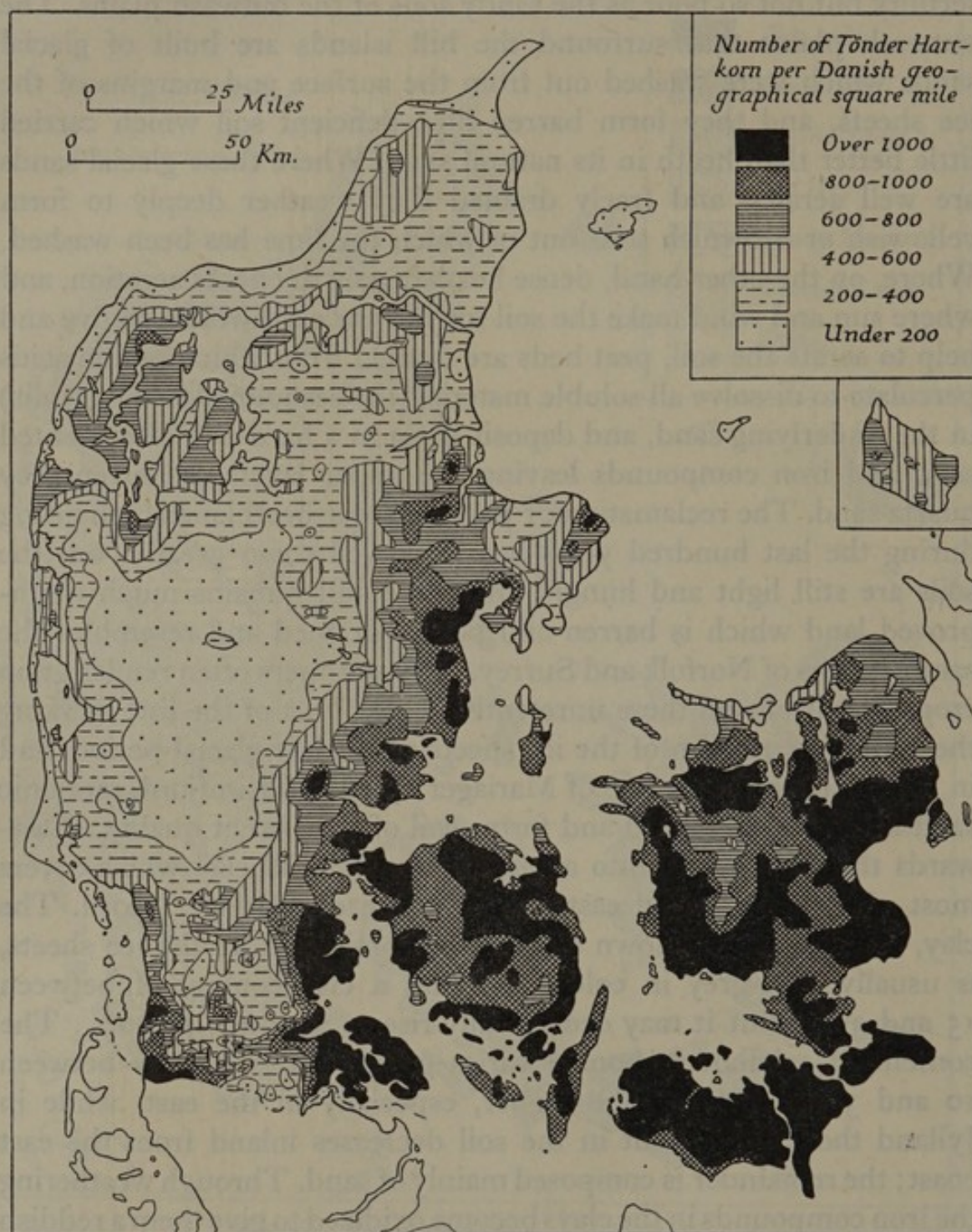


Fig. 58. The distribution of Hartkorn

Based on a map in E. Jensen, *Danish Agriculture*, p. 77 (Copenhagen, 1937).

The map shows, in effect, the distribution of land value. The *Tønne Hartkorn* was the old unit of valuation used to determine the land tax. It represented the area on which the tax was one 'ton' of 'hard corn' (rye or barley); one Tønne = 3.8 English bushels. The assessment was first carried out in 1664 and revised in 1688 and again in 1844. Note the close correlation between this map and that of soil types (Fig. 57). A Danish geographical square mile = 21.9 English sq. miles.

DISTRIBUTION OF CROPS

Grain Crops

The distribution of crops and livestock reflects the influences of variations in the quality of the soil. Climatic differences are slight in such a small country. The growing season increases from about 150 days in the north to about 200 days in the coastlands of the south. The growing season starts 14–30 days earlier in the islands than in north and north-west Jylland, but in west Jylland the frost-free period is about a month longer than in the islands. Otherwise the chief variations are a decrease in rainfall, and an increase in sunshine, from west to east.

Wheat. Although the acreage under wheat has doubled during the last 50 years, chiefly at the expense of rye, it is of small importance. It is grown on the best soils and almost exclusively as winter wheat sown usually during the latter half of September, because in Denmark the summer is relatively short and spring wheat cannot compete in yield with other spring crops such as barley and oats. It is grown chiefly in south-east Jylland and the islands where the heavier clay loams, lower rainfall and greater sunshine afford better and more assured crops; it occupied some 134,000 ha. in 1938. The Danes grow varieties of wheat which give high yields and are good for use as fodder. Danish wheat is soft and is unsuitable for bread-making; most of the crop is fed to animals. Only 10–20% of the crop is used for bread, and hard wheat for human consumption is normally imported from Canada and Argentina. The average yield of wheat in Denmark is 3,000 kg. per hectare but 5,000–5,500 kg. are often obtained under favourable conditions.

Barley. Oats and barley, grown separately as well as in mixed crops with some leguminous plants, are the chief cereals and occupy three-quarters of the area under cereals. Nearly all the barley grown is the two-rowed variety which is sown in spring, usually between the middle of March and the end of April. Two-rowed barley is grown chiefly on the clay loams of eastern Jylland and the islands, especially Lolland and Langeland. On the best land it may occupy about two-thirds of the total area under cereals, but in west and central Jylland the acreage is small and falls very low in the poorest areas. Six-rowed barley (or bere), on the other hand, is grown on the poorer soils, chiefly in western Jylland and in the part of the peninsula which lies north of Limfjord, but the total area is small (about 4,000 ha.), and

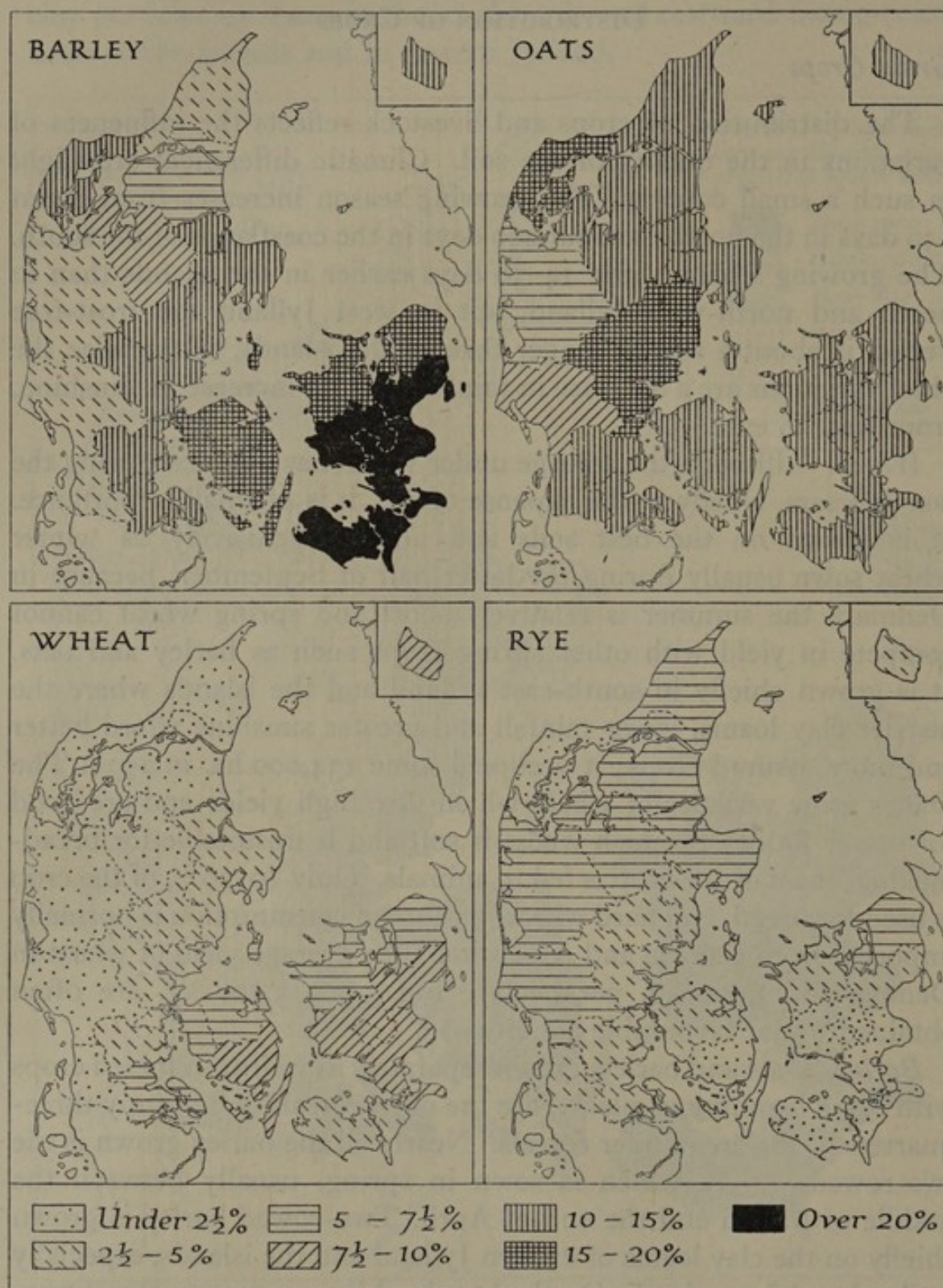


Fig. 59. The distribution of barley, oats, wheat and rye in 1938

Based on figures in *Statistiske Meddelelser*, 4. Række, 108. Bind, Nr. 5 (Köbenhavn, 1939).

The proportions of land under the several crops have been calculated as percentages of the total farmland in each county (*Amt.*).

is only 0.3 % of the total area under cereals. Barley is grown as a separate crop mainly on the larger farms; the smaller farms prefer to grow more mixed cereals and rye. The barley is used mainly as fodder, and although Denmark is self-sufficient in malting barley, and may export a little in some years, only a small proportion of the crop is used in this way. Barley follows root crops in the rotation and is used increasingly instead of oats as a cover crop for clover, since the newer varieties of barley are less shade-producing. The crop occupied some 400,000 ha. in 1938, and the average yields are 3,000 kg. per hectare, but crops of 5,000–5,500 kg. per hectare are produced under the best conditions.

Oats. Oats are specially important as a tolerant crop, of high feeding value, on medium and poor lands where it is more important than barley which is the chief crop on the better lands. Both grey oats and yellow (or white) oats are grown, the former chiefly on the meagre and acid soils of central and western Jylland, and to a less extent in northern Jylland, and the latter in eastern Jylland and, to a smaller extent, in the islands. Grey oats are of small importance and occupied only about 18,000 ha. in 1938 or 1.3 % of the total cereal acreage in the country as a whole, while white oats are as important as two-rowed barley, each occupying rather more than a quarter of the total acreage under cereals. Almost all the crop is used for fodder. In 1938 the oat crop occupied 381,000 ha. The yield averages 2,700 kg. per hectare but rises to 5,000–5,500 kg. per hectare under good conditions. In the rotation oats usually follow clover, but they may be grown after roots or barley. The crop is sown about the same time as barley.

Mixed 'Cereals'. This crop is grown as a mixture of oats, barley, peas and vetches. Its cultivation on a considerable scale is peculiar to Denmark, where it occupies nearly a quarter of the cereal acreage and is thus nearly as important as either oats or barley. The crop, which occupied 307,000 ha. in 1938, is widespread in its distribution and is most characteristic of the poorer cereal lands where it may occupy about a half of the acreage under cereals, while on the better cereal lands this proportion is usually less than 10 %. It has not been demonstrated that any advantage in yield is obtained by growing the crops together rather than separately. The practice has been explained as a survival from the last century when the improvement of land in Jylland, by liming and marling, made it possible to grow barley on land which had previously been fit for oats only, but the farmers were chary of risking barley as a sole crop and compromised by growing

mixed grain. The practice has become well established and has even increased in recent years.

Rye. Rye is the characteristic crop of the poor lands, especially the reclaimed heathlands, and is therefore most important in central and western Jylland and in the area north of Limfjord, where it may occupy as much as a quarter of the total acreage under cereals. The acreage under rye has decreased steadily since the improvement of agriculture, for while it occupied about a quarter of the total cereal acreage at the end of last century it now occupies only about a tenth of the area under cereals but is still larger than the area devoted to wheat. The crop is still general in its distribution but is almost negligible in Lolland and Falster. The crop is most important among small-holders. It is grown mainly as a winter crop, sown between the middle of August and the end of September, but on some of the poorest lands in western and central Jylland it is preferred as a spring crop to oats and barley; in such cases it is grown in addition to, and not instead of, winter rye. Danish-grown rye is used as fodder, for although Danes eat nearly as much rye bread as wheat bread, most of the rye for bread is imported. The average yield of the rye crop is 1,800 kg. per hectare but 4,000–4,500 kg. per hectare may be obtained on the better lands. The crop occupied 147,000 ha. in 1938.

Root Crops

The growing of root crops as an important feature came rather late to Denmark, and dates from the period of the change of emphasis from grain farming to livestock farming during the eighties of last century. Root cultivation developed in intimate connexion with the dairy industry, since good winter feeding became necessary for maintaining butter production in winter. The acreage under root crops was only 0.5 % of the agricultural area in 1876; it increased to 3 % in 1896, and in 1938 it occupied about 532,000 ha. or approximately 16 % of the total agricultural area.

Swedes, Mangolds, Turnips and Carrots. Since light soils predominate in Denmark, swedes are the most important of the root crops and occupy 36 % of the total acreage under roots. Mangolds come next in importance and occupy about 28 % of the root-crop acreage. Swedes are predominant in the north and west of the country because they are hardier and are better suited to the light soils. Mangolds, on the other hand, predominate in the heavier and better soils of the southern and eastern parts. Turnips and carrots are of small im-

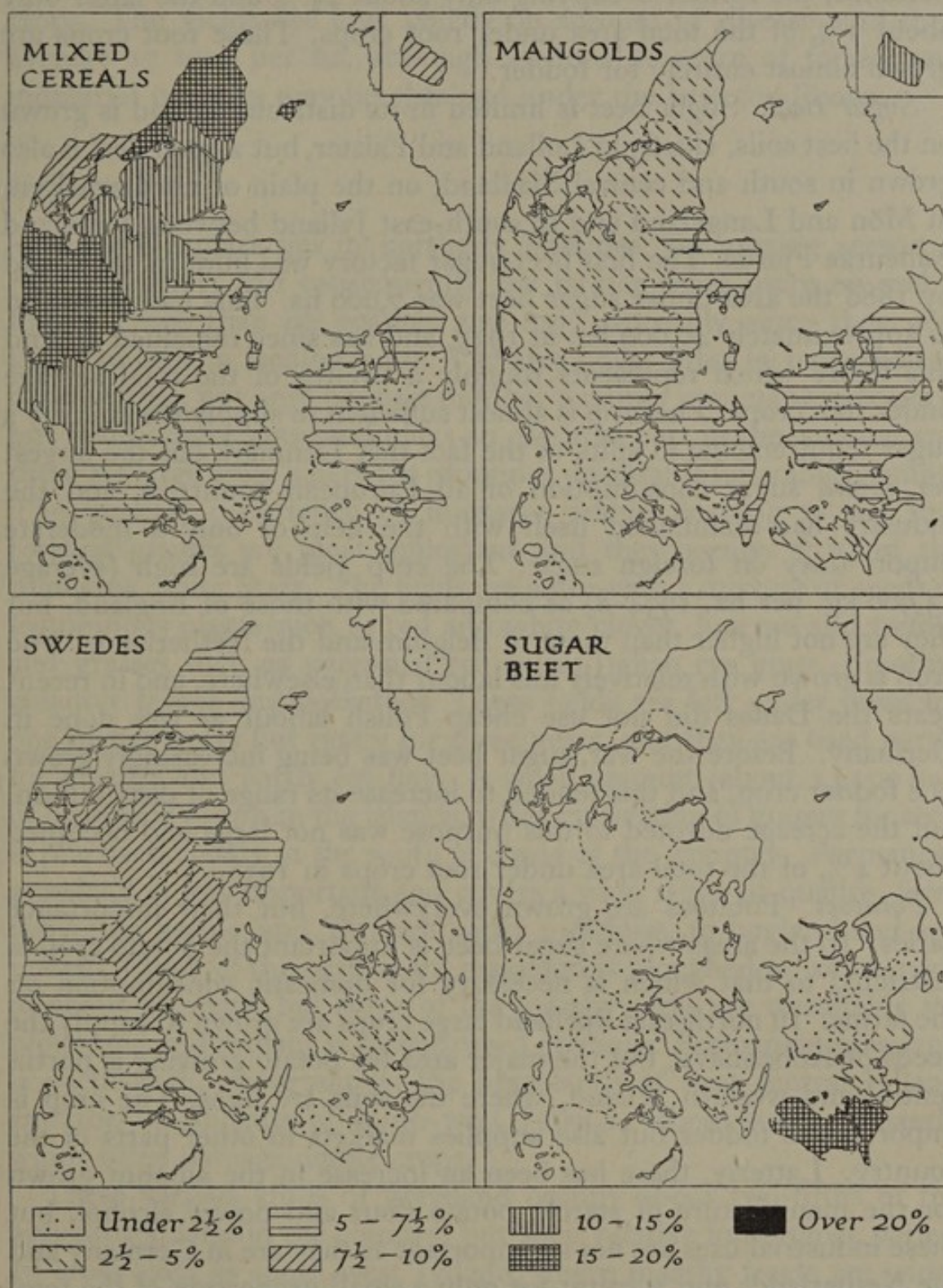


Fig. 60. The distribution of mixed cereals, mangolds, swedes and sugar beet in 1938

Based on figures in *Statistiske Meddelelser*, 4. Række, 108. Bind, Nr. 5 (København, 1939).

The proportions of land under the several crops have been calculated as percentages of the total farmland in each county (*Amt.*).

portance, the former occupying only about $2\frac{1}{2}\%$ and the latter only about 1% of the total area under root crops. These root crops are grown almost entirely for fodder.

Sugar Beet. Sugar beet is limited in its distribution and is grown on the best soils, chiefly in Lolland and Falster, but a good deal is also grown in south and central Sjælland, on the plain of northern Fyn, in Mön and Langeland and in south-east Jylland between Vejle and Aabenraa Fjords. The first beet-sugar factory was built in 1873, and by 1888 the area under sugar beet was 7,000 ha. This had increased to approximately 40,000 ha. in 1935, and has since remained around this figure which represents roughly a twelfth of the total acreage under root crops. The crop is almost sufficient to supply the country's sugar requirements in spite of the fact that Denmark has the largest *per capita* sugar consumption of all European countries, and the industry has maintained itself with the help of only a moderate import duty on foreign sugar. The crop yields are high (average 33,900 kg. per ha. 1934-8) as compared with those of England, but they are not higher than those of Belgium and the Netherlands. The crop is grown with relatively less labour than elsewhere, and in recent years the Danes did not use cheap Polish labour as was done in Germany. Before the war, sugar beet was being increasingly grown as a fodder crop, and this tended to increase its range of distribution, but the acreage devoted to this purpose was not large and occupied about 4% of the total area under root crops in 1938.

Potatoes. Potatoes are grown everywhere, but their importance varies. In the areas where sugar beet is important the potato crop is restricted to that which is necessary for domestic consumption on the farms. In north-east Sjælland large crops are grown to supply the needs of Köbenhavn, but the major area for potato growing is north, central and western Jylland, where the soils are light. The crop is important as fodder but also supplies markets in other parts of the country. Latterly, there has been an increase in the amount grown for the manufacture of starch, potato flour and power alcohol, but these industrial uses are not so important as they are in Germany and the Netherlands and account for only a small proportion of the total crop, more than half of which is used for fodder. The potato crop in Denmark has increased by about 50% since 1913. It reached its peak about 1920 when it occupied about 3% of all the agricultural land, but it has since declined and now occupies some $2\frac{1}{2}\%$ of the total agricultural area, in the country as a whole, although it may take up twice this proportion of the land in those areas where it is an

important crop. Potatoes take a similar place in the rotation to root crops. The yields are low, chiefly on account of disease, and they average 17 tons per ha. although 40 tons or more of fodder and industrial potatoes may be obtained under the best conditions.

Grassland

Since Denmark lies in northerly latitudes, the grazing season is relatively short and consequently the farmer relies more on arable fodder crops than on pasture and hay, especially since they give larger returns in feeding value. The area under grass is, nevertheless, considerable, not only because outdoor summer grazing is necessary, but also because grassland plays an essential part in the rotation and there are large areas where the ground is unsuitable for arable farming. The general occurrence of intensive arable farming means that rotation grasses are most important and they occupy 57% of the total area under grass. The fields are sown with a mixture of seeds of leguminous plants such as red and white clover, lucerne and trefoil, and grasses such as perennial rye grass, Italian rye grass, timothy, meadow fescue and cocksfoot. These fields are left under grass for one or two years but rarely for three years, and they are used partly for grazing and partly for hay. A small amount (about 14,000 ha.) of lucerne is grown in the islands, while cultivation of grasses for seed is practised chiefly in the south and east of the country. Permanent grassland is less important and covers a wide range of quality, from converted arable land, through water meadows, to bogland and salt marsh. Much of the permanent grassland is ploughed up at intervals of about 20 years, but some of the marshy areas are unsuitable for ploughing and remain as unimproved grazings. Permanent grassland is particularly important on the heathlands of west central Jylland and the marshlands of south-west Jylland, where strong westerly winds often damage arable crops.

These various kinds of grassland occupy about two-fifths of the agricultural land in the country, but their relative importance varies. In areas such as south-west Jylland, where marshy tracts are widespread, grassland occupies about two-thirds of the agricultural area, whereas, at the other extreme, on the rich arable soils of Lolland and Falster only about a quarter of the land is in grass.

Finally, market gardening is practised almost exclusively near the larger towns, especially around Köbenhavn, Odense and Aarhus.

LIVESTOCK

Cattle. Since the change to livestock farming at the end of the last century, there has been a steady increase in the numbers of cattle, a marked increase in the numbers of pigs and an equally marked decline in the numbers of sheep. The numbers of horses show only a slight increase. Since Danish farming is everywhere concerned primarily with dairying and bacon production, it follows that distributions of livestock show no marked regional contrasts, and the chief differences occur in the density of the animal population which varies with the fertility of the land and the yield of the harvests. In the country as a whole the density of the cattle population is one head to every hectare ($2\frac{1}{2}$ acres) as compared with one head to just under $4\frac{1}{2}$ acres in England and Wales. Dairy cattle numbered 1,627,000 in 1938. They are the farmer's chief interest, and since dairy cows which are killed off on account of age or low milk yield provide sufficient beef to meet Denmark's domestic needs, there is little rearing of beef cattle except in the districts around Limfjord and on the marshes of south-west Jylland, where much has been done to improve the breed of fat cattle by importing Shorthorns from England. Some 150,000 head of fat cattle are exported annually, chiefly to Germany and also to Belgium and Italy. The export of beef and veal was about 20,000 tons in 1937 and 15,000 tons in 1938.

Pigs. The Danish saying that 'the pig hangs on the cow's tail' expresses the close relationship between dairy farming and pig rearing. The by-products of the dairy industry, skimmed milk, butter-milk and whey, are used together with ground cereals, especially barley but also wheat and rye, as feeding stuffs for pigs. In July 1938 there were 2,884,600 pigs in the country. This represents a general density of one pig per 1.1 ha. of agricultural land or roughly four pigs to every five people. The density of the pig population correlates fairly closely with the quality of the soil except that it is low in Lolland and Falster. It is densest in Fyn and Sjælland and least dense in south-west Jylland, where cattle are reared mainly for beef, and on the meagre heathlands of west Jylland. The density of livestock per 100 ha. of farmland as compared with some other European countries is:

	Cattle	Pigs		Cattle	Pigs
Denmark	93	111	Eire	84	20
Netherlands	109	71	Sweden	61	27
Germany	71	83	Switzerland	71	40
France	45	20	Britain	43	21

Source: *Documentation for the European Conference on Rural Life*, 1939, p. 19 (International Institute of Agriculture, Rome, 1939).

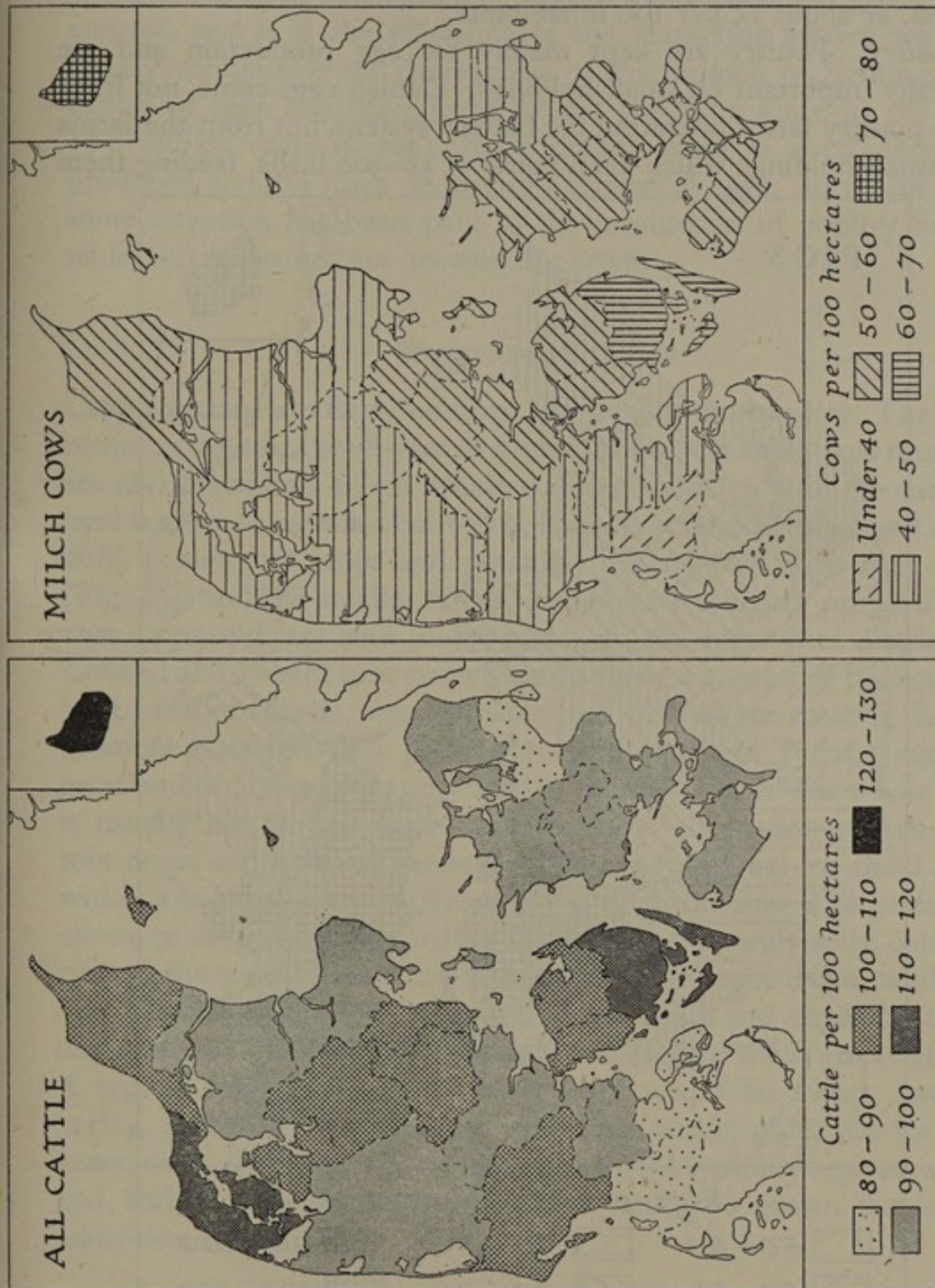


Fig. 61. The distribution of all cattle and milch cows in 1938
 Based on figures in *Statistiske Meddelelser*, 4. Række, 108. Bind, Nr. 5 (København, 1939).
 The figures of density are calculated per 100 ha. of farmland.

Horses are reared mainly for agricultural work and numbered about 564,500 in 1938. The horse population averages about 17 per 100 ha. or about 15 per 100 inhabitants.

Poultry. Poultry are kept mainly for egg production and are specially important on small-holdings. Danish eggs come, not from large poultry farms operating the battery system, but from the farms and small-holdings which keep flocks of 50-300 birds, feeding them

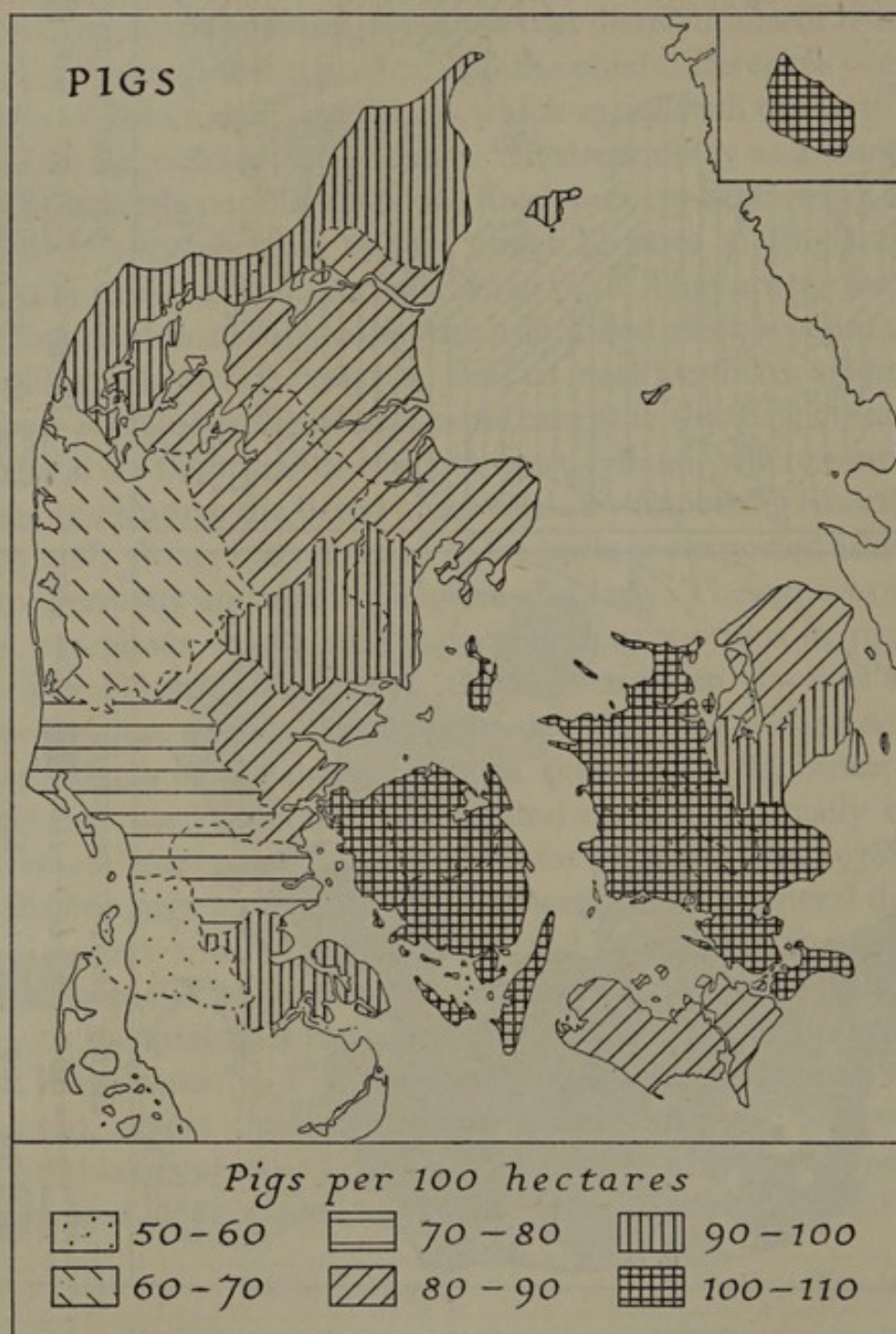


Fig. 62. The distribution of pigs in 1938

Based on figures in *Statistiske Meddelelser*, 4. Række, 108. Bind, Nr. 5 (København, 1939).

The figures of density are calculated per 100 ha. of farmland.

on home-grown, as well as imported, grain. Approximately four-fifths of the total production of eggs is exported under government control, and it is the efficiency of the marketing system which is largely responsible for the success of this branch of farming. The export of eggs to Britain grew from 1.5 million score in 1875 and 17.2 million score in 1905, to 80 million score in 1937. Denmark produced about a third of Britain's import of eggs. In recent years some attention has been paid to the production of poultry for the table, but it has not yet become important.

ROTATION OF CROPS

Crop rotations are fairly uniform throughout the country. The most common rotations are 8-year or 7-year, but 6-year and 9-year rotations are also practised. In the whole country about 50% of the rotation land is given to cereals, about 30% is under rotation grasses and about 20% grows root crops and potatoes, but regional variations occur (Fig. 63), and the smaller farms tend to have a higher proportion of root crops and less land under grass. In the sugar-beet districts of Lolland and Falster root crops occupy about a quarter of the rotation land. In the islands, approximately one-fifth of the rotation land is rotation grassland, but in western and southern Jylland rotation grassland occupies about one-third of the arable land. The whole farm is usually run under one rotation scheme, alternating cereals with root crops and rotation grasses, and it is exceptional for small areas within a holding to be cultivated in a special rotation. The particular choice of crops varies according to the soil. On sandy soils, oats and rye are the usual cereals and turnips the usual root crops, while on loamy soils, wheat and barley, and mangolds and sugar beet, are characteristic. Potatoes occupy light soils where these are available. A typical rotation on good clayey loam would be wheat, swedes, barley, mangolds, barley sown with grass seeds, grassland for two years, oats. On light soils rye and oats would typically replace wheat and barley, and swedes and potatoes would be grown instead of mangolds.

VOLUME OF PRODUCTION

Crop Yields

Danish agriculture is remarkable for the high crop yields which are obtained. For the average yields of crops in Denmark as compared with some other countries during recent years (1934-8), expressed in hundreds of kilograms per hectare, see p. 252.

	Wheat	Rye	Barley	Oats	Potatoes	Sugar beet
Denmark	30.4	17.8	29.8	26.8	171.3	344.2
Netherlands	30.3	22.8	29.5	24.8	187.0	381.0
Eire	23.7	18.8	24.7	24.4	191.6	245.3
Britain	23.1	16.0	20.9	20.4	169.1	220.3
Germany	22.8	17.3	21.6	20.2	168.7	305.4
France	15.4	11.6	14.5	14.0	111.8	275.9
U.S.A.	8.8	7.3	11.3	9.7	77.7	250.6

Source: *Statistisk Aarbog*, 1939, p. 257 (Köbenhavn, 1939).

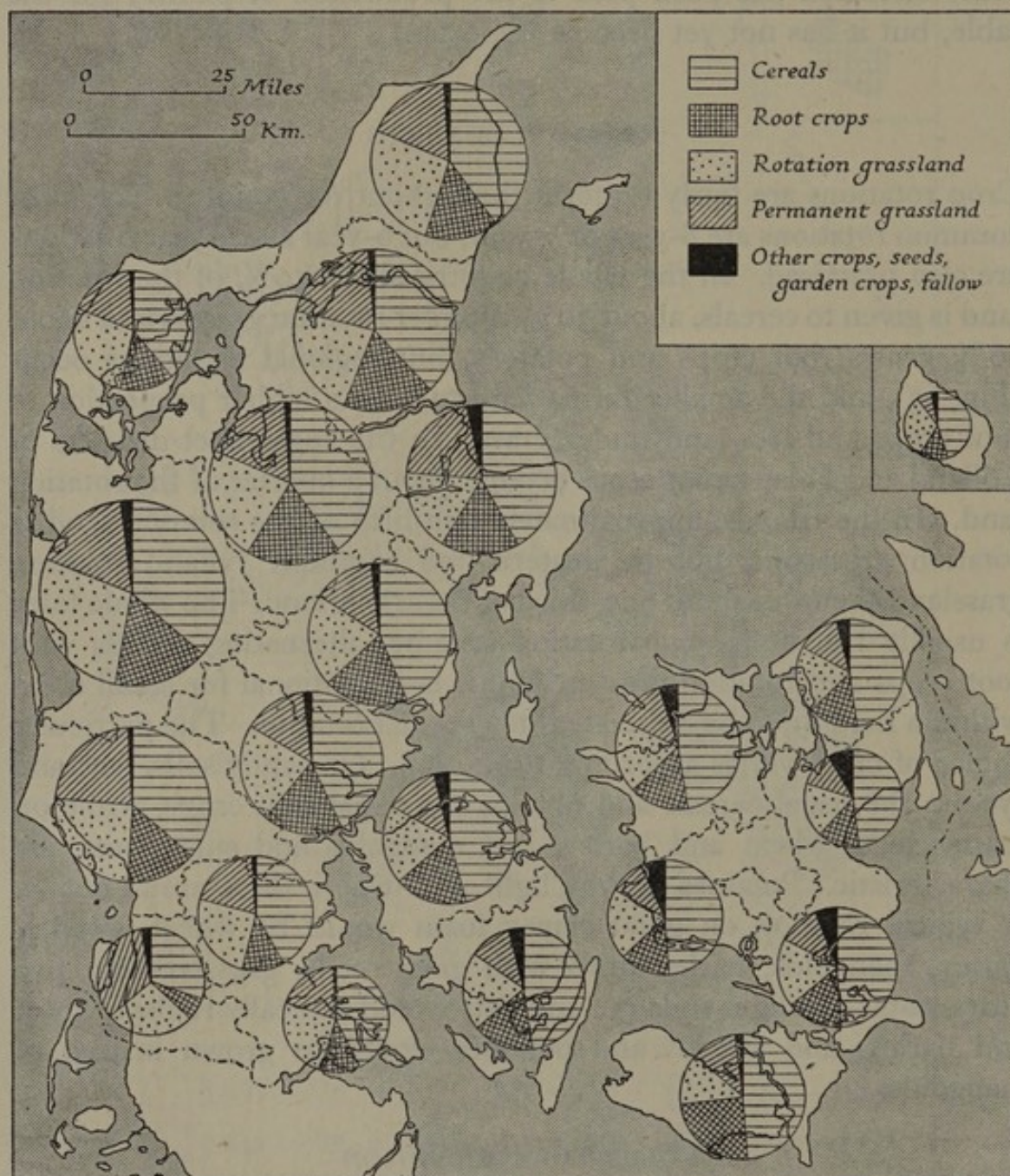


Fig. 63. The proportions of farmland devoted to different groups of crops, by counties (*Amter*), 1938

Based on figures in *Statistiske Meddelelser*, 4. Række, 108. Bind, Nr. 5 (Köbenhavn, 1939).

The areas of the circles are proportional to the area of farmland in each county.

In Denmark the yield of sown hay is 44 cwt. per acre and that of meadow hay is 32 cwt. per acre as compared with 28 and 20 cwt. per acre respectively in Britain, in spite of the fact that the British climate is more favourable for grassland farming. In terms of crop units (see footnote, p. 234) cereals comprise about two-fifths of the total harvest yield of the country, about one-third of the yield consists of grass, fodder root crops contribute between a quarter and one-fifth of the yield and sugar beet and potatoes account for the bulk of the remainder. Stability of production of the main crops, which usually varies less than 10% from year to year, is an outstanding feature. The total production and yield of the several crops in 1938 are given in the table on p. 254.

Livestock Produce

The milk yield of Danish cows is equally high and averages about 700 gal. per annum as against 540 gal. per annum in England. In 1937 the average yield per cow in Denmark was 3,500 kg. of milk and 140 kg. of butter. The cattle are not kept in large herds. About 92% of the herds consist of less than fifteen milch cows, and such herds comprise approximately 70% of all dairy cattle. The total annual production of butter reached its peak in 1931 when it was 195 million kg. Since that date it has declined and was 190 million kg. in 1938. In 1938 some 179 million kg. of bacon were exported. The by-products of the pig-rearing industry are of considerable importance, for Denmark produces some 25,000 tons of lard, about 25,000 tons of pig-casings and about 1,000 tons of bristles annually. In addition, dried blood meal, bone meal and meat meal are produced. It was estimated in 1931-2, when production was at its highest and before export was restricted, that the home market absorbed only about 12% of the butter, 15% of the bacon, and 30% of the eggs produced, and that the remainder was sold abroad. It is estimated that in recent years Denmark has produced about 30% of the butter, 50% of the bacon and ham, and 15% of the eggs entering into world trade. Livestock products represent about 90% of the value of produce sold off farms.

FARM MANAGEMENT AND LABOUR

Since the aim of Danish farming everywhere is to produce as much fodder as possible for livestock and to obtain as high a yield of milk, rich in butter-fats, from dairy cows, farm management shows a high

Production and Yield of Crops, 1938

Production in thousands of metric tons, yield in hundreds of kg. per hectare

		Sjælland	Bornholm	Lolland-Falster	Fyn	East Jylland	North Jylland	West Jylland	South Jylland	Whole country*	Average 1934-8
Wheat	Production Yield	169.5 38.3	15.1 40.7	20.8 40.5	79.2 36.0	74.3 33.1	20.0 29.2	42.3 28.2	39.7 33.0	470 35.1	376.9 30.4
Rye	Production Yield	46.7 27.3	4.1 27.7	3.0 30.6	15.9 24.9	50.9 19.2	53.2 18.4	82.3 16.6	27.5 19.5	288 19.5	258.4 17.8
Barley	Production Yield	413.4 36.6	16.0 36.8	177.6 40.6	189.4 36.3	232.6 32.7	111.8 29.0	117.6 27.8	100.9 31.5	138 34.2	1,084.1 29.8
Oats	Production Yield	230.6 37.0	14.8 36.5	60.1 42.5	112.6 36.3	236.4 29.4	190.6 26.7	171.5 25.0	127.6 29.8	1,164 30.5	1,006.9 26.8
Mixed cereals	Production Yield	108.0 35.0	13.2 36.2	12.8 40.3	62.6 34.7	102.8 25.0	193.1 25.6	248.5 22.9	54.3 25.6	808 26.3	769.2 23.9
Potatoes	Production Yield	162.1 155	6.5 123	10.1 146	51.6 142	218.9 178	367.1 196	564.6 193	51.8 142	1,456 181	1,327.2 171
Mangolds	Production Yield	2,076.6 630	300.6 695	211.4 587	1,178.3 658	2,261.4 645	1,086.4 571	1,543.2 562	392.7 521	9,205 612	8,827.4 588
Fodder beets (for fodder)	Production Yield	268.1 545	12.1 562	136.5 493	231.3 563	205.4 537	198.0 482	352.2 490	114.4 423	1,545 509	808.6 508
Swedes	Production Yield	1,540.6 654	18.2 612	82.7 543	819.7 676	2,724.4 633	2,462.8 614	3,098.9 584	735.1 488	11,624 608	11,538.8 580
Sugar beets (for fodder)	Production Yield	117.8 445	5.3 402	27.3 387	82.5 416	124.2 429	96.6 369	301.1 393	89.1 366	859 400	— —
Sugar beets (for sugar)	Production Yield	311.6 379	— —	808.5 351	206.0 359	16.4 373	0.2 292	3.8 333	16.5 362	1,410 359	— 339

* The figures for the whole country include production in areas that lie within municipal boundaries and which are not included in the regional figures.

Source: *Statistisk Aarbog*, 1939, p. 48 (København, 1939).

degree of uniformity throughout the land. Farms are generally small and are worked for the greater part as family farms, about 95 % of the 203,500 holdings being worked by owner-occupiers; in England the proportion of holdings so farmed is little more than one-third. About 96,000 of the cultivators are small-holders, a similar number are 'farmers', and only about 1,750 are gentleman farmers and landed aristocracy. About 16,000 of the small-holders do not give the whole of their time to their own holding but work, on the average, about 132 days a year for other people in return for wages. These are employed mainly on the larger farms. About 57 % of the holdings, occupying $28\frac{1}{2}$ % of the agricultural area, are small family farms which employ no regular agricultural labour. Farm servants in Denmark number about 166,000, forming about 37 % of the total agricultural population. They are mostly the sons and daughters of other farmers. They spend a number of years learning farming practice on different farms in different districts and they will later own and farm their own holdings. They serve this period of 'apprenticeship' usually while they are between 14 and 25 years of age, and it is estimated that not much more than 5 % of them remain as agricultural servants all their lives. They live in the farmhouse as members of the family. Farm servants who do not live in as members of the farmhouse are relatively unimportant in Denmark and are engaged by only about 4 % of Danish farmers. They are important only in the sugar-beet growing of Lolland and Falster and on some of the larger dairy farms in Fyn and Sjælland. They are chiefly older married men and they live usually in cottages owned by their employers. In addition, some casual labour is employed and is said to have increased in recent years, partly because of the increased area devoted to root crops which require periods of heavy work especially when drawing and storing the crop, and partly because the economic depression curtailed markets and reduced the margin of profit so that Danish farmers have had to economize labour. Before 1914 some 12,000 Polish labourers, mostly women, migrated to Denmark each spring to work on sugar-beet farms, but since 1919 this number declined rapidly and in recent years was usually less than 2,000. Otherwise, little female labour is employed on Danish farms as compared with other continental countries. Women comprise less than a quarter of the numbers engaged in agriculture, and the female farm servants are mostly the daughters of small-holders whose holdings are too small to require the services of all members of the family. It is more usual for young women to migrate to the towns to find occupation.

USE OF MACHINERY

The burden of farm work is lightened very materially by extensive use of agricultural machinery. Considering the generally small size of Danish farms, relatively more use is made of machinery than in any other country in Europe; this results from the high proportion of arable land and the need for machinery to prepare these crops for fodder, as well as from the intensive and progressive character of Danish farming. Of the 203,500 farms in Denmark, of which only about 4,836 are over 60 ha. in area, the statistics for 1936 show that 73,511 had electric motors installed, 34,822 used petrol engines, 112,237 owned seed drills, 82,303 had reaper-binders, 115,915 had hay-mowing machines and 19,954 possess root-lifting machines. These figures are generally about double the numbers used in 1923. Excluding the small-holdings and the larger farms, and taking the holdings between 15 and 30 ha., which is the most typical group, 53 % of these use an electric motor, 74 % use a seed drill, 88 % have a hay-mowing machine and 70 % use a reaper-binder. Milking machines are not widely used, partly because it is believed that hand milking gives cleaner milk. Their use is increasing on larger farms, but not more than about 5 % of Danish cows are milked by machine. Electricity is widely used for lighting in farm buildings as well as in farmhouses.

CO-OPERATIVE ASSOCIATIONS

Farm management is closely linked with the co-operative organizations. While the Danish farmer cultivates his land and manages his crops and livestock independently, he markets his produce and buys his raw materials co-operatively.

Of the 200,000 farmers in Denmark over 190,000 are members of one or more co-operative associations. Most of these are heads of families, which means that a far greater number is concerned with co-operative organization, and each of the 190,000 members will usually be concerned with more than one co-operative organization. Usually a farmer is a member of at least three or four co-operative organizations, and he may belong to as many as eight or nine. For example, farmers' co-operative societies for sale and purchase possess between them nearly 600,000 members. Almost every farmer belongs to both a co-operative dairy and a co-operative bacon-curing factory, while about half the farmers buy some of their feeding stuffs through co-operative societies.

Co-operative Dairies

The co-operative dairy, in particular, plays an important part in the daily management of the farm, especially since 92% of the agricultural holdings are connected with such dairies which handle about

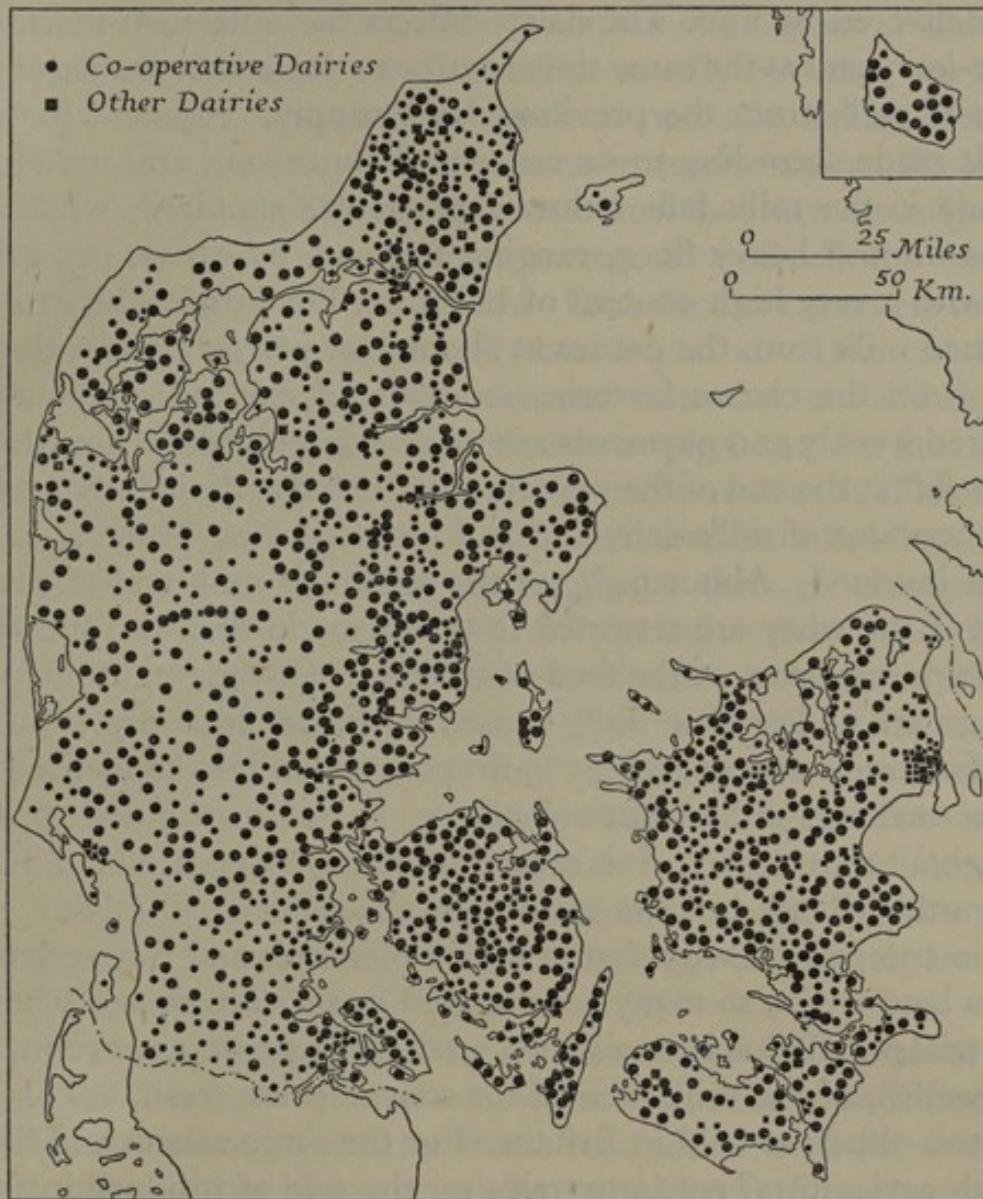


Fig. 64. The distribution of dairies

Based on a map in *Denmark; Agriculture*, p. 216 (Copenhagen, 1935).

The dots represent co-operative dairies and the squares represent private dairies.

90% of all milk sold from farms. Of the 1,732 dairies in Denmark in 1937, 1,405 were co-operative concerns with a membership of 190,000, and these were responsible for 94% of the butter production. The dairies are fairly evenly distributed throughout the country (Fig. 64) and are not particularly large units. On the average, each dairy has some 144 members, each with a herd of about eight milch

cows and an annual turn-over of about 413,000 kroner. The dairy is administered by a committee of 8-10 members who are usually unpaid. A paid manager is responsible for technical management. The ultimate control rests with the general meeting of members, each of whom has one vote irrespective of his property or of the amount of milk delivered by him. The dairy collects the milk each morning by motor-lorry and at the same time returns to the farmer the pasteurized skimmed milk from the previous day's supply. Payment for whole milk is made according to its content of butter-fat, and a deduction is made if the milk falls below a particular standard, while many dairies impose heavy fines, ranging from 1s. 6d. to 3s. per gal., for milk with a very high content of bacteria. The farmers buy back the skimmed milk from the dairies at about 1½d. per gal., while they buy whey from the cheese factories at about ½d. per gal. Accounts are rendered weekly and payments are made every second or fourth week. Profits left at the end of the year are distributed as dividends according to the amount of milk delivered and not according to the amount of capital invested. About 94% of the skimmed milk and about two-thirds of the whey are returned to the farms in this way and form a very important part of the feed of the pigs. Of the total milk output of Denmark no less than 80% is used for butter and only 3% for the manufacture of cheese and 0.5% for conversion into condensed milk. Cheese-making, unlike butter-making, is not distributed generally throughout the country. It is most important in Fyn, Lolland, Falster, and south Jylland, but the output of cheese is small (about 30,000 tons) in comparison with that of the Netherlands and Switzerland.

In a land where so many are engaged in agriculture and where the industrial population is small, only a relatively small proportion, about one-twelfth, of the milk, is sold for consumption fresh, as compared with two-thirds so sold in Britain. For the same reason and because Danish agricultural economy rests on the sale of produce in foreign markets, only about a third of the annual output of butter, cheese and milk was consumed in Denmark itself in 1938, and this represents a marked increase on the domestic consumption of the years before the economic depression when, for example, in 1928, less than a fifth of the output went to home markets. The reduction of butter exports made necessary an expansion of the home market, and by propaganda the annual domestic consumption was raised from 13 to 20 lb. per head. The Danes increase their butter exports by eating largely margarine of which they are the largest consumers in Europe, having an annual consumption of 40 lb. per head per annum in spite of the

fact that butter is cheap and plentiful. Yet it is the farming population that uses most margarine. Thus about 83% of the annual butter output was exported before the present war.

Co-operative Bacon Factories

The co-operative bacon factories are run in association with a body of farmers in a large or small area but usually covering the territory of several co-operative dairies. Each co-operative bacon factory has 30-40 times as many members as a co-operative dairy. The factories require a larger capital expenditure and they are usually limited liability concerns and are not guaranteed with all the members' property as is usual for the dairies. Each farmer contracts to deliver a certain number of pigs annually over a period which may be 5-20 years. The animals have to be delivered when they are within a range of 12 lb. of the specified weight for bacon pigs, and the factories pay premiums for pigs of the correct proportions and size. This helps to ensure a regular supply and prevents farmers from holding back the pigs in the hope of securing better prices through changes in the market or in the supply of animals. Of the eighty-four bacon factories in Denmark in 1937, sixty-one were co-operative concerns. They had 192,180 members and were responsible for 85% of the country's output. Killings averaged 19 per member. The bacon factories usually sold their produce through brokers in England, but nineteen factories joined to set up a selling organization, the Danish Bacon Company, which had headquarters in London and branches in a number of cities. This company distributed about one-third of all Danish pig products marketed in England.

Similarly, local egg-collecting circles contract, for a year at a time, to market their eggs through a co-operative selling association. Eggs supplied to collecting centres must be marked with the number of the supplier so that bad eggs can be traced back. Export eggs which do not conform to standard are confiscated and the exporter is fined. The eggs are paid for according to weight. In 1937 there were in Denmark 800 co-operative egg circles with a total membership of 45,000. These associations do not play such an important role as the dairies and bacon factories, and they deal with only about a quarter of the volume of the egg trade.

Buying and Selling Associations

In 1937 there were 1,476 co-operative societies, with 93,275 members, for the purchase of animal feeding stuffs and 1,458 co-operative

societies, with 55,757 members, for buying chemical fertilizers. These societies supplied about a half of the fodder and two-fifths of the fertilizers used in the country. Co-operative butter export associations handled nearly a half of the total butter exports, and two-fifths of the exports of meat and cattle were managed by co-operative concerns. Co-operation is essentially a farmers' movement in Denmark. Even the co-operative retail stores are predominantly rural in their distribution, and of some 1,850 such stores only about a hundred are in the towns. Co-operative selling for export has been made easier because the products are fairly uniform and they go to a few large markets. In England, on the other hand, co-operation has succeeded chiefly among large industrial populations with similar incomes and like demands.

The quality and uniformity of exported farm produce is further ensured by the control of the exporting bodies which are under government supervision. Certain standards of quality are laid down by law, and only the produce which conforms to these standards may be exported. Each dairy and bacon factory possesses a registered number and may use particular trade-marks. Produce for export is examined periodically for quality, and consistent failure to adhere to the standard laid down results in the suspension of the dairy or factory concerned from the right to export produce. It is by these means that Danish agricultural products attain their uniformity of quality although they come from 200,000 different farms and are processed at some 1,700 dairies and over eighty bacon factories.

The improvement of agriculture is continually being pressed forward by means of technical advisers and through the medium of agricultural schools, experimental stations and local and regional agricultural societies. Technical advisers are appointed and maintained by the state and are administered by the Royal Agricultural Society of Denmark. Advisers are also maintained, with the aid of state grants, by the agricultural societies, and there is one adviser to every 700 holdings. There are twenty agricultural schools (see p. 162) in Denmark. Some schools specialize in dairying or horticulture, while four of the agricultural schools cater specifically for the instruction of small-holders. There are seventeen experimental stations situated in districts with varying natural conditions, and probably in no other country is scientific research in such close contact with the general farming population. Heathlands are still being reclaimed at an average rate of about 5,000 ha. a year, and they now occupy less than one-third of their area in 1866.

THE VULNERABILITY OF DANISH AGRICULTURE

Danish agriculture is based on the intensive production of fodder crops at home and on the large yields of its livestock. The success of both of these features depends to a considerable extent on the importation of cheap feeding stuffs and of chemical fertilizers from overseas. In 1930, before the effects of the economic depression were felt, Denmark imported about 1,400,000 tons of unground grain and pulses, about 729,000 tons of oil-cake and oil-cake meal, and 217,000 tons of fertilizer. The contraction of markets following on the economic depression reduced the ability of the Danish farmer to keep up the numbers of his livestock and the volume of imported agricultural raw materials, and by 1934 the import of grain and pulses had fallen to about 860,000 tons, that of oil-cake and oil-cake meal to 550,000 tons, and that of fertilizers to 196,000 tons.

The Effects of the War of 1914-18

This reduction in buying-capacity as a result of contraction of markets is only one aspect of the vulnerability of Danish economy. Danish agriculture is also dependent on the unhindered importation of agricultural raw materials from overseas. During 1917-19 Denmark suffered great difficulties, as a result of the blockade, in importing oil-cake, and there followed a marked drop in the yield of milch cows in spite of attempts to find substitutes for imported oil-cake. The researches of Frederiksen showed that a reduction of 1 kg. in the amount of oil-cake fed to dairy cows led to a reduction of $2\frac{1}{2}$ kg. in the milk supply. The average annual yield of butter-fat per cow fell from 129 kg. in 1916 to 90 kg. in 1919. Owing partly to the difficulty of obtaining raw materials and partly to the obstacles to free export, the exported agricultural produce of Denmark fell during the war of 1914-18 to approximately the same amount as that exported in 1880. The export of butter fell from an average of 99 million kg. during the years 1910-14 to 15 million kg. in 1918, and that of bacon from 129 million kg. to 3 million kg. for the same years. Crops were very poor in 1917* and 1918, and during the same years there was a very large reduction in the number of pigs which fell from 2,496,706 in 1914 to 620,880 in 1918, and by July 1920 they had increased to only about a million. Dairy cattle and pigs had to be slaughtered for want of fodder, and the export of live cattle increased to 305,000 head in 1916. The numbers of cattle in Denmark fell by 22% during the war years and did not reach the pre-war figure until 1923. The total crop

* The dry summer of 1917 was a contributory factor.

yield of Denmark during 1917 and 1918 was 57.4 million crop units as compared with 69.6 million crop units during 1910-14, that is to say, production fell, by about 18%, to approximately the level it was at in 1900-4. Danish agricultural export did not attain its general pre-war level until 1922-3.

Effects of the World Depression, 1930-31

On the average, Danish farms sell over nine-tenths of their livestock produce. Danish farming is thus dependent on highly organized overseas markets in which it has to face world competition, the possibility of tariffs to protect the home farming of the importing countries, and, in Britain, the competition of empire marketing schemes with their discrimination against foreign countries. The volume of Danish agricultural production is not sufficiently large to enable Denmark to exert any monopolistic influence on prices or policies. She has to accept world market prices and adjust her production to the conditions of world trade. The economy of Denmark, which has no protected imperial markets and few mechanical-industrial resources, is thus very sensitive to changes in prices and highly vulnerable to changes in the trade policies of those countries where it sells its goods. It depends on the custom of other countries over which it has no control and can exert little influence. For these reasons the world economic depression and the rise of economic nationalism, with its erection of tariff barriers to protect home production in the face of political unrest and to provide in agriculture an outlet for unemployment, brought severe economic difficulties to Denmark. Markets contracted and prices fell. The price index for agricultural produce fell from 144 in 1929 to 79 in 1932, representing a decrease of about 45%. Between 1929 and 1932 the prices of dairy produce fell by 40%, those of bacon fell by 52%, and those of eggs decreased by 37%. Between 1930 and 1932 Denmark's exports of agricultural produce, which had been worth 1,219 million kroner in 1930, fell by 25%, and during these years there was practically no return on capital invested in agriculture. For example, the average gross income per hectare in 1928-9 was 900 kroner and the costs of production were 750 kroner: in 1931-2 the corresponding figures were 525 and 575 kroner respectively. In September 1931 Denmark followed Britain's retreat from the gold standard; in February 1933 the Danish krone was devalued from 18.16 to 22.40 to the £, and since then until the outbreak of the present war Danish currency remained fixed to sterling. Denmark strove to reduce her costs of production by checking imports of agricultural raw materials. Tariffs

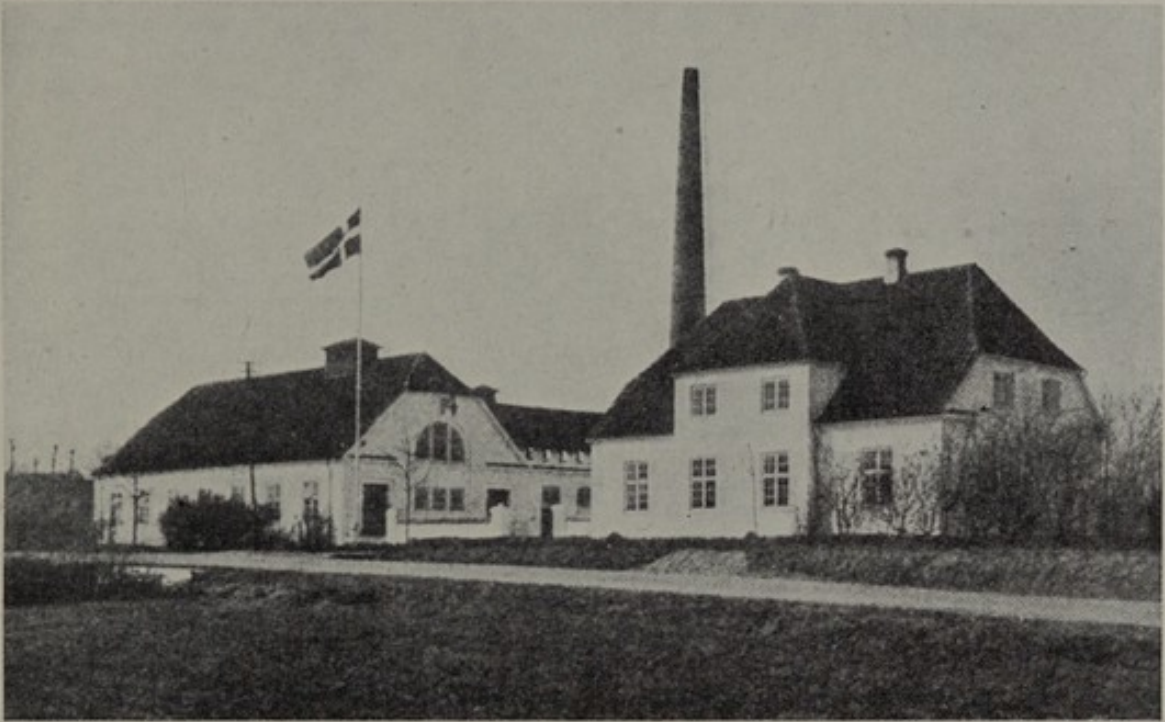


Plate 42. A co-operative dairy



Plate 43. Storage hall at a bacon factory

Note the uniformity of the carcasses, which reflects the influence of regulations regarding size, weight and proportions.



Plate 44. Fish-packing sheds at Frederikshavn

In the foreground can be seen several containers, with holed sides, for carrying live fish. These containers are towed through the water behind the fishing boats.



Plate 45. The fish market at Köbenhavn (Copenhagen)

The fish market is held along Gammel Strand on the north side of Slotsholm.

were erected against the importation of grain and measures were taken to increase the use of home-grown wheat and rye for bread-making, while a guaranteed price for potatoes led to the disappearance of imports of potato flour. In March 1932, Britain imposed a 10% *ad valorem* duty on foreign butter and eggs, but in November of the same year this was replaced by a duty calculated according to weight, which meant, in effect, an increase in the tariff. At the same time Britain adopted a quota system for imported bacon which, by the end of 1933, reduced the Danish export to Britain by nearly a half. The German duty on Danish butter was also increased substantially. To meet these new developments the home consumption of butter was increased through propaganda and by imposing an import duty on the raw materials used in the manufacture of margarine, while the dairy farmer was helped by imposing a levy of about 1½d. per lb. on the Danish consumer in order to counteract reduced prices in overseas markets. In 1935-6 butter prices improved and the duty lapsed, but it came into force again in the following year. The British quota system for imported bacon was met by issuing a number of pig cards in accordance with the number of bacon pigs required for export. These cards were distributed among farmers according to the value of the farm, the production of skimmed milk and whey, and the output of pigs during the previous year. Each pig marketed had to be accompanied by such a card, and pigs produced above the number of cards held by the farmer fetched rather less than half the price of those sold with cards. In this way pig production was reduced to only 2% over the number of cards issued, and the pig population of Denmark fell from 5 million to 3 million head, while pig prices rose from 82 öre per kg. in 1932 to 170 öre per kg. in 1938. The government reduced milk production by buying up tuberculous cattle for destruction; output was reduced further by decreasing the imports of oil-cake for feeding. Denmark regulated her agricultural production by concluding trade agreements with her chief customers and by adjusting her output to the quotas which they imposed.

Thus before the outbreak of the present war Danish agriculture was adapting itself to a phase of reduced output and curtailed export, and, as a result, rural migration to the towns was increasing. This migration, which averaged some 9,000 persons annually between 1925 and 1929, rose to an average of nearly 24,000 between 1933 and 1937, and while the former figure probably represented little more than the natural increase of the farming population, the latter was almost certainly greater than that which can be explained by natural causes, so that the farming population is probably on the decline.

Chapter XII

FISHERIES

The Chief Fishing Grounds: Yield of Fisheries by Kind: The Fishing Fleet: Administration of Fisheries: Import and Export of Fish

In 1938 a total of 13,043 people were full-time and 5,425 people were part-time fishermen. The total value of the catch was some 43 million kroner. The total numbers employed, both full and part-time, form only $3\frac{1}{2}$ and $4\frac{1}{2}\%$ of the numbers employed in agriculture and industry respectively. The value of the fisheries was approximately the same as that of the boot and shoe or the paper trades and was about a quarter of the value of the output of the oil-pressing mills, less than a third of the value of the output of iron ships, and about half the value of the production of the margarine factories. The value of the Danish fisheries is approximately half of those of Scotland, a seventh of those of England and Wales and slightly more than a third of those of Norway.

The Danish catch in the Skagerrak and the Baltic Sea was second only to that of Sweden, but Denmark played only a small part in the

Landings of Fish by several Nations in North European waters, 1937 (in thousands of tons)

	North Sea	Baltic Sea and Skagerrak	Iceland and Faroes	Total
Belgium	19	—	4	23
Denmark	26	58	1	85
England and Wales	248	—	212	460
Faroes	—	—	29	29
Finland	—	19	6	25
France	35	—	13	48
Germany	297	53	104	454
Iceland	—	—	336	336
Latvia	—	14	—	14
Norway	299	12	26	337
Netherlands	185	—	—	185
Poland	7	7	—	14
Scotland	185	—	17	202
Sweden	11	106	2	119
Total	1,312	269	750	2,331

Source: *Bulletin Statistique des Pêches Maritime des Pays du Nord et de l'Ouest de l'Europe*, Tome XXVII, p. xv (Copenhagen, 1939).

Yield of Danish Fisheries in various waters, 1938

	North Sea tons	Skagerrak tons	Kattegat tons	The Sound tons	The Belts Sea tons	Baltic Sea		Lim-fjord tons	Ring-købing and Nissum Fjords tons	Total		% of total value
						W. part tons	E. part tons			tons	1,000 kroner	
Plaice	16,083	1,570	2,195	56	822	142	349	397	0.4	2,1615	18,539	43.5
Eels	30	—	493	238	1,317	121	389	788	269	3,645	5,035	11.8
Cod	3,435	1,434	3,160	1,318	5,758	669	3,452	70	1	19,298	4,693	11.0
Herring	260	2,990	2,226	112	4,155	289	4,025	449	19	14,525	3,539	8.3
Flounder	12	3	955	252	1,284	52	397	54	396	3,406	1,331	3.1
Dab	1,102	81	1,054	46	892	195	148	—	—	3,519	1,282	3.0
Mackerel	187	849	3,957	291	650	5	33	—	—	5,973	1,298	3.0
Sole	309	19	197	0.4	6	—	—	0.3	0.1	531	964	2.3
Haddock	1,462	57	0.3	0.1	2	0.1	—	—	—	1,522	752	1.8
Turbot	284	54	74	0.6	15	2	33	2	—	464	561	1.3
Garfish	26	29	806	370	706	14	147	—	0.1	2,099	447	1.0
Brill	72	29	178	4	18	0.7	—	—	—	302	305	0.7
Salmon	0.5	3	20	0.6	4	0.3	28	0	3	59	301	0.7
Lemon Sole	170	47	12	—	0.3	—	—	—	—	230	268	0.6
Whiting	3	3,719	567	0.03	57	0.5	—	—	—	4,347	143	0.3
Trout	0.7	0.7	16	—	14	0.5	6	25	2	64	134	0.3
Witch	166	11	4	—	—	—	—	—	—	181	112	0.3
Other fishes	1,489	773	1,340	45	457	41	17	700	71	4,925	2,969	7.0
Total	25,091	11,669	17,254	2,733	16,157	1,532	9,024	2,485	761	86,705	42,673	100
% of total weight	28.9	13.5	19.9	3.1	18.6	1.8	10.4	0.9	2.9	100		
% of total value	42.3	8.5	17.4	2.9	15.2	1.5	7.1	1.0	4.0	100		

Source: *Fiskeriberetning for Aaret 1938*, p. 35 (København, 1939).

Note. The above figures include 82 tons of cod and 786 tons of other fish, with a total value of 5 million kroner, which were landed from the North Sea, by Danish vessels, at foreign ports. Amounts over 1 ton are given to the nearest unit.

North Sea fisheries in comparison with countries such as Britain, Norway and Germany, although her catch in the latter waters is nearly half the total taken in the Skagerrak and the Baltic.

THE CHIEF FISHING GROUNDS

It will be seen from the table on p. 265 that in 1938 nearly one-third of the catch by weight and two-fifths of the catch by value were taken from the North Sea. Next in importance are the Kattegat and the Belts Sea. These three areas account for three-quarters of the total value of the fisheries.

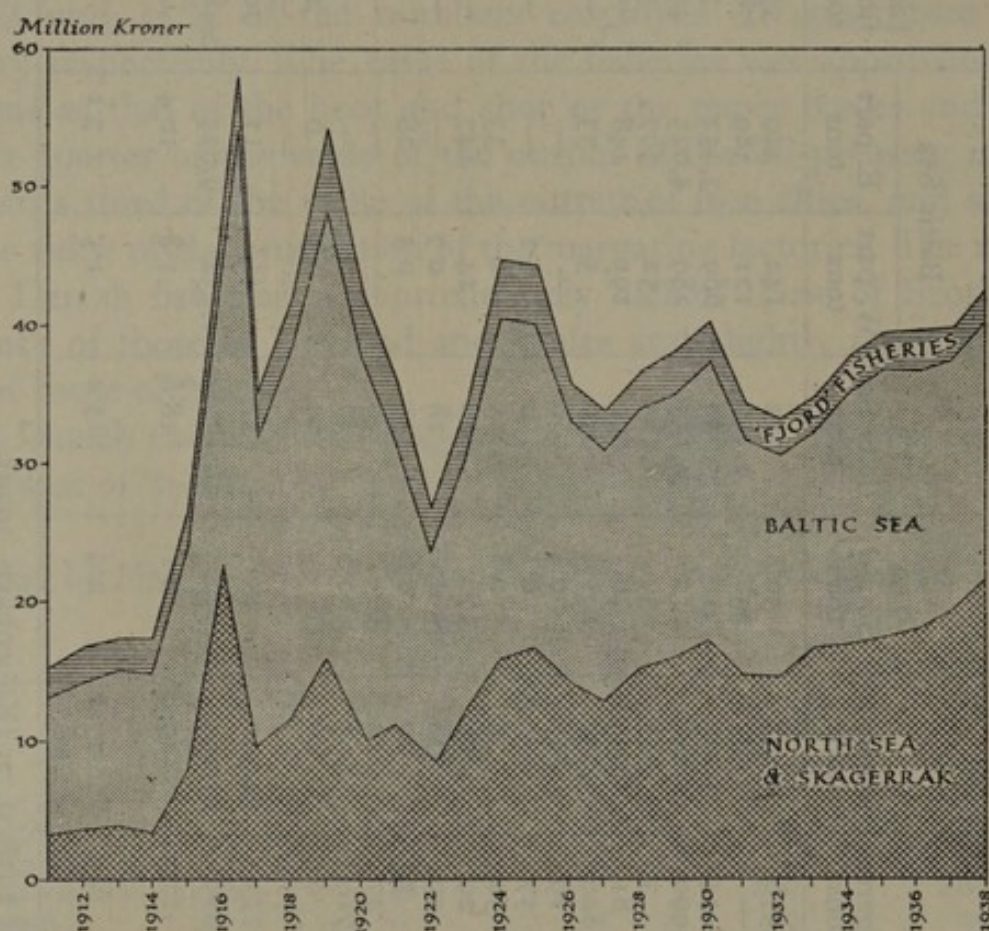


Fig. 65. The yield of Danish fisheries in different waters, by value 1911-38
Based on figures in *Fiskeriberetning*, 1938 (Köbenhavn, 1939).

The 'fjord' fisheries are those carried on in Limfjord, Ringköbing Fjord and Nisum Fjord.

The North Sea fisheries are based on a small number of fishing harbours, namely, Esbjerg, Hvidesande, Tyborön, Hirtshals and Hanstholm. Smaller centres, such as Vorupör and Lökken, also partake in the fisheries, but on the west coast the small-boat fishing

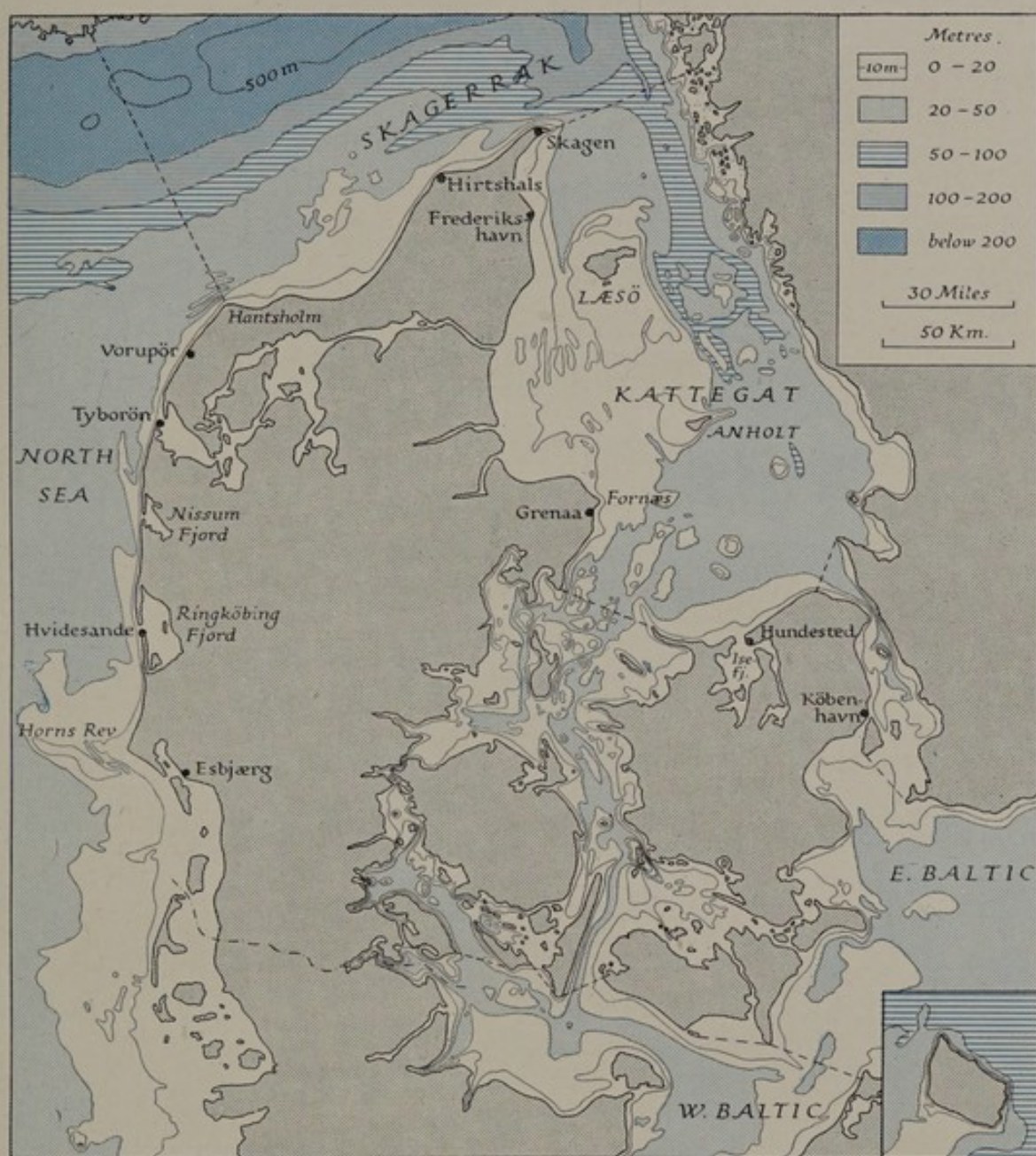


Fig. 66. The seas around Denmark

Based on the *Geodætisk Institut's* 1 : 1,000,000 map (København, 1934).

The broken lines indicate the boundaries of the fishing areas used in the fisheries statistics. The area between the Kattegat and the West Baltic is known as the Belts Sea.



is of little importance compared with the fishing from cutters which use mainly Danish seine-nets. Within the Skaw, on the other hand, fishing takes place from a great number of centres which vary from open beaches, shelter-moles and piers to considerable ports. Within the Skaw small vessels are most important and fixed nets are much used. The chief centres are Skagen, Frederikshavn and Grenaa but harbours such as Anholt Havn, Vesterö (Læsö), Hundested, Lynæs and Gilleleje are primarily fishing ports. Limfjord has some fifty harbours which serve the fjord fisheries, although Lemvig and Tyborön are also centres for the North Sea fisheries. Over a quarter of the full-time fishermen work from Esbjerg, Tyborön, Skagen, Frederikshavn, Grenaa, and Hundested, and two-fifths of the catch by weight and value is landed at these ports.

*Landings of the Chief Fishes at six Danish Ports
(including landings by foreign vessels)*

	Esbjærg tons	Tybo- rön tons	Skagen tons	Frederiks- havn tons	Grenaa tons	Köben- havn tons
Plaice	9,702	2,695	1,033	523	150	14
Flounder	2	—	6	77	60	115
Dab	290	96	74	201	209	3
Sole and Lemon Sole	158	91	64	65	3	—
Turbot	175	94	48	16	3	—
Brill	25	37	30	60	—	—
Cod	879	653	555	296	690	1,778
Haddock	663	406	69	0.3	—	—
Whiting	19	—	7,001	13	—	—
Mackerel	1	70	2,959	968	67	173
Herring	0.4	8	10,550	95	239	39
Eels	—	—	—	3	—	75
Salmon	—	—	10	3	1	0.2
Other fishes	534.6	363	1,097	759.7	72	258.8
Total	12,449	4,513	23,496	3,080	1,494	2,456
Total value (million kroner)	8.6	2.9	4.4	1.5	0.6	0.9

Source: *Fiskeriberetning*, 1938, pp. 51-70 (Köbenhavn, 1939).

YIELD OF FISHERIES BY KIND

Although the plaice fisheries are followed closely in quantity by those of cod and herring, they are much the most valuable and account for nearly half of the value of the total catch. The eel fisheries are rela-

tively small in quantity and come next to the plaice fisheries in value, but are followed closely by cod and herring. Next in value are dab, flounder and mackerel (see p. 265).

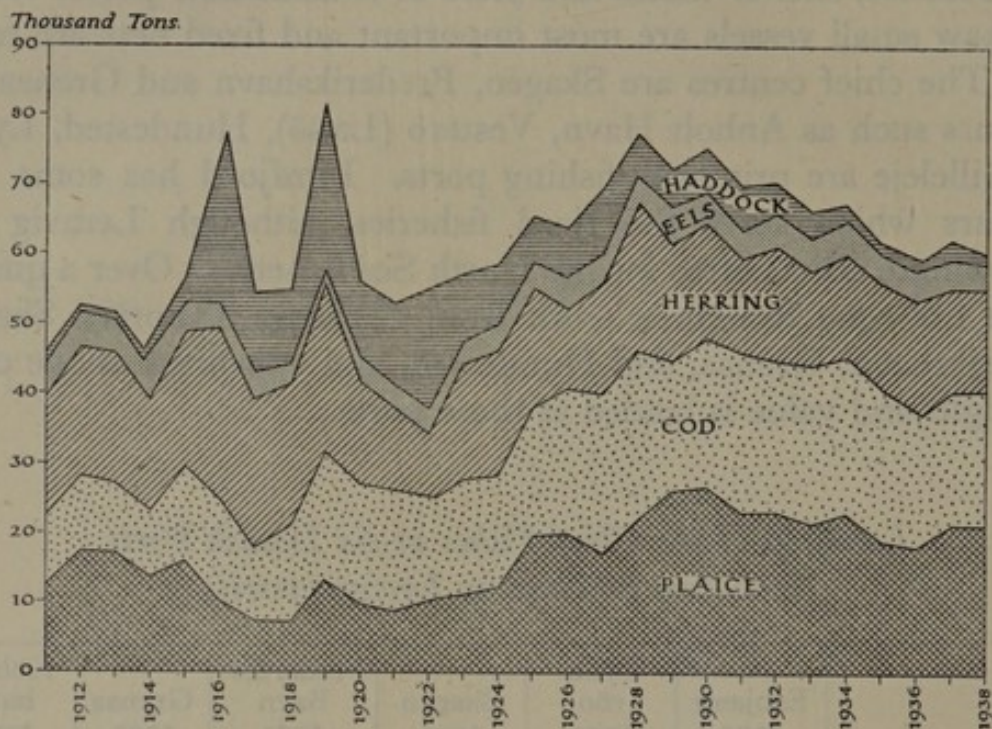


Fig. 67. The yield of Danish fisheries in all waters, by kind
Based on figures in *Fiskeriberetning*, 1938 (Köbenhavn, 1939).

The Plaice Fisheries

Plaice are caught in all Danish waters, but the chief areas are the North Sea and the Kattegat where about two-thirds and up to a quarter, respectively, of the total catch are usually made. The cutters, working mainly from Esbjerg and Tyborön, fish the whole of the area south of latitude 57° N and westwards to depths of 50 m. (27 fathoms) and to the north-east border of the Dogger. The season extends from February to December, with the vessels fishing mainly north and south of Horns Rev in depths of up to 20 m. (11 fathoms) in spring and early summer and then spreading westwards. From the small harbours along the coast small boats, using seine-nets, fish in depths of up to 50 m. (27 fathoms) but the catch is small. Some Danish vessels fish the central part of the North Sea from British, mostly English, harbours from spring to autumn, and others, working mainly south of latitude 55° N, land their catches in German, Dutch and Belgian ports.

The Skagerrak is worked mainly from Skagen and Hirtshals. They fish in spring and early summer to depths of 75 m. (40 fathoms), but

in autumn they work closer inshore in depths of up to 20 m. (11 fathoms). In the Kattegat the largest catches are made in Aalborg Bugt and around Læsö. These grounds are worked mainly by boats from Frederikshavn, Skagen, and Grenaa.

The chief gear used are the Danish seine-nets, otter trawls and nets. In the North Sea and the Kattegat the seine-net is dominant. The Danish seine-net is not dissimilar from many other forms: it is the technique of using it which gives it its name. The boat attaches one end of the line to a buoyed anchor and pays out line and net over a 4-5 mile course, turning to stretch the net to its fullest extent and then returning to the anchored buoy where the other line is taken on board and the boat attached to the anchor. The net is then hauled in with winches. The net is laid across the current and the whole process takes up to two hours according to the depth in which fishing occurs and the length of line used. Otter trawls are used to a small extent in the Kattegat but the chief area for this gear is the Belts Sea and the western Baltic, where seine-nets are also used. The net used with the otter-boards (1-1.1 x 0.6-0.8 m.) is 8-11 m. long, 0.5-1.5 m. high and usually without wings. The width of the bag is usually between 3 and 5 m. and it has a 40-55 mm. mesh. The use of bags broader than 5 m. is forbidden in Danish waters. The use of otter trawls in small fjords and other restricted waters is forbidden unless local regulations make exception.

The catch is distributed fresh, usually alive, and is carried in the wells of the boats. Further distribution is usually made in transports, the larger of which are schooner-rigged ships of 15-40 tons with auxiliary motors; others are small boat-shaped containers with holed sides, which are towed through the water (Plate 44). The chief direction of this movement by water is from the north of the Kattegat to København, but some of the catch is disposed of in nearby Swedish and German ports. Many North Sea boats have no wells, and in such craft the fish are placed on ice for up to 10 days until the boat has caught an adequate load, usually about 10 tons, before returning to port.

The Cod Fisheries

Cod are caught in all Danish waters, but the catches in the Kattegat and the Belts Sea are each usually equal in amount to those of the North Sea and Skagerrak together. The most important fishing is done within the 50 m. (27 fathoms) line. The fishing season extends from the end of August to April or May, although some summer fishing

is done from Esbjerg and also in the Belts Sea, especially the Little Belt, but these summer catches of small fish are of little value.

In the North Sea the chief fishing area in early summer lies north-west and west of Vyl and Horns Rev to approximately the 40 m. (22 fathoms) line; in autumn it extends farther seawards, usually between the 40 m. line and the north-east border of the Dogger, but in December the main fishing area lies again nearer the coast.

Cod is caught mainly with Danish seine-nets and long lines but also with otter-trawls and bow-nets (Danish: *Ruser*). The seine-net is used mainly in the North Sea, in the deeper parts of the Kattegat and the Belts Sea, and in the Baltic between Mön, Rügen and Falsterbo. Otter trawls are used especially in the deeper part of the Belts Sea and north of Fyn. Bow-nets are used in the shallow waters along the east coast of Jylland, on the banks around Læsö and, above all, in the Belts Sea. Line fishing is practised in all Danish waters, especially where the bottom is not suitable for net fishing. It is particularly important north and south of Hanstholm in depths of over 30 m. (16 fathoms), in the Skagerrak, on the flats within the 20 m. (11 fathoms) line along the east coast of Jylland, on the banks around Læsö, in the waters between Anholt and Fornæs, and along the east coast of Sjælland off Lolland, east and south of Mön, and, above all, around Bornholm. The lines are 100–200 m. long and carry 100–600 hooks; 40–50 lines are usually set together. In these shallow areas the net fishing is too intensive to permit the wide use of stationary gear such as bow-nets.

The cod catch is dispatched fresh, mostly living, from the fishing centres inside the Skaw, but from the west coast of Jylland the fish are sent packed in ice. From the eastern harbours part of the catch is sent alive in transport vessels to Norwegian, Swedish and German ports.

The Herring Fisheries

The herring fisheries are largely confined to coastal waters and, as with all herring fisheries, is very variable. Normally the southern part of the Kattegat, the Belts Sea and the eastern Baltic yield the largest catches. Herring are caught in all months, but the technique differs seasonally. In the shallow waters of the Kattegat, Sound, Belts Sea and western Baltic the main catches are taken in spring, early summer and autumn, but in summer the temperature of these waters rises above the optimum for these fish. In the eastern Baltic around Bornholm the herring is caught in shoals throughout the

year, using fixed nets in spring and autumn and drift nets in summer; the drift nets are sunk to depths at which the water is sufficiently cold. In waters outside the Skaw the herring catch is usually small and is taken close to land, mainly with fixed nets, along the Skagerrak coast and between Bulbjærg and Hanstholm.

The chief gear used are trap nets and herring nets. The trap nets are set on 14-50 poles fixed in the bottom, singly or in rows, in shallow waters up to depths of 8-10 m. (4-7 fathoms) and reaching from the bottom to the surface. The lower border of the net is weighted with chains or other weights. Where the current is strong two lines of poles are used and the wing of the net is suspended between them. On the west coast of Jylland attempts have been made to use floating trap-nets in which the apparatus is held by anchored buoys. Herring nets are large tow-nets with deep wings 60-85 m. long, attached to a bag 12-20 m. long, 3-10 m. high and with a 12-25 mm. mesh. They are used with two boats, each drawing one wing and anchoring together to haul in. Smaller herring nets are also used as drift-nets which are attached to long ropes and move with the current. The nets are used in rows, 50-80 together in the Kattegat, but usually 15-40 elsewhere, and are sunk to the required depths (up to 25 m.) with weights and are suspended on lines from cork floats.

The home market consumes 8,000-10,000 tons of the herring catch annually. The fish are gutted on board and are dispatched in boxes on ice. The bulk is consumed fresh or smoked, but part of the autumn catch is salted. The output of salt herring does not satisfy the demand and 3,000-4,000 tons are imported annually. The export is mainly of fresh herrings and goes chiefly to Germany and Sweden. Little of the catch is preserved because the yield of the fisheries is not sufficiently stable to maintain a large canning industry.

The Eel Fisheries

The eel fisheries are entirely confined to coastal waters. The chief areas are the fjords, bays and sheltered coastal waters within the Skaw. The fishery is most intensive and productive in the fjords and bays of the Belts Sea, followed by the central and western parts of Limfjord and the inner part of the Kattegat and Isefjord; catches in the waters outside the Skaw are insignificant and the fisheries are pursued only at the mouths of the haffs and in the shallows south of Blaavands Huk. The fishery is carried on throughout the year. From spring until well into the autumn (October) adolescent or 'yellow' eels are caught, but the grown 'white' eels are caught only from

August to November. In winter, when eels go to the bottom, they are caught only by sticking. White eels are caught with bow-nets and trap-nets and yellow eels with bow-nets, surface-nets, trap-nets, drift-nets, tow-nets, seine-nets and various devices for sticking the fish. The chief gear are the bow-nets which are set close to land in depths up to 12 m. (7 fathoms). The nets are held on 2-7 poles and are set singly, or in rows, opening in the direction of the migration of the eels. Trap-nets are used chiefly for catching white eels; yellow eels are caught mainly in drift-, tow-, and seine-nets. The eels are caught during their migration to the sea. The nets are placed in long lines or fences outwards from the coast to depths of 10 or 15 m. (5-8 fathoms). The right to set eel fences outwards from the coast is held traditionally by the coast dwellers, and others can obtain this right by lease or purchase only. The fences may stretch seawards for up to 3 km. and include over eighty bow-nets or up to eighteen trap-nets. Eel nets (drift and tow) are fine-mesh (10-14 mm.), short-winged (7-9 m.) nets with a bag 6-10 m. long and 1-3 m. high. The net is weighted with stone, chain or iron and 6-8 rows of cork floats are fastened to the upper side of the bag. Drift- and tow-nets may not be used in Limfjord. In Limfjord, the east Jylland fjords, Isefjord and the Sound, a good deal of angling for eels is done from the beginning of May until the end of September. Eel sticking is done mostly from October to March using weighted poles attached to lines. The eels are caught on still dark nights by using torches or strong lamps attached to the bows of the boats.

The eel fishery is very variable. A high temperature in early summer, and especially in July, increases the yield of the yellow-eel fishery, while high mean temperatures in July and August increases the yield of the white-eel fishery. The greater part of the catch is exported, but there is a compensating import of eels from Norway and Sweden. The eels are dispatched alive in transport boats, many of which are Dutch and German, or else they are packed in ice and sent overland. Those sold at home are mostly marketed alive, but a considerable part of the catch is smoked; only a small part of the catch is salted. White eels are often kept in tanks to be sold during the winter when prices are high.

Minor Fisheries

Mackerel. The main catch of mackerel is made in the Kattegat. The mackerel come from the north in shoals every spring and leave again in October and November; the catch varies according to the

numbers of fish and the nearness of their migration to the coast. The shoals appear to be largest and most numerous when there is a strong spring in-current and high salinity in the deeper waters of the Kattegat. The fish are caught near the coast with standing gear, especially trap-nets, and also with drift-nets and tow-nets. About two-thirds of the catch is sold in Denmark, either fresh or smoked.

Flounder, Dab and Sole. Flounder are caught mainly in the fjords and are of small importance along the west Jylland coast. Occasionally large catches (c. 1,000 tons) are made in the Belts Sea; the chief other areas are the Kattegat, the Sound and the waters around Bornholm. The fish are usually caught during the plaice fishing and with the same gear—fixed nets, otter trawls and seine-nets. When the fish leave the shallow waters in spring and autumn they are often caught in the trap-nets laid for other fish.

Dab are caught all the year, mainly in the Kattegat and the Belts Sea. Some are caught around Bornholm, but few are landed from the Skagerrak. They are caught in the same gear as flounder and plaice.

The catch of sole is very variable. The fish are caught mainly by small vessels in the North Sea during May and June, but some are also taken in fixed nets if the fish come close inshore to spawn. Some are also caught in shallow waters (under 20 m.) in the Kattegat in May and June.

Haddock. Haddock are caught mainly in the North Sea, especially in the Esbjerg area. They do not usually spawn in the waters within the Skaw, but every autumn and winter some haddock migrate from the north through the Skagerrak with a strong inflow of salty warm water and are caught in the Kattegat. The fishery is not pursued separately and the fish are usually caught together with cod, mainly in seine-nets, but in the North Sea and the Kattegat much angling is done.

The fishery fluctuates annually and is markedly seasonal, since the fish migrate to the shallower waters in winter and away from the coast in summer. Some fish are landed at Esbjerg throughout the year, but the largest catches are made during the latter half of the year and the smallest between February and May. The fishery is carried out over the whole of the eastern part of the North Sea between 54 and 57° N and in depths of 20–60 m. (10–30 fathoms) as far as the northern border of the Dogger, and for a short time also north-west of the Dogger. The bulk of the catch is exported on ice and only a small part is smoked.

Salmon and Trout. An important salmon fishery is carried on around Bornholm only, but there is also some fishing in the estuaries and fjords of west Jylland. The fishery is carried on in a zone 20–25 km. wide around the coast of Bornholm with drift-nets from February to May, while within about 1 km. of the land fixed nets are set. The fish are caught by hook between October and January.

Sea trout are caught on all coasts, especially those within the Skaw, with trap-nets and bow-nets. Aalbæk Bugt is one of the chief areas, but a considerable fishery is also pursued in the fjords and estuaries. Both salmon and trout are marketed fresh and a considerable part of the catch is exported.

Other Fishes. Whiting are caught mainly in the Skagerrak, while skate is caught in the Skagerrak and also in the deeper parts of the eastern Kattegat; in addition some are caught in the channels between the shoals of south-west Jylland. The catches of these fishes do not constitute a separate fishery but are made up of those taken incidentally while engaged in the other fisheries. In the same way sprats and brisling are a by-product of the herring fishery and are caught chiefly in Limfjord, Isefjord and the Belts Sea. Garfish are caught from early summer to autumn in trap-nets off the east coast of Jylland in the eastern part of the Great Belt, around Læsö and in most fjords and bays within the Skaw.

Shell-fish. The lobster fishery yielded 160 tons with a value of 491,716 kroner in 1938. The chief catches are made in the Skagerrak, especially between Hirtshals and Bulbjærg, in Jammerbugt and north-west of Lökken and Rubjærg, where the bottom is stony or shingly. Along the North Sea coast the fishery is important north of Tyborön only. The other important areas are the western part of Limfjord, the Kattegat around Læsö, on the banks between Læsö and Anholt, and off the coast of the broad peninsula which lies between Aalborg Bugt and Aarhus Bugt.

Crabs are caught in the North Sea, Skagerrak and Kattegat in depths of 20–40 m. (11–22 fathoms). Only one species, *Cancer pagurus* Leach, is of economic importance, since the shore crab (*Carcinus maenas* Leach), which is common in shallow waters on all Danish coasts, is not used except locally in south Sjælland.

Prawns (*Palaemon fabricii*) are caught in increasing quantities in the Baltic. The largest yield (c. 200 tons) is obtained from the Belts Sea, especially Smaalandsfarvandet and the waters south of Fyn. They are also caught in considerable quantities in Limfjord, around Læsö, Isefjord and the southern part of the Sound. The main season

is summer and the catch reaches its maximum in August when the season closes. The total catch varied between 400 and 500 tons.

Limfjord is the centre of an important oyster fishery. Researches have shown that a profitable and regular oyster fishery over a long period of years is not possible in the Danish climate. Consequently, since 1923, the fjord has been stocked annually with about 2 million oysters bought in the Netherlands, and these become marketable after about two years in the fjord. The transplanting of the young oysters is carried out chiefly in Nissum Bredning where conditions are most suitable. The oysters lie in depths of 5–8 m. (16–26 ft.), since the winter freezing and the strong growth of eel grass hinders their development in shallower waters. The fishing season begins on 1 September and closes on 15 May. The oysters, after being landed, are sent to Örodde near Nyköbing (Mors), where they are cleaned and sorted in large concrete tanks. Some small, scattered, oyster beds are also found in the shallow seas off south-west Jylland on the eastern sides of Fanö and Romö. The total catches were about 130,000 oysters in 1935–6, 400,000 in 1936–7, 300,000 in 1937–8 and 800,000 in 1938–9.

Mussels are widespread in the Danish fjords, but it is only in Limfjord and Isefjord that they are of economic importance. In Vejle and Aabenraa fjords mussels are reared, over 3 or 4 years, on branches of alder and beech set in the bottom in 4–6 m. (13–20 ft.) of water. The total catch was between 2,000 and 2,500 tons a year.

THE FISHING FLEET

The sea-going fishing fleet, which includes no steam-driven vessels, consists of two main types of vessel, one ranging between 15 and 25 tons and the other ranging between 25 and 45 tons. The larger type of boat has increased markedly in number since 1920 and is used mainly for seine-net fishing in the central and western North Sea. The newer cutters have wells which usually occupy half the length of the boat and the larger boats have a deckhouse. The standard measurements of the cutters with wells have the following range: length 8.8–18 m. (29–59 ft.), width 3.45–5.15 m. (11–17 ft.), depth 1.6–2.7 m. (5¼–9 ft.), horse-power 20–90, speed 6½–8 knots. Cutters without wells may range between 20 and 75 tons and have the following measurements: length 13.5–23 m. (44–75 ft.), width 4.4–6 m. (14½–19½ ft.), depth 2.1–3.1 m. (6¾–10 ft.), horse-power 40–120, speed 7–8½ knots. A 40-ton boat can carry about 6 tons of ice.

The smaller vessels are more varied in type. A common type, especially for otter-trawling in the Belts Sea, is a vessel of about 10 tons and 10-15 horse-power, with the following measurements: length 9 m. ($29\frac{1}{2}$ ft.), breadth 3.3 m. ($10\frac{3}{4}$ ft.), depth 1.5 m. (5 ft.). (See Plate 47.)

Sailing vessels, without motors, are still used locally for net and line fishing. In the Little Belt a 18-20 ft. boat with two smack-sails is common; in the waters south of Fyn a shallow wherry is wide-spread, while along the Kattegat coast the open wherry is a common type.

Number and Value of Fishing Vessels in Different Areas, 1938

	100-55 tons	55-15 tons	15-5 tons		Under 5 tons		Rowing boats etc.	Millions of kroner	
	With motors	With motors	With motors	With sail	With motors	With sail		Value of boats	Value of gear
North Sea	4	398	129	—	131	80	140	12.7	17.8
Skagerrak	—	27	48	—	82	3	88	1.1	
Kattegat	1	367	649	1	591	106	1,372	13.5	
The Sound	—	1	102	—	136	40	237	0.6	
Belts Sea	—	38	851	6	1,221	588	3,556	5.7	
Baltic Sea									
(west part)	—	7	135	1	120	65	371	0.8	
Baltic Sea									
(east part)	—	8	196	2	312	121	790	1.7	
Limfjord	—	—	26	—	608	135	819	1.2	
Ringkøbing and Nissum Fjords	—	8	82	—	140	47	450	0.6	
Total	5	854	2,218	10	3,341	1,185	7,823	37.9	

Source: *Fiskeriberetning*, 1938, p. 37 (Köbenhavn, 1939).

Few vessels are owned by companies and manned by paid crews. Usually the fishermen work independently or in small groups of two to five men who own the boats and fishing gear. The state grants loans at low interest to individuals and small groups for the purchase of boats and gear. The state also supports various navigation schools and signal stations and makes grants towards research on fisheries. Men in charge of sea-going fishing vessels must have passed an elementary examination in navigation. These examinations and the courses which prepare for them are held at the navigation schools.

Most fishermen are members of local associations of which there are some 200. These local associations are, in turn, affiliated to two main bodies, the Danish Fishermen's Association with headquarters



Plate 46. Motor cutters on the west coast of Jylland (Jutland)

The photograph shows two types of cutter used for fishing with seine-nets. Those in the background are deep sea ketches.



Plate 47. Clinker-built half-deck motor boat

This type of boat is widely used, in the waters within the Skaw, for line fishing and net tending. This boat is 6 tons gross and is fitted with a 6 h.p. motor.



Plate 48. Fish-curing in Bornholm
The herrings are smoked over open wood fires.

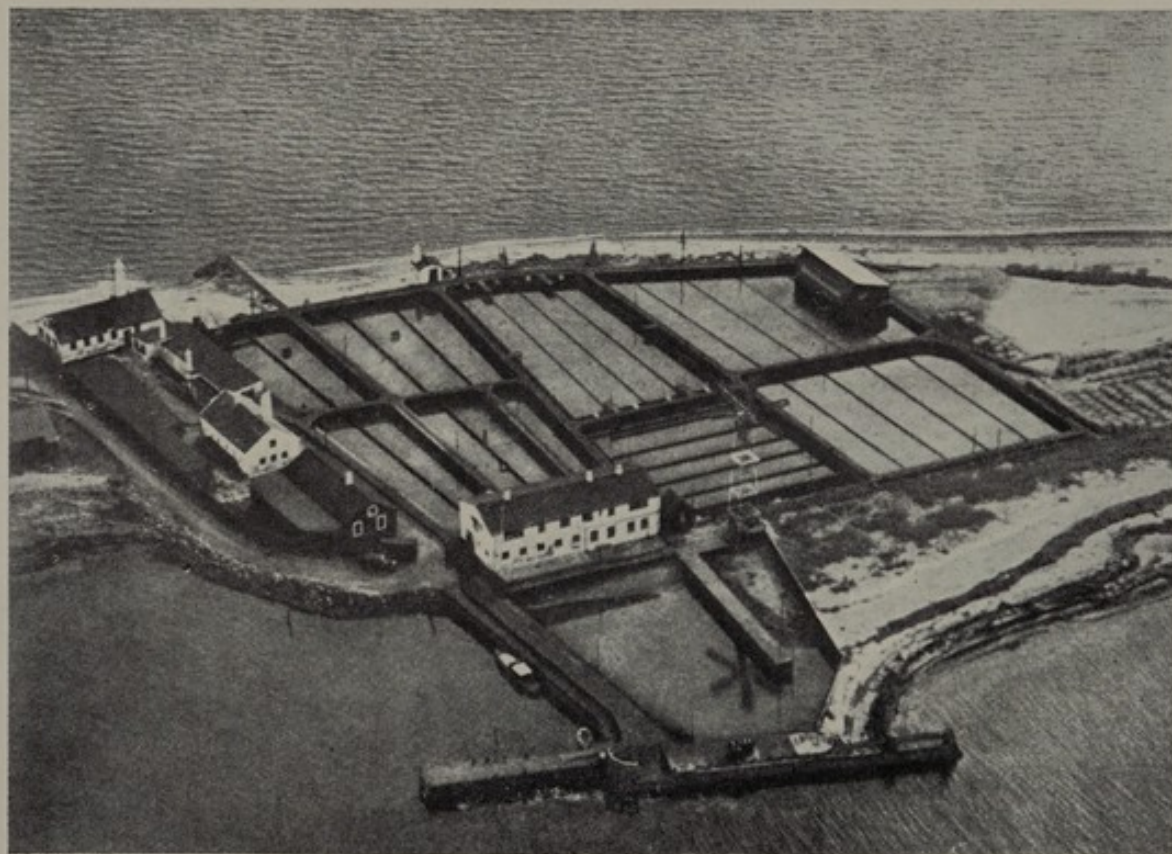


Plate 49. Oyster-tanks at Örodde, near Nyköping (Mors)

in Köbenhavn and the West Jylland Fishermen's Association with headquarters at Esbjerg.

In several places the fishermen have formed co-operative fish-marketing associations and also purchasing societies for buying gear. There are also credit societies and various mutual aid societies for the voluntary insurance of boats, but all persons engaged in sea-fishing must be members of the Insurance Association of Danish Fishermen and Sailors which is also supported from public funds.

ADMINISTRATION OF FISHERIES

The administration of fresh-water and sea-water fisheries rests with *Fiskeridirektoratet*, which is controlled by a director of fisheries under *Ministeriet for Landbrug og Fiskeri*. The directorate also supervises the fishery control which is a separate fisheries policing department and has the same authority as the civil police. *Den danske biologiske Station* and the *Kommissionen for Danmarks Fiskeri og Havundersøgelser* carry out fisheries research, much of which, such as that on eels and plaice, has been of outstanding importance.

Köbenhavn is the headquarters of the *Conseil Permanent International pour l'Exploration de la Mer*.

IMPORT AND EXPORT OF FISH

The total export of fresh fish in 1937 totalled some 55,000 tons, out of a total catch of 88,000 tons, and was valued at 33 million kroner. The bulk of the export, which consisted mainly of flat fish, mostly plaice (22,000 tons), cod and haddock (11,000 tons), eels (4,000 tons), and herring (13,000 tons), went to Britain and Germany, each country taking 21,000 tons, but whereas the export to Germany was valued at 10 million kroner, that to Britain realized 15½ million kroner. Five thousand tons were exported to Sweden and some 2,000 tons each to Norway and Belgium; other exports were small. Exports of smoked, salted and dried fish, chiefly herring and eels, totalled 444 tons and went mainly to Sweden and Germany. Exports of canned fish totalled 306 tons and of shellfish 38 tons, valued at 245,000 and 161,000 kroner respectively, and were widely distributed.

Imports of fresh fish totalled some 16,000 tons valued at 4.3 million kroner; all but a thousand tons were bought from Sweden. Other imports were 6,500 tons of spiced and salt herring from various countries, 4,000 tons of salt cod and clip-fish, mainly from Greenland and Iceland, and 500 tons of canned fish, mostly sardines from Portugal and brisling from Norway.

Chapter XIII

INDUSTRIES

General Features: Summary of Industrial Production (by value): Food Industries: Agricultural Equipment: Vegetable Oils: Shipbuilding: Marine Engineering: General Engineering: Iron and Steel Works: Textiles: Leather: Rubber: Chemical Industries: Cement: Bricks and Tiles

Fuel and Power: Peat; Lignite; Coal Imports; Electricity; Gas Works; Petroleum Products

GENERAL FEATURES

Danish industries are predominantly of the soil and of the sea. The country possesses none of the basic raw material necessary for large-scale mechanical industries which are so dependent upon iron and steel as materials and coal, oil and water as sources of power. The young sedimentary rocks which underlie the country are without minerals, except for some lignite deposits and the limestone which supplies a cement-making industry. The low relief of the country offers no long, steep slopes, great water-collecting grounds, or glaciers to provide sources of water power, and while there are numerous streams the head of water is inadequate for the development of hydro-electricity on a large scale. In Denmark the economic revolution of the nineteenth century was primarily concerned with agricultural improvements and did not involve widespread industrial development. Industry was a slow growth which followed on the reorganization of agricultural economy after about 1870. It developed in response to the need for mechanical equipment to produce, prepare and transport farming commodities, as agriculture became organized for intensive output and production for sale and export. A prosperous agriculture increased incomes which in turn created a home market for industrial products and led to the establishment of many industries which cater mainly for domestic needs. Before the coming of scientific farming, the indifferent soils and climate of Denmark and the insecurity and inadequacy of harvests made sea-faring, whether for plunder, conquest and emigration as in Viking times, or for fishing and trade, a necessary supplement to agriculture. In modern times a considerable merchant navy is needed to transport agricultural goods to world markets and to bring into the country raw materials such as fodder crops and chemical fertilizers for agriculture, and metals,

coal and oil for the machinery and power which are necessary for dealing with, and carrying, the produce of the soil.

Since Denmark has to buy her industrial raw materials on the world market and sell her manufactured goods abroad in competition with industrial countries more richly endowed with mineral wealth, Danish manufactures represent investments of skill and organization. She cannot hope to become a mass producer, and so her goods rely on quality, rather than on price and quantity, for competitive power. High quality has won her wide, if not large, markets, and her wares have earned renown which is often out of proportion to the scale of the industry and of the manufacturing concerns which supply them. Danish industry is organized mainly in small limited liability companies and private firms, except for co-operative concerns which are chiefly agricultural in character. According to the industrial census of 1935 there were 2,752 limited liability companies with a total personnel of 125,981; co-operative industrial enterprises numbered 2,566 and employed 17,816 people; 3,498 private companies employed 40,556 people, while 92,804 concerns were owned by individuals and employed 256,306 people. State and public enterprises made up a total of 102,296 industrial concerns with a total personnel of 459,775 of which two-thirds are workmen. Only 380 establishments employed more than a hundred workers and 1,869 concerns employed between 20 and 100 workers; over 42,000 establishments had less than six workers each.

The absence of raw material and power resources at home has also meant that Denmark has no large industrial regions based on coal-fields as in Britain, or on lowlands adjacent to high mountains as in northern Italy. Her industries are dispersed and are mainly in the ports, since there is no advantage, but only greater expense, in carrying imported raw materials any farther, and the ports facilitate distribution throughout the archipelago and to foreign countries. Coal is usually as cheap in Danish ports as in the south of England, and freight rates from overseas are lower than railway rates from Hamburg or Bremen to a town in central Germany. Some industries have arisen in rural centres to supply local needs. Köbenhavn, as the capital and chief port, has concerns representing almost every industry in the country. It is the chief marketing centre and has the usual metropolitan industries of luxury goods which depend so much on status and fashion. In Denmark, therefore, it is necessary to speak of individual concerns, since a few of these sometimes comprise the bulk of a particular industry.

The industries of Denmark can be divided into five groups:

(i) Food-processing industries, which prepare and pack agricultural products; (ii) industries which provide agricultural equipment, including the preparation of feeding cake as well as machinery for tillage, dairying, food-processing and packing; (iii) transport industries, especially shipbuilding and marine engineering; (iv) a number of small industries which supply the national need for textiles, rubber, luxury articles, and electric equipment; and (v) a small group of industries of which cement manufacture is the most important, and which depend on raw materials produced in Denmark.

SUMMARY OF INDUSTRIAL PRODUCTION (BY VALUE)

The total value of industrial production in recent years has been about 3,000 million kroner, of which the food industries account for about 40%. In comparison the entire group of metal industries accounted for 20-23%; textile industries accounted for 6-7%, and the stone, clay and glass group, the leather industries and the timber industries each provided about 3% of the total value. The value of production in some individual industries in the years immediately before the outbreak of war was (in million kroner)

	1938	1937	1936
Iron and steel ships	95.6	66.5	53.4
Ship repairing	31.2	31.9	21.8
Machinery for ships	38.8	29.6	23.6
Iron goods	34.1	35.6	32.6
Machinery and foundry goods	178.4	172.1	128.4
Electrical goods	69.5	63.4	77.0
Tin-plate goods	29.6	29.2	28.3
Cotton goods	62.6	66.5	68.6
Woollen goods	40.0	44.9	45.8
Knitwear	58.7	54.6	57.3
Clothing	196.1	187.2	179.5
Shoes	41.9	38.6	39.1
Cement	16.8	14.4	15.0
Bricks, tiles, etc.	23.7	23.3	26.2
Rubber manufactures	22.4	23.2	22.5
Vegetable oils	57.5	90.6	76.5
Oil-cakes and feeding stuffs	57.4	74.4	58.3
Margarine	66.6	72.7	67.9
Mineral fertilizers	17.9	19.2	18.7

Source: *Statistisk Aarbog*, 1939, pp. 60-5 (Köbenhavn, 1939).

It will be seen from Fig. 68 that industrial production in Denmark has increased steadily since the nadir of the world depression in 1932. Since 1935 the textile and stone, clay and glass groups have declined

slightly, and the only group to show marked expansion has been the metal industries.

Comparison of index numbers of industrial production for different countries is difficult because methods of computation are diverse. The trend of production in Denmark has been broadly similar to that in other west European countries, but Denmark suffered less from the depression and recovered more rapidly. Since 1932 the number

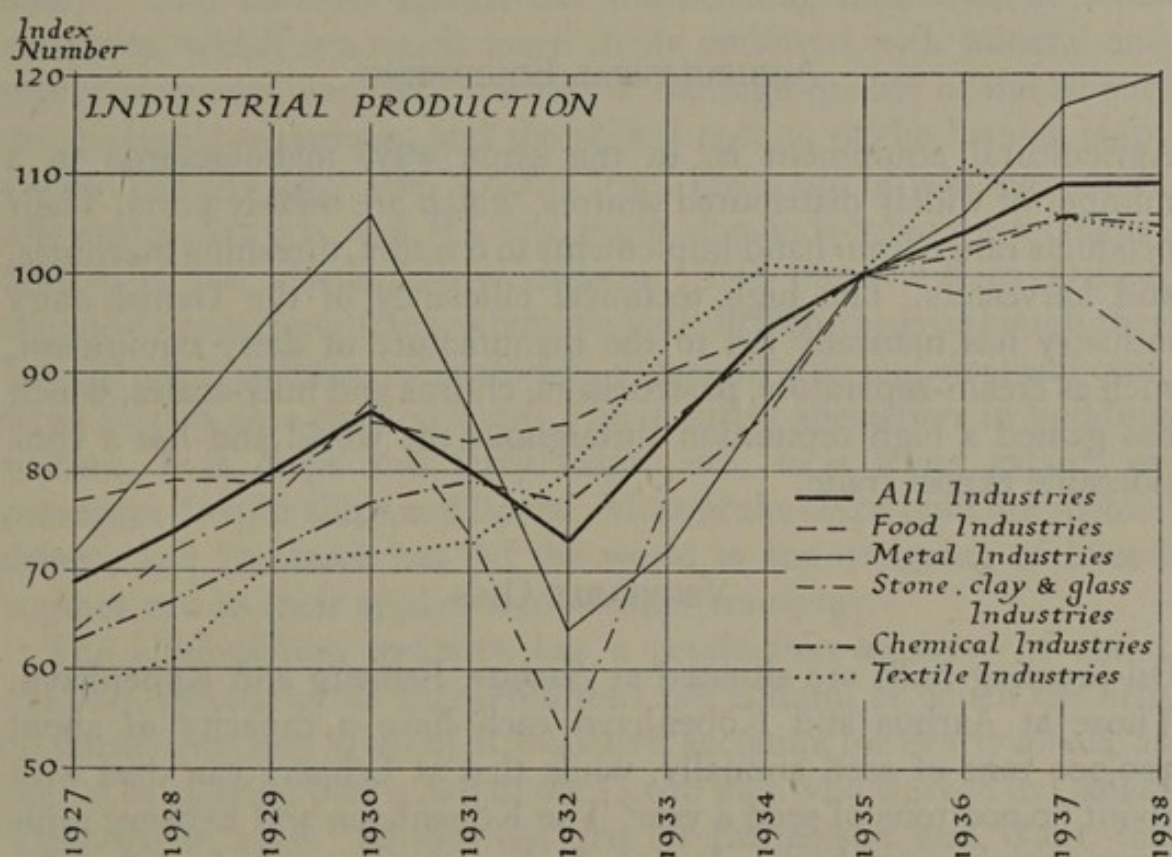


Fig. 68. The trend of industrial production in Denmark, 1927-38, by index numbers (1935 = 100)

Based on figures in *Statistisk Aarbog*, 1928-39 (Köbenhavn, 1928-39).

The index numbers are calculated on the basis of the output and activity of the manufacturing industries in different years, using the year 1935 as the base.

of employees in industry and the total number of hours worked have increased steadily and unemployment declined until 1937, when a slight increase set in and was maintained in 1938 (see Fig. 32).

FOOD INDUSTRIES

The food industries have already been dealt with in the chapter on agriculture. They employ nearly one-fifth of the industrial population, but this proportion does not include the primary producers. The

manufacturing centres, namely, the dairies, bacon factories, abattoirs and packing centres are widely distributed but tend to form larger units, and to be more diverse in type, at the ports and the market towns which form collecting centres for the surrounding countryside. This is specially true of canning and other industries which depend upon imported raw materials. Nine sugar factories and two refineries employ some 2,400 workers and produce 233,000 tons of sugar a year.

AGRICULTURAL EQUIPMENT

Agricultural equipment is, in the same way, manufactured in a number of widely distributed centres, which are mainly ports. Their products range from hand implements to tractors, threshing machines, and harvesters. The high technical efficiency of the Danish dairy industry has naturally led to the manufacture of dairy equipment, such as cream-separators, pasteurizers, churns and milk-scales, which has gained a high reputation throughout the world and has a considerable export trade.

VEGETABLE OILS

Oil-pressing mills are situated at Aarhus, Esbjerg and København. Those at Aarhus and København each have a capacity of about 300,000 tons of seed annually, while that at Esbjerg can deal with about 60,000 tons of seed a year. The København and Esbjerg mills press mainly soya beans, but at Aarhus copra, ground nuts, palm kernels and *Sesamum* seeds are also worked. A mill at Sønderborg had given up crushing but was still refining vegetable oils in 1938. The annual output of vegetable oils in recent years has been between 120,000 and 140,000 tons, for which Denmark imports between 350,000 and 450,000 tons of oil-bearing seeds, nuts and beans, and about 40,000 tons of vegetable oil annually. Apart from a small soap industry and the manufacture of edible oils, the bulk of the oil is used by the margarine factories. The pulp which remains after extraction of the oil is used in the manufacture of cattle-feeding cake and meal, the annual production of which is between 250,000 and 300,000 tons. In 1938 there were 111 margarine factories which employed a total of about 1,100 workers. The largest concerns are the co-operative factory at Aarhus, the factories of Otto Mönsted, Ltd., at Aarhus and København, and the Unilever factories at Sønderborg, Korsør and

Vejen. These large factories produce about 70 % of the total margarine output of the country, which in recent years has been between 70,000 and 80,000 tons a year.

SHIPBUILDING

Shipbuilding is one of Denmark's leading industries. It has been able to hold its own against the shipbuilding industries of other countries, which are much more richly endowed with mineral and power resources, probably because of the high quality of the labour, the perfected technique, and the skilled costing of the Danish shipyards. The industry also benefits from low costs of administration, low rental charges, and the low profit demands which are characteristic of the shipbuilding concerns. For these reasons Danish shipyards have been able to compete with British yards although they bought much of their raw materials, especially iron and steel and coal, from Britain on a sterling basis. The industry specializes in building tankers, fruit ships and ferry ships, and, to a lesser extent, on passenger-freight ships and liners. Most of the ships built are motor-driven, and Denmark has led the world in the designing of Diesel engines and in their application to water transport.

The shipbuilding industry has a production capacity of about 250,000–300,000 gross registered tons per annum, of which the firm of Burmeister and Wain of Köbenhavn accounts for nearly a half, as well as employing over a half of the 14,000 men who worked in Danish shipyards in 1938. Besides the firm of Burmeister and Wain, the chief yards are at Nakskov, Odense and Helsingör, but there are smaller yards at Aalborg, Aarhus, Frederikssund, Frederikshavn, Marstal and Svendborg, as well as the Royal Naval Dockyard in Köbenhavn which constructs naval vessels. Some of these yards are small concerns, but they all build steel ships. There are several other yards which construct only wooden ships and boats; some of these are mentioned in Chapter XVII.

In 1938, Denmark launched thirty-eight ships with a total gross tonnage of 165,000 and 260,000 h.p. This tonnage showed an increase of 37,000 gross tons on that of 1937 and was a peak figure. Nearly all of the 1938 output consisted of motor vessels.

The firm of Burmeister and Wain (*A/S Burmeister & Wain's Maskin- og Skibsbyggeri*) started in 1843 as a small machine-shop owned by Hans Baumgarten. Three years later a young engineer, Carl Burmeister, became his partner, and the firm began to build

steam engines for marine use; by 1861 the number of employees had increased from sixty to about 500. About this time Baumgarten retired and an Englishman, William Wain, entered the firm. In 1872 the private company became a joint-stock company, and during the early seventies it prospered in shipbuilding and in constructing stationary steam engines. In 1898 the firm bought the patent rights of Rudolf Diesel's invention. Six years later the first stationary Diesel engine was supplied to a rural power station in Denmark. The firm now specialized in Diesel engines which obviously held much promise for a country without coal or much water power. The achievement of Burmeister and Wain has been to adapt what had been designed as a stationary engine to marine propulsion. They built the first ocean-going motor ship, the *Selandia*, a vessel of 4,950 gross tons, which did her maiden voyage from Köbenhavn to Bangkok and back in 1912 (22 February–26 June) at a speed of 11 knots and with a fuel consumption of 9 tons in 24 hr. After the success of the *Selandia* the firm became the leading builder of marine Diesel engines. In 1930 it built its first double-acting, two-cycle, marine motor which was installed in the *Amerika*. Nearly half of the world's motor vessels of over 2,000 tons are equipped with Burmeister and Wain motors built by this firm or by those which hold licences for their manufacture.

The firm is established in Köbenhavn where it owns a shipyard at Refshaleöen, a Diesel-engine works in Christianshavn, an iron foundry in Strandgade, and foundries and steel works at Teglholmen. The shipyard at Refshaleöen has six building slips and can build vessels up to 160 m. (530 ft.) long. It builds mainly cargo and passenger motor vessels, but also refrigerator ships and tankers. The output of the yards is up to six ships, each of 15,000 tons and of ordinary construction, every year. The largest vessel built here was one of 10,568 gross registered tons. Burmeister and Wain also own the Köbenhavn Floating Dock and Shipyard (*Köbenhavns Flydedok og Skibsværft*) in Strandgade, which had six berths to take ships up to 350 ft. long. This would represent a building capacity of about 48,000 tons, but the yard has been closed since 1933. This yard has, in addition, a small dry dock capable of taking ships up to 6,000–7,000 tons, as well as the necessary fitting-out quays.

The launching output of *A/S Burmeister and Wain* in 1938 was four cargo ships of 1,068–8,400 gross tons, two cargo-passenger ships each of 6,672 gross tons, two fruit ships each of 3,259 gross tons, and one tanker of 5,480 gross tons, representing in all a gross tonnage of 48,260.

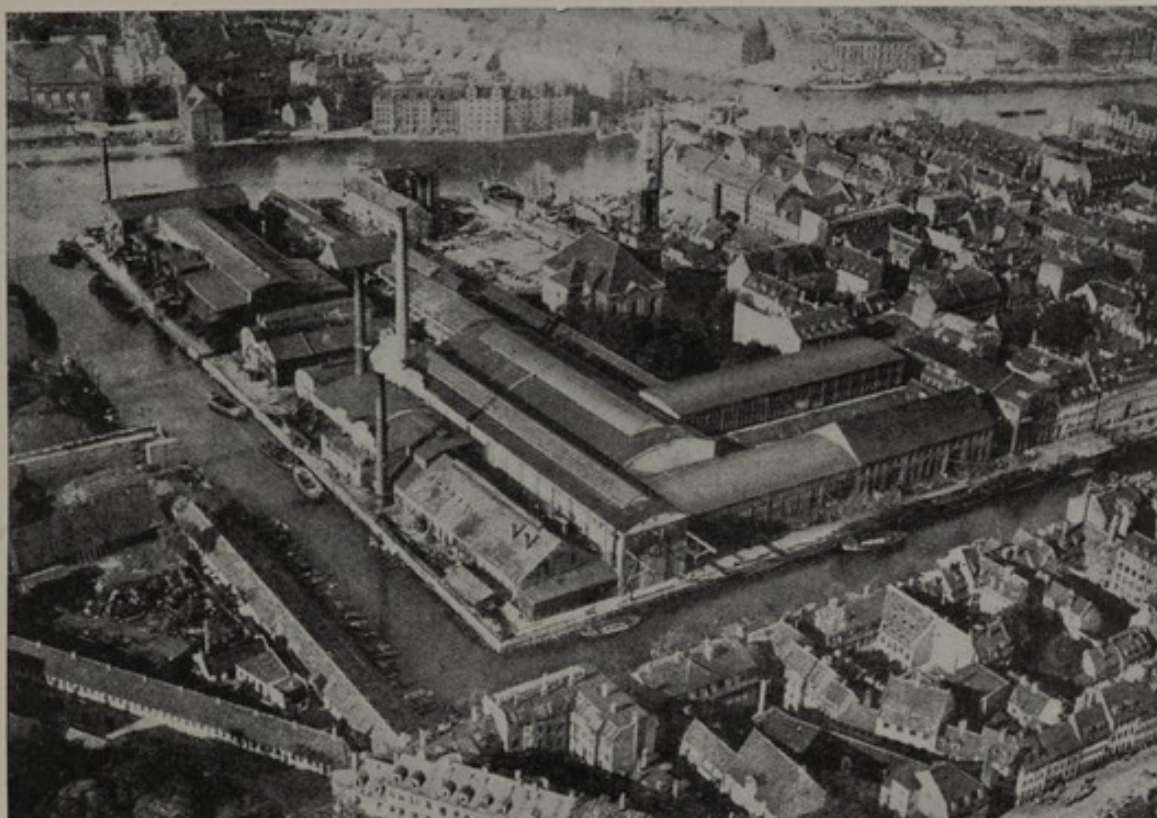


Plate 50. Burmeister and Wain's engine works in Christianshavn, Köbenhavn

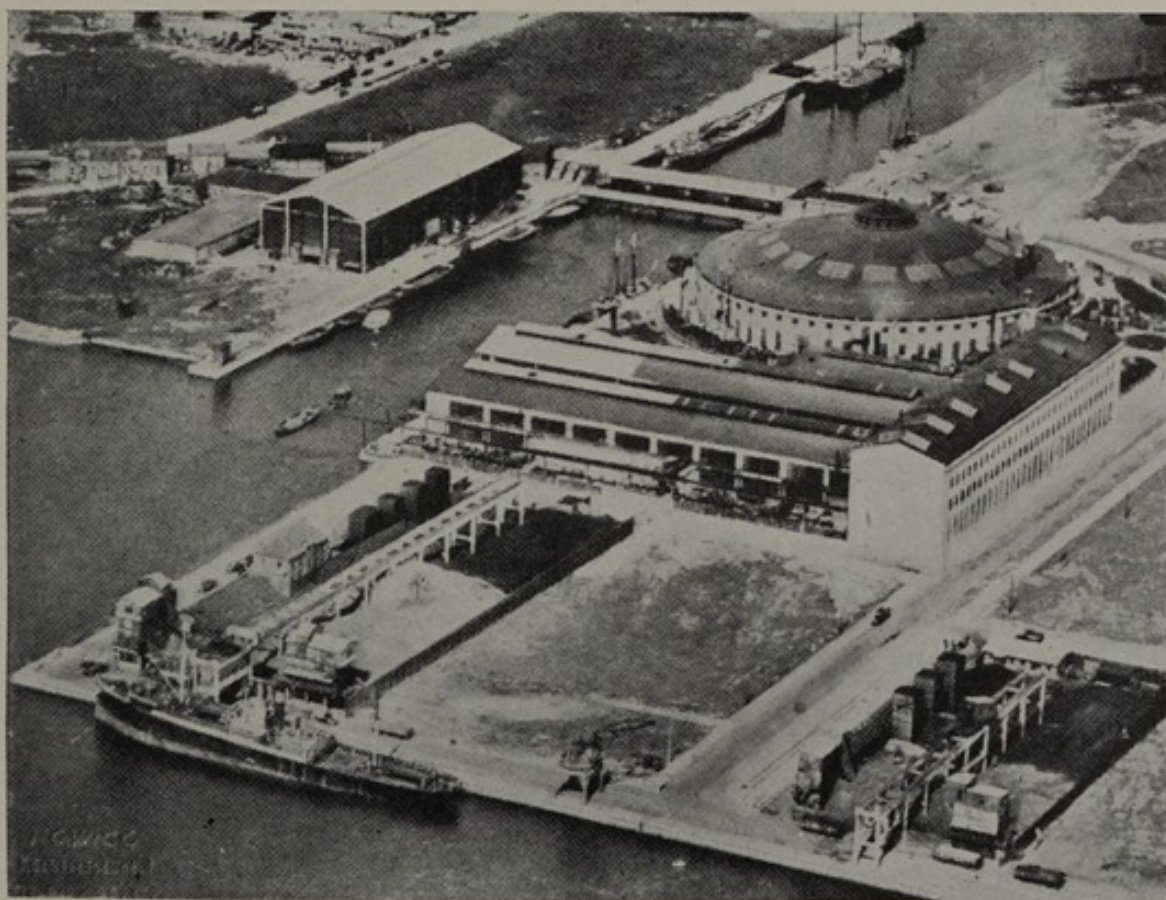


Plate 51. Burmeister and Wain's foundry and steel-works on Teglholmen

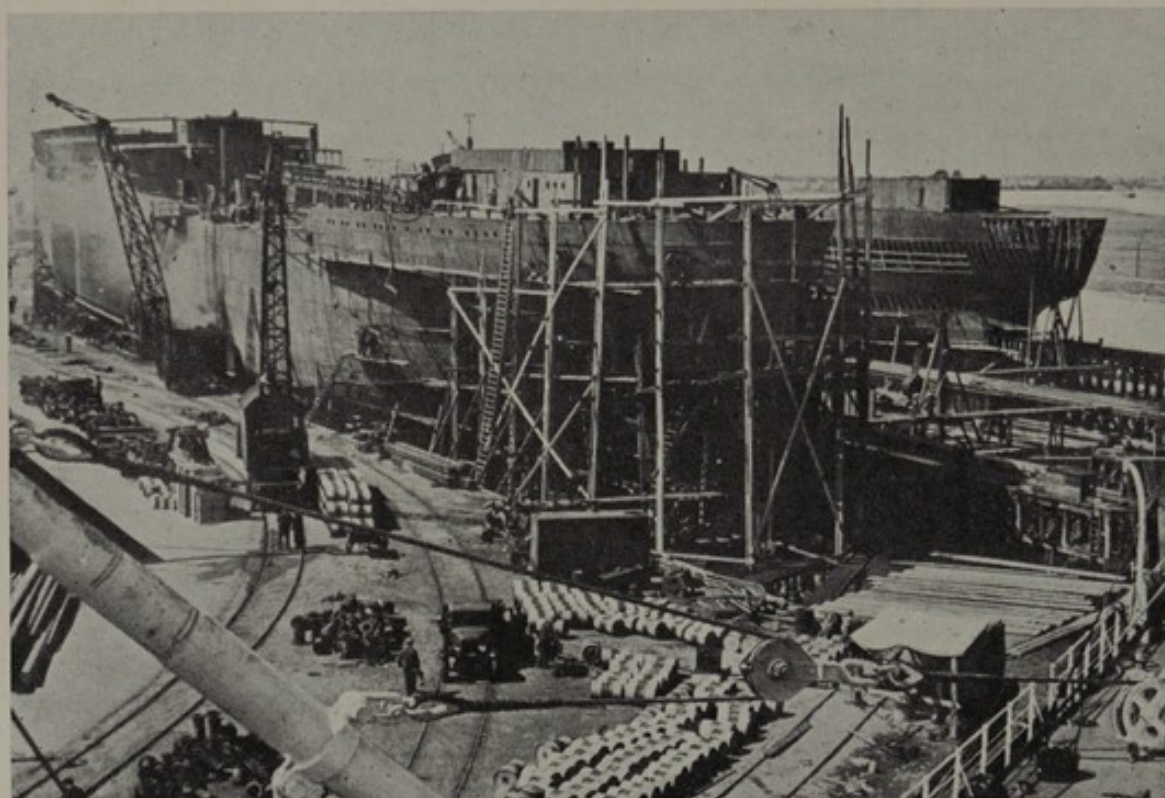


Plate 52. The building slips at the Odense shipyard
The location of the yard in relation to the port and canal is shown in Plate 78.



Plate 53. The shipbuilding yard and engineering works at Helsingör (Elsinore)
The view is taken looking north from the entrance to the harbour. On the right are the two building slips. To the left of these is a ship on the patent slip, another is in the dry dock, and a third is moored alongside the east quay of Vestre Havn (cf. plan facing p. 436). A part of the fishing and yacht harbour (Helsingör Nordhavn), which lies north of Kronborg point, can be seen in the background.

The Royal Naval Dockyard at København has three building slips of 150 m. (500 ft.) which are used for building small coastal and inspection ships. This dockyard, which is the only warship-building concern in Denmark, has built almost the whole of the Danish navy including a cruiser of 3,800 tons. It can build submarines of up to about 500 tons and employs about a thousand men.

Launching output, 1938: one minelayer of 270 gross tons.

The Odense shipbuilding yard (*Odense Staalskibsværft*) has three building slips ranging between 145 and 150 m. (480 and 500 ft.) in length and can construct ships up to 18,000 d.w. tons, but the largest ship built here was of 9,425 gross tons. Its annual output capacity is about 65,000 tons, but it has no engine works and obtains machinery from Burmeister and Wain. The yard specializes in building tankers.

Launching output, 1938: six tankers, one cargo ship and one passenger ship totalling 63,724 gross tons.

The Nakskov shipbuilding yard (*Nakskov Skibsværft A/S*) is owned by the East Asiatic Co., and has four building slips up to 160 m. (525 ft.) long. Its output capacity is about 35,000–40,000 tons a year. The largest vessel built at these yards was of 11,108 gross tons. These yards, like those of Odense, are supplied with engines by Burmeister and Wain.

Launching output, 1938: four ships with a total gross tonnage of 27,951.

The Helsingör Shipbuilding and Engineering Co. (*A/S Helsingørs Jernskibs- og Maskinbyggeri*) possesses two building slips which will take ships up to 130 m. (430 ft.) long. The maximum annual output of this shipyard is about 25,000 gross tons, while the largest ship built here was of 6,214 gross tons. The company specializes in building ships of about 105 m. (350 ft.) in length.

Launching output, 1938: seven cargo and fruit ships totalling 16,635 gross tons.

At Aalborg there is a shipbuilding yard (*Aalborg Værft A/S*) with two building slips capable of taking ships up to 145 m. (480 ft.) long. The building capacity of this yard is estimated at six ships with a total tonnage of 12,000 a year. It specializes in small steamships and tankers for coastal traffic.

Launching output, 1938: two cargo ships of 1,800 and 1,000 gross tons, one tanker of 320 gross tons and one salvage tug of 334 gross tons.

The yard at Frederikshavn (*Frederikshavns Værft og Flydedok A/S*) has one building slip which will take vessels up to 105 m. (350 ft.) long; the largest ship ever built here was of 5,500 gross tons.

Launching output, 1938: two cargo ships totalling 4,200 gross tons.

At Svendborg there are two yards (*Svendborgs Skibsværft A/S*) which build small craft as also does the shipbuilding yard at Frederikssund. Esbjerg has some slips for fishing vessels but does no building, while the firm of Brodrene Nipper at Skagen is little more than a good service depot. Ship repairs can be carried out at several ports (details are given in Chapter XVII).

MARINE ENGINEERING

Marine engineering naturally goes hand in hand with shipbuilding. Burmeister and Wain of Köbenhavn is the only firm of importance. It manufactures not only all the engines for the vessels that it builds itself, but also supplies the other shipbuilding yards which may install the machinery themselves or may send vessels to the yards of the Köbenhavn firm to be fitted out. The engine works of Burmeister and Wain at Christianshavn have an annual capacity of 250,000 i.h.p., which would not only cover the needs of Denmark's total output of ships but would leave a surplus of about 50,000 h.p. for export. Another machine shop in Strandgade specializes in the production of Diesel engines up to 65 h.p. This firm has another engine works at Holeby, between Maribo and Rødby, on the island of Falster. This works specializes in the manufacture of submarine Diesel engines, and its output is estimated at 10,000 i.h.p. per annum. Another engine works, owned by the same firm, is situated at Frederikshavn and specializes in the construction of standard Diesel engines up to 1,000 h.p. for smaller craft such as trawlers, tugs and inspection boats. Its annual capacity is estimated as being at least 20,000 i.h.p.

The engine works of the Helsingör shipyard specializes in building steam ship engines, and boiler plant for land use. The works have a maximum annual capacity of 30,000 i.h.p. Other important manufacturers of marine engines are Frichs A/S of Aarhus and the Atlas Company (*Atlas Maskinfabrik A/S*) of Köbenhavn. The Atlas Company has a maximum annual capacity of 50,000 i.h.p. of marine turbines, while Frichs A/S have a maximum annual capacity of 20,000 i.h.p. Several small firms at the ports manufacture mechanical equipment such as winches, valves and gauges for ships.

The production of ship's engines in 1938 totalled some 250,000 i.h.p. in main and auxiliary Diesel engines and about 6,000 i.h.p. in steam

engines with exhaust steam turbines. The bulk of this production was installed in vessels built in Danish shipyards, but part of it was sent to foreign shipbuilding concerns.

GENERAL ENGINEERING

The chief concerns are at the ports and the important businesses are few. The firm of Frichs A/S of Aarhus manufactures Diesel railcars and locomotives, engineering plant, cranes, Diesel engines, boilers and small machinery. It makes its own type of Diesel engine as well as Burmeister and Wain's types which it manufactures under licence. In recent years the firm has started building Diesel-electric locomotives. It employs 2,000–3,000 workers and its annual output of locomotives is estimated at 20–30 main-line engines, Diesel or steam-driven. This output meets practically the whole of Denmark's demand for locomotives, and the firm has executed contracts in foreign countries. The Scandia works at Randers are the chief builders of railway carriages. The firm of Thos. Sabroe, also of Aarhus, employs about 1,100 workers and produces compressors, air-conditioning plant and refrigerating machinery for land and marine use, which arose out of its original specialization in dairy machinery. The firm of F. L. Smidth and Co., which has its works at Valby, Köbenhavn, specializes in the manufacture of cement-making machinery and in the erection of cement works. Thrige and Co. of Odense are electrical engineers and produce dynamos, motors, steering gear, winches, windlasses, etc.; they employ 2,000–3,000 workers and build large power-station plant. The Titan works at Köbenhavn is a similar concern, but it also produces dairy machinery and light agricultural machinery. The *Nordisk Kabel og Traad A/S* at Köbenhavn makes cables and wire for general purposes but chiefly for shipbuilding. It is the only concern of its kind in Denmark and employs about a thousand people. The ports and inland towns contain a total of about 100 foundries, many of which make machinery on a small scale.

A land of ports and sea channels, with a home cement industry, has inevitably developed a constructional engineering industry which specializes in harbour construction and bridge building; all the leading concerns are in Köbenhavn.

Machine tools for the engineering industry are manufactured at several centres of which Köbenhavn and Aarhus are the most important. The annual value of the output is about $2\frac{1}{4}$ million kroner, of which about two-thirds is exported. The goods manufactured

include mechanical presses, milling machinery, lathes, drilling machinery, etc.

These industries, like the other metallurgical industries of Denmark, are supplied with imported raw materials. The imports of some of these raw materials during recent years have been (in thousands of tons):

	1935	1936	1937	1938
Iron and steel (including pig iron)	408.7	493.5	489.2	386.5
Copper and copper alloys	12.9	13.0	12.6	13.0
Lead	10.8	8.0	9.8	6.7
Zinc	9.7	9.9	6.8	9.0
Aluminium	1.3	1.5	1.6	1.7

Source: *Vare-Ind-og Udførsel*, 1935-8 (Köbenhavn, 1936-9).

IRON AND STEEL WORKS

There are three steel works in Denmark. These are owned and operated by the following companies: A/S Burmeister and Wain, A/S Frichs of Aarhus and A/S Varde Staalværk. Burmeister and Wain's steel works and foundries are at Teglholmen in the south harbour at København. The steel works has two basic, oil-fired, Siemens-Martin open-hearth furnaces, one being used while the other is being relined. The maximum capacity of these furnaces is 32 tons per charge and three to four charges are taken every 24 hr. The iron foundry has three cupolas, two of which have a melting capacity of 18-20 tons an hour and the third has a capacity of 14-16 tons an hour. There is also an oil-fired refining rotatory furnace for special iron mixes. The annual output (1938) of the steelworks is about 20,000 tons, which includes various alloys such as chrome steel and chrome-molybdenum steel as well as the ordinary steel types. The output of the iron foundry in 1938 was about 18,000 tons. The forging department has three large air-hydraulic forging presses, and the annual output of steel forgings is about 4,500 tons. These works use annually about 20,000 tons of pig iron and a similar quantity of steel scrap, and they burn between 5,000 and 10,000 tons of oil. The foundry at Burmeister and Wain's disused shipyard at Strandgade was brought into use again in July 1937, and was used for making cast-iron pipes and for remelting scrap collected from the machine shops. It uses oil-fired, crucible, melting furnaces and also works brass, bronze, gun-metal, etc.

A/S Frichs of Aarhus has two Bessemer converters with a capacity of 20-30 tons each.

These two firms produce metal chiefly to meet their own requirements. The steel works at Varde, on the other hand, produce a general range of castings for sale. They have two Siemens-Martin open-hearth furnaces, each with a capacity of 20-30 tons; their production is about 4,000-5,000 tons of steel a year. This firm was the first Danish concern to undertake the production of stainless steel, which it did in 1939.

In spite of Denmark's dependence on imported metals, she exports about 80,000 tons of steel scrap a year. Denmark's annual imports of iron and steel average about 450,000 tons, but she produces about 100,000 tons of steel scrap every year. The existing steel works cannot handle more than 20,000 tons of this, and consequently the remainder is exported. The steel production of Denmark covers approximately one-third of her normal consumption.

Manufactures of other metals are of small account. The most important in quantity are electro-plated goods, the production of which averages about 150 tons a year. The output of tin-plate goods is between 8 and 12 tons, while silver goods average about 50 tons a year.

TEXTILES

The textile industries developed from a domestic industry based on local wool. The growth of the dairy and bacon industry and the development of intensive cultivation of fodder crops led to a marked decline in the number of sheep, so that the woollen industry is now small and is centred at Horsens. The industry possesses a total of about 100,000 spindles and 1,100 looms and employs about 3,000 workers in forty-six factories. The manufacture of hosiery, lingerie and ready-made clothing is carried on in several centres, especially near Aarhus.

The spinning and weaving of cotton has become relatively more important than wool, although it also is small and caters for the home market. København and Vejle have over two-thirds of all the cotton spindles in the country. Less important centres are Aalborg, Brede, Viborg and Hellebæk, where the firms are not exclusively concerned with spinning but also carry out weaving to a greater or smaller degree. Denmark has a total of approximately 4,000 cotton-weaving looms. There are about fifty weaving mills which employ a total of about

3,500 workers, and five spinning mills with a total of some 2,000 employees. The retained imports of cotton into Denmark have varied between 1,500 and 2,000 tons between 1933 and 1938. Manufacturers of cotton goods are found in a number of towns such as Aalborg, Grenaa, Hellebæk, Herning, Kolding, Odense, Vejle and Svendborg, apart from Köbenhavn which has the largest number of such firms.

The textile industry as a whole employs about 20,000 people, over half of whom are women. The cotton-spinning mills can supply only about four-fifths of the yarn requirements of the weaving mills, while the cotton- and wool-weaving mills satisfy little more than half of the domestic demand for cloth. There is practically no manufacture of artificial silk yarn, but the clothing industry is able to supply the home requirements except for luxury articles.

LEATHER

The leather industry covers 96% of domestic needs. It is supplied from some two dozen tanneries, and by far the greater part of their output is used for the manufacture of footwear, while agricultural equipment such as harness uses a considerable amount. The density of the cattle population of Denmark is such that the production of leather is much greater than the domestic need, and there is a considerable export of hides and skins, chiefly to Germany. On the basis of animal slaughterings in Denmark in 1938 the production of hides and skins would be about 8,700 tons of cattle hides, 2,400 tons of calf skins, 2,000 tons of sheep and lamb skins, and 550 tons of horse hides. The boot and shoe production during that year was about $5\frac{1}{4}$ million pairs, while some 7,700 tons of cattle hides and 3,900 tons of calf skins were exported. Denmark needs to import sheep and goat skins, since she keeps only relatively small numbers of these animals, and such imports in 1938 were about 130 tons of sheep skins and 70 tons of goat skins. The leather industry employs normally about 6,000 factory workers, of whom more than 4,000 are employed in over 100 shoe factories.

RUBBER

Rubber manufacturing has developed rapidly in Denmark during the last decade. In 1929 the consumption of crude rubber was only 800 tons, but in recent years it has grown to about 3,000 tons. In 1939 there were twenty-one factories in production, and these employed some 2,400 workers. The two chief factories are *A/S de*

Forenede Gummi- og Luftringefabriker, Schiønning og Arvé of København, which employs between 600 and 800 workers, and *A/S Dansk Galoche og Gummifabrik* at Køge, with some 1,250 employees. The former of these two companies has an important subsidiary concern (*A/S Skandinavisk Gummi-Kompagnie*) at Odense. The other concerns are mostly small. Five firms, including the factories of the Dunlop and Goodyear companies, are situated in or near København. Others are situated at Horsens (two firms), Odense, Vordingborg and Helsingør. The last-mentioned factory manufactures chiefly rubber shoes, while that at Odense makes driving and conveyor belts. The other smaller factories are concerned chiefly with supplying household needs. In 1939 the consumption of crude rubber was 2,344 tons, of synthetic rubber 54 tons, and of devulcanized (or 'scrap') rubber 772 tons. Danish factories do not fully supply the country's needs, and there is a considerable import of manufactured goods especially rubber tyres of which 2,450 tons were imported in 1938. Imports of tyres, balata belting, rubber floor coverings and rubber footwear came mainly from Britain, while ebonite products were imported chiefly from Germany.

CHEMICAL INDUSTRIES

The chemical industry of Denmark supplies over a half of the country's requirements. Of the various branches of the industries, the manufacture of soap, fertilizers, mineral dyes and pharmaceutical products are well developed, but on account of the absence of minerals and ores the production of heavy chemicals is small. Soap and allied products are manufactured in thirty-nine small concerns which employed 780 people in 1938.

The manufacture of chemical fertilizers is concerned chiefly with the production of superphosphates which is in the hands of the *Dansk Svovlsyre og Superphosphat Fabrik A/S* which has four factories, at Nørre-Sundby, Fredericia, Kalundborg and Kastrup, and headquarters in København. The industry used chiefly phosphates from Morocco and has an annual capacity of about 400,000 tons. The annual production of superphosphates was about 350,000 tons and approximated to consumption.

The most important of the heavy chemicals produced in Denmark is sulphuric acid which is made in five plants, employing 628 workers in 1938, and owned by the superphosphate company mentioned above. The output is about 200,000 tons a year. There is no pro-

duction of mineral acids of importance and, of the organic acids, acetic acid is the only one which is produced in any quantity, but even this is inadequate for home needs. The manufacture of soda crystals and bleaching soda is carried out in fourteen plants and production is sufficient to leave a supply for export. The larger works are under the control of *A/S Danske Oliemøller og Sæbefabrik*. In 1938 the production of soda crystals was 19,380 tons. Seventeen concerns produce compressed gases, mainly oxygen, hydrogen, ammonia, acetylene and liquid carbonic acid, for home needs. Forty concerns, employing a total of 650 workers, manufacture dyes and varnishes.

Denmark owns the cryolite mine at Ivigtut in Greenland which is the only important one in the world, although there are small deposits at Pikes Peak in Colorado, and at Miask in the Urals. The mining concession is held by a Köbenhavn firm which divides the raw material between a firm in Philadelphia, holding the monopoly for the United States, and a Danish firm, the *Öresunds Kemiske Fabriker*. This firm, which is established at Köbenhavn, refines cryolite ($3\text{NaF} \cdot \text{AlF}_3$) which is used as a flux in the smelting of aluminium and is also used in the manufacture of opaque glass, enamel and ceramics.

Spirits are distilled by *De danske Spritfabrikker* which absorbed all other concerns after the war of 1914-18. The output in 1938 was 95,800 hl., calculated at 100% strength, as compared with 103,700 hl. in 1937, and about 94,000 hl. in 1936. Distilling of spirits and the making of yeast are now concentrated in two factories, at Aalborg and Randers, but the company possesses a reserve distillery and yeast factory at Hobro. The factories use mainly potatoes and molasses as raw materials; the amounts used in recent years have been about 30,000 tons of potatoes and 20,000 tons of molasses a year. About 90% of the total output consists of technical spirits and yeast, because, since the tax on spirits in Denmark is the second highest in the world and is surpassed by only that of Britain, the amount of drinking spirits consumed is small, although in 1916, before the high taxes were imposed, 68% of the output was spirits for drinking.

The preparation of pharmaceutical products has arisen out of the slaughtering industry. They are made by forty-five different firms which employ a total of 880 workers. Insulin is by far the most important product; 90% of Denmark's total output of this commodity is exported. Other important products of the industry are liver extracts, preparations made from stomach linings, sex hormones, pepsin, ascorbic acid and iron and vitamin preparations.

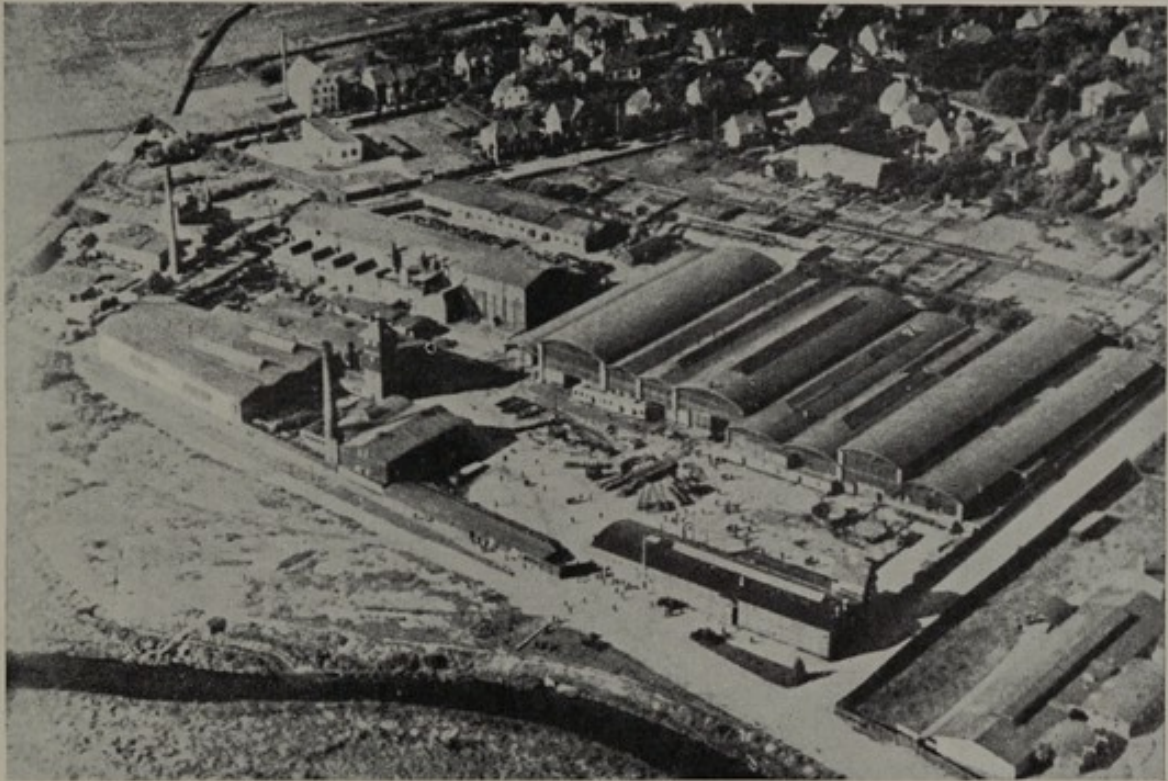


Plate 54. The Frichs engineering works at Aarhus

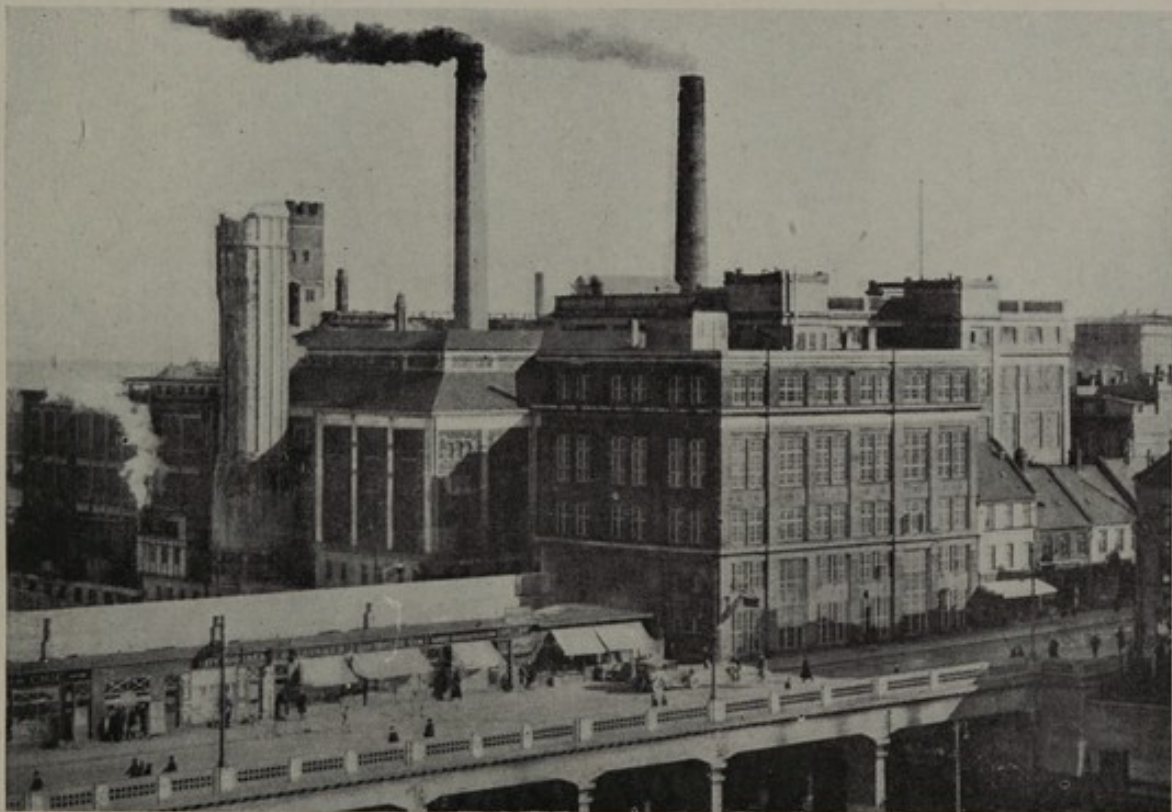


Plate 55. The oil mills at Aarhus

The photograph shows the mills in the town. The same firm owns another works in the port area (see plan facing p. 375).



Plate 56. Limestone quarry in north-east Jylland (Jutland)
The limestone is used, with clay, in the manufacture of cement.

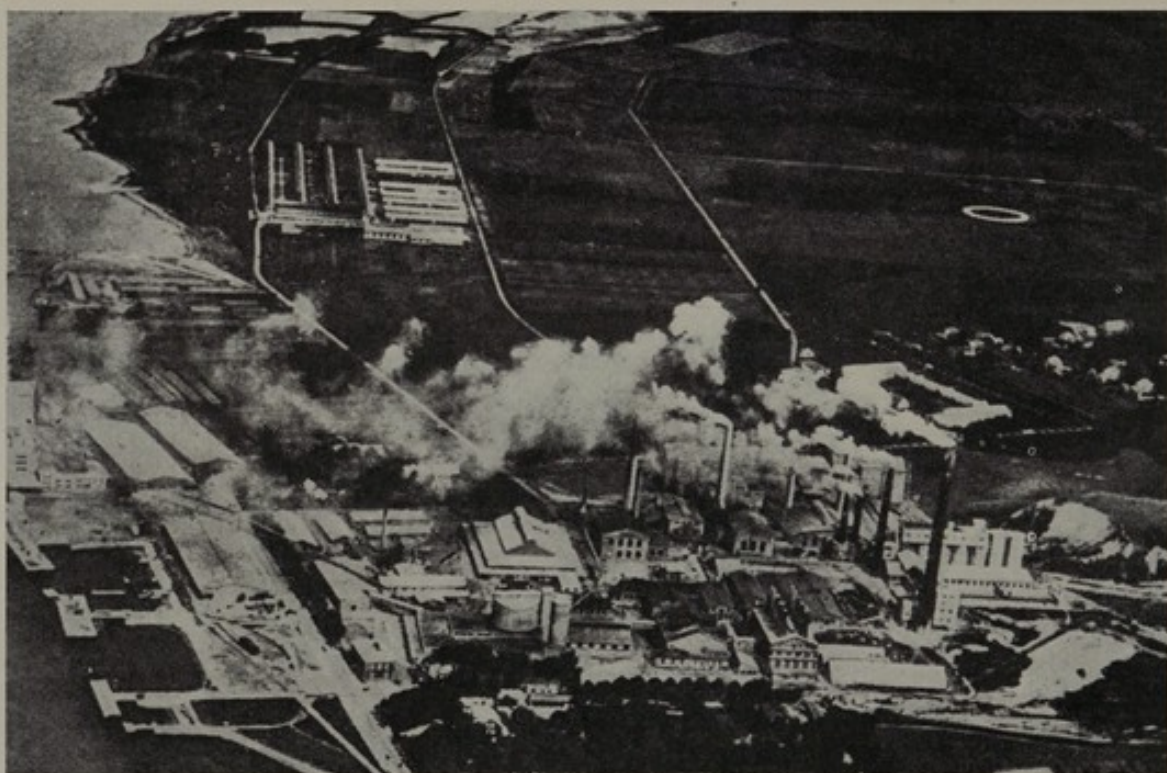


Plate 57. The Rørdal cement works at Aalborg
The location of the works in relation to the port is shown on the plan facing p. 374. In the background is part of the Aalborg airfield.

CEMENT

The cement and clay-processing industries employ about 10,000 workers. They are the only manufactures, other than food industries, which derive their raw materials from within the country. The cement industry, which employs about 1,500 workers, is centred at Aalborg and near Mariager Fjord, where the limestone and chalk lie immediately underneath the clayey glacial deposits. The works at Aalborg use white chalk and late glacial Yoldia clay, although one concern uses washed-out moraine clay. The works along Mariager Fjord use white chalk and dark grey, Tertiary clay. The addition of pulverized Mo clay to Portland cement produces a cement which is better suited to submarine constructions than is ordinary Portland cement on account of the high proportion of free silica in the Mo clay. The process of rationalization has been carried so far that production is now in the hands of two companies. In 1937, five companies were incorporated under the name of *Aalborg Portland Cementfabrik A/S*, which has three works at Aalborg, one at Nørre-Sundby, and three works near Hadsund on Mariager Fjord. This company has an output of 820,000–870,000 tons of artificial Portland cement a year. The other company is the *Dansk Andels Cementfabrik* with works at Lindholm to the west of Nørre-Sundby. These works have an annual output of about 135,000 tons of artificial Portland cement. It will be seen therefore that the main part of the cement industry is centred at Aalborg where most of the works are situated on the water front of Limfjord and have their own wharves where vessels up to 10,000 tons can load direct.

The production capacity of the Danish cement industry as a whole is estimated at between 925,000 and 1,000,000 tons a year, but during the 10 years before 1938 the actual production was highest, at 799,456 tons, in 1929. Production declined to 414,746 tons in 1932 but rose to 792,369 tons in 1936. In 1938 the output was 640,000 tons. The annual consumption of cement in Denmark has recently fluctuated between about 420,000 and 460,000 tons, so that there has been a surplus varying between about 220,000 and 330,000 tons, for export. Of these exports the Irish Free State takes usually about one-third.

BRICKS AND TILES

The widespread occurrence of clays in Denmark has lent itself to the establishment of brickworks in many localities. Diluvial clay, late-glacial fresh-water clay and Yoldia clay are the raw materials most often used, and the large deposits of late-glacial fresh-water clay at Stenstrup in Fyn are specially important. Near large towns, moraine clay is often used, but the preliminary treatment which is necessary for such clays increases the cost of production. In Jylland, Oligocene and Miocene clays are often used, in spite of the fact that they contain pyrites and gypsum which sometimes have to be removed by washing. Bricks are also made by mixing burnt lime and sand, or cement and sand, while in recent years Mo clay has been increasingly used for brick making. Facing stones and tiles are most commonly made of the upper, non-calcareous red clay.

The limestone rocks of Denmark are well suited to burning for lime, since their content of calcium carbonate is high. Workings are numerous, but the largest quarry is at Fakse in the south of Sjælland, where the workings are over a kilometre long and about 30 m. deep. The stone is burnt for lime for agricultural purpose and is also worked for building purposes. Clayey limestones, which have a clay content of 10–20% or more, have valuable hydraulic properties and are worked, especially at Klintebjærg, north-west of Nyköbing in Sjælland, and at Mariager, to produce hydraulic lime and Roman cement. Of the latter, 4,500–5,000 tons were exported annually in 1936 and 1937.

Production in recent years has been 400–500 million bricks and about 15 million tiles.

The manufacture of porcelain and glass is carried out chiefly in København. Several firms, such as the Royal København Porcelain works, and the Bing and Gröndahl works, have won international reputation for aesthetic products which have made København one of the leading porcelain cities.

FUEL AND POWER

The sources of power, like other industrial raw materials, are mostly imported. The fuel resources of the country are limited to deposits of peat, up to 10 m. deep, some beds of lignite, of Miocene age, mainly in central and western Jylland, and some thin seams of poor coal in Bornholm (see pp. 497–8).

Peat

Peat is normally used only as domestic fuel in rural areas where it is cut to satisfy family needs, since its value is too low to warrant its transport over long distances. But the restriction of fuel imports in wartime lead to its more extensive exploitation for national needs. The peat deposits are of various kinds. High-moor peat is formed in depressions where the water does not contain lime; in such deposits it is the lower, converted layers lying beneath the loose layers, which provide good fuel. Low-moor peat is formed in depressions where the water contains lime, and it varies from almost pure organic layers, of high fuel value, to peaty mud which has no value as fuel. In the extreme north of Jylland overlying deposits of blown sand have, by pressure, transformed the peaty beds until in places they resemble brown coal.

The production of peat averaged about half a million tons a year between 1921 and 1939. Production is limited by a short season of about 100 days, between the end of April and the beginning of August, when peat can be cut and carried fairly easily. Furthermore, peat drying on a large scale would take agricultural land out of production and would make heavy labour demands which would reduce agricultural output, but the main difficulty would be the provision of adequate transport.

Lignite

The lignite deposits are found locally over a wide area in Jylland and occur in beds which are sometimes 2 m. thick. The lignite is often friable and has a high proportion of sulphur and ash, so that normally it is rarely profitable to dig, but under war conditions it provides a valuable, if inferior, source of fuel. During the war of 1914-18 large pits were opened at Fasterholt and Trolldhede which lie respectively south-south-east and south-west of Herning.

Coal Imports

Before the present war the home production of fuel in Denmark was only about 8% of the country's needs. The supplying of coal to Denmark, as to the other Scandinavian countries, has been a matter of great competition between Britain, Germany, and Poland. During the period 1935-7 the average proportions of the total coal imports supplied by these countries were, approximately, Britain 80%, Germany 15% and Poland 6%, the remaining 5% being supplied by

other countries. Coke is supplied by Britain (75 %) and Germany (25 %). Denmark's imports of hard coal and coke in recent years have been (in thousands of tons):

	Hard coal	Coke
1936	4,109	1,659
1937	4,220	1,677
1938	3,856	1,391
1939	4,270	1,504

In addition, Denmark imported briquettes from Germany in the following quantities: 70,000 tons in 1936, 127,000 tons in 1937, 153,000 tons in 1938 and 232,000 tons in 1939.

In 1938, Danish gas, water and electricity undertakings consumed 655,000 tons of gas coal and 625 tons of other coal and coke. Private industries consumed 1,105,000 tons of coal and 106,000 tons of coke. The largest group of industrial consumers was the stone, clay and glass group which used 368,400 tons of fuel. Food industries consumed 314,100 tons of coal and 27,300 tons of coke, while the chemical industry used 225,100 tons of coal and 4,750 tons of coke, and the metallurgical industry used 71,700 tons of coal and 43,000 tons of coke.

Electricity

Generating Stations. Denmark, unlike the other Scandinavian countries, has only limited water-power resources. Most of the generating plants are thermal, less than 3 % of the current generated being derived from water power. All the larger stations use coal, but many of the smaller stations use Diesel engines. About 65 % of the current is produced from coal. In 1938 there were 475 public power stations which had a net production of 788 million kWh. About two-thirds of this number are small local works with a total annual output of about 25 million kWh. In addition, there were 314 private power plants with capacity of over 30 kW. These have a total installed capacity of 120,000 kW. and an annual output of about 350 million kWh. Another thousand small producing plants have a total capacity of 4,000 kW. The details of the 140 larger works are:

Capacity in kW.	No. of works	Net output 1936-7
Over 5 million	18	544
2-5 million	17	38
1-2 million	21	31
0.5-1 million	17	10
Under 0.5 million	67	14

The most important generating stations are at Köbenhavn, Masnedö, Aarhus and Isefjord. At Köbenhavn the H.C. Ørsted station is to the south of the city and has a capacity of 145,000 kW.; the Gothersgade station has a capacity of 30,000 kW. The power station at Masnedö is at the northern end of Masnedö opposite Vordingborg: this plant was first put into service in 1940 and has a capacity of 50,000 kW. The Aarhus power station has a capacity of 30,000 kW. The Isefjord power station, which is near Kyndby on the east shore of Isefjord in north Sjælland, was probably first operated in 1940 and had originally a capacity of 30,000 kW. Later the original installation was duplicated to give the station a capacity of 60,000 kW., and the ultimate designed capacity of the station is 110,000 kW.

The location and general size of most of the other power stations are shown in Fig. 69. The most important hydro-electric plant is at Tange on the Gudenaa, south-east of Viborg.

Transmission Networks. Until recent years each town or rural area was supplied by its own small generating station, but increasing loads have led to the building of high-voltage transmission networks. The grid, however, is still in its infancy in Denmark and has not proceeded further than linking up groups of three or four areas which were previously independent. Most of the main transmission lines carry a.c. at 50–60 kV., but there are also networks at about 10 kV. for supplying rural areas. The transmission and distribution are mostly by overhead cables. The spread of the grid network has proceeded farthest in Sjælland where power is concentrated in a few large stations and the grid covers almost the whole island. The Isefjord generating station supplies the north of Sjælland. Köbenhavn is supplied by the H.C. Ørsted and Gothersgade stations in the city, while the suburbs and adjacent areas are served by a number of smaller stations. The new works on Masnedö supplies the south of Sjælland and the island of Falster. Two power lines (and one reserve cable) cross Masnedsund by under-water cable to Næstved and Lillevang, and another cable crosses Störstrom to Eskildstrup sub-station in Falster. The east of Sjælland possesses several smaller generating stations in the chief towns. In Fyn generating stations are small, except at Odense, and are not closely linked. Jylland has three main power systems, one centred at Aarhus, the other at Aabenraa and the third group is formed by the towns of Horsens, Vejle, Kolding and Fredericia. The Aarhus system comprises nine plants, including a hydro-electric station at Tange on the Gudenaa, and a grid which



Fig. 69. Electricity generating stations and transmission networks

Based on official sources.

Since the outbreak of war the Odense power station has been linked with the Jylland (Jutland) grid. A 60 kV. transmission line between Odense and Svendborg and a 10 kV. line between Svendborg and Faaborg have been under construction and probably completed.

extends to Grenaa, Randers, Skive, Framlev and Skanderborg. The Aabenraa grid extends to Haderslev, Skærbæk, Tönder and the island of Als; it is connected with the German grid system through Hamburg. It was reported in 1940 that the grid between Haderslev and Harte had been completed, thus linking the Aabenraa and the Horsens-Kolding-Fredericia systems.

Denmark is also linked with the Swedish power system by three under-water cables which cross the Sound between Helsingör and Hälsingborg. Denmark buys annually about 50 million kWh. of electricity, most of which comes from Sweden and a little from Germany.

Further large power stations have been projected, namely, one of 30,000 kW. capacity at Esbjerg and another, of unknown size, at Fredericia, to serve the Horsens-Kolding-Fredericia system. There have been several projects for further exploitation of hydro-electricity in Jylland. The most prominent of these is that for building three plants on the Skernaa with a total output of 14 million kWh. a year. The consumption of electricity in 1937-8 was 668 million kWh., of which 35% was used for lighting, 60% for power and 5% for heating.

Gas Works

At the end of 1938 there were 108 gas works in Denmark. The most important are in Köbenhavn, Aarhus and Odense. The works at Aarhus and Odense each have an annual production of some 13 million cu.m. a year. In Köbenhavn the Östre Gasværk produces about 40 million cu.m. and the Valby works produce about 47 million cu.m. a year, while the plant at Hellerup nearby produces 11½ million cu.m. a year. The Köbenhavn gas works are interconnected by high-pressure pipe-lines.

The remaining 103 gas works are of varying size and are found in the larger towns.

Petroleum Products

All petroleum products are imported. There is no refinery which produces the full range of products. The main import centre is Köbenhavn, but Fredericia and Nyborg are main centres for Jylland and Fyn respectively. From these centres, coasting vessels and rail tanks distribute petroleum products to several sub-centres at other

ports which distribute to surrounding areas. The consumption of petroleum products in recent years was (in tons):

	1937	1938	1939
Gasoline	295,687	306,670	299,548
White spirit	4,332	4,310	5,194
Kerosene	96,787	94,085	102,659
Gas and Diesel oil	209,029	214,401	232,681
Fuel oil	11,919	14,894	17,949
Automotive gas oil	695	1,151	1,768

The consumption of lubricating oil is about 25,000 tons a year.

Chapter XIV

COMMERCE

Historical Background: Commercial Policy: General Features of Denmark's Trade:
Import Trade by Commodities: Export Trade by Commodities: Foreign
Trade by Countries

HISTORICAL BACKGROUND

The Period before the War of 1914-18

Foreign trade and commerce have always been essential supplements to agriculture in the national economy of Denmark and have shown a sustained growth since medieval times. With the decline of the Hanseatic League, Köbenhavn rose to first rank in Baltic trade, and during the expansion of world trade which followed on the colonial enterprises of the sixteenth and seventeenth centuries Denmark became the premier trading nation among Baltic lands. The period between the sixteenth and early nineteenth centuries saw the formation of trading companies, the extension of commercial interests to America and to eastern Asia, and the growth of a considerable merchant fleet. Denmark became the carrier and trader for much of the Baltic area, while her home trade was concerned mainly with the export of livestock and cereals. During the eighteenth century the country enjoyed almost unbroken peace and Denmark took advantage of the wars between her neighbours to extend her overseas trade. In 1805 the merchant fleet numbered over a thousand ships with a total tonnage of over 72,000 tons. This period of prosperity came to an end during the Napoleonic wars which resulted in the destruction of Danish naval power, and nearly the whole of the merchant fleet fell into British hands. A period of commercial stagnation followed. Overseas connexions were broken, commercial houses were ruined and Köbenhavn lost its pre-eminence in Baltic trade and fell behind Hamburg and Lübeck.

Danish commerce revived towards the middle of the nineteenth century and followed, for a time, a course similar to that along which it had developed earlier. But the nineteenth century saw the growth of industry in west European countries, and trade in industrial raw materials and manufactured goods came to occupy a larger share in

world commerce as ships became larger and more powerful. Steam-driven iron ships made profitable the carrying of bulky raw materials, and long-distance trade was no longer confined largely to luxury products of high value in relation to bulk. Improved communications and the gathering speed of industrial and commercial progress led to the economic advancement of Baltic lands which had long remained backward, and they now began to develop their own economic organizations and commercial relations. In Denmark the change was marked by the development of dairy farming which called for imports of agricultural raw materials on a large scale and for imports of industrial raw materials to provide the mechanical equipment necessary for processing and transporting the agricultural produce. In 1848 steam communication was established between Jylland and England and trade between the two countries grew rapidly. After 1870 industrial growth showed considerable development. Thus Danish commerce acquired its outstanding modern characteristics which were, briefly, the importing of cereals, oil-cakes and fertilizers for agriculture and of coal, oil and metals for industry, and the exporting of dairy products, ships, and the machinery for those branches of industry in which she has specialized. She had a large credit balance on her exports of foodstuffs, and with this she financed a large part of her imports of raw materials, but her carrying trade had also been maintained and the 'invisible exports' derived from these activities were an important factor in maintaining her balance of trade.

The Period after the War of 1914-18

During the war foreign trade continued to flourish until the intensification of the submarine campaign in 1917 brought it almost to a standstill. After the war of 1914-18 livestock and soil fertility needed to be built up, commerce suffered from scarcity of shipping, and there was depression and unemployment. The country was flooded with German goods that were offered at prices with which Danish industries could not compete, and at the same time Denmark was deprived of one of her most important markets for agricultural produce and fish because Germany could not pay. Denmark tried to develop other markets and she began to buy her raw materials direct from the producing countries instead of importing them via Hamburg as she had done to a considerable extent before 1914. By about 1925 recovery was under way and the volume of trade, by quantity and value of both imports and exports, expanded. By 1928

the visible adverse trade balance was lower than it had been since 1917 and was over 50 million kroner less than it was in 1913.

This recovery was interrupted by the world economic depression, and although this came later to Denmark than to most countries, the year 1930 showed a decrease in the volume of trade and the largest debit balance since 1925. By 1933 recovery had begun, especially in the trade with Britain which was developed by deliberate policy and found expression in the Anglo-Danish trade agreement of 1934. The succeeding years showed a steady increase in trade, and in 1937 imports were higher, both in volume and value, than in any year since 1930. The greater part of the increase in imports was due to increased purchases in Britain.

COMMERCIAL POLICY

Denmark's natural policy is one of international free trade. She requires free access to world markets for her agricultural products and, in order to be able to sell these at competitive prices, unrestricted importation of agricultural raw materials such as fodder stuffs and fertilizers is to her advantage, since this lowers costs of production. Her industrial activities depend to a great extent on the volume of her sales of foodstuffs abroad, since it is with the proceeds of these that she purchases her industrial raw materials. Since she has to import almost all these raw materials, unrestricted importation reduces the cost of manufacturing. Many of her industries would welcome measures of protection but since they cater mainly for the home market high prices to this largely agricultural market would serve only to raise the expenses of her dominant economic activity. Furthermore, a decrease in purchases of manufactures abroad would probably result in diminished sales of foodstuffs. Her sales of industrial goods abroad are mainly of those in which she has specialized and been able to maintain in free competition.

But the depression coloured the trade of Denmark, as of all countries, throughout the thirties. Markets became disorganized and contracted, prices fell and purchasing power was reduced. The most usual remedies were to reduce imports and to provide, at home, goods which were formerly bought in other countries and so use the labour which contracting markets had rendered superfluous. Thus agricultural countries expanded their industries and industrial countries developed their agriculture and protected it with tariffs, quotas and other import restrictions. Denmark, with few industrial resources,

could not expand her industries on a large scale without increasing her imports of industrial raw materials, and since her markets were contracting and agricultural prices had fallen markedly, this was difficult. She effected instead a reduction of her imports of fodder, fertilizers and manufactured goods; the restriction of imported manufactures led to some expansion of light industries at home. She maintained her sales abroad, as far as possible, by concluding bilateral trade agreements and by making her purchases mainly in those countries where she sold her own products. Thus the commercial policy of Denmark was largely governed by the policies of the countries where she sold most of her goods.

The small countries of north-west Europe sought to protect themselves in the years of depression by concluding the Oslo Convention in 1930. The countries of the so-called Oslo group were Denmark, Norway, Sweden, Finland, the Netherlands, Belgium and Luxembourg. Their aim was to check economic nationalism and to reduce tariffs. By the terms of the Convention the signatories agreed to give mutual notice of any proposed imposition or increases of tariffs so that they could take steps to safeguard their interests. In May 1937 the countries signed an agreement at the Hague by which they agreed to grant mutual trade concessions. The Netherlands, Belgium and Luxembourg, which had quota systems, agreed to abolish quotas for specified commodities from the other signatory countries and not to increase tariffs and duties on these goods. The other signatories agreed not to introduce quotas or increase tariffs on specified commodities. The agreement expired in 1938 and was not renewed.

Early in 1932, Denmark introduced control of her foreign trade by a system of import licences which compelled Danish firms to buy goods in those countries for which licences were issued, and imports were restricted to what the government regarded as being within the country's purchasing power. The scheme was operated by determining, on the basis of estimates of receipts from exports and shipping for the coming half-year, the amount of imports which should be permitted. The bulk of this amount was then allocated broadly to large items such as grain, feeding stuffs and oilseeds, which were on the free list, and to fuel and raw materials such as iron, steel, timber, textiles and yarns, for Danish industry. The goods on the free list might be bought anywhere, but the purchases of other goods were allocated to various countries mainly in accordance with commercial agreements that had been concluded with other countries and which frequently contained minimum quotas for specified goods. These

allocations were then distributed among individual importers. Thus the quotas varied according to the total amount of imports permitted, the allocation for particular commodities, and the allocation by countries. Licences for raw materials and semi-manufactures were issued on a fairly generous scale, but allocations for luxury goods and articles which competed with Danish products were restricted stringently. In spite of complaints that the system compelled importers to buy in expensive markets at the wrong time and that small purchases increased the profits of dealers, the system remained in force, but control became less rigid and an increasing number of commodities were placed on the free list as trade recovered, especially after 1936.

The system of import control implemented the terms of the trade agreements which were concluded with foreign countries. The most important of these was that which was made with the United Kingdom in April 1933, and renewed in June 1936. By this agreement Denmark sought to protect her trade in face of the principle of imperial preference which the Ottawa Agreements had put into force and through which Britain bought more butter from New Zealand, more bacon from Canada, and less from Denmark. By the terms of the Anglo-Danish commercial agreement, Denmark was allocated not less than 62% of the total British imports of bacon and hams from countries outside the British Commonwealth, a minimum of 2,300,000 cwt. of butter, a minimum of 38% of British egg imports, and not less than 412,000 cwt. of fresh and salted fish a year. The United Kingdom, on the other hand, was granted the right to terminate the agreement if in any one year the amount of coal imported from Britain was less than 80% of the total Danish imports of coal. The agreement also underlined agreements between Danish and British commercial organizations regarding the use of British salt, saltpetre, jute and paper for treating and packing foodstuffs exported to Britain.

Trade with the colony of Greenland is a monopoly of the Danish government and is carried on by the Royal Greenland Trading Company of Köbenhavn under the supervision of the Greenland Administration (see pp. 154-5). The traffic passes through Köbenhavn and is carried in the company's ships which visit the trading posts along the coast of Greenland in summer. The prices of imports and exports are determined in Köbenhavn, and lists of fixed prices are issued to the trading stations. These prices are fixed arbitrarily and are maintained over long periods without reference to fluctuations on

the world market. The general principle adopted is that the prices of necessities to Greenlanders are kept low and those of luxuries are placed high, while the prices paid for Greenland goods are fixed at levels which enable the Greenlanders to meet their needs.

GENERAL FEATURES OF DENMARK'S TRADE

Among European countries Denmark ranked ninth in order of importance judged by total value of imports and exports. Her trade formed only about $1\frac{1}{2}\%$ of the value of world trade and less than 3% of European trade, but her population is only about 1% of Europe's population. The value of trade per head of population is higher than in any European country except Belgium.

Per capita Value of Imports and Exports Combined, in 1937 (in old U.S.A. gold dollars)

Belgium and Luxembourg	122	Netherlands	102	Finland	66
Denmark	112	Sweden	99	Germany	40
Norway	106	United Kingdom	91	France	37

Source: *Statistical Yearbook of the League of Nations*, 1938-9, p. 219 (Geneva, 1939).

The position of Denmark between Britain and Germany has been of fundamental importance in her commercial relations. These two industrial countries offered a market for her agricultural produce and could, in return, provide her with most of her needs in industrial raw materials, especially coal and refined metals, and also some of her necessary agricultural raw materials such as fertilizers. Modern problems of over-production and their associated tendencies towards economic nationalism, implemented through bilateral trade agreements and preferential tariffs, precipitated experiments in international barter so that countries tended to buy where they sold. Thus approximately three-quarters by value of Danish exports were sold to Britain and Germany, while over 60% by value of Danish imports were paid for in these two countries. These figures exaggerate the dependence of Denmark on her neighbours for imported goods, especially in regard to Britain, because Danish trade statistics were compiled according to the country where payment was made, irrespective of the sources of the commodities concerned. Thus goods paid for in London or some other British centre were classed as imports from Britain, whereas the goods might have originated from

some other country and might even have been shipped direct from that country to a Danish port.

One of the chief features of recent years has been the progressive decline of the trade between Denmark and Germany in both imports and exports and the increase in the British share of the total imports of Denmark (see Figs. 70, 71). This was a natural tendency during and after the depression because countries had to increase their share of imports from countries where they had an active trade balance; they did this especially in those countries where they were allowed to use this balance freely. For this reason Denmark turned to Britain rather than to Germany. Thus Germany's share in Denmark's imports decreased from one-third to a quarter between 1928 and 1938, while that of Britain increased from 14 to 38%. This increase in European trade occurred chiefly at the expense of countries outside Europe whose share fell from 28 to 16%. Much of the increase in Denmark's trade with Britain was due to expansion of transit trade, because Britain increased her trade with her overseas territories and dominions to an extent which changed a credit balance of exports to them into a debit balance, and so she received interest on her investments in this way without its passing through trade with other countries. Some of these imports were then distributed to countries such as Denmark.

Denmark's credit balance of trade with Britain played an important part in financing her excess import values from other countries such as Germany. The proportion of Danish exports to Britain had, on the other hand, decreased owing chiefly to restrictions on imports of dairy produce.

Next in importance to Britain and Germany in Danish foreign trade was Sweden, which normally supplied 6-7% of Danish imports and took 4-5% of total Danish exports. The United States of America supplied, on an average, about 5% of Danish imports but, on account of the distance between the two countries and the similarity of their products, the United States took only about 1% of Danish exports. The remainder of Denmark's foreign trade was distributed among a number of countries of which Norway, the Low Countries and France were the most important. Thus, while Denmark's share in the trade of Europe was small, the proportions of her import and export trade that were carried on with European countries were greater than in the case of any other country of north-west Europe. They contrasted markedly with Britain whose trade with her Empire was greater than that which she conducted with European

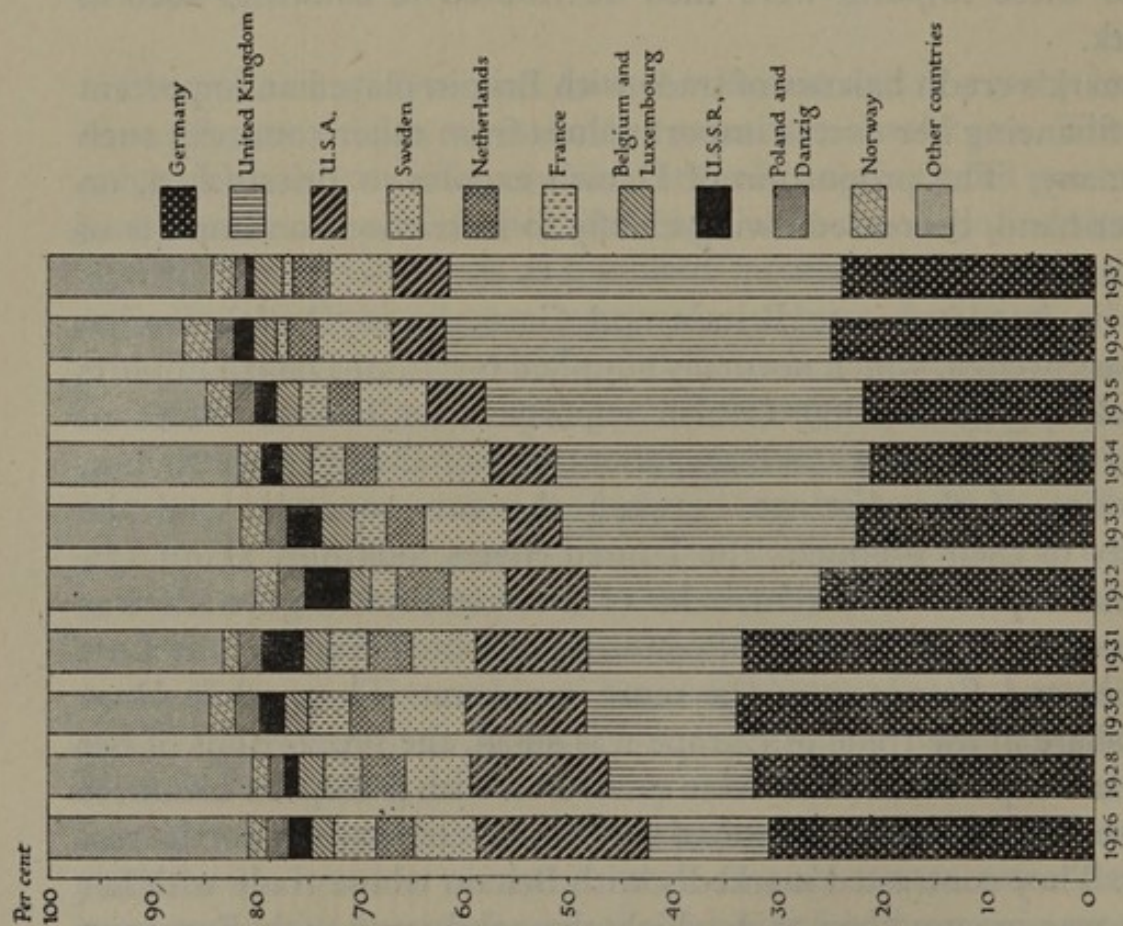


Fig. 70. The distribution of Denmark's import trade with different countries, by value

Based on statistics in *Danmarks Vare-Ind-og Udførsel*, 1926-37 (København, 1927-38).

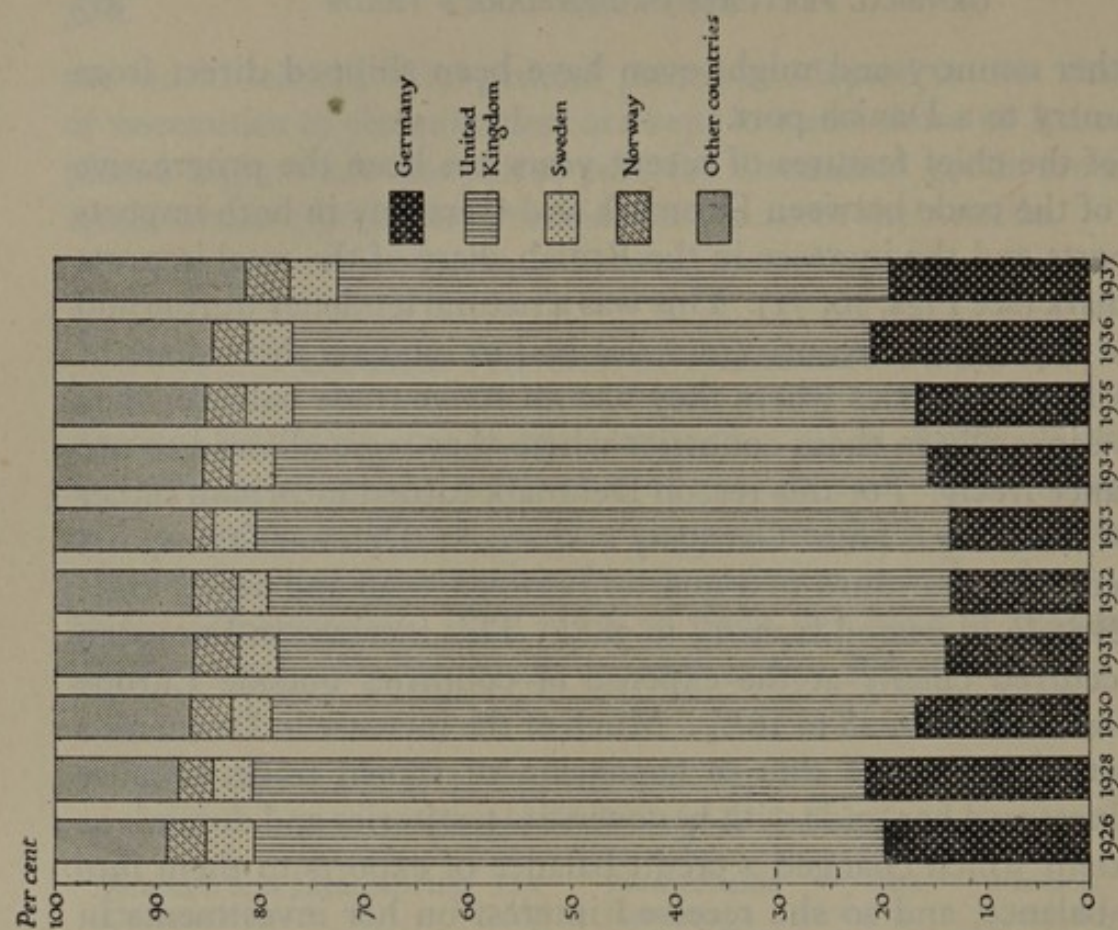


Fig. 71. The distribution of Denmark's export trade with different countries, by value

Based on statistics in *Danmarks Vare-Ind-og Udførsel*, 1926-37 (København, 1927-38).

countries. The following table demonstrates the conditions in 1935 which was a fairly normal year:

	Imports		Exports	
	Share in total imports of Europe†	Share of imports derived from Europe†	Share in total exports of Europe†	Share of exports absorbed by Europe†
	%	%	%	%
Denmark	2.4	85	2.9	96
Norway	1.7	72	1.6	72
Sweden	3.2	79	3.6	75
Finland	1.0	74	1.5	80
United Kingdom	29.6	34	23.1	37
Germany	14.4	57	18.9	72
France	11.9	38	11.3	53
Netherlands	5.5	63	5.0	77
Belgium and Luxembourg	5.3	59	6.4	71

† Excluding the U.S.S.R.

Source: *Europe's Trade*, p. 16 (League of Nations, Geneva, 1941).

Imports were consistently higher in value than exports, but the discrepancy was offset by the so-called 'invisible exports' of which the earnings of the Danish mercantile marine abroad formed the most important item and were far larger than receipts from foreign investments.

Balance of payments, 1937-8 (in millions of kroner)

	Payments	
	1937	1938
A. Current expenses:		
Total imports	1,702	1,665
Interest on foreign debts	95	90
Profits of foreign firms operating in Denmark	15	15
Expenses of Danish tourists abroad	50	50
Expenses of Danish mercantile marine at foreign ports (port dues, coal, etc.)	105	95
Other expenses	20	20
	1,987	1,935
B. Capital charges:		
Amortisation of debt	45	45
Repatriation of Danish securities	29	63
Purchase of foreign securities	9	12
Increase of foreign debts	101	117
Other expenses	15	15
	199	252
Total expenses	2,186	2,187

<i>Receipts</i>		1937	1938
A. Current receipts:			
Total exports		1,607	1,582
Gross shipping freights earned abroad		305	279
Transport of foreign passengers in Danish ships		5	5
Interest on foreign investments		15	15
Receipts from Danish enterprises abroad		35	40
Receipts and dues from foreign ships at Danish ports		85	75
Receipts from tourists		30	35
Other receipts		15	15
		2,097	2,046
B. Capital receipts:			
Public loans		31	55
Export of Danish securities		27	18
Export of foreign securities		11	11
Investment of foreign capital in Denmark		10	20
Increase of short-term external debts		-5	10
		74	114
Total receipts		2,171	2,160

Source: *Statistisk Aarbog*, 1939, p. 120 (Köbenhavn, 1939).

IMPORT TRADE BY COMMODITIES*

The chief groups of commodities among Denmark's imports, approximately in order of value were (value in millions of kroner):

	1935	1936	1937
Coal and coke, etc.	118.2	139.5	185.6
Raw iron and steel and semi-manufactured and manufactured iron and steel goods	115.5	136.7	157.9
Grain and pulses	87.7	105.7	152.6
Vehicles, machinery, instruments, clocks, etc.	85.3	104.5	119.3
Vegetable substances (mainly oil seeds)	93.1	102.4	119.7
Oil, rubber, tallow, resin, tar, etc.	82.0	100.5	114.0
Animal feeding stuffs	78.9	98.5	109.7
Timber (unworked and sawn)	61.6	62.1	64.9
Soft goods of vegetable materials	54.7	59.3	62.4
'Colonial' goods	61.0	51.2	55.2
Non-ferrous metals and metal goods	45.1	47.7	57.4
Fertilizers	43.0	48.1	46.4
Soft goods of wool and hair	38.4	42.9	43.8
Yarn, rope, etc.	35.5	39.4	36.7
Other goods	286.7	303.7	323.0
Total imports (for consumption)	1,286.7	1,442.2	1,648.6

Source: *Danmarks Vare-Ind-og Udførsel*, 1935-7 (Köbenhavn, 1936-8).

The above groups of specified commodities comprised, normally, between 75 and 80% by value of all Danish imports.

* The following discussion of trade, by commodities and countries, is based on the statistics for 1935-7 which were the most typical years in a period of transition. By 1935, recovery from the depression was well under way and after 1937 the prospect of war led to the building up of emergency stocks and in industrial countries much productive capacity was diverted from exports to armaments.

Imports of Coal and Coke

Denmark imported about 4 million tons of coal and about 1.6 million tons of coke every year; these form about a tenth of the total value of her imports. According to the Anglo-Danish trade agreement of 1934, Denmark undertook to buy 80% of her coal and coke from Britain; this undertaking was fulfilled. Before the conclusion of the agreement the coal market in Denmark, as in the Baltic lands generally, was a field of keen rivalry between Britain, Poland and Germany. British coalfields suffered from this competition, since working costs, and especially wages, were lower in the two continental countries. Germany and Poland retained small shares of the Danish coal trade and provided about 15 and 6% respectively of the coal imports of Denmark in 1936 and 1937, but in 1935 Poland supplied 11% and Germany 7% of the total imports. The coke imports of Denmark were supplied almost exclusively by Britain and Germany, but while Germany supplied two-thirds of the coke for locomotives the bulk (80-85%) of the imports of coke for domestic heating, which is nearly three times as large as the import of locomotive coke, came from Britain. The import of briquettes, which varied between 70,000 and 130,000 tons in recent years, was derived entirely from Germany.

Imports of Iron and Steel

Denmark had to import all her iron. Her annual import of unworked iron, in the form of pig-iron, ferro-alloys and scrap iron, averaged between 50,000 and 60,000 tons. In 1935 and 1937 Britain and Germany supplied approximately equal quantities, each country sending approximately a quarter and a third respectively of the total imports in these two years. In 1936, however, the German share of the import rose to 43% while that of Britain fell to 23%. Sweden was the only other considerable supplier of unworked iron, and her share of the import was about 10% in 1935 and 1936, but it rose to 27% in 1937 when the import from Britain and Germany was smaller than in previous years.

Of semi-worked iron and steel, Denmark imported about 180,000 tons in the form of structural steel, sections and bars, in 1936 and 1937. Rather more than four-fifths of this came from Germany, while the remainder came from Belgium and Luxembourg and from Britain in roughly equal shares totalling about 15% of the total import of these goods. Shipbuilding plates, black-sheets and tin-plates were bought almost entirely in Britain and Germany. Of the 50,000 tons

of shipbuilding plates and the 20,000 tons of tin-plates imported annually, Germany supplied about a half and Britain slightly less. But whereas Germany supplied about four-fifths of the 30,000–40,000 tons of black-sheets, Britain supplied a like proportion of the 20,000 tons of galvanized sheets, imported every year.

Imports of Non-ferrous Metals

Imports of raw copper averaged about 5,000 tons annually. The relative importance of the sources of this metal varied widely, for while two-thirds of the import in 1937 was bought in Britain, in 1936 and 1935 Germany supplied 45 and 60% respectively of the import, while the British share fell to 20 and 10%.

Two-fifths of the imports of raw zinc were bought in Belgium and Luxembourg, but Germany's share increased from about 7% in 1935 to 32% in 1937 and so reduced the purchases of zinc in Britain and Holland which totalled 12–20% and 17–22% respectively in 1936 and 1935. The total import fluctuated around 5,000 tons a year.

Denmark used little raw tin and bought only about 700 tons a year. Two-fifths of this was bought in the Netherlands and was derived probably from the East Indies. Purchases of tin in Britain amounted to half the total import of this metal in 1935 but fell to 36% in 1936 and to 28% in 1937.

In 1935 and 1936 Germany provided over four-fifths of Denmark's purchases of lead, but in 1937 her share fell to about one-third of the total and Britain's share rose to three-fifths, whereas it had been insignificant during the two previous years. The total annual import was normally 7,000–9,000 tons.

Imports of aluminium grew from 650 tons in 1935 to 950 tons in 1937, and was almost all supplied by Norway.

Imports of semi-worked copper were about 5,000 or 6,000 tons annually. Sweden usually provided between three-fifths and four-fifths of the total, while the bulk of the remainder was supplied by Britain and Germany in approximately equal quantities. Between 600 and 1,200 tons of semi-worked brass were bought every year and were supplied almost entirely by Germany and Sweden in approximately equal proportions.

The annual purchase of semi-worked zinc was between 3,000 and 4,000 tons, four-fifths of which was bought, in approximately equal quantities, in Belgium and Germany. Imports of semi-worked lead and aluminium were each about 600 tons a year. The lead came mainly as accumulator plates, about half of which was bought in

Britain and one-third in Germany. Two-fifths of the aluminium was bought in Germany, one-third in Norway and a quarter in Switzerland.

Imports of Feeding Stuffs

Indoor feeding of cattle and fattening of pigs make demands for grain beyond the growing capacity of the country. The consumption was such that cereals were much the more important item, in terms of value, of all the raw materials used in agriculture. The quantity imported varied according to the volume of the home harvests and also, like all other agricultural raw materials, according to price levels of farm produce and the prosperity of the farming community. The proportions which different grains formed of the total import also fluctuated according to needs and to the relative prices of these grains on the world market. Generally Denmark imported about a half of her needs of wheat, 40% of her rye and all her maize; she was self-sufficient in oats and barley only. The amounts imported and the countries of purchase are shown in the table on p. 314.

Most of the animal feeding stuffs, other than grain, were imported in the form of oil-bearing seeds and nuts, mainly cotton-seed, sunflower seed, linseed, groundnuts, palm nuts, coconuts and soya beans. These were pressed for oil at the Danish ports, especially Aarhus (see p. 282). The oil was used mainly in the manufacture of margarine and the residual pump was made into cattle-feeding cake. Denmark imported about 400,000 tons of oil seeds annually. About 17% of this import was paid for in Britain although obviously the materials were derived from warmer lands. About 8% was bought from Germany, 6-9% from Brazil and 4-9% from Argentina. Before 1937 Russia provided about one-fifth of the total import, but in 1938 this fell to 5%. The Netherlands supplied about 7%. Rumania and the United States were smaller suppliers.

Imports of Fertilizers

To increase home production and so to reduce the import of fodder, large quantities of chemical fertilizers were imported. Imports of raw phosphates were about 200,000 tons annually. Four-fifths of this came from Morocco and the remainder from Algeria, Tunisia and Holland. Some 90,000 tons of calcium nitrate were bought from Norway and up to about 10,000 tons from Switzerland. From the rich potash fields of Germany came about 90,000 tons of fertilizers in 1936 and 1937, but in 1935 the German supplies were some 55,000 tons and a further 17,000 tons were bought from Spain.

Imports of Grain, 1935-7

	1937		1936		1935	
	Quantity tons	Chief sources	Quantity tons	Chief sources	Quantity tons	Chief sources
Wheat	172,558	U.S.A. 61% Argentina 7½% U.K. 6½%	243,272	U.S.A. 48% Sweden 20% Poland 7%	365,062	U.S.A. 21½% France 40½% Belgium 8%
Rye	125,304	Netherlands 22½% U.S.S.R. 20½% U.S.A. 15%	214,487	Poland 40% Netherlands 15½%	187,408	Poland 27½% Germany 26½% Argentina 12%
Oats	48,389	Belgium 29% Argentina 25½% Netherlands 19½%	30,321	Netherlands 57½% Poland 22½%	25,816	Poland 43½% U.K. 28% Argentina 16½%
Barley	31,883	Romania 35½% Belgium 23½% U.K. 15% Argentina 13%	36,660	Romania 28% Netherlands 20% Germany 12½%	25,354	Poland 80%
Maize	628,790	Argentina 30½% Belgium 22½% U.K. 12%	327,166	Argentina 33% Belgium 26% U.K. 17%	220,365	Argentina 32½% U.K. 21½% Belgium 12½%

Source: *Danmarks Vare-Ind-og Udførsel, 1935-7* (Köbenhavn, 1936-8).

Note. Exports of barley and oats are usually in excess of imports.

About 40,000 tons of saltpetre were bought every year from Chile and another 100,000 tons were bought in the United States.

Imports of Tallow, Oil and Rubber

In the commodity group which includes tallow, oil, rubber, etc., the chief items were train oil, gasoline and gas oil. The annual import of train oil was about 40,000—45,000 tons a year, almost all of which was bought in Norway and Britain. In 1935 and 1936 Norway and Britain supplied approximately equal quantities, but in 1937 Britain's share rose to about three-quarters of the total import. Imports of other animal oils and fats were small in comparison and totalled only some 2,000 tons annually; nearly all was supplied by Norway. Imports of gasoline rose from about 245,000 tons in 1935 to 280,000 tons in 1936 and to 310,000 tons in 1937, and while three-quarters of the import was bought in Britain in 1935 this country provided 88% of the total in 1936 and 95% of the total import in 1937.

The imports of gas oil were almost identical in quantity with those of gasoline during each of the years 1935–7, and Britain's share of the import rose from 60% in 1935 to 80% in 1937. The bulk of the remainder came from the U.S.S.R. Imports of rubber averaged about 3,000 tons a year, of which Britain supplied over four-fifths.

Imports of Textiles

Imports of textile fibres were small, since the textile-manufacturing industries of Denmark were concerned mainly with supplying the home market and a good deal of the raw materials were imported as yarns, just as metals were imported in semi-worked state, so as to reduce the volume of fuel imports for power. Imports of wool were about 2,500–3,000 tons annually, of which about four-fifths were bought in Britain and most of the remainder was bought in approximately equal quantities direct from Argentina and from Australia and New Zealand. Purchases of raw cotton on the other hand, were much larger and were between 7,000 and 9,000 tons a year, of which about 90% came from the United States and the remainder from Britain. A similar quantity of hemp was bought every year, almost entirely from Britain.

Germany's dye industry gained her a larger share of the trade in coloured yarns than of that in uncoloured yarns, for while Britain held four-fifths of the trade in uncoloured woollen yarn and nine-tenths of the trade in uncoloured cotton yarn, Germany shared fairly equally with Britain the supply of coloured yarns to Denmark. The approxi-

mate quantities of these commodities imported every year were: uncoloured woollen yarn, 1,300 tons; coloured woollen yarn, 400–500 tons; uncoloured cotton yarn, 1300–1700 tons; coloured cotton yarn, 200 tons. Artificial silk yarn, on the other hand, was bought mainly in Germany which provided from a half to three-quarters of the total annual import of some 1,300 tons. The remainder was shared fairly equally between Britain, Italy and Switzerland.

Imports of Machinery

Germany provided about four-fifths of the import of steam-driven machinery, while Sweden normally supplied a similar proportion of the import of Diesel motors. Although Denmark manufactured electric motors she also bought some from Britain, Sweden and Germany, but the proportions of the market supplied by each country has varied considerably in recent years. Drills, self-binders, cranes and elevators, other than those manufactured in Denmark, were supplied mainly by Germany.

Imports of Colonial Goods

In the import group classified as colonial goods, coffee and tobacco were much the most important items by value. Of the 29,000 tons of coffee imported annually, 30–45 % was bought in the Netherlands and the Netherlands East Indies. Brazil supplied about one-third of the import and the remainder was bought in Venezuela and the West Indies. Danish purchases of cocoa and chocolate were made almost entirely in Britain. Before 1937 Denmark bought most of her rice from Spain, but after the outbreak of civil war she transferred her custom to Italy from which she bought two-thirds of her rice imports in 1937; most of the remainder was bought from Siam.

EXPORT TRADE BY COMMODITIES

Dairy produce, bacon, meat and offal constituted together over one-half of the total value of Danish exports. The export of live animals and of eggs accounted for a further 15 %, and agricultural products as a whole made up nearly three-quarters of the value of all Danish exports. Denmark had much the largest balance of food exports of all European countries, although some other countries had a higher cultivated area per head of population (see Fig. 72). Of industrial products, which comprised less than a quarter of the total

value of the country's exports, machinery and apparatus, animal and vegetable oils, ships, and metal goods were the most important commodity groups. The details of the values of exports in each of these groups of commodities in recent years were (in millions of kroner):

	1935	1936	1937
Bacon, meat and offal	416.5	379.3	404.9
Butter, cream, milk and cheese	300.0	344.3	381.7
Eggs	88.8	112.3	129.8
Live animals	32.9	79.4	93.8
Tallow, oil, rubber, resin, tar, etc.	58.2	54.1	70.3
Machinery, apparatus, instruments, vehicles, etc.	54.6	67.2	82.3
Ships	32.9	41.1	55.7
Fish	37.0	34.5	33.4
Other goods	192.5	214.3	289.5
Total exports	1,213.4	1,326.5	1,541.4

Source: *Danmarks Vare-Ind-og Udførsel*, 1935-7 (Köbenhavn, 1936-8).

Exports of Agricultural Produce

While Denmark sold nearly all her bacon and ham in Britain, she sold her live animals mainly to Germany. Bacon exports before the war were subject to control (see p. 263) and were between 175,000 and 200,000 tons. Exports of live animals, on the other hand, were more variable, since they fluctuated according to the need for reducing or increasing the numbers of livestock in response to the market for dairy produce and bacon. For example, the export of horned cattle rose from about 97,000 head in 1935 to 172,000 head in 1937. Germany bought over four-fifths of these numbers, and the bulk of the remainder was sold to Belgium and Luxembourg although Switzerland and Italy were also purchasers. Similarly, the export of live pigs rose from 53,000 head in 1935 to 184,000 head in 1936 and 167,000 head in 1937. In each of these years Germany took virtually the whole of these numbers and also the export of live fowls and chickens, which grew from 8,000 in 1935 to 275,000 birds in 1937. The recent reduction in the numbers of livestock was also reflected in the exports of fresh beef and veal which increased from 85,000 tons in 1935 to 220,000 tons in 1937. In 1935 and 1936 Germany took nearly a half of this export, but in 1937 nearly three-quarters of it was sold in the Netherlands. The offal, such as liver, hearts, kidneys and guts, was sold almost entirely to Germany, whose manufactures of a great variety of sausage made large demands for such products.

Denmark's export of butter which was about 138,000 tons in 1935 grew gradually to about 153,000 tons in 1937. This export was almost entirely shared by Britain and Germany. Britain's share was maintained fairly consistently at about three-quarters of the total export and Germany's share was about 23%. The manufacture of cheese

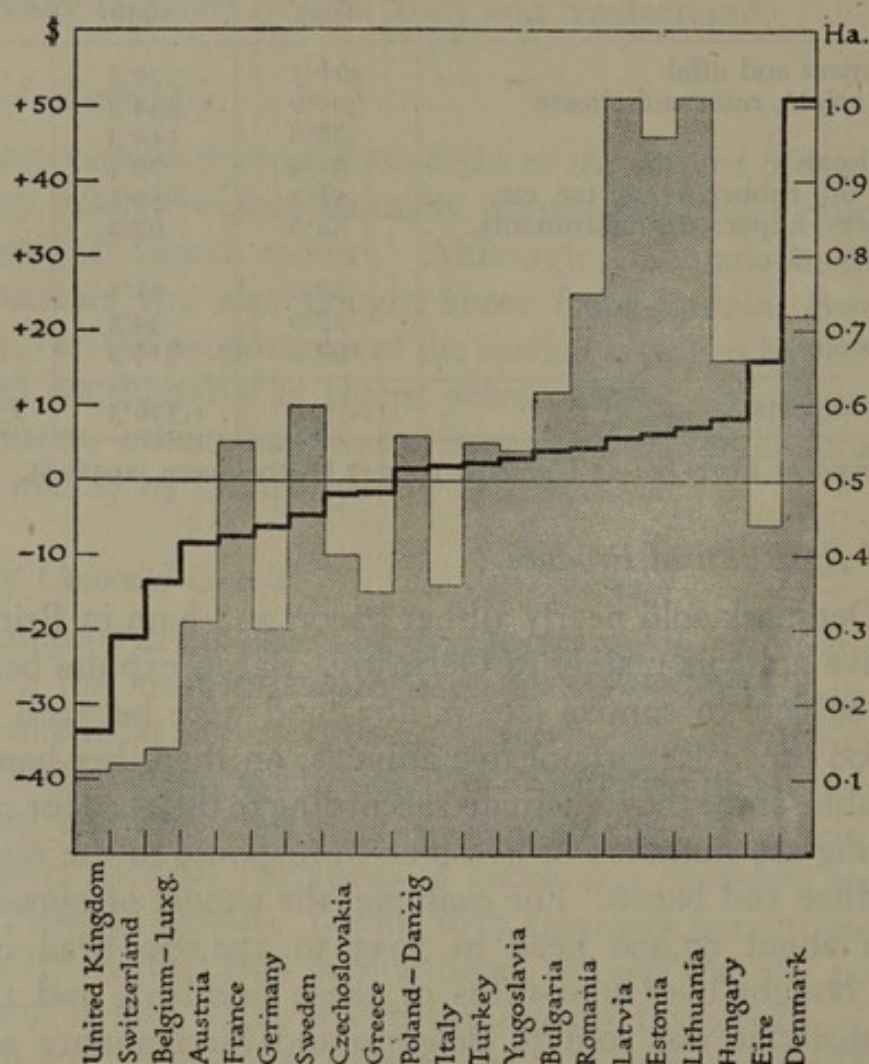


Fig. 72. The trade in foodstuffs per head of population in relation to the cultivated area per head of population in several European countries during 1936

Based on a diagram in *Europe's Trade*, p. 14 (League of Nations, Geneva, 1941).

The thick line, which should be read against the scale marked on the left-hand side of the diagram, represents the value in dollars of the net imports (minus values) or the net exports (plus values) of foodstuffs and live animals per head of population. The stippled area, which should be read against the scale marked on the right-hand side of the diagram, shows the cultivated area (arable land, tree and bush crops) in hectares per head of population. The countries are arranged from left to right in the order of magnitude of their balance of trade in foodstuffs. Thus the food-importing industrial countries appear on the left and the agricultural food-exporting countries appear on the right. The high efficiency of Danish farming and the high value of dairy produce give her the highest food exports, in relation to the size of her population, although the area under cultivation per head is lower than in several other countries where agriculture is more backward or more extensive.

for export had not developed on anything like the same scale because the market for fresh butter was so good. Recently, however, cheese making received more attention, and the Danish cheese industry had been building up a wider and larger market. Exports of cheese grew from some 6,660 tons in 1935 to 9,400 tons in 1936. Germany bought more than a half of the total export while the purchase of the United States grew from about 15% of the total export in 1935 and 1936 to about one-quarter in 1937. Britain's purchases were 10-15% of the total export.

Danish eggs went mainly with Danish bacon to Britain, where about three-quarters of a total export of between 70 and 80 million score, fresh and preserved, were sold. Germany bought the bulk of the remainder.

Sweden shared with Britain the export of animal fats and they absorbed rather more than half of the total export of between 21,000 and 24,000 tons; the bulk of the remainder went to Belgium, Finland and the Netherlands.

Exports of Vegetable Oils

The oil-pressing industry of Denmark produced a surplus of vegetable oils for export. Sweden and Morocco were the chief buyers of these oils, although Britain bought anything from one-third to three-quarters of the export of palm oil, which ranged between 5,000 and 16,000 tons a year. Sweden bought over one-third of the amounts of coconut oil and one-fifth of both the soya-bean oil and the groundnut oil sold abroad, while Morocco bought an approximately equal quantity of soya-bean oil and about one-tenth of the groundnut oil. Coconut oil and fat formed the largest export and amounted to between 18,000 and 25,000 tons annually and was followed closely by soya-bean oil at between 16,000 and 19,000 tons. Groundnut oil sold abroad was between 7,000 and 11,000 tons. Other buyers of considerable amounts of vegetable oils were Norway, Finland and Switzerland.

Exports of Cement

Denmark exported between 250,000 and 330,000 tons of Portland cement annually. Eire was the most regular customer and bought, on an average, about one-third of the total export each year. The United States bought about 15% and Lithuania about 5-7% of the total exports. The remainder went to different countries in different years.

Exports of Ships

The destination of ships sold to foreign countries naturally varied from year to year, since, owing to the conditions of world shipping, the demands for new tonnage were not rapidly recurrent. Norway with her large mercantile marine and her relatively poor facilities for shipbuilding was the most regular purchaser of Danish ships and bought mainly new-built motor ships. In 1937 and 1935 she bought about three-quarters, both by tonnage and value, of new motor ships sold abroad by Denmark, but in 1936 Holland and France each took about a quarter, by tonnage and value, of the total export of such ships. Norway also bought about three-quarters of the export of second-hand motor vessels. Otherwise, steam and motor ships, new and transferred, were sold mainly to the Baltic countries, although sales were also made from time to time to lands as far afield as South Africa and Chile.

FOREIGN TRADE BY COUNTRIES

Trade with the United Kingdom

During the years immediately before the war Denmark sold between 53 and 67% by value of her exports to Britain, but she bought only between 30 and 38% by value of her imports in Britain. Denmark's exports to Britain were nearly one-third larger than those of Germany and consisted mainly of bacon and dairy produce. Her annual export of bacon to Britain was about 175,000 tons. This was, effectively, the total Danish export of bacon and represented about 45% by value of all her sales in Britain. Next in importance to bacon was butter, of which the annual sales to Britain were about 110,000 tons and formed about one-third of the total value of Danish exports to Britain. Of the remaining Danish exports, eggs were the only commodity of considerable value and represented some 10% by value of Danish exports to Britain. The export of fresh and preserved eggs to Britain grew from some 39 million score in 1935 to 60 million score in 1937. The remainder of the Danish exports was made up mainly of fish, condensed milk and cream, vegetable and animal oils and fats, skins and hides, and machinery, but none of these groups of commodities represented more than about 2% of the total value of British purchases in Denmark.

In return Denmark imported from Britain chiefly coal and coke, iron and steel, textiles, yarn and thread, but payments were also made

in Britain for oil seeds and mineral oils which originated from other lands. Coal and coke formed about one-fifth of the value of Denmark's purchases, and were about 4.4 million tons in the years 1935-7, representing, on the average, approximately 80%, both by weight and value, of Denmark's total importation of coal and coke.

Value of Danish Imports and Exports by Countries
(in millions of kroner)

	Imports			Exports		
	1935	1936	1937	1935	1936	1937
United Kingdom	479.2	542.3	641.9	730.8	742.5	823.0
Germany	292.2	376.0	407.1	203.4	278.0	296.5
Sweden	89.8	101.0	103.4	56.2	59.0	71.7
Norway	33.5	43.5	38.2	46.8	43.6	67.5
Finland	22.7	23.7	23.7	14.6	19.5	31.8
Poland and Danzig	25.9	26.9	16.9	7.2	6.7	14.2
European Russia	28.2	29.9	14.9	0.7	6.6	3.6
Netherlands	40.2	44.7	56.6	13.5	17.1	26.5
Belgium and Luxembourg	29.3	32.4	44.7	18.7	17.8	33.3
France	36.2	15.9	19.9	11.4	19.9	9.5
U.S.A.	69.8	79.0	92.8	9.1	11.2	28.8
Argentina	20.0	23.1	42.5	2.6	3.5	6.2
Brazil	14.2	15.0	18.9	2.4	9.2	10.9
Iceland	3.7	3.9	3.5	5.8	4.3	5.2
Greenland	4.6	2.8	6.8	1.1	1.5	1.8
Other countries	140.6	125.9	169.9	89.1	86.1	110.9
Total	1330.1	1486.0	1701.7	1213.4	1326.5	1541.4

Source: *Danmarks Vare-Ind-og Udførsel*, 1935-7 (Köbenhavn, 1936-8).

The distribution of Denmark's coal imports among the British coalfields remained very stable. The Northumberland and Durham coalfield and the Scottish coalfields supplied the bulk of the exports, each of these regions providing about 45% of the total coal imports. The Yorkshire and Derbyshire coalfields provided about 7% and the Welsh coalfields about 3%. In addition, Britain provided Denmark with about three-quarters, both by weight and value, of her coke imports.

Next in importance by value among Danish purchases in Britain were oil-bearing seeds and nuts which were derived from British and other lands overseas. Such imports formed about 15% of the total purchases in Britain. In the same way mineral oils imported from other lands and paid for in Britain accounted for some 10% by value of the total imports. Normally 6-7% of the value of imports from

Britain were composed of manufactures of vegetable fibres, and a further 4-5% consisted of manufactured goods of wool and hair. Imports of yarn formed about 4%, and slightly worked iron goods formed about 4% by value of imports from Britain. The remainder of Britain's exports to Denmark consisted mainly of metal ores, motor cars, cycles, oil cakes and feeding stuffs, animal fats and oils, leather, rubber and grain.

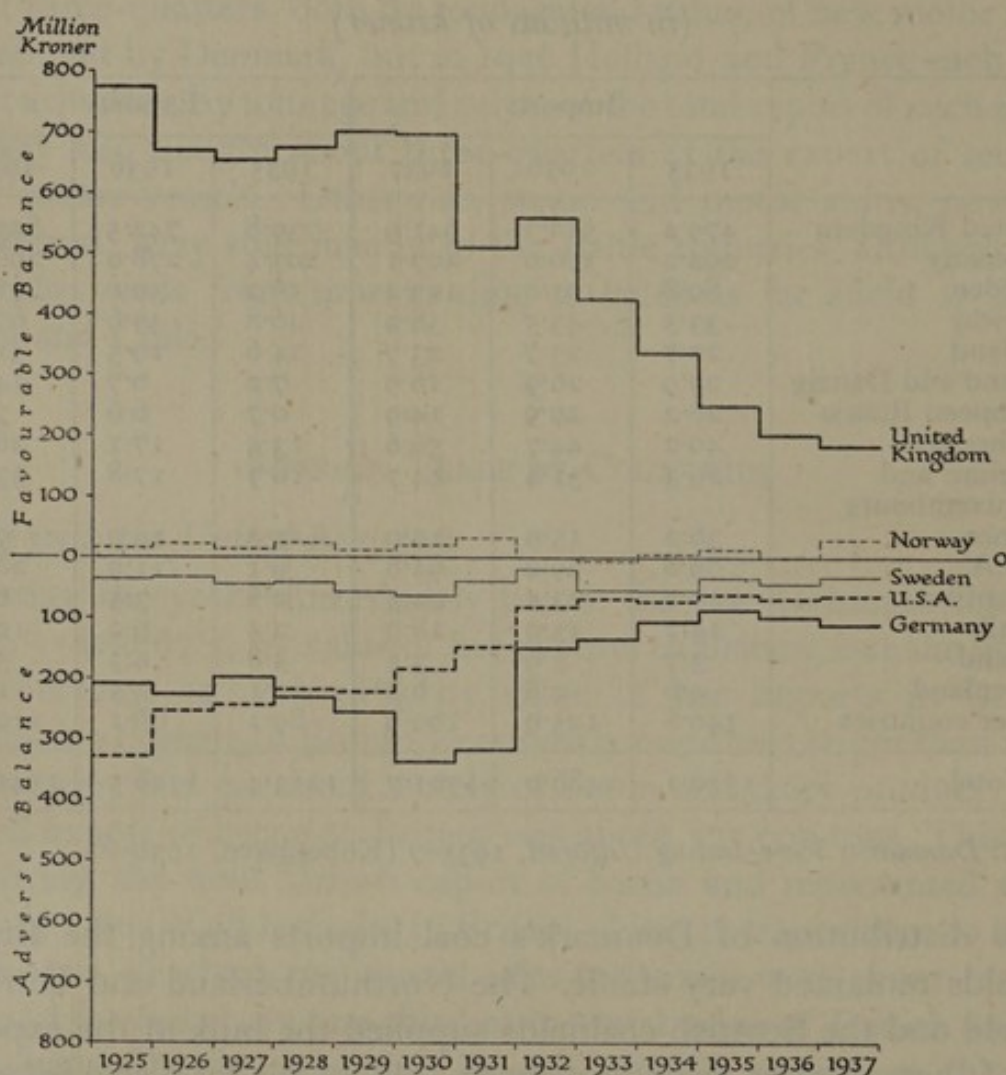


Fig. 73. The balance of trade between Denmark and her chief customers, 1924-37

Based on statistics in *Danmarks Vare-Ind-og Udførsel* (Köbenhavn, 1925-37).

The diagram shows the balances which are favourable or are adverse to Denmark. The reduction in the favourable balance with the United Kingdom after the economic depression of the early thirties was due to decreased sales in, and increased purchases from, Britain. The latter resulted in small purchases from Germany.

Trade with Germany

Denmark bought about a quarter of her imports, by value, in Germany to whom she sold about one-fifth of her total exports. The

balance of trade between the two countries was, in contrast with Anglo-Danish trade, favourable to Germany to the extent of between 90 and 100 million kroner. Denmark sold to Germany chiefly live animals, offal, butter, eggs and, of smaller value, skins and vegetable oils; she bought from her mainly manufactured goods. Germany held the bulk of the trade in silk textiles and supplied two-thirds of Denmark's imports of glass and earthenware, nearly half the imports of iron and steel, more than half the trade in chemicals, one-third of the imports of machinery and vehicles, and a considerable part of the imports of fertilizers.

Rather more than a quarter of the value of Danish sales to Germany consisted of live cattle, live pigs, meat and offal. Sales of butter were of similar value. One-tenth of Denmark's receipts from Germany were paid for eggs and about half as much was received for edible fats and margarine. The most important other purchases were fish, skins and hides, horses and cheese, but none of these items represented more than about a fortieth part of the total value of exports to Germany.

More than one-fifth of Denmark's purchases from Germany consisted of iron goods and almost one-tenth consisted of coal and coke. Chemicals, machinery and fertilizers each formed about one-twentieth of the total value of imports from Germany. The chief other items were textiles which together account for one-eighth of Denmark's purchases in Germany, and approximately equal amounts of this total were spent on yarn and on manufactures of silk, wool and vegetable fibres.

Trade with Sweden

Among the Scandinavian countries, Sweden held pride of place in the volume of trade with Denmark. In contrast with the predominantly agricultural nature of her exports to Britain and Germany, Denmark served Sweden mainly as a supplier of industrial goods. Motor cars and cycles from her assembly plants made up about 15% of the sales to Sweden. Machinery and machine parts, especially Diesel motors, refrigerating plant and vacuum cleaners, accounted for another tenth, while vegetable oils and fats from the Danish oil mills formed between 12 and 15% of the total value of exports, and animal fodder stuffs made up a further 6-8%. In spite of Sweden's importance as a producer of iron ore, Denmark sold to her annually a quantity of iron goods which was equal to about 6-8% of the total export value. The remainder consisted chiefly of skins and hides, fish, textiles and non-

ferrous metals, each of which formed about 3 % of the total export. In most years Denmark also sold some ships to Sweden.

The largest item among Denmark's purchases from Sweden was timber, which accounted for rather more than a quarter of the total value of her purchases. Imports of paper and wood pulp formed, on an average, about 15 % of the total import value. Purchases of raw iron were very small, but semi-worked iron and iron goods made up one-tenth of all purchases. Other significant imports were Diesel motors, mowing and reaping machines, ball-bearings and machine parts.

Trade with Norway

The balance of trade with Norway was in Denmark's favour. The chief single item among the sales to Norway was ships, including both new-built and transferred vessels, which in some years accounted for nearly a half of the total value of sales. Cars and cycles, distributed from assembly plants in Köbenhavn, comprised up to a quarter of the total value. Other regular sales consisted of grain, vegetable oils and fats, fodder stuffs, machinery and iron goods. Sales in each of these groups usually ranged between two and five million kroner.

Chemical fertilizers, chiefly saltpetre, usually formed one-third of the value of Danish purchases in Norway, and paper accounted for a further one-eighth. Up to 10 million kroner might be spent in a year on animal fats and oils, mainly whale oil and cod-liver oil. Fish, raw metals and ships were the only other significant items.

Trade with Finland

Denmark's exports to Finland were similar in character to those which she supplied to Norway. Feeding stuffs were the chief item and usually accounted for over a quarter of the total value of the exports. Cars and cycles were almost as important and formed nearly one-fifth of the total export value. About two million kroner were received for vegetable fats and oils, while sales of machinery varied between 700,000 and 2,700,000 kroner a year. Skins, hides and chemicals were other significant items.

More than a half of Denmark's purchases in Finland consisted of timber. The remainder consisted almost exclusively of paper and wood pulp.

Trade with Poland and Danzig

The value of the trade in different commodities between Denmark and Poland fluctuated considerably. Cars and cycles represented,

fairly consistently, 15-20% of the value of Danish exports, while coal and grain made up about 60% of the value of Danish purchases in Poland. Iron and iron goods represented between one-fifth and one-third of the value of Danish exports, while fodder, animal fats and vegetable oils each varied between one-tenth and one-fifth of the value of all exports. Apart from coal and grain, Denmark's purchases in Poland were mainly feeding stuffs and timber.

Trade with the U.S.S.R.

Denmark bought from Russia grain and feeding stuffs, which comprised about three-fifths of the value of her purchases; mineral oils and some timber formed nearly all the remainder. Danish sales to Russia were usually insignificant and consisted chiefly of machinery, except when the volume of exports was expanded by the sale of ships.

Trade with the Netherlands

The statistics of Danish imports from the Netherlands are misleading in that about two-fifths of the value of purchases consisted of grain and fodder which were imported from other lands through Dutch ports. Similarly, about one-third of the imports consisted of colonial goods, chiefly tobacco and some coffee. Direct imports consisted of relatively small quantities of iron and other metals and still smaller quantities of textiles. The imports through Dutch ports and from the Dutch colonies tipped the balance of trade heavily in favour of the Netherlands.

In return, Denmark sold fresh meat, hides and skins, animal and vegetable oils and machinery in the Dutch market, but the value of sales was less than half that of purchases.

Trade with Belgium and Luxembourg

The volume of trade with Belgium and Luxembourg was not quite so large as that carried on with the Netherlands, but it was similar in that the balance was well in Belgium's favour. A further similarity was that a good deal of the grain, which accounted for about half the total imports, originated in other lands and passed through Antwerp. The remainder of the imports consisted mainly of feeding stuffs, iron, and manufactures of vegetable fibres.

Danish sales to Belgium and Luxembourg consisted of agricultural produce except for sales of machinery to the value of about a million kroner. Live cattle formed, on the average, about one-fifth of the total

value of sales, but there was also a return sale of grain to a similar value. Butter, meat, animal fats and fish, each to the value of one or two million kroner, made up the bulk of the remainder.

Trade with France

A quarter of Denmark's purchases from France consisted of semi-worked iron and steel. Rather more than two million kroner were spent on yarn and, on the average, a similar amount on animal feeding stuffs. Some 800,000 kroner were spent on wines. This left the balance of trade in France's favour because Danish sales of butter, bacon, offal, skins and hides and vegetable oils were relatively small, each being less than a million kroner in value and together they formed only about one-fifth of the total exports. Sales of machinery, in some years, equalled them in value while the remainder consisted of fish, seeds and chemical products. Sales of ships usually formed the bulk of exports and accounted for one-third, and sometimes as much as a half of the total value of sales.

Trade with the United States

Trade with the United States was heavily in that country's favour, since Denmark bought from her grain and fodder and motor-car parts for assembly in plants owned by American companies in Köbenhavn. Grain and fodder usually represented about one-third of the total value of purchases, while motor-car parts formed rather more than a quarter of the value of imports. Textiles made up another one-eighth of the imports and were twice as valuable as purchases of mineral oils in America, since most of these were imported through the United Kingdom. Up to three million kroner a year were usually spent on tobacco.

It might have been thought that Denmark had little to sell to America, since the Middle West produces an immense volume of agricultural commodities and New England has such a variety of highly skilled mechanical industries. Yet she sold to America cheese to the value of about two million kroner in 1935 and 1936 and to nearly twice this value in 1937; this represented about one-eighth of the value of all Danish sales in America. Vegetable oils and fats accounted for one-fifth of the sales in 1937 and showed more than a ten-fold increase over previous years. The most important other exports were hides and skins, non-ferrous metal goods, preserved meat, seeds and machinery.

Trade with Argentina

Denmark's imports from Argentina, like those from the United States, consisted of grain, fodder and oil-bearing seeds. Denmark had, in turn, little to offer to a country like Argentina which is concerned mainly with producing primary food products. The balance of trade was therefore heavily in Argentina's favour. Two-thirds of the Danish purchases from Argentina consisted of grain, one-fifth consisted of fodder, and the remainder was skins, hides and wool. Half of Denmark's sales to Argentina consisted of machinery and the remainder consisted of iron goods, garden produce and chemical products.

Trade with Brazil

Danish trade with Brazil was expanding in both imports and exports. Between one-third and one-half of the Danish sales to Brazil consisted of iron goods, machinery contributed a further 15% of the value, and manufactured goods of leather, bone and hair were of approximately equal value. The only other item of consequence among exports was malt.

Two-fifths of the value of Danish purchases in Brazil consisted of animal fodder and one-half consisted of coffee. The Danes are great coffee drinkers, and in addition to the coffee imported from Brazil they spent between three and five million kroner on this beverage in the Netherlands East Indies. The remainder of the imports from these islands consisted of oil-bearing seeds and nuts.

Trade with Iceland and Greenland

Denmark bought from Iceland mainly fish, whale oil and mutton, but the total value of purchases was less than four million kroner. She supplied her, in return, with cereals, chemicals, vegetable oils and fats, iron goods and machinery to the value of about five million kroner. Trade with Greenland was a monopoly of the Danish government. By far the most important of Greenland's exports was cryolite, which in 1937 formed three-quarters of the total value of her exports. Fish came next in importance, while whale oil, seal oil, and skins were the only other significant items. In return Denmark supplied the country's needs of grain, groceries, timber, and manufactured goods.

Chapter XV

PUBLIC FINANCE

State Finances: Revenue and Expenditure; State Assets and Liabilities

Local Government Finances: Revenue; Expenditure

Currency.

Financial Institutions: Banks; Savings Banks; Credit and Mortgage Institutions

STATE FINANCES

The revenue and expenditure of the state are voted by the *Rigsdag*. The budget is presented to the *Folketing* in October, and after protracted debate is sent to the *Landsting* in March. After approval by the *Rigsdag* and the Crown, it comes into force for the following financial year which begins on 1 April. A supplementary budget is passed towards the end of the financial year.

Current Account: Revenue and Expenditure

The revenue and expenditure on the current account for recent years were as follows (in million kroner):

	1934-5	1935-6	1936-7	1937-8
<i>Revenue</i>				
From capital investments	12.4	8.8	12.0	18.4
Interest on public funds	49.9	51.0	51.9	51.8
Taxes on real estate	11.8	12.1	12.5	13.6
Taxes on incomes and holdings	102.9	119.5	144.6	180.1
Motor tax	28.4	32.1	37.3	43.9
Customs and excise	303.6	291.0	305.3	321.0
Other receipts	7.4	6.9	6.2	9.2
	516.4	521.4	569.8	638.0
<i>Less:</i> Deficit on public undertakings	-19.3	-15.0	-10.8	-17.6
Interest paid on debts	-74.2	-73.2	-71.1	-75.1
Total revenue	422.9	433.2	487.9	545.3
<i>Expenditure</i>				
Administration	28.8	30.3	32.9	33.2
Social services	137.5	137.5	144.6	162.9
Education, science, art	60.5	62.8	64.9	68.1
Health services	17.1	14.9	16.8	19.1
Justice and police	17.4	18.7	19.6	20.8
Roads and sanitation	16.5	15.7	12.4	15.8
Encouragement of trade and industry	23.1	24.2	39.4	57.7
National Defence	45.0	47.4	48.2	59.2
Miscellaneous expenses	58.7	68.2	81.7	85.1
Total expenditure	404.7	419.8	460.5	521.9

Source: Statistisk Aarbog, 1939, pp. 180-1 (Köbenhavn, 1939).

See Note on facing page.

Revenue

Neglecting the debit items included under revenue, rather more than a half of the total was derived from customs and excise duties, and, on an average, about a quarter was derived from income tax. About one-third of the revenue from customs and excise was derived from import duties. Of the excise duties, the taxes on spirits, beer and tobacco each yielded about 40 million kroner. Some 18 million kroner came from taxes on sugar and a further 14 million kroner came from sales of confectionery; taxes on gasoline yielded some 26 million kroner, while a further duty, imposed by a law of 1932, yielded 20 million kroner which were allocated towards the cost of the Storström bridge.

The import duties were mainly specific duties from which the industries of the country derived, on the whole, only a small measure of protection. The chief specific duties were imposed on wines, fruit, coffee, cocoa, tea, tobacco leaf, wood, paper, yarn, woollen goods, and rubber. Some *ad valorem* duties were imposed, the chief being on carpets and machinery, while some articles such as footwear and motor lorries were subject to combined weight and *ad valorem* duties.

State income tax was levied on personal incomes and on profits of corporations. The tax on personal incomes was low and ranged from $\frac{1}{2}$ % for the first 500 kroner of taxable income to 25 % for the amount of taxable income over 1000 kroner; allowances were made for wives and children. The tax on corporations was levied on profits above 5 % and varied from 7 % to rather more than 15 %, according to the rate of profit in proportion to the invested capital.

The taxes on real property were assessed on the value of land and of buildings at rates of 1.1 and 1.5 % respectively; the tax on land yielded about 8 million and that on buildings about 5 million kroner. Of miscellaneous receipts about 3 million kroner accrued from profits on the state lottery.

The chief items which went to produce the deficit on public enterprises were a loss of 20 million kroner on the State Railways in

Note. The state accounts are compiled on the net system. The balance of payments by public undertakings is posted to revenue whether it be surplus or deficit. Thus deficits are deducted direct from revenue and are not posted to expenditure as is usual in state budgets. The expenditure on public undertakings includes interest due on, and contributions to, the sinking fund for real property and plant, which thus receive contributions for their upkeep from the current account. Similarly, the expenditure on wages to employees of the state includes contributions towards the cost of their pensions.

1937-8 (14 millions in 1936-7), and a loss of some 2 million kroner on the ports owned by the state. The chief credit items in this account were profits of nearly 4 million kroner from posts and telegraphs and of some half a million kroner each on forests and the mint. On the other hand, part of the interest on public funds was derived from land and from capital invested in these enterprises.

Of the interest on debts, 30 million kroner represented interest on the external national debt and about 25 million kroner the interest on the internal national debt.

Expenditure

The outstanding features of state expenditure were that, on an average, one-third of the total current expenditure was on social services and almost 15 % was on public education. About 11 % of the expenditure was incurred in national defence.

The expenditure of the several departments of state for the financial year 1937-8 were:

	Million kroner		Million kroner
Rigsdag	2.3	Ministry of Justice	21.3
Ministry of State	1.2	Ecclesiastical Affairs	3.3
Foreign Affairs	6.4	Education	75.9
Agriculture and Fisheries	42.2	War	38.2
Home Affairs	35.2	Marine	30.8
Social Welfare	164.8	Finance	28.0
Public Works	17.1	Pensions	19.5
Trade, Industry and Shipping	9.9		

Source: *Statistisk Aarbog*, 1939, pp. 195-203 (Köbenhavn, 1939).

Of the 38 million kroner spent on agriculture, over 8 millions went to finance the agricultural debt, 6 millions were absorbed by the butter subsidy and a similar amount by the wheat fund. Three million kroner were spent on soil improvement and a similar amount on fisheries, mainly in assistance to fishermen but partly in fisheries control, research and life-saving. The liabilities of the Ministry of Home Affairs were mostly on account of health services. Nearly a half of its expenditure was on hospitals, asylums and sanitation, although $8\frac{1}{2}$ million kroner were spent on public buildings, parks and gardens. More than half of the 8 million kroner spent on hospitals went towards tuberculosis sanatoria, and the bulk of the money spent on sanitation was expended on measures to prevent epidemics.

The comprehensive system of health insurance and pensions accounted for 77 million kroner of the expenditure of the Ministry of Social Affairs. Old age pensions absorbed nearly two-thirds of this amount and sickness insurance accounted for the remainder. In addition, 31 million kroner were spent on unemployment insurance, 12½ millions on child welfare and maintenance, and 23 millions on the maintenance of defective and abnormal people. The expenditure of the Ministry of Public Works included 11 million kroner spent on the State Railways, in addition to the deficit entered in the revenue account.

Thirty-eight million kroner were spent on education in elementary schools, nearly all in the form of grants to municipal schools. Higher schools absorbed 12 million kroner in equal shares to state schools and to municipal and private schools. Seven millions were spent on institutions for higher education such as universities, colleges and academies, while another 5 million kroner were allocated to museums and libraries.

Thirty-one million kroner were spent on the army and 11½ million kroner on the fleet, but the Ministry of Marine also spent about 4 millions on the lighthouse service and nearly 3 millions on fisheries inspection. The expenditure of the Ministry of Finance was incurred mainly in the collection of customs and taxes, while that of the Ministry of Pensions was on account of pensions to state officials and their dependants. Forty million kroner were spent in this way, but the gross expenditure was reduced by nearly 21 million kroner derived from superannuation contributions and grants from institutions and from other ministries.

State Assets and Liabilities

The balance sheet for 31 March 1938 gave the total assets as 2,001 million kroner, rather more than a quarter of which was represented by the State Railways. The value of posts and telegraphs was returned as 58 million kroner, ports owned by the state were valued at 49 million kroner, and buildings, forests, institutions such as colleges, schools, asylums, museums and hospitals, and the lands, buildings and assets of the Ministries of War and Marine, totalled 520 million kroner. The value of bonds held was 134 million kroner, outstanding debts and loans totalled 132 million kroner, while the remainder was held mainly in special funds such as those for state loans, land loans and the crisis fund. The crisis fund was established in May 1933 for the purpose of supporting financial institutions

which might be in difficulties as a result of interest abatements or moratoria granted to agriculture.

The liabilities of the state totalled 1,646 million kroner. Thus the net assets of the state were 355 million kroner. The national debt was 1,197 million kroner, of which 542 million kroner were internal debt and 655 million kroner were external debt. The national debt in former years was:

	Million kroner	Kroner per head of population
1914	361	126
1925	1,212	355
1930	1,355	383
1935	1,251	339
1936	1,220	328
1937	1,229	328
1938	1,197	318

The remaining liabilities were holdings against treasury notes and bonds and the funds established for specific purposes.

LOCAL GOVERNMENT FINANCES

Revenue

The finances of the local authorities are administered by the urban and rural communes (counties and parishes). Revenues are derived from public properties and enterprises, rates, fines and levies, and taxes, but they also receive contributions from the state towards expenditure on education, highways, old-age pensions and poor relief. The revenues from different sources for the financial year 1937-8 totalled some 560 million kroner, of which 45 % was derived from income tax, and 23 % was from rates.

Local income tax was levied on persons residing in the commune and on the amounts earned in the commune by those living outside its boundaries. In the case of the latter the tax might be adjusted according to the amount paid in the commune of residence. The assessments were increased up to 50, 35, 25 and 15 %, according to whether the income was derived from capital, real estate, salary or pension. Then, after deductions for children, the assessed taxable income might be increased by 50 % or reduced by 70 % according to the circumstances of the taxpayer which were determined, in the main, according to the size of the income, the increase on large incomes acting, in effect, as a surtax. On these finally adjusted

assessments the income tax was calculated as a flat rate which was determined according to the estimated expenditure of the commune. Thus, while in the United Kingdom income tax is levied at differential rates on different income levels, in Denmark the assessments are adjusted according to the source and amount of the income, and the rate of taxation is uniform within the commune although it might vary from commune to commune.

Rates are levied as a ground tax assessed on the value of the land and as a property tax assessed on the value of buildings.

Expenditure

Expenditure in 1937-8 amounted to 499 million kroner. About 16 % of the total expenditure was on public education which, combined with 68 million kroner spent by the state on this account, represents a high proportion of national expenditure. The largest item in the expenditure of local authorities is on social services which account for one-third of the total. Public assistance is paid almost entirely by them and they share with the state the costs of old-age pensions and unemployment insurance. Expenditure on health services amounted to 46 million kroner which included the maintenance of hospitals. Eighty-seven million kroner were spent on roads and sanitation, and the chief other items were costs of administration and maintenance of justice and police services.

CURRENCY

The monetary unit is the *krone* of 100 *öre*. The standard of value is gold and the krone contains 0.403226 grm. of gold. Since September 1931 Denmark has been off the gold standard, and since January 1933 the krone has been pegged to sterling at an exchange rate of 22.40 to the £ sterling. The par rate of exchange was 18.159 kroner to the £ sterling. Denmark has the same monetary system as Norway and Sweden, and there was a monetary union between the three countries from 1875 until the war of 1914-18. When they returned to the gold standard they all adopted the same parity and all followed Britain off the gold standard.

The circulating media are the notes of the *Nationalbank* and coins of aluminium bronze, nickel, iron and bronze with nominal values of 2, 1 and $\frac{1}{2}$ kroner, and 25, 10, 5, 2 and 1 *öre*. There were also gold coins of 20 and 10 kroner value.

FINANCIAL INSTITUTIONS

Banks

Apart from the *Nationalbank*, the greater part of the banking business of the country is transacted by the three largest banks, namely *Privatbanken i København*, established in 1857, *Den danske Landmansbank*, *Hypotek-og Vekselbank*, established in 1871, and the *Københavns Handelsbank*, established in 1873. In December 1938 there were 163 banks in Denmark, but nearly half the total of the balance sheets of all banks was represented by the three banks mentioned above. With some exceptions, such as *Aarhus Privatbanken*, *Fyns Diskonto Kasse* at Odense and the *Varde Bank*, they are of only local importance and are not very large. A classification of the banks by size of their share capital in 1938 gives the following figures:

Banks with share capital of	Number	% of share capital of all banks
40-50 million kroner	3	48.2
10-15 million kroner	2	7.9
5-10 million kroner	3	7.1
2-5 million kroner	15	13.0
1-2 million kroner	22	8.4
500,000-1 million kroner	39	8.1
200,000-500,000 kroner	64	6.5
Under 200,000 kroner	15	0.7

Source: *Statistisk Aarbog*, 1939, pp. 124-5 (København, 1939).

Danmarks Nationalbank is the only bank of issue. Established as a state bank in 1813, it became a private joint-stock bank five years later and remained as such until April 1936, although the government exercised a measure of supervision over its affairs. In 1936 it was formed into an independent institution managed by three governors and a board of directors chosen and controlled by the government and the chief trades and industries. It operates in the interests of the country alone and has no longer to consider the interests of shareholders.

The bank must have a gold reserve covering at least 25 % of the total active note issue. In 1938 the note circulation was 441 million kroner, and the gold reserve was some 118 million kroner or about 26 $\frac{3}{4}$ %. The profits of the bank for the years 1935-8 averaged about 6 $\frac{1}{2}$ million kroner a year, which, apart from allocations to the reserve fund, go to the state which advanced the capital fund of 50 million

kroner. This sum was to be redeemed gradually from the surplus profits of the bank. The value of the share capital is also 50 million kroner issued as debentures with a nominal value of twice the face value of the shares.

The commercial banks had a share capital of 294 million kroner on 30 November 1939 and a reserve fund of 201 millions. They are controlled by the regulations stipulated in the Banks Act of 1919 and amended by an Act of 1930. Banks must have a total capital of not less than 300,000 kroner. They are under the supervision of a bank inspector appointed by the government and to whom accounts and monthly returns must be submitted. Bank regulations must be approved by the Ministry of Commerce. Release of foreign currency by banks were subject to the production of an import licence (see pp. 304-5).

Savings Banks

In 1938 there were 524 savings banks in Denmark. Of this number, 416 were in rural communes, 103 were in provincial towns and five were in Köbenhavn. The deposits in the various banks for the financial year 1937-8 are shown in the following table. Four of the savings banks had deposits of over 100 million kroner each.

	No. of savings banks with deposits of:				Total deposits in millions of kroner
	Over 5 million kroner	1-5 million kroner	$\frac{1}{2}$ -1 million kroner	Under $\frac{1}{2}$ million kroner	
Köbenhavn	4	0	1	0	680.8
Provincial towns	63	31	6	3	1,208.8
Rural communes	7	68	180	161	308.9
Total deposits in millions of kroner	1,849.2	230.5	96.0	22.8	2,198.5

Source: *Statistisk Aarbog*, 1939, pp. 124-5 (Köbenhavn, 1939).

Most of the money is invested in bonds and in mortgages, mainly on farm properties, and they make small short-term personal loans within their intimate knowledge of local conditions and persons. The deposits represent largely the savings of the rural population who contribute the bulk of the deposits at the banks in the provincial towns in contrast with the commercial banks which serve the industrial and commercial community mainly. More than half the individual deposits are in accounts of less than 200 kroner, and only 106,000 accounts, out of a total of about 2 $\frac{1}{4}$ million, are in amounts of

over 5,000 kroner although the latter form more than a half of the total sums deposited.

One of the features of Danish banking was the high rate of interest. The interest on overdrafts or cash credits in banks was between 6 and 7 %. Savings Banks paid 4 % and commercial banks maintained this rate to within $\frac{1}{2}$ % and paid $2\frac{1}{2}$ % even on current accounts.

Credit and Mortgage Institutions

In Denmark the granting of loans against pledges in real estate is organized mainly through credit associations and mortgage societies. These institutions are formed of property owners who seek loans, on joint liability, over long periods of redemption, usually about sixty years. The credit associations grant loans on first mortgages up to three-fifths of the appraised value of properties; the mortgage societies grant loans on second mortgages, and the maximum liability may reach three-quarters of the value of properties. The associations and societies operate usually within certain localities and often specialize in either landed or town properties. The associations and societies do not lend cash but issue bonds which can be traded on the stock exchange and rank as trustee stock. The borrower must pay interest and a contribution to the gradual paying-off of the loan.

In 1938 there were in Denmark thirteen credit associations which had outstanding loans to the amount of 4,882 million kroner. Mortgage societies numbered eight, with a total of 489 million kroner in outstanding loans. It has been calculated that, on an average, about 60 % of the commercial value of farms is covered by debt. Until the depression of the early thirties the burden of debt was not seriously felt, but contracting markets, falling prices and restricted output increased the load on agriculture. Short-term credit forms only about a fifth of total indebtedness and covers mainly advances for land improvement, building or purchase of machinery. The quick and regular returns of Danish farming did not create a need for loans to cover large fluctuations in working capital.

The *Kongeriget Danmarks Hypotekbank* exchanges its own bonds for those of credit and mortgage institutions and takes up loans on its own bonds. For this purpose the state furnished the bank with a reserve fund of 30 million kroner. The bank facilitated the sale of bonds abroad since it offered the additional guarantee of amalgamation and its bonds had the status of a gilt-edged security. The total amount of bonds outstanding at any time must not exceed eight times the amount of the reserve fund.

Chapter XVI

MERCANTILE MARINE

The Work of the Merchant Fleet: The Composition of the Merchant Fleet: The Age of the Merchant Fleet: Shipping Companies: State-owned Ships: Shipping Lines and Services

Denmark, like Norway, Sweden, the Netherlands and Greece, is a small nation with a large mercantile marine. In 1939 the Danish merchant fleet ranked twelfth in order of total tonnage among national fleets, but the tonnage per head of population was exceeded by that of Norway, Britain and the Netherlands only. Denmark built the world's first ocean-going motor ship in 1912 and, with Norway, she has held the lead in the transition from steam to motor propulsion. Thus while the Danish fleet formed 1.7% of the total world tonnage of steam and motor ships over 100 gross tons, Denmark owned 3.6% of the total tonnage of motor vessels. It was a matter of pride among Danish shipowners that the country's shipping was not subsidized in any way and that they were able to hold their own in competition

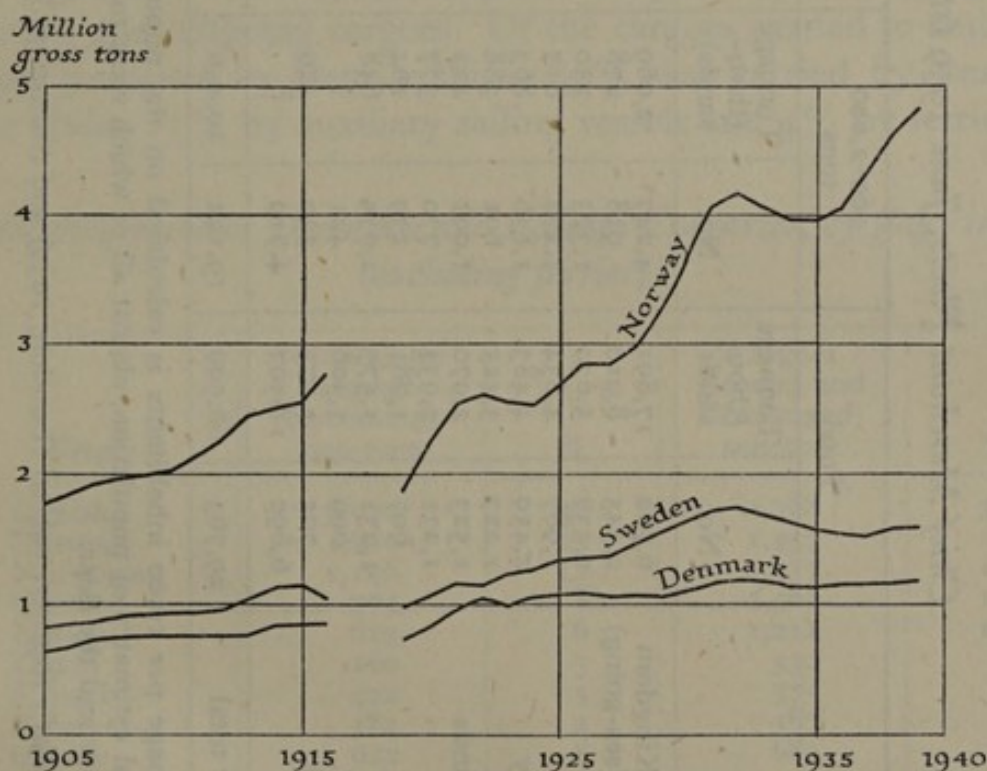


Fig. 74. The growth of the merchant fleets of Denmark, Norway and Sweden, by tonnage, 1905-39

Based on statistics in *Lloyd's Register*, 1939-40, vol. III (London, 1939).

Chief Merchant Fleets, June 1939 (steam and motor ships of over 100 gross tons)

	Total		100-2,000 tons		2,000-6,000 tons		6,000-10,000 tons		10,000 tons and over		Tonnage per 1,000 inhabitants
	No.	Tonnage (thou-sands)	No.	Tonnage (thou-sands)	No.	Tonnage (thou-sands)	No.	Tonnage (thou-sands)	No.	Tonnage (thou-sands)	
United Kingdom	6,722	17,891	4,247	2,069	1,475	6,434	761	5,742	239	3,646	377
U.S.A. (sea-going)	2,345	8,910	918	478	822	3,601	542	3,939	63	892	68
Japan	2,337	5,630	1,373	750	696	2,695	230	1,705	38	480	78
Norway	1,987	4,834	1,272	817	441	1,770	252	1,975	22	272	1,655
Germany	2,459	4,483	1,836	863	405	1,534	174	1,302	44	784	66
Italy	1,227	3,425	691	388	399	1,692	107	763	30	582	79
Netherlands	1,523	2,970	1,091	422	244	888	153	1,158	35	502	340
France	1,231	2,934	770	377	333	1,226	90	721	38	610	70
Greece	607	1,781	239	164	345	1,453	22	147	1	17	251
Sweden	1,231	1,577	1,035	648	161	595	27	206	8	128	250
U.S.S.R.	699	1,306	421	?	251	?	25	?	2	?	8
Denmark	705	1,175	530	429	139	454	31	239	5	53	310
Others	6,690	11,593	4,719	?	1,552	?	366	?	53	?	—
World total	29,763	68,509	19,142	10,456	7,263	28,703	2,780	20,750	578	8,600	—

The tonnage per 1,000 inhabitants is calculated on the population of the country (excluding overseas territories) according to the latest official estimates of population, almost all of which were made during the latter half of 1938. The figures for Germany are for the 1933 territory and the Saar.

Sources: *Lloyd's Register*, vol. III (London, 1939) and *Statistical Yearbook of the League of Nations*, 1938-9 (Geneva, 1939).

with other countries under the strict rules which are enforced regarding the wages and accommodation of crews. The table on p. 338 sets out the details of the chief merchant fleets in order of size.

It will be seen that the Danish merchant fleet, like that of Sweden, differs from those of other countries in that about two-fifths of the tonnage consists of ships of less than 2,000 tons, and over three-quarters of the tonnage is accounted for by ships of up to 6,000 tons. In the other countries, except Greece, ships of over 6,000 tons comprise about two-fifths or more of the total tonnage. The large number of small ships is due to the busy coastwise, and North Sea and Baltic, trade carried on direct from small ports which cannot accommodate large ships.

THE WORK OF THE MERCHANT FLEET

Shipping between Denmark and Foreign Countries

Danish ships formed about two-fifths of the tonnage entering Danish ports, and they carried a similar proportion of the cargoes loaded and discharged, which amounted to some 13 million tons in 1938. Swedish, Norwegian, British and German ships were the only other significant carriers, and together they transported 45% of all incoming and outgoing cargoes. Of the cargoes carried to and from foreign countries by Danish ships, 83% was carried by steam or motor ships, 13% by auxiliary sailing vessels and 4% by ferries.

Shipping between Denmark and Foreign Countries, by flag, 1938 (excluding ferries)

Flag	Net register tonnage (incoming) 000 tons	%	Cargoes (loaded and discharged) 000 tons	%
Danish	4,030	41	4,788	38
Swedish	1,460	15	1,557	12
Norwegian	1,146	12	1,357	11
German	775	8	1,563	12
British	623	6	1,212	10
Dutch	260	3	530	4
Finnish	472	5	575	5
Estonian	184	2	387	3
Others	922	8	682	5
Totals	9,872	100	12,651	100

Source: *Danmarks Handelsflaade og Skibsfart*, 1938, in *Statistiske Meddelelser*, 4. Række, 110. Bind, Nr. 3 (Köbenhavn, 1940).

Danish ships carried 36% of the 10.6 million tons of incoming cargoes and 48% of 2.0 million tons of outgoing cargoes in 1938. The wide discrepancy between imports and exports arises from the small bulk, but high value, of Danish exports in comparison with the bulky raw materials which make up the import traffic. Thus about half the outgoing ships leave in ballast. Danish ships carried the bulk of both exports and imports between Denmark and Britain, France, U.S.A., Poland and Danzig, but the greater part of the trade with Sweden, Finland, Germany and the Netherlands was carried in the ships of those countries respectively. Details of the traffic between Denmark and other countries in 1938 are given in the table below, which shows no significant change from conditions in 1936 and 1937. In addition, Danish ships carried 8.6 million tons of cargo between foreign countries. The chief areas of this foreign carrying are the North Sea, the Baltic, and the ports of the English Channel; coal and timber are the most important cargoes.

*Traffic between Denmark and Foreign Countries 1938
(excluding ferries)*

	Imports			Exports		
	Total imports in thousands of tons	% carried in Danish ships	% carried in the country's ships	Total exports in thousands of tons	% carried in Danish ships	% carried in the country's ships
United Kingdom	4,372	38	18	641	77	10
Germany	1,964	35	46	350	35	58
Sweden	449	28	60	320	34	57
Netherlands	463	16	43	79	4	65
Norway	206	23	36	80	52	22
Finland	221	9	59	100	4	75
Russian Baltic ports	75	17	64	—	0	97
Poland	202	49	9	54	70	—
Danzig	178	53	0	23	62	0
Belgium	138	65	1	103	38	1
France	43	61	0	12	66	0
British North America (east coast)	118	43	0	2	7	0
U.S.A. (east coast)	465	25	15	54	40	10
U.S.A. (west coast)	39	87	0	3	100	0
Brazil	134	65	0	3	26	0
Argentina	206	50	0	10	1	0

Source: *Statistiske Meddelelser*, 4. Række, 110. Bind, Nr. 3, pp. 18-19 (Köbenhavn, 1940).

The merchant fleet of Norway carried most of the trade between Denmark and the east coast of America that was not carried in Danish bottoms, while Swedish ships took a prominent part in the import trade from Norway, France, Belgium, Canada and Argentina. A considerable part of the trade within the Baltic was carried in sailing and sail-motor ships, and in the trade with Sweden more than twice as much cargo, consisting largely of timber, was carried in such ships as in steam and motor vessels. Estonian ships took a prominent part in the trade with Finland and Poland. Swedish and Norwegian ships carried nearly a quarter of the cargoes from Britain to Denmark, and German ships carried much of the imports from Dutch and Belgian ports.

Coastwise Shipping

Coastwise shipping, which carried between $2\frac{1}{2}$ and $2\frac{3}{4}$ million tons, apart from ferry services, was almost entirely done by Danish ships. Auxiliary sailing ships carried about a half of all cargoes, and regular line services from Köbenhavn carried most of the remainder. Between 1935 and 1938, foreign ships carried less than 5% of the total traffic. The chief foreign participants were Swedish, German and Dutch ships.

Freight Earnings

Only a small part of the Danish merchant fleet is employed in trading to and from the home country. The greater part of the fleet is engaged in traffic between foreign countries, and most of its freight earnings are gained abroad.

The gross freight earnings of the merchant fleet fell to 146 million kroner during the depression but recovered rapidly to 200 million kroner in 1935, and was 279 million kroner in 1938. Approximately one-eighth of this amount was earned by ships on time charter to foreign countries, chiefly American, and the remainder was earned in almost exactly equal proportions by regular and by tramp services. Rather more than three-quarters of the gross freight earnings was gained in the service of foreign countries, and of the remainder rather more than two-thirds was earned in importing goods to Denmark. The greater part of the earnings in the import traffic was acquired by regular services which also accounted for virtually all the freight earnings on Danish exports which require rapid and prompt delivery. Of the earnings from foreign countries, a half was

gained by tramp services, a third by regular services, and the remainder by ships on time charter. Usually over one-third of the gross earnings were spent on coal, stores, port charges, etc. The net earnings are an important contribution towards balancing the trade between Denmark and foreign countries (see pp. 309-10).

The active tonnage in both 1937 and 1938 was about 1,030 thousand gross tons, but on account of increase in the size of the fleet the laid-up tonnage in 1938 was 37,000 tons as compared with 8,000 tons in 1937. Shipping had recovered from the depression, when about a quarter of the fleet was laid up, and the freight index had risen as shown in Fig. 75.

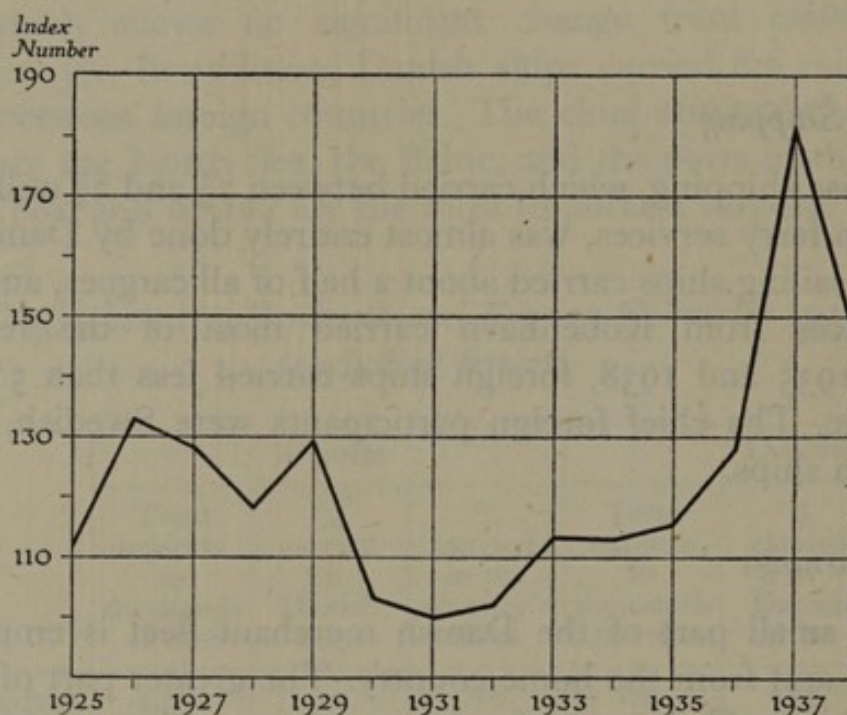


Fig. 75. The movements of the freight index, 1925-38 (base 1931 = 100)
Based on figures in the reports on *Economic Conditions in Denmark* (Department of Overseas Trade, London) and *Statistisk Aarbog* (Köbenhavn, annually).

THE COMPOSITION OF THE MERCHANT FLEET

At the end of 1938 the merchant fleet was made up of the following categories of ships of over 20 gross tons:

	Steam-ships	Motor ships without sail	Auxiliary sailing vessels		Sail-ships	Total
			Fishing	Others		
Number	502	239	519	634	8	1,902
Gross tonnage	578,980	569,203	16,711	44,539	1,035	1,210,468

Source: *Statistiske Meddelelser*, 4. Række, 110. Bind, Nr. 3 (Köbenhavn, 1940).

These include, apart from ships owned by the state (see p. 350), the following vessels for special purposes:

	No.	Gross tonnage
Tugs, salvage ships and port craft	67	6,685
Ice-breakers	5	1,385
Sand-pumpers and dredgers	24	6,576
Cable-laying ships	3	4,578
Yachts	12	726
Club-ships and training ships	2	520

The following table classifies the steam- and motor-driven ships by tonnage and predominant usage.

Gross tonnage	Steam-ships				Motor-ships			
	Passenger ships		Cargo ships		Passenger ships		Cargo ships	
	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage
20-50	8	329	1	34	12	433	8	337
50-100	9	687	3	267	19	1,653	17	1,448
100-500	17	4,569	21	6,492	7	1,668	16	3,310
500-1,000	5	3,379	43	34,920	4	2,496	0	0
1,000-1,500	8	9,980	99	126,958	3	3,872	0	0
1,500-2,000	3	5,065	82	144,356	3	5,479	11	18,818
2,000-3,000	5	11,925	53	121,917	5	13,132	9	21,053
3,000-4,000	0	0	5	17,284	2	6,151	11	36,296
4,000-5,000	0	0	4	18,029	1	4,913	19	85,570
5,000-6,000	0	0	4	21,499	4	22,070	9	48,344
6,000-8,000	0	0	0	0	0	0	17	116,260
8,000-10,000	0	0	1	8,571	3	25,725	9	78,926
Over 10,000	0	0	0	0	3	31,550	2	21,211
Total	55	35,934	316	500,327	66	119,142	128	431,573

Source: *Statistiske Meddelelser*, 4. Række, 110. Bind, Nr. 3, p. 32 (Köbenhavn, 1940).

Thus while 77% of the passenger ship tonnage was motor-driven, only 46% of the cargo ships was so propelled. In recent years there had been a rapid increase in the number of motor-ships and the largest and newest vessels were almost all motor-propelled. Three-quarters of the tonnage of steam-driven passenger ships were vessels of between 1,000 and 3,000 gross tons, and only one ship was over 6,000 tons, but two-thirds of the motor-driven passenger vessels were ships of over 5,000 tons and nearly a half were over 8,000 tons. Similarly, while nearly four-fifths of the tonnage of steam-driven cargo ships consisted of vessels of between 1,000 and 3,000 gross tons, a similar proportion of the tonnage of motor-driven cargo ships was

over 4,000 gross tons, and a half were vessels of over 6,000 tons. The largest ships are of about 10,000 tons. The largest motor-ships were used in combined passenger and cargo traffic on regular routes and several ran with cargo only. Most of the medium-sized vessels, motor-ships and steam-ships alike, were engaged in the tramp trade. Many of the smaller ships were built for combined passenger and cargo traffic in coastwise and short sea trades.

Tanker Fleet

In June 1939 Denmark owned fourteen oil tankers of over 1,000 tons which formed about 1% of the world total of tanker tonnage. In addition, fifteen ships of 102,131 gross tons carried mineral and vegetable oils in peak tanks or double-bottom compartments. The details of the tankers are:

Gross tons	No.	Tonnage
1,000— 5,000	1	1,099
5,000— 7,500	3	17,436
7,500—10,000	8	66,723
10,000—12,500	2	21,211
Total	14	106,469

Twelve of these ships, totalling 96,802 gross tons, are motor-driven. Based on information supplied by Lloyd's.

Six tankers, representing 40% of the total tanker tonnage, were built in 1928. Five of the ships, representing 42% of the total tonnage, were of later date, but only one of these, of 9,397 gross tons, was built after 1936. Eleven of the tankers were built in Denmark, while the United Kingdom, Germany and the U.S.A. built the other three. Two companies owned the whole of this tanker fleet. *D/S af 1912 A/S og D/S Svendborg A/S*, one of the companies managed by A. P. Möller of Köbenhavn, owned ten of the ships which represented 72% of the total tonnage; the remaining four tankers were owned by *Det danske Petroleums A/S*, a subsidiary of the Standard Oil Co. of New Jersey.

THE AGE OF THE MERCHANT FLEET

A classification of the merchant fleet according to the age of ships of different tonnage groups is given in the following table.

Three-quarters of the Danish merchant ships by tonnage had been built after the war of 1914–18, and about one-third of the tonnage

The Composition of the Danish Merchant Fleet by Age in 1939

	Under 5 years		5 and under 10 years		10 and under 15 years		15 and under 20 years		20 and under 25 years		25 years and over		Total	
	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons
100-500	14	3,457	23	4,675	16	3,483	43	9,780	43	8,846	106	21,435	245	51,676
500-1,000	4	2,980	3	2,448	5	4,379	14	11,653	8	5,793	35	26,078	69	53,331
1,000-2,000	23	39,164	28	43,904	19	29,830	68	96,266	27	38,136	51	77,192	216	324,492
2,000-4,000	17	42,471	12	33,536	12	33,108	37	89,130	11	27,989	7	15,925	96	242,159
4,000-6,000	8	38,440	8	40,418	15	75,699	8	38,389	1	4,774	3	14,266	43	211,986
6,000-8,000	3	19,755	2	13,889	3	21,431	2	12,898	5	34,234	2	13,273	17	115,480
8,000-10,000	3	27,705	3	26,792	4	34,059	3	25,932	1	8,571	—	—	14	123,059
10,000-15,000	2	21,802	3	30,959	—	—	—	—	—	—	—	—	5	52,761
Total	74	195,774	82	196,621	74	201,989	175	284,048	96	128,343	204	168,169	705	1,174,944

Source: *Lloyd's Register*, 1939-40, vol. III (London, 1939).

had been added after 1929. Ships built between 1919 and 1924, to replace losses during the war of 1914-18, still formed the largest age group, not only by total tonnage but also among ships between 1,000 and 4,000 tons. The largest ships are, not unnaturally, those built during the last ten years.

The age of Denmark's merchant fleet in comparison with those of some other countries is given in the following table. It will be seen that the Danish fleet is, on the whole, rather older than those of Norway, Britain and the Netherlands but is markedly different from that of Greece which contains a high proportion of old ships purchased from other countries.

Age of Merchant Fleets in 1939

	Total gross tonnage (thousands)	Age in years as % of total tonnage					
		Under 5	5-10	10-15	15-20	20-25	Over 25
Denmark	1,175	16.7	16.8	17.2	24.2	10.8	14.3
Norway	4,834	24.6	20.7	18.4	15.7	9.8	10.8
Sweden	1,577	15.0	9.9	15.5	18.5	9.3	31.8
Netherlands	2,970	22.5	14.9	18.9	25.5	9.4	8.8
Germany	4,483	19.9	5.3	22.9	32.5	5.2	14.2
Greece	1,781	5.8	0.5	2.8	13.3	33.4	44.2
United Kingdom	17,891	21.1	10.5	24.1	21.0	12.6	10.7
World	68,509	15.4	9.9	15.7	22.0	16.4	20.6

Source: *Lloyd's Register*, 1939-40, vol. III (London, 1939).

SHIPPING COMPANIES

In 1938 there were fifty-two ship-owning companies of which thirty-five had their headquarters in Köbenhavn. Most of the sailing ships, with and without motors, were owned in the provincial ports, especially Svendborg and Marstal, where the majority of the sailing vessels have long been centred. The chief companies and their fleets, in June 1939, are given in the following table.

The East Asiatic Company's fleet consisted entirely of motor-ships built in Denmark. A characteristic feature of these ships was that, with four exceptions, they had no funnels. Eleven of the ships were built by the Nakskov yard and fifteen by Burmeister and Wain, who built the engines for all the vessels. Seven of the ships, comprising 23% of the total gross tonnage of the fleet, were built between 1913

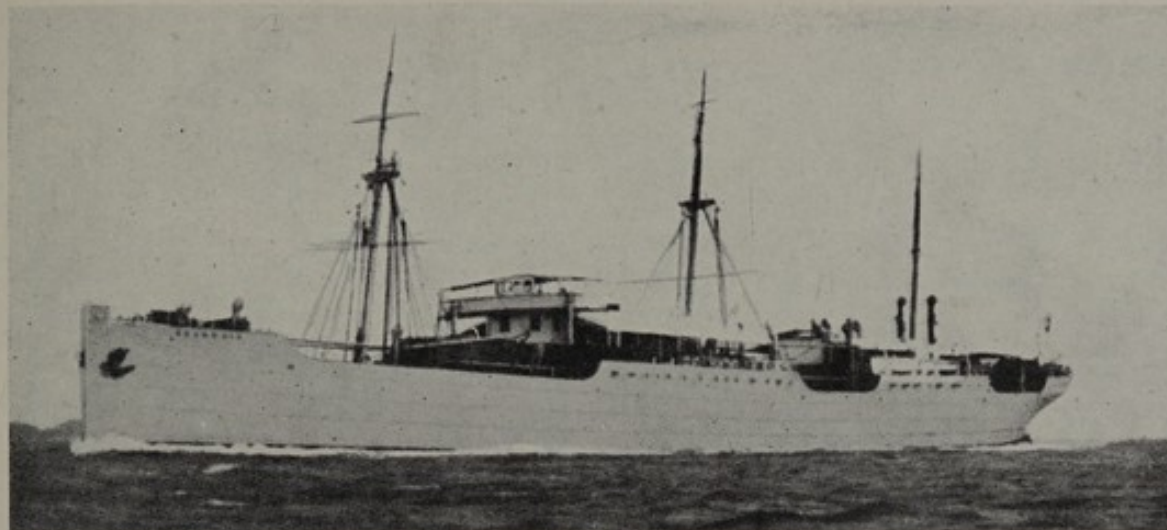


Plate 58. M.V. *Selandia*

The first ocean-going motor ship (see p. 284) which was sold by the East Asiatic company after 25 years' service during which she covered over 1,200,000 miles. The ship has been renamed the *Norseman* and is a cargo vessel with a service speed of $10\frac{1}{2}$ –11 knots.

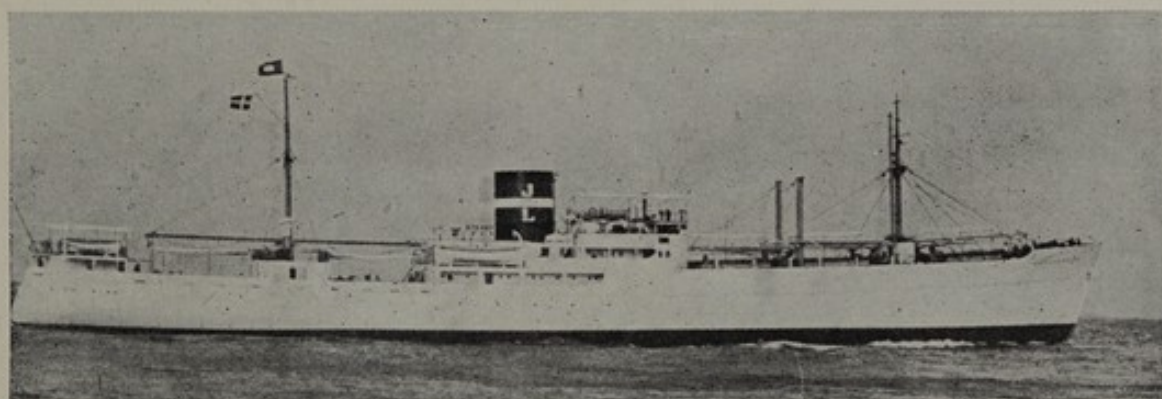


Plate 59. M.V. *American Reefer*

Owned by *Rederiet Ocean A/S* (J. Lauritzen). Built in 1936 by the Nakskov shipyard and engined by Burmeister and Wain. Tonnage, 2,328 gross. Speed $15\frac{1}{2}$ knots.

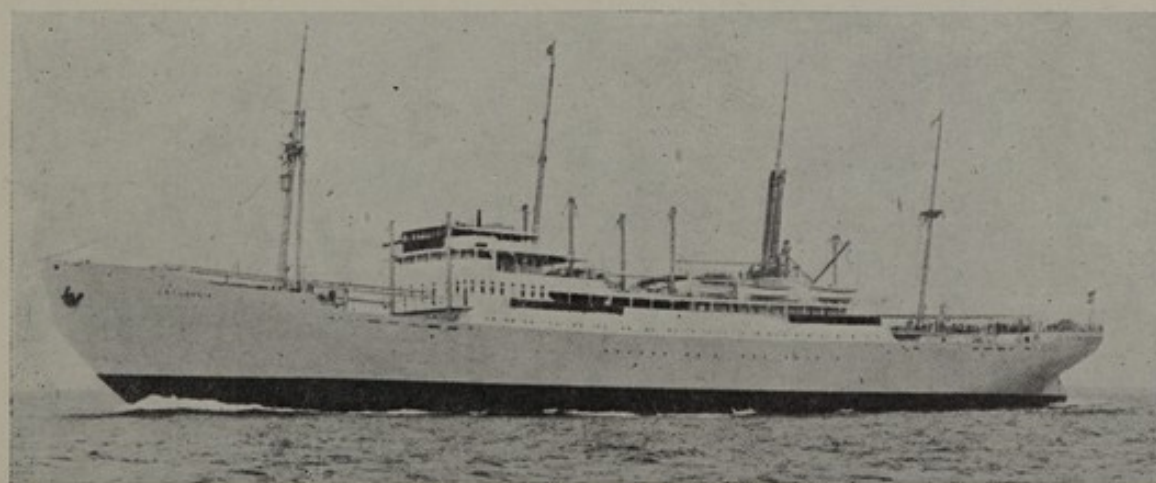


Plate 60. M.V. *Jutlandia*

This ship is typical of the East Asiatic Company's fleet and was built in 1934 by the Nakskov shipyard with engines by Burmeister and Wain. She was the first unit in this fleet to have Maierform bows. Tonnage 8,457 gross. Speed 15 knots.



Plate 61. M.V. *Aalborghus*

Owned by the United Steamship Company and built in 1936 for the regular night service between Köbenhavn (Copenhagen) and Aalborg. The hull was built at the Nakskov shipyard and the engines by Burmeister and Wain. Tonnage 2,079 gross. Speed 17 knots.

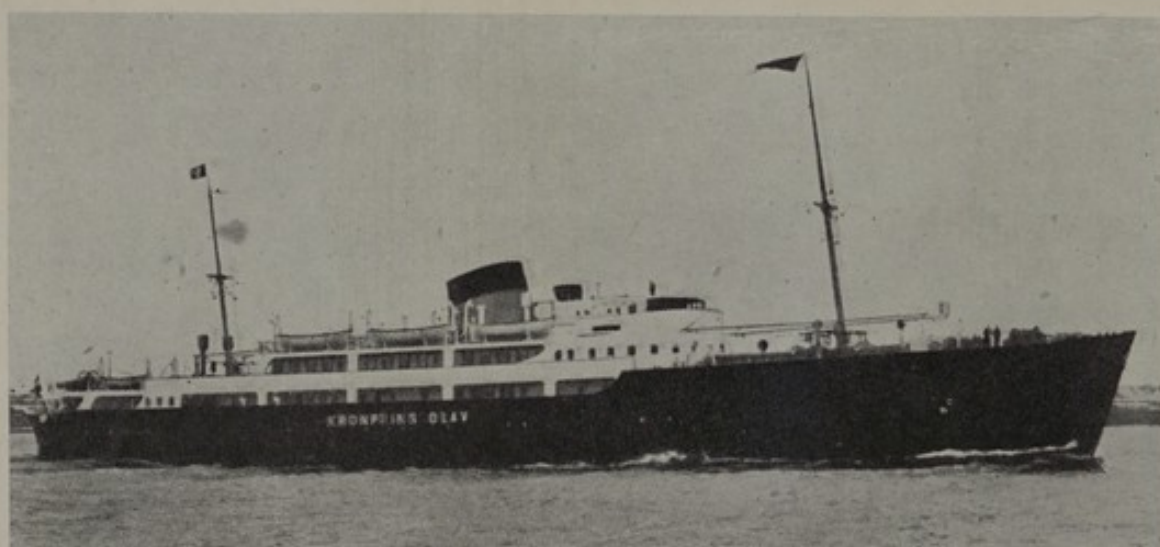


Plate 62. M.V. *Kronprins Olav*

Built in 1937 at the Helsingör (Elsinore) shipyard and engined with the first Diesels built by this yard under licence from Burmeister and Wain. She was engaged in the passenger service between Köbenhavn and Oslo. Tonnage 3,038 gross. Speed 18 knots.

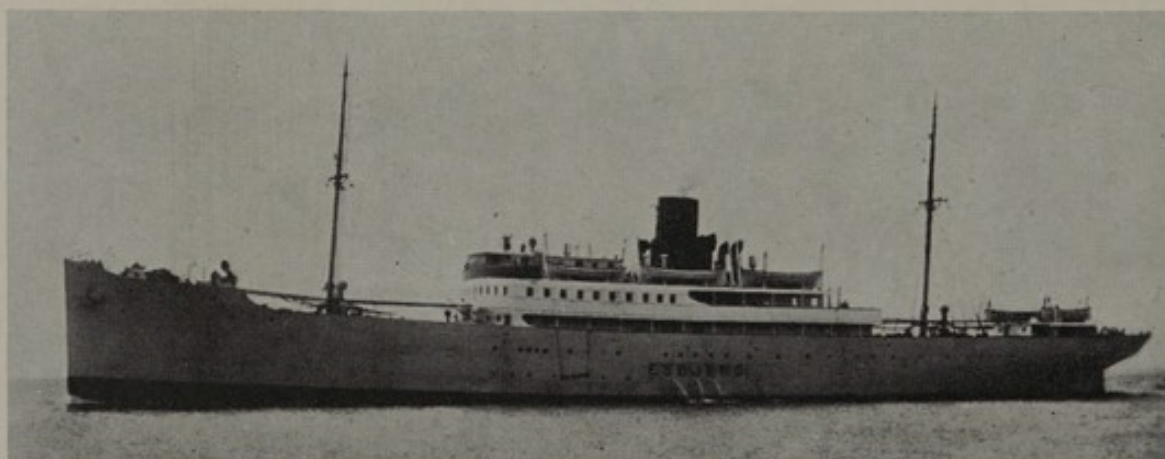


Plate 63. M.V. *Esbjerg*

One of four sister ships (*Parkeston*, *Jylland*, *England*), all of 2,762 gross tons, which were built between 1925 and 1932 for the Harwich-Esbjærg service. All were built at the Helsingör (Elsinore) shipyard and engined by Burmeister and Wain. Speed 15 knots.

and 1916, eight ships comprising 28% of the tonnage were built between 1919 and 1929, and eleven were built between 1929 and 1939. The ships were cargo-passenger ships of 12-16 knots, and traded mostly between north Europe and the Far East via Mediterranean or West and South African ports, although some went via the United States, West Indies and the Pacific. Four of the ships had a total of 447,400 c.c. of refrigerated space. In addition, three motor-ships and five steam-ships, totalling 6,216 gross tons, were owned by a subsidiary company in Siam. They flew the Siamese flag and traded exclusively in the Far East.

Chief Shipping Companies 1939

	Steam-ships		Motor-ships		Total	
	No.	Gross tonnage	No.	Gross tonnage	No.	Gross tonnage
A/S Det Østasiatiske Kompagni (The East Asiatic Company Ltd.)	—	—	26	195,040	26	195,040
Det Forenede Dampskibs Selskab A/S (The United Steamship Co. Ltd.)	74	115,920	23	61,396	97	177,316
A. P. Möller's Lines	21	41,632	25	149,419	46	191,051
J. Lauritzen's Lines	40	58,194	10	18,558	50	76,752
D/S Norden A/S	1	3,726	8	36,602	9	40,328
D/S Torm A/S	17	24,251	7	13,989	24	38,240
A/S, D/S Dannebrog	16	30,747	1	4,551	17	35,298
D/S, A/S Progress	26	32,383	—	—	26	32,383
D/S Orient A/S	—	—	6	29,924	6	29,924

Based on information supplied by Lloyd's.

The fleet of the United Steamship Company is varied in type, size and age of ships. Two-thirds of the tonnage of the fleet was built in Denmark, a fifth in the United Kingdom, and the remainder mainly in Norway and Sweden. Fifty-six of the ships, comprising 47% of the total tonnage, were built before 1919; 40% of the fleet tonnage were built between 1920 and 1929. Eight ships, of a total gross tonnage of 16,048, and all of them motor-ships of Danish construction, were added between 1936 and 1939. Some of the ships carried cargo only, some had accommodation for a few passengers, and others were concerned mainly with passenger traffic. Twenty-three ships had a total refrigerated space of 900,000 c.c. The smaller ships were engaged in Baltic and North Sea trade, but the larger vessels traded mainly with the west coast of Africa, the east coast of North and Central America, and the Plate estuary in South America;

thirty-nine of the ships had speeds of 12 knots or more. In addition to the steam-ships and motor-ships, the company owned several steel lighters and tugs.

A. P. Möller's Lines comprised three companies, the *D/S Svendborg A/S*, the *D/S af 1912 A/S*, and the partnership formed by these two companies—*D/S af 1912 A/S og D/S Svendborg A/S*. The first company, which was the oldest (1904), had nine ships with a total tonnage of 22,187 gross. All the ships, except one built in 1937 and one which was launched in August 1939, were built between 1920 and 1927 and were all cargo ships of 8–11 knots which traded with almost all parts of the world. The second company owned three motor-ships of 13–14 knots and fifteen steam-ships of 9–11 knots which totalled 39,792 gross tons. Ten steam-ships and two motor-ships, which together comprised 70% of the total tonnage of the fleet, were built during the years 1921 and 1925. One steam-ship and two motor-ships, each of approximately 2,000 gross tons, were added between 1931 and 1938. The ships of this company, like the former, carried cargo only and traded mainly with the Baltic, the Mediterranean and the intervening coasts, the west coast of Africa and the east coast of North America. The third company was established in 1928 which was also the date of building of its six oldest ships. Ten of the ships were motor-driven tankers of 11–12 knots (see p. 344). The other nine were motor-ships of 14–15½ knots, all of which were between 5,000 and 7,000 gross tons and were cargo ships with accommodation for twelve first-class passengers each. The whole fleet, except three ships built in Germany, and one built at Newcastle-on-Tyne, was built in Denmark, thirteen at the Odense shipyard which is also managed by A. P. Möller, and two by Burmeister and Wain who built the engines for all the Danish-built ships. At the outbreak of war this company had one tanker building at Nakskov and one motor-ship and two motor tankers building at the Odense shipyard. Each of these vessels was of 15,350 dead-weight tons. The range of voyages made by these ships extended from North America to the Pacific and the Far East, and from the Baltic to the Mediterranean and the west coast of Africa.

J. Lauritzen's Lines comprise three companies, *J. Lauritzen's D/S, A/S, Rederiet Ocean A/S, and A/S, D/S Vesterhavet*. The first company had no ships in commission in 1939 but two were under construction. *Rederiet Ocean A/S* was formed in 1938. It had seven motor-ships ranging between 1,831 and 3,159 gross tons, and eight steam-ships ranging between 1,471 and 1,700 gross tons and of 12 knots speed. They were all cargo vessels but the motor-ships each

had accommodation for up to twelve passengers. These were fast ships (14-16 knots) which had a total refrigerated space of about one million c.c. and engaged in the fruit trade. The oldest of the ships was built in 1931 and twelve of them were built between 1935 and 1937. They were all built in Denmark, five of the motor-ships being built by the Naskov yard and six of the steam-ships by the Helsingör yard. The engines of the motor-ships were all built by Burmeister and Wain, while those of the steam-ships were all built by the Helsingör works. The ships traded mainly between the shores of the Atlantic and westwards into the Pacific. *A/S, D/S Vesterhavet* had thirty-two steam-ships and two schooners with auxiliary motors. The total gross tonnage of the fleet was 45,417 gross tons, of which 42% had been built between 1920 and 1924 and 36% was made up of twelve ships built between 1930 and 1938. At the outbreak of war the company had two motor-ships, of about 2,700 and 2,900 gross tons respectively, under construction at the Aalborg shipyard which is owned by the Lauritzen concern. Apart from ten ships built in Germany during the early twenties, almost the whole of the fleet was built at Danish yards and consisted entirely of cargo ships with speeds of between 9 and 12 knots, and they traded mainly along the west coast of Europe and into the Mediterranean.

A/S, D/S Dannebrog owned one motor-ship of 4,551 gross tons, built in 1929, and sixteen steam-ships ranging between 1,256 and 3,300 tons and totalling 30,747 gross tons. Half of the steam-ship tonnage was built between 1914 and 1920 and the remainder between 1922 and 1930. Seven of the ships were built in Denmark, four at West Hartlepool and four in Holland. The ships engaged in general trade and had speeds of about 9 knots. The older ships traded in the Baltic and along the west coast of Europe from Greenland and the White Sea to the Mediterranean. The newer and larger ships traded with the west coast of Africa, and, via North America and the West Indies, with the Far East.

D/S Norden A/S owned one steam-ship of 3,726 gross tons, built in Denmark in 1916, and eight motor-ships of about 4,500 tons built in Denmark between 1923 and 1938. Their voyages covered both east and west coasts of the Atlantic and across the Pacific to the Far East.

D/S Torm A/S owned seventeen steam-ships of between 1,142 and 1,700 gross tons and seven motor-ships ranging between 1,554 and 2,282 gross tons. All the ships, except two built in Germany, were built in Denmark and were cargo vessels. The motor-ships all had speeds of 13-14 knots, and while three of the steam-ships had this

speed the others were mainly of 9 knots. Nine of the steamships were built between 1918 and 1924, and five between 1930 and 1935. All the motor-ships were built between 1933 and 1938. They traded between the Baltic, British, Mediterranean, North American and West African ports.

The ships of *D/S, A/S Progress* were all small cargo ships ranging between 766 and 2,144 gross tons. The youngest ship in the fleet was built in 1925 and the oldest in 1898. Nineteen of the ships were bought from other firms, eight of the ships having been built in Germany and eleven in Denmark. The ships traded in the Baltic and along the west coast of Europe into the Mediterranean.

The six motor-ships of *D/S Orient A/S* were all built between 1926 and 1937 at the Naskov yards and fitted with engines by Burmeister and Wain. They were cargo ships of 11 knots speed and traded as far afield as Australia and the Far East, both via North America and via the Cape of Good Hope. The ships range in tonnage between 4,454 and 6,049 gross tons.

STATE-OWNED SHIPS

The state owned as many as eighty-nine ships with a total gross tonnage of 43,448. Nine steam-ships, totalling 11,475 tons, and four motor-ships totalling 7,795 tons, were fitted with rail tracks for the train-ferry services, and three motor-ships, totalling 2,793 tons, were used as car ferries. Six vessels, totalling 473 gross tons, were used in the postal service to Fanö and across Limfjord, while five steam-ships and one motor-ship, totalling 3,881 tons, as well as thirteen sail-ships with auxiliary motors, were in the service of the Greenland Administration for trading with the colony. The remainder consisted of seven ice-breakers totalling 4,961 tons, seven sand-pumping and dredging ships, three tugs and thirteen other vessels.

SHIPPING LINES AND SERVICES

Apart from services to Baltic, West European and Mediterranean ports, Danish companies ran regular services to America, Australia and the Far East. The East Asiatic Company operated three routes. The Bangkok line, from Köbenhavn via North Sea and Mediterranean ports to Colombo, Penang, Port Swettenham, Singapore and Bangkok, ran every three weeks, while the Japan line, calling at Göteborg, Oslo, Hamburg, Antwerp, Rotterdam and Genoa, ran monthly services to the chief Chinese and Japanese ports, as far north as Dairen, Yoko-

hama, and to Vladivostock. They also operated a local route in the Far East, from Siam to Chinese ports.

The only service from Denmark to Australia was also operated by this company. The ships ran monthly from Köbenhavn to Freemantle, Adelaide, Melbourne, Sydney, Brisbane and New Zealand. Danish companies did not maintain lines to India and South Africa, but a Swedish line to these ports called at Köbenhavn.

Services to America were more frequent and numerous. The United Steamship Company ran monthly services to the chief ports on the east coast of North America, fortnightly services to New York, Galveston and New Orleans, and services approximately every ten days to Bahia, Rio de Janeiro, Santos, and Buenos Aires. The west coast of North America was served by the West Indies and North Pacific line of the East Asiatic Company. The ships ran from Köbenhavn to West Indian ports and on to Los Angeles Harbor, San Francisco, Portland, Seattle and Vancouver.

Services to European and Mediterranean ports were very numerous. From Köbenhavn routes were operated to all the chief Baltic ports in Germany and the Baltic States, but the services to Finland and the east coast of Sweden were all operated by Finnish and Swedish companies respectively. Most of the larger Danish provincial ports were linked with these services.

Services to the ports of the North Sea were equally numerous. The chief Norwegian ports were served weekly from Denmark, by the United Steamship Company almost exclusively. This company also operated the daily service between Harwich and Esbjerg, the twice-weekly service between Grimsby and Esbjerg and the weekly services from Köbenhavn to London, to Hull, to Newcastle-on-Tyne, and to Manchester, Liverpool and Swansea. It also ran weekly services from Odense, Aarhus and Aalborg to Leith and to Newcastle-on-Tyne.

From the Danish provincial ports the company of C. Clausen of Aarhus ran weekly services, with small ships, to Kiel, Hamburg, Bremen, Rotterdam and Amsterdam. The United Steamship Company also ran weekly services from Köbenhavn, Aarhus and Aalborg, to Hamburg and Kiel. The same company ran services approximately fortnightly from Köbenhavn to Antwerp, Dunkirk, Havre, La Pallice and Bordeaux, and also to Antwerp, Lisbon, Oporto and Mediterranean ports in Europe, the Levant and North Africa.

Services between home ports were frequent and comprehensive, for in addition to the ferry routes (see pp. 451, 477-80) numerous regular services were operated from Köbenhavn to most provincial ports and also between several of the provincial ports.

Chapter XVII

PORTS

Köbenhavn (Copenhagen): Aalborg-Nørre-Sundby: Aarhus: Esbjerg: Odense: Frederikshavn: Nakskov: Korsör: Nyborg: Kolding: Randers: Fredericia: Rudkøbing: Horsens: Vejle: Haderslev: Kalundborg: Svendborg: Assens: Middelfart: Aabenraa: Köge: Sønderborg: Nyköbing (Falster): Helsingör (Elsinore): Hirtshals: Gedser

The mountains of the Scandinavian peninsula form a barrier to land communication between the northern countries and the Atlantic Ocean, but the Baltic Sea affords a seaway between the mountains and the plains. The position of the Danish archipelago athwart this passage to the open ocean has given the country special importance in the maritime traffic of northern Europe, not only because it could, in the days when it was a great naval power, control the passage of the Sound and the Belts, but also because it served as an *entrepôt* for Baltic trade. Denmark has therefore grown economically, as well as politically, around the channels which connect the Kattegat with the Baltic Sea. For this reason and because the islands and eastern Jylland are the richest parts of the country, the chief ports of Denmark developed along her Baltic seaboard. After the Industrial Revolution changed the economy of north-west Europe, the economic outlook of Denmark became focused westwards rather than eastwards and she became progressively more dependent on western lands, especially Britain, for her markets and the raw materials necessary for her agriculture and her mechanical industries. These developments might have led to some decline in the traffic of her Baltic ports except for the poor and difficult nature of her North Sea coastline which is such that Esbjerg is the only important port along this coast and is, moreover, one that had to be created to serve a special purpose. The ports around the Belts and the Sound have thus not only retained, but have enhanced, their former importance as the termini of the seaways which knit the archipelago together. The coming of railways served to make them better collecting and distributing centres and to make possible railway ferry services between the various parts of the country.

The Baltic ports of Denmark have almost all developed as a result of natural advantages of location and site. They are old ports which

have grown gradually as ships became bigger and they have prospered largely in proportion to the natural advantages they possessed. Along the east coast of Jylland the larger ports are almost all fjord ports. The exceptions are, Aarhus which is on a large sheltered bay, and Fredericia which is at the crossing to Fyn. The ports grew at the heads of the fjords, which offered protection and shelter and were the head of navigation because the Danish streams are too small to allow navigation farther inland, even by boats. In the days of small ships these fjords provided adequate depths, and the history of the ports has been one of enlarging and deepening channels. This has been fairly easy on account of the soft bottoms of sand and mud, and if the Danish streams offer no possibility of navigation, they at least do not encumber their estuaries with large quantities of silt because, in this lowlying land, gradients are gentle and the erosive power of the streams is small. In the islands the chief ports lie along the great waterways into the Baltic Sea and at the crossings between the islands.

Tides. Along the west coast of Jylland the spring rise of the tide decreases from 1.8 m. (6 ft.) in Listertief to 1.5 m. (5 ft.) in Graadyb. The mean rise decreases from 1.5 m. (5 ft.) at Blaavands Huk to 0.3 m. (1 ft.) at the Skaw. In the Baltic the tidal range is barely perceptible, and even in the Kattegat it does not exceed 0.3 m. (1 ft.), but considerable changes in the water level may be caused by strong winds which, according to their direction, may raise or lower the water level as much as 0.9 m. (3 ft.) and even more in the narrower waters. Particularly severe gales may, very occasionally, cause great floods in some localities where the water may rise 3 m. (10 ft.) above mean level.

The Danish Harbour Pilot (*Den danske Havnelods*) describes 427 separate places used by ships and boats. These are marked, and the harbours are named, on the coast maps (Figs. 9-18). They range from major ports to small harbours and from elaborate and well-equipped lay-outs such as København to single piers and jetties. The statistical record of port activities (*Danmarks Handelsflaade og Skibsfart*) gives details for seventy customs districts (*Tolldistrikter*) which are mainly concerned with individual ports, but may, especially in the cases of fjords and minor ports, group together several small centres. The following table gives the number and total tonnage of ships entered, and the weight of goods discharged and loaded, in each of the customs districts where the tonnage of ships entered was about 100,000 tons or more. In almost all cases the bulk, if not all, of the

traffic was recorded for the port which gives its name to the district. These ports are described in some detail, which is greater for the four ports where the tonnage entered was about a million or more. In addition, Helsingør and Gedser are described on account of their importance as terminals of ferry services to Sweden and Germany respectively, while Hirtshals has been chosen for description because it is the only port of consequence, other than Esbjerg, along the west coast of Jylland: Hobro-Mariager has not been described since the traffic of the district includes that of the three ports of Hobro, Mariager and Hadsund (see p. 38), which are all small, and of the loading places along the fjord.

The depths given are those at mean water level in all cases except Esbjerg for which the figures refer to M.L.W.S. The figures are taken from *Den danske Havnelods*, issued by the Danish Hydrographic Office in 1936 and revised in a Supplement dated December 1937.

Shipping at the chief Danish Ports, 1938

	No. of ships entered	Net tonnage (thousands)	Goods discharged and loaded (thousands of tons)
Köbenhavn	19,939	7,469	6,476
Aalborg-Nørre-Sundby	5,764	1,386	1,650
Aarhus	4,270	1,217	1,382
Esbjerg	987	998	694
Odense	2,417	494	728
Rønne	1,458	431	212
Frederikshavn	1,257	423	108
Nakskov	2,215	314	277
Korsör	1,816	284	286
Nyborg	731	284	549
Kolding	1,732	260	274
Randers	1,069	253	281
Fredericia	917	252	285
Rudköbing	3,617	241	95
Horsens	1,230	204	261
Vejle	1,002	197	254
Haderslev	3,126	177	160
Kalundborg	874	153	329
Svendborg	2,473	145	185
Assens	2,785	132	115
Allinge	1,168	127	163
Middelfart	530	124	67
Aabenraa	999	120	172
Køge	1,054	118	230
Sønderborg	1,300	112	116
Hobro-Mariager	1,307	112	235
Nyköbing (Falster)	1,275	98	170

Source: *Danmarks Handelsflaade og Skibsfart*, 1938 (Köbenhavn, 1939).

The other ports which are centres of customs districts are listed below. They receive some mention in Chapter II on the pages entered after each name:

Æbeltoft, p. 39	Holbæk, p. 45	Roskilde, p. 45
Ærøsköbing, p. 51	Kerteminde, p. 44	Sæby, p. 37
Bandholm-Maribo, p. 49	Lemvig, p. 33	Saksköbing, p. 49
Bogense, p. 42	Lögstör, p. 33	Skagen, p. 37
Faaborg, p. 43	Marstal, p. 51	Skælskör, p. 46
Fakse, p. 46	Næstved, p. 46	Skive, p. 33
Frederikssund, p. 45	Neksö, p. 506	Stege, p. 48
Frederiksværk, p. 45	Nyköbing (Mors), p. 33	Struer, p. 33
Graasten, p. 41	Nyköbing (Sjælland), p. 45	Stubbeköbing, p. 48
Grenaa, p. 39	Nysted, p. 49	Svaneke, p. 505
Gudhjem, p. 505	Præsto, p. 46	Tisted, p. 33
Hasle, p. 503	Ringköbing, p. 31	Vordingborg, p. 46

In addition, Hjörning, Padborg, Tönder and Viborg, all inland towns, are centres of customs districts under which are recorded the shipping details of small ports, such as Hirtshals (p. 440) and Höjer (p. 28), and groups of loading places along fjords. The island of Samsö is the only other customs district and its returns are, in the main, those of the port of Kolby Kaas (p. 50).

Note. The following port plans are all based on the surveyed plans in *Den danske Havnelods* (Köbenhavn, 1936, with Supplement of amendments to December 1937) and amended where necessary from air photographs taken during the spring and early summer of 1943.

KÖBENHAVN (COPENHAGEN)

55° 42' N, 12° 37' E. Population 843,168 in 1935

Köbenhavn is at the south-west end of the Sound which separates the island of Sjælland from Sweden and connects the Kattegat with the Baltic Sea. It stands at the entrance to the Baltic and has a hinterland of lowlying, undulating country which gives easy land communications across Sjælland, south of Isefjord and its branches, to Fyn and Jylland. The port has grown along both sides of a narrow natural channel which separates the island of Amager from Sjælland and is deep, well-sheltered and practically tideless, but strong winds from west and north-west may raise the water level 1.4 m. (4½ ft.) and winds from east and south may lower it 1.1 m. (3½ ft.).

Köbenhavn is not only the capital of Denmark and the chief port and commercial centre of the country but is also an important *entrepôt* for Baltic trade and includes a free port. The Sound has always carried the largest volume of traffic into the Baltic, and Köbenhavn holds the key position on it. It is the only naval base in the country. The port has a total water area of about 500 ha. (1,235 acres) and measures 8.4 km. (5 miles) from the breakwaters in the north to the dam in the south. The total length of the quays is 37 km. (23 miles), of which about 23 km. (14 miles) are stone quays and the remainder are wooden wharves. The government and the city each own about 1.5 km. of quayage, and 9 km. are the property of private companies; the remainder of the quayage is owned by the Port Authority. The Port of Köbenhavn Authority owns a land area of 116 ha. (286½ acres) and the Free Port covers an additional land area of 52 ha.

Approach and Access

The channel along which the port has grown is a branch of the Sound. Off Köbenhavn the Sound has three main channels, namely, Kalvebodstrand along which Köbenhavn has grown, Drogden which lies between the islands of Amager and Saltholm, and Flintrännan between Saltholm and Skåne. The fairway through Drogden is divided into two channels by a large sandbank named Middelgrund. Kongedyb, the western of these two channels, is the entrance for large ships into Kalvebodstrand and the port of Köbenhavn. Small ships can enter the port (a) from the north along a 4 m. (13 ft.) channel, Stubbeløb, which leads across Stubben bank; (b) from the east along Lynetteløb (depth 5 m. (16¼ ft.)) which crosses the flat between Trekroner fort and Lynnetten; (c) from the south along Kalleboer (depth 2.7 m. (9 ft.)) and through the lock in the dam at the south end of the port.

North-west of the main entrance channel into the port a separate channel, dredged to a depth of 6.3 m. (20½ ft.) over a width of 53 m. (174 ft.), extends from the south end of Skudeløb into Benzinhavn and Kalkbrænderihavn. Close south of Benzinhavn is Skudehavn which is approached by a 4 m. (13 ft.) channel across Stubben bank.

The main entrance from Köbenhavn roadstead into the port lies along Kronløb, which is dredged to a depth of 10 m. (32¾ ft.) over a least width of 150 m. (490 ft.) and passes between two breakwaters, the ends of which are 160 m. (525 ft.) apart. Access is easy.

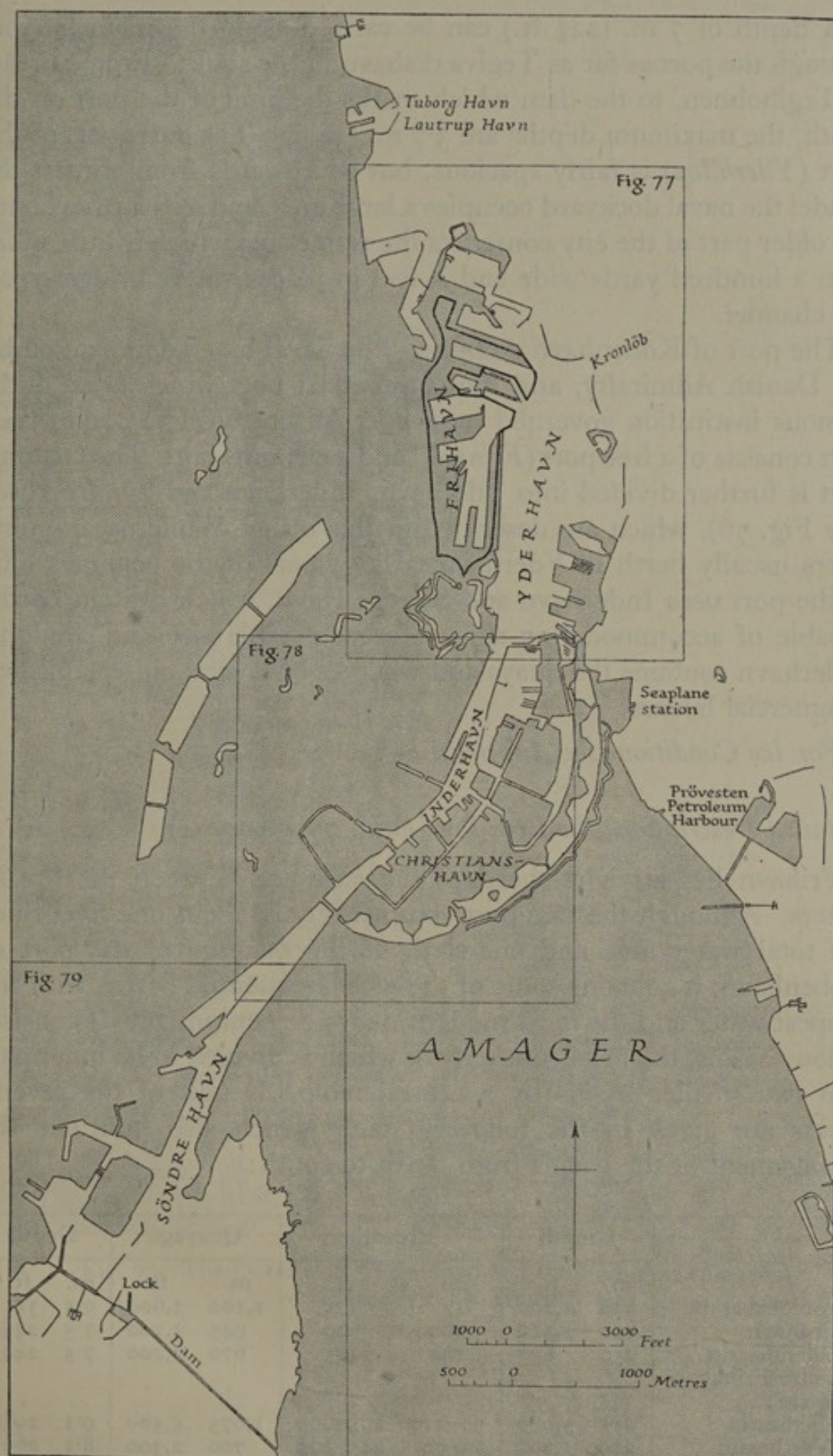


Fig. 76. Key to the port plans of Köbenhavn (Copenhagen)

A depth of 7 m. ($22\frac{3}{4}$ ft.) can be carried along the main fairway through the port as far as Teglværkshavn in the south. From abreast of Tegllholmen, to the dam which marks the limit of the port on the south, the maximum depths are 3.7 m. (12 ft.). The outer part of the port (*Yderhavn*) is fairly spacious, but southwards from abreast the citadel the naval dockyard occupies a large area, and still farther south the older part of the city constricts the water area which is little more than a hundred yards wide and is less in places where bridges span the channel.

The port of København comprises the naval base administered by the Danish Admiralty, and the commercial port which is an autonomous institution governed by a Port Authority. The commercial port consists of a free port (*Frihavn*) and a customs port. The customs port is further divided into Yderhavn, Inderhavn and Søndre Havn (see Fig. 76), which are described in this order. While ocean-going liners usually berth in Yderhavn, a large part of the general traffic of the port uses Inderhavn and Søndre Havn, which contain berths capable of accommodating ships of considerable size and draught. Inderhavn contains the quays and wharves of several old-established commercial houses.

For Ice Conditions see Appendix IV.

Detailed Description: the Free Port (Fig. 77, Plate 64)

Frihavn lies straight ahead of the entrance between the breakwaters. Although the free port comprises only about one-twelfth of the total water area and one-sixth of the quayage of the port of København, it contains some of the most frequented berths with the deepest water and the most modern quayside equipment. It consists of four basins, the most southerly of which is divided in its inner part into two smaller basins by a central mole. Details of the several basins are given in the following table which also indicates the arrangement of the basins from north to south:

	Length		Breadth		Quayage		Depth	
	m.	ft.	m.	ft.	m.	ft.	m.	ft.
Kronløbsbassin	670	2,200	115	375	1,100	3,600	9.5	31
Nordhavn	400	1,310	190	620	945	3,100	7.5	$24\frac{1}{2}$
Mellembassin	250	820	142	465	670	2,200	7.5	$24\frac{1}{2}$
Søndre Frihavns- bassin:								
Östbassin	915	3,000	90-210	295-690	1,675	5,500	9.1	$29\frac{3}{4}$
Vestbassin	300	1,000	75-90	245-295	700	2,300	8.1	$26\frac{1}{2}$

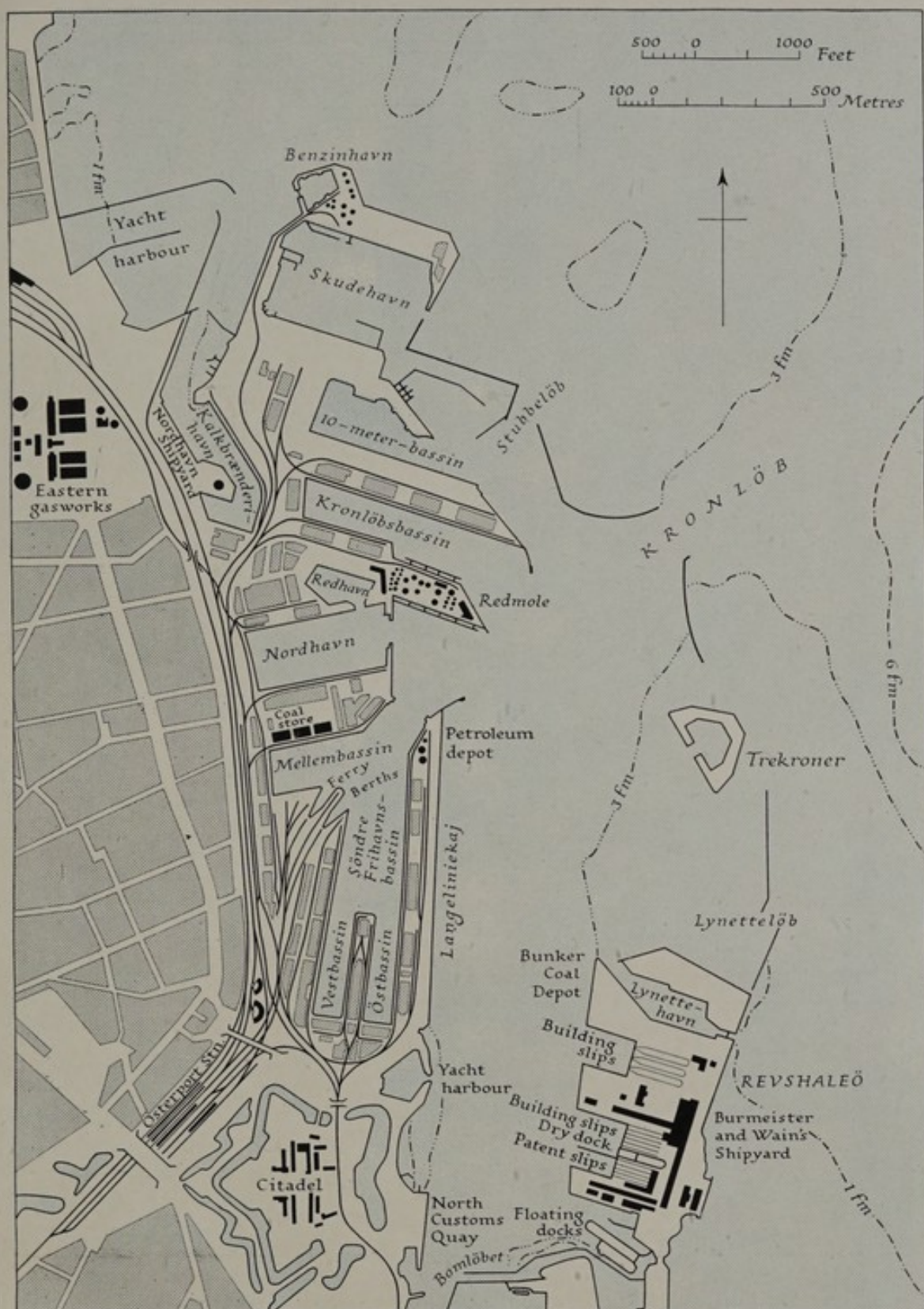


Fig. 77. The Outer Port (Yderhavn) and the Free Port (Frihavn) at København (Copenhagen)



Fig. 78. The Inner Harbour (*Inderhavn*) at Köbenhavn (Copenhagen)

In 1938 the Free Port had forty-nine travelling cranes with capacities ranging from 1 to 20 tons, three mobile petrol-electric cranes of $3\frac{1}{2}$ tons capacity, six steam locomotive cranes of 5–8 tons capacity, and eight coaling cranes which discharge 50–100 tons per hour.

The area of the free port is surrounded by a barrier, guarded by customs officials. Within this area goods may be unloaded, transhipped, stored, repacked or manufactured without payment of customs dues except on those which enter Denmark. This is therefore an area of large warehouses, cold stores, special fruit sheds and grain silos: the warehouse floor-space owned by the Free Port Company is over $2\frac{1}{2}$ million sq. ft., and there are 565,000 cu. ft. of cold-storage space. The absence of customs duties in the Free Port has naturally attracted shippers and manufacturers who have an export trade; many of these have their own warehouses and factories. Among the more conspicuous buildings are the grain silo of 11,000 tons capacity on the interior mole in Søndre Frihavnsbassin, and another of like capacity on the quay of the West Basin. A third large silo, of 3,000 tons capacity, is on the quay of Kronløbsbassin. On the north side of Mellembassin is a large discharging plant and storage area for coal and coke; at the north end of the east quay of Søndre Frihavnsbassin is an oil-storage depot.

Between Mellembassin and Søndre Frihavnsbassin are the two berths and terminals of the train ferry to Malmö in Sweden. Close south-west of the Free Port is Österport station, the second largest station in the city, with sidings and engine sheds. From it railway lines run on to all the quays of the Free Port.

Detailed Description: the Customs Port (Figs. 77–9, Plates 65–9)

Yderhavn. Yderhavn invests Frihavn on the north, the east and the south. It extends from close north of the yacht harbour in the north to Bomløbet in the south. It includes: (a) the yacht harbour, Kalkbrænderihavn, Benzinhavn, Skudehavn and the '10 m. bassin', to the north of the Free Port; (b) Redhavn and Redmole wharves between Kronløbsbassin and Nordhavn; (c) Langelinie kaj and another yacht harbour which are on the east side of Søndre Frihavnsbassin, and the North Customs quay which is in front of the citadel; (d) Lynettehavn, the bunker coal depot, and the shipyards of Burmeister and Wain on Revshaleö, which occupy the east side of Yderhavn south of the dismantled fort of Trekroner. The main channel from the

entrance to Bomløbet is 8.1 m. (26½ ft.) deep. The details of these basins and quays are:

	Length		Breadth		Quayage		Depth	
	m.	ft.	m.	ft.	m.	ft.	m.	ft.
Kalkbrænderihavn	700	2,300	130	425	1,370	4,500	2.8-6.3	9-20½
Benzinhavn	115	380	58-90	190-290	245	810	6.3	20½
Skudehavn	470	1,540	300	1,000	610	2,010	4.0	13
10 m. Bassin	500	1,640	140	460	670	2,200	10.0	32½
Redhavn	180	590	75	250	—	—	4.3	14
Redmole wharves	300	1,000	—	—	670	2,200	8.1-9.5	26½-31
Langeliniekaj	915	3,000	—	—	915	3,020	9.1	29½
North Customs quay	215	705	—	—	215	710	7.5	24½
Lynettehavn	360	1,180	110	360	670	2,200	2.1-4.0	6½-13
Revshaleö (basin on west side)	150	490	110	360	365	1,200	6.5-8.1	21½-26

Kalkbrænderihavn is used chiefly for unloading coal, timber, sand and stone. It includes the ship-repairing yard of Nordhavns Værftet A/S. Benzinhavn was specially built for storing petroleum and petroleum products, but in 1936 a new petroleum harbour was built on the site of the dismantled fort at Prövesten, east of the north point of Amager. Skudehavn is used for pleasure craft and has yacht and boat-building yards, and an iron foundry. Redmole is administered by the Port Authority, but for customs purposes it lies within the boundary of the Free Port. It is used for storing fuel and lubricating oils. Ocean liners berth alongside Langeliniekaj, while pleasure steamers from Swedish and north German ports, especially Kiel, Lübeck and Stettin, berth at the North Customs quay which also handles a good deal of the general cargo passing between Denmark, Sweden and north Germany.

In 1938 Yderhavn had twelve cranes with capacities ranging from 1 to 5 tons and one electric crane of 100 tons capacity at Revshaleö.

Inderhavn. Yderhavn leads through Bomløbet into Inderhavn which extends south to Langebro. Bomløbet has a navigable width of 60 m. and the channel is 8.1 m. (26½ ft.) deep as far as Kvæsthusbro quays. On the east side of the main channel is the naval base, dockyard and arsenal. The west side is formed by the South Customs quay and the long quay of Larsens Plads on which are warehouses and silos. Behind these is the Royal Palace, Amalienborg. This quay dealt particularly with imported grain and with exports of general cargo to Britain and the Baltic countries. Ships of *Det Forenede Dampskibsselskab* berth here and also alongside Kvæsthusbro, which



Plate 64. The Free Port (*Frihavn*), Köbenhavn (Copenhagen)

In the foreground is Søndre Frihavnsbassin; on the extreme right is Langeliniekaj as it was before it was widened and lengthened in 1933-5. Near the middle of the photograph are the berths of the train-ferry to Malmö and to the right of these are the Redmole oil quays (cf. Fig. 77).



Plate 65. The naval dockyard, Köbenhavn

The view, which was taken looking west, shows the northern half of the dockyard and, beyond, the quay of Larsens Plads. In the right foreground are the two floating docks of Burmeister and Wain.



Plate 66. The inner harbour (*Inderhavn*), Köbenhavn (Copenhagen)

The view was taken looking north. In the foreground is *Langebro* and behind it, near the middle of the photograph, is *Knippelsbro*. On the left, between the two bridges, is *Slotsholm*, the island on which the town was first established. In the background is the naval dockyard (cf. Fig. 78).



Plate 67. Slotsholm and Havnegade, Köbenhavn

The long building with the light roof is the Bourse; behind it is Christiansborg where the parliament and Supreme Court meet.

is a mole lying parallel to the southern part of Larsens Plads. Practically all the sea-borne goods traffic between Köbenhavn and other Danish ports is loaded and discharged at Kvæsthusbro. In 1938 work was in progress to lengthen and widen this mole.

South of the north end of Kvæsthusbro the depth of the main channel decreases to 7.5 m. ($24\frac{1}{4}$ ft.). The channel is narrow (45-110 m.) and is backed on the west side by historic buildings, numerous churches and narrow streets; the east side is an area of warehouses and factories with wharves. The stretch from here to Langebro is the nucleus around which the city grew. On the west side the Nyhavns Kanal, which is lined with old gabled houses, lies at right angles to the main channel and leads into the square of Kongens Nytorv; it is used by fishing boats and small craft. Between the Nyhavns Kanal and the new Knippelsbro are the Havnegade quays where the boats to Sweden and Bornholm berth. On the east side of the main channel is Islands Plads, where ships of the regular service to Iceland berth. Close south are the wharves of the Greenland Trading Company (*Grønlandske Handels Plads*), on which there is a factory for dealing with whale blubber and liver which is sent salted, in casks, from Greenland. Farther south are some small basins and the large warehouses of the United Storage Company, whose wharves are used by ships plying between Köbenhavn and Iceland and the Faroes.

Knippelsbro is a road bridge with a roadway 21 m. (68 ft.) wide and two side walks. It has a double bascule which leaves a passage 35 m. (115 ft.) wide. North-west of Knippelsbro, the Börskanal lies in front of the stock exchange and leads into Gammel Strand along which is the old fish market. The return branch of the canal rejoins the main channel close north of Langebro. The area enclosed by these canals is known as Slotsholm.

Between Knippelsbro and Langebro the main channel is bordered on the west by the storehouses of *De danske Sukkerfabrikker* and the Kristiansgade quays which were normally used by large ships that left every Thursday with agricultural produce for Britain. On the opposite side of the channel are the erecting shops of Burmeister and Wain and the sugar refineries of *De danske Sukkerfabrikker*. Behind Burmeister and Wain's erecting shops and along the north side of the Christianshavn canal are the engine works of the same company. Langebro, a rolling-lift bridge which leaves a passage 33 m. (100 ft.) wide, carries a road, 23 m. (75 ft.) wide, and a railway across to Amager.

Details of quayage and depths in Inderhavn are:

	Quayage		Depth	
	m.	ft.	m.	ft.
South Customs	300	985	6.9	22½
Larsens Plads	550	1,800	7.5-8.1	24½-26½
Kvæsthusbro	425	1,395	4.7-6.9	15½-22½
Havnegade	500	1,640	6.9	22½
Kristiansgade	550	1,800	6.9	22½

In 1938 Inderhavn had eleven cranes ranging in capacity from 1 to 25 tons, and two electric cranes of 50-100 tons capacity at Burmeister and Wain's engineering works in Christianshavn.

Søndre Havn. Søndre Havn extends from Langebro to the dam which marks the south limit of the port. The main channel is 7½ m. (24½ ft.) deep as far as the south end of the quay called Islands Brygge, whence a 7 m. (22¾ ft.) channel leads into Teglværkshavn; the channel from abreast Tegholmen to the lock in the dam is 3.7 m. (12 ft.) deep.

Søndre Havn is mainly concerned with coal, raw materials and industrial products. Several factories have been built, especially around Teglværkshavn, and commercial interests are less prominent here than in Inderhavn and Frihavn. The east side of Søndre Havn is occupied by the long quay of Islands Brygge which is used for a variety of purposes, especially for unloading coal, timber, stone and sand. About half-way along the quay is the *Dansk Sojakagefabrik*, to which the ships of the East Asiatic Company bring oil-bearing nuts, beans and seeds and from which animal fodder is distributed to provincial ports by small motor ships. On the west side of the channel, in the north, is a row of coaling berths and depots called Kalvebod Brygge. This leads into Gasværkshavn which lies between it and a short mole projecting north. South of Gasværkshavn and between it and Enghave Brygge is Fiskerihavn (depths 2.5-5 m: 8-16½ ft.), where small fishing boats are laid up, but there is also a timber yard and a ship-breaking yard. Enghave Brygge is used chiefly for unloading coal, especially for the large H.C. Ørsted power station behind the quay. Between the south end of Enghave Brygge and Tegholmen a 4 m. (13 ft.) deep channel leads at right angles to the main channel, into Frederiksholmshavn which is a small industrial harbour. It includes the wharves of the Otto Mönsted margarine factory and of the firm of Lemvig, Müller and Munck which manufactures iron and steel goods. Tegholmen has been created by infilling within concrete walls. On it is Burmeister and Wain's steel and cast-

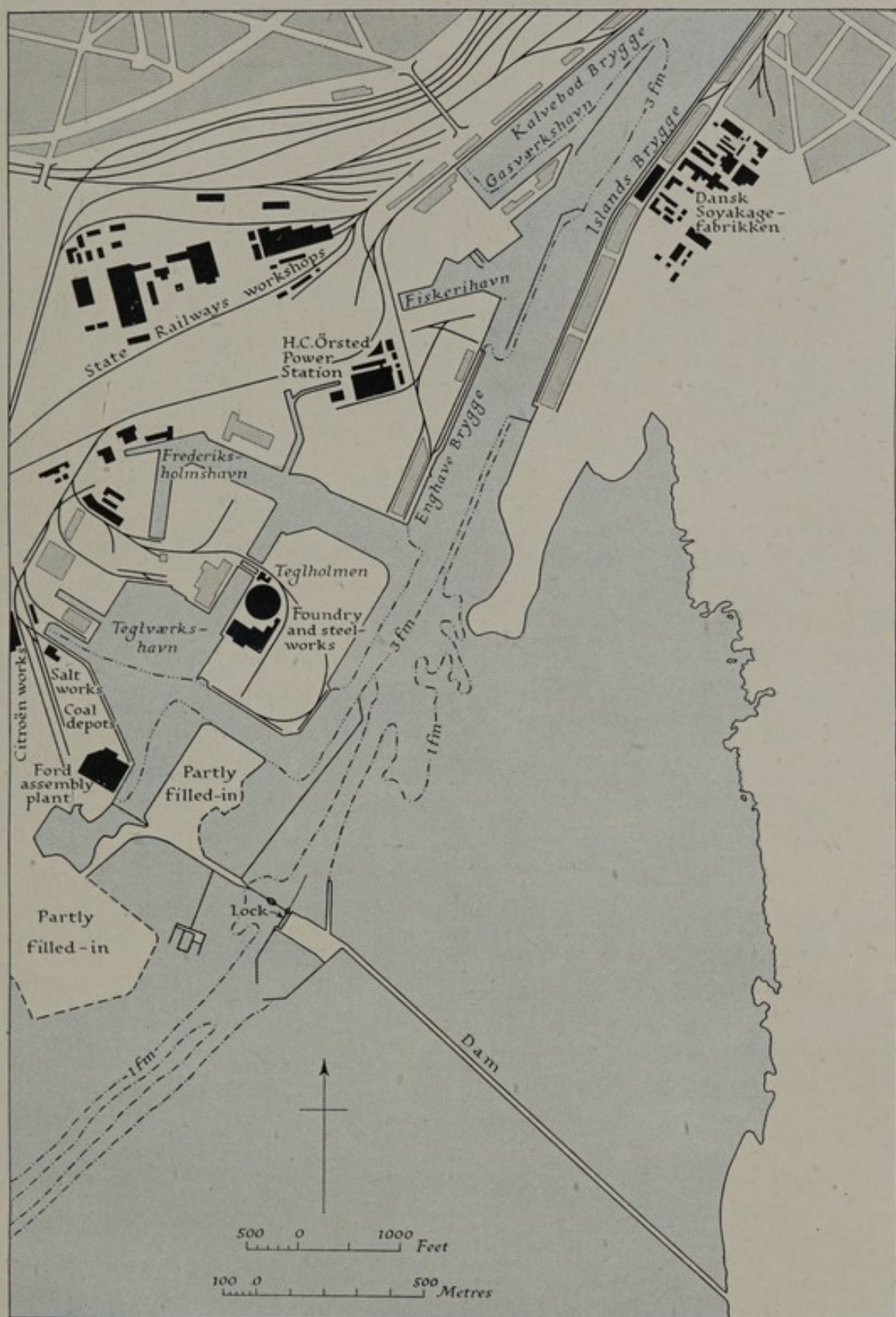


Fig. 79. The South Harbour (*Søndre Havn*) at København (Copenhagen)

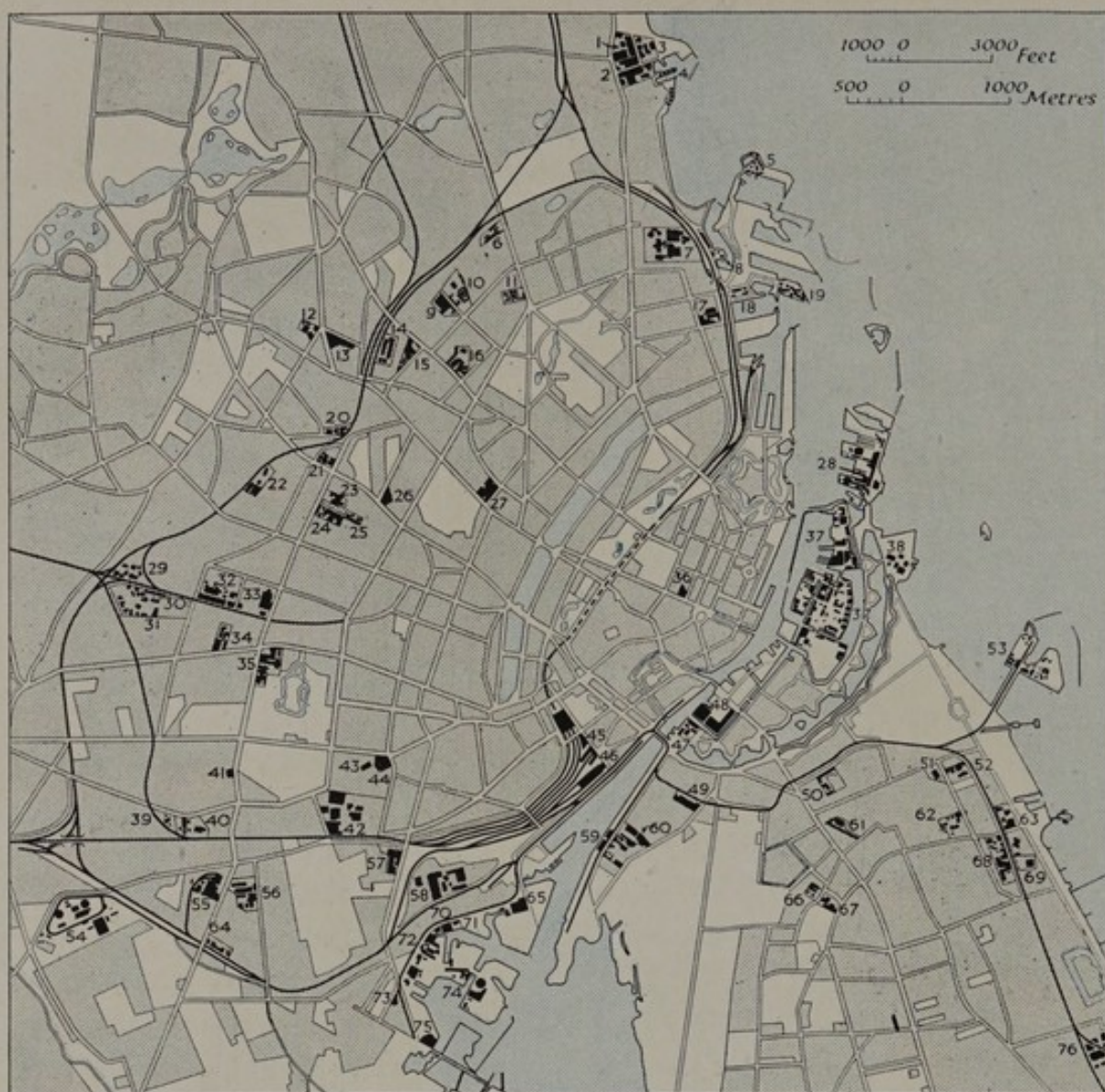


Fig. 80. The location of some of the chief industrial concerns in Köbenhavn (Copenhagen)

Based on the *Geodætisk Institut's* 1 : 15,000 map (Köbenhavn, 1937), supplemented with information from *Krak's Vejviser* (Köbenhavn, 1939).

- | | | |
|---|--|--|
| 1. Glassworks | 29. Cement works | 53. Prøvesten oil harbour |
| 2. Tuborg brewery | 30. Flintholm gasworks | 54. Valby gasworks |
| 3. Gasworks | 31. Power station | 55. Engineering works
(F. L. Smidth) |
| 4. Petroleum tanks | 32. Cable and wire factory
(Nordisk Kabel og Traad) | 56. Engineering works
(Diesel engines) |
| 5. Petroleum tanks | 33. Paper factory | 57. Tramways workshop |
| 6. Canning factory | 34. Electrical engineering works
(Fisker & Nielsen) | 58. State Railway workshops |
| 7. Eastern gasworks | 35. Porcelain factory
(Royal Copenhagen) | 59. Oil mill
(Danske Sojakage Fabrik) |
| 8. Nordhavnsværft | 36. Gothersgade power station | 60. Pencil factory |
| 9. General Motors assembly
plant | 37. Naval dockyard and arsenal | 61. Rope works |
| 10. Lauritz Knudsen (engineering) | 38. Seaplane base | 62. Gasworks |
| 11. Oil mill | 39. Porcelain factory (Norden) | 63. Volund engineering works |
| 12. Soap factory (Schous) | 40. Cotton spinning mill | 64. Soap factory |
| 13. Can factory (milk churns, etc.,
hollow ware) | 41. Stainless steel mill | 65. H.C. Ørsted power station |
| 14. Paper factory | 42. Carlsberg brewery | 66. Tobacco |
| 15. Rubber factory | 43. Brewery | 67. Canning factory |
| 16. Titan engineering works | 44. Porcelain factory
(Bing & Grøndahl) | 68. Cable and wire factory
(Nordisk Kabel og Traad) |
| 17. Chemical works | 45. Railway station | 69. Scandia Vabis works |
| 18. Madsen arms factory | 46. Goods station | 70. Margarine factory
(Otto Mönsted) |
| 19. Petroleum depot | 47. Sugar factory | 71. Lemvig, Muller and Munch
(Iron and steel goods) |
| 20. Atlas engineering works | 48. Burmeister & Wain's
engineering works | 72. General Motors |
| 21. Electrical engineering works
(Generators Ltd.) | 49. Small arms factory | 73. Citroën assembly plant |
| 22. Soap factory (Silvan) | 50. Can factory
(Glud & Marstrand) | 74. Burmeister & Wain's
foundry and steel works |
| 23. Can factory (cf. 13) | 51. Tobacco factory | 75. Ford assembly plant |
| 24. Brewery | 52. Bookbinding and printing
works | 76. Chemical works |
| 25. Knitwear factory | | |
| 26. Brewery | | |
| 27. Engineering works | | |
| 28. Burmeister and Wain's shipyard | | |

iron foundry (p. 288), and along the quays on the south side are coal depots with discharging plant. Behind this artificial island is Tegl-værkshavn which has several factories especially on its south-west side where the Citroën and Ford motor companies have their assembly plants and where there are also coal depots with discharging plants.

Details of quayage and depths in Søndre Havn are:

	Quayage		Depth	
	m.	ft.	m.	ft.
Islands Brygge	1,780	7,840	6.2-7.5	20½-24½
Kalvebod Brygge	1,000	3,280	6.9	22½
Gasværkshavn	335	1,100	6.2	20½
Enghave Brygge	730	2,395	6.3	20½
Frederiksholmshavn	525	1,720	3.7-4.0	12-13
Tegholmen	425	1,395	7.0	23
Teglværkshavn	1,190	3,900	5.0-7.0	16½-23

In 1938 there were in Søndre Havn sixty cranes ranging in capacity from 1 to 40 tons.

The dam across the south of the harbour is 2.2 km. (1½ miles) long. The lock in the dam is 53.3 m. (175 ft.) long, 11.3 m. (37 ft.) wide and 3.7 m. (12 ft.) deep. From the lock a channel with a least depth of 3.1 m. (10 ft.) leads south into Køge Bugt, but the area around the channel almost dries. Twenty-eight sluices in the dam regulate the flow of water through the port. It was reported in February 1939 that it had been decided to straighten and deepen the channel from the lock to Køge Bugt.

Beyond the north limit of the port are Tuborg Havn and Lautrup Havn which, in addition to serving the Tuborg brewery, are used for storing petroleum and other inflammables. The two harbours, which lie within two breakwaters and on either side of a mole, are approached by a channel dredged to 6.3 m. (20½ ft.) over a width of 25 m. (82 ft.). Depths in the harbours range from 1.2 to 6.3 m. (3¾-20½ ft.).

East of Amager Island is the new Prøvesten oil harbour, which is connected to the port and city by a causeway, 700 m. (765 yd.) long, which carries road and railway. Depths alongside the quays are 9.1 m. (29¾ ft.).

Port Facilities

In addition to the 152 cranes already mentioned, the port has two floating cranes of 6-7 tons, four floating cranes of between 40 and 70 tons capacity, and several coal, sand and grain elevators. Railways run on to all quays except those in Christianshavn. Burmeister and

Wain's shipyards include one dry dock, two floating docks and three patent slips and can undertake all repairs to hulls and machinery. Nordhavnsværft has three patent slips, and although on a smaller scale than Burmeister and Wain, can undertake all classes of repair work. The naval dockyard has one dry dock and three floating docks. The details of the equipment are:

Owner	Type	Extreme length		Width at entrance		Depth on sill or on keel blocks		Lifting power
		m.	ft.	m.	ft.	m.	ft.	
Burmeister and Wain	Dry	144·8	475	19·8	65	7·1	23 $\frac{1}{4}$	—
	Floating	182·9	600	21·9	72	7·5	24 $\frac{1}{2}$	13,600
	Floating	134·1	440	21·0	69	6·6	21 $\frac{1}{2}$	8,000
	Patent slips:							
	Nos. 1 and 2	83·8	275	—	—	4·6	15 (A.)	1,600
	No. 3	94·5	310	—	—	1·5	4 $\frac{3}{4}$ (F.)	2,000
Nordhavns- værft	Patent slips:							
	No. 1	50·0	165	—	—	5·3	17 $\frac{1}{4}$ (A.)	2,000
	No. 2	36·5	120	—	—	2·1	6 $\frac{3}{4}$ (F.)	—
	No. 3	20·0	65	—	—	4·2	13 $\frac{3}{4}$ (A.)	550
State	Dry	94·5	310	18·1	59 $\frac{1}{2}$	2·7	9 (F.)	225
	Floating	58·0	190	9·6	31 $\frac{1}{2}$	1·5	5 (F.)	65
	Floating	34·5	113	9·4	31	0·8	2 $\frac{1}{4}$ (F.)	—
	Floating	64·0	210	13·7	45	6·1	20	320
	Floating					3·9	12 $\frac{3}{4}$	250
						3·6	11 $\frac{1}{4}$	1,200
						3·8	12 $\frac{1}{2}$	

Details of building slips are given on pp. 284-5.

The Bunker Coal Depot has two electric cranes, each with a capacity of 100 tons per hour. The Redmole oil installation can bunker ships at the rate of 250 tons per pump per hour. Tank lighters, with pumping capacity of 250 tons per hour, supply oil anywhere in the harbour or roadstead.

In 1938 the Port Authority owned one ice-breaker of 1,800 i.h.p., two ice-breaking tugs of 350 and 90 i.h.p., one 40-ton floating crane and seven smaller barge cranes, two dredgers, nine hopper barges and thirty-two transport barges. The naval dockyard has one floating crane of 75 tons capacity.

Søndre Frihavnsbassin has two suction plants for grain, each with a capacity of 200 tons per hour, and three smaller suction plants each with a capacity of 50 tons per hour. There are also two elevators each with a capacity of 120-130 tons per hour. On Larsens Plads are two grain suction plants each with a capacity of 50 tons per hour.

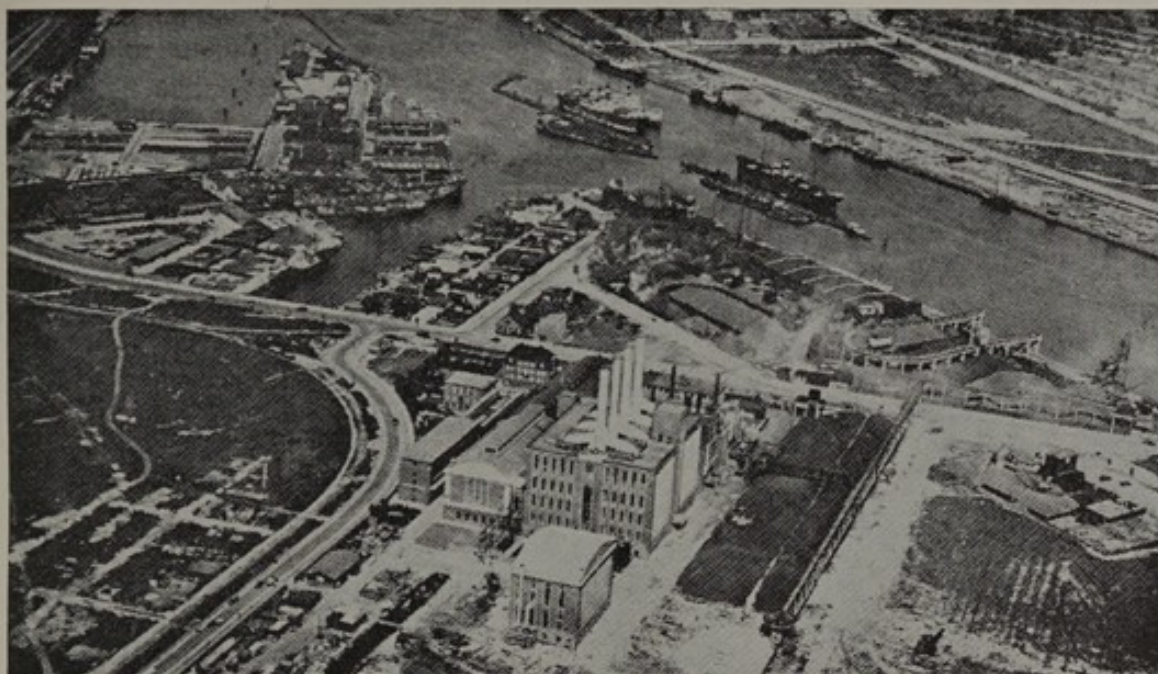


Plate 68. Part of the south harbour (*Søndre Havn*), Köbenhavn (Copenhagen)

The view has been taken looking north-east. In the foreground is the H.C. Ørsted power station and beyond is Enghave Brygge. In the left centre is Fiskerihavn and in the top left is Gasværkshavn.

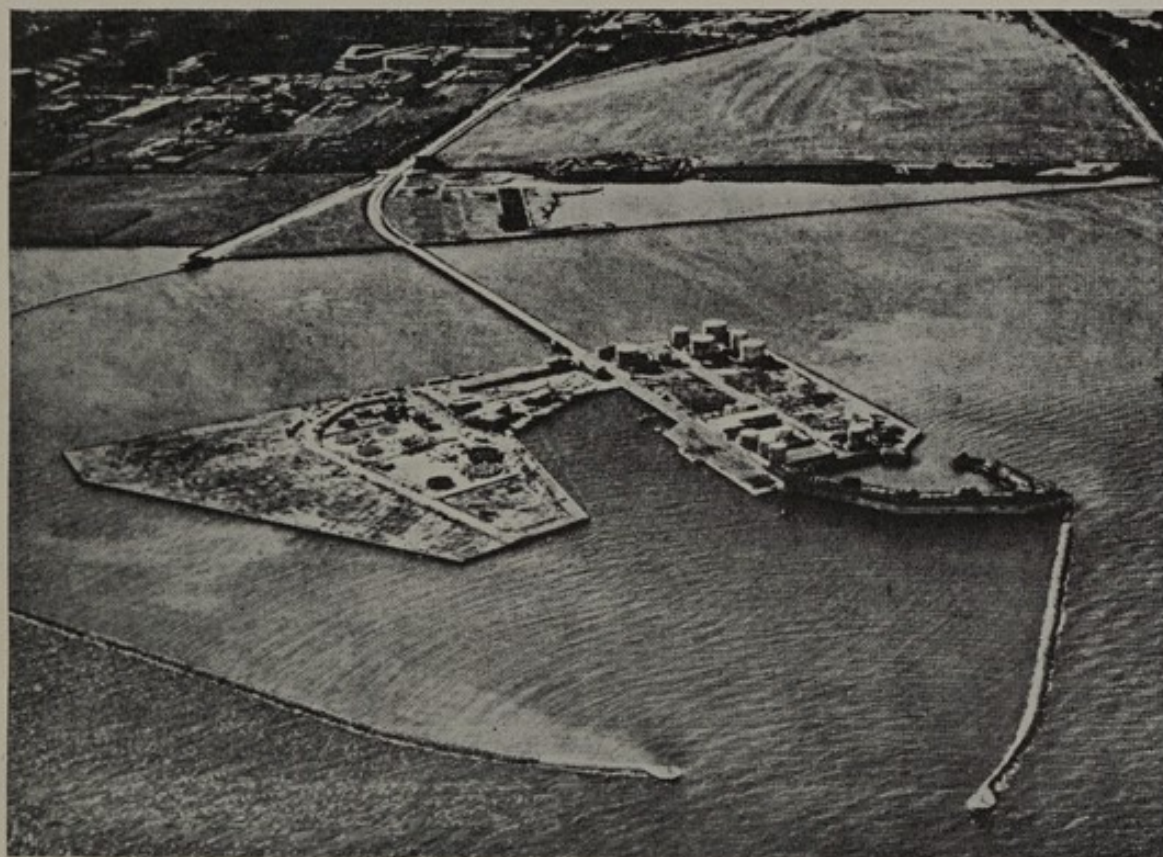


Plate 69. Prøvesten oil harbour, Köbenhavn

View looking east. The harbour was opened in 1936 and is an important centre for redistribution, both to Danish and to other Baltic ports. It was intended to remove the storage facilities at Benzinhavn to Prøvesten eventually.



Plate 70. Kongens Nytorv, Köbenhavn (Copenhagen)

The view has been taken looking south. Facing the square is the Royal Theatre and to the left is the Nyhavns Kanal.



Plate 71. Raadhusplads, Köbenhavn, from the south

The town hall is on the right-hand side of the square. The broad street running into the south side of the square is Vesterbrogade. At the south-west corner of the square is the Dagmar Theatre.

The Town

The site of the modern port has long been used as a natural harbour and around it the town has grown. The nucleus of the city lies on low ground between the sea and a series of fresh-water lakes in Sjælland, and on the northern tip of the island of Amager. The line of fresh-water lakes have become converted by buildings and roads into a series of rectangular water-bodies known as Sankt Jørgens Sø, Peblings Sø and Sortedams Sø. The old city was formerly surrounded by ramparts and moats which have since become converted into boulevards and gardens that extend from the citadel in the north to the Tivoli gardens in the south. Beyond the boulevards extend large suburbs.

The inner city, lying within the boulevards, centres on the large irregular 'square' known as Kongens Nytorv which lies at the head of Nyhavns Kanal and from which a main thoroughfare, Gothersgade, leads across the boulevards and lakes to the outer city. This thoroughfare separates an area of long and broad streets, enclosing rectangular blocks, lying to the north, from a district of narrow winding streets lying to the south. Approximately midway between Nyhavns Kanal and the citadel, and behind the quays of Inderhavn, is the royal palace, Amalienborg.

Across the area of narrow streets to the south of Gothersgade a series of streets extends in a sinuous line between Kongens Nytorv and Raadhus Plads, the other main square of the city. These streets are known collectively as Stroget and form the chief shopping centre. South of Stroget is Slotsholm, which is surrounded by an arm of Inderhavn and was the first nucleus of the city. On it stand Christiansborg where the parliament and the supreme court sit and here also are the exchange, the treasury, the record office, the Royal Library and the Thorwaldsen Museum. On the opposite side of the harbour is the crescent-shaped district of Christianshavn which is joined to Sjælland by two bridges, Knippelsbro and Langebro.

History

The settlement which eventually grew into the city and port of København remained a fishing village until the twelfth century and was called simply *Havn*. It is first mentioned in historical records in 1043 when it was cited, not as a commercial centre, but as a port of refuge for Svend Estridson's fleet after it had been defeated by Magnus the Good in an engagement off Aarhus. Valdemar I presented the village to Bishop Absalon who, in 1167, built a castle on,

and fortified, the island called Slotsholm and used it as a base for operations against the territories along the south coast of the Baltic. In 1186 Absalon bestowed the castle and the town on the see of Roskilde. The castle acquired still greater importance when Absalon attached the archbishopric of Lund to the see of Roskilde, especially since it lay on the direct route between Roskilde and Lund by the most convenient passage across the Sound. The commercial activities of the town also grew rapidly as merchants established themselves around the harbour, so that the town became known as *Köbenhavn*, or merchant's harbour, and in 1254 it received municipal privileges. It was also important as a ferry port because the merchants of the Netherlands, in order to be independent of Lübeck, used the route Ribe - Kolding - Föns - Odense - Nyborg - Korsör - Slagelse - Roskilde - Köbenhavn - Dragör - Skanör for their trade with the Baltic lands.

During the thirteenth century the commerce of the Baltic region was largely controlled by the confederation of German cities which was known as the Hanseatic League and which established trading centres throughout the area and operated especially from Hamburg and Lübeck. Its merchants traded in Denmark, as elsewhere, and established themselves in Köbenhavn and other Danish towns. While the Hanseatic League controlled the trade of the northern seas, Köbenhavn remained, of necessity, of secondary importance, but during the thirteenth century the foundations of its future greatness were laid. During this century the trade, especially in salt, grain and timber, between the ports of the southern part of the North Sea and those of the east Baltic expanded and the sea route through the Skagerrak, around the Skaw, and through the Kattegat to the Baltic, came into common use. This route was opened up by the Dutch who have left their traces in place-names such as Blaavands Huk, Skagerrak, Kattegat and Drogden. The Sound now became the most-used passage between the Kattegat and the Baltic Sea. It provided the easiest and most direct route because the deep-water channel in the northern part of the Little Belt is long, narrow and sinuous, while the Great Belt, although wide, is dangerous in the north because the waters between Sjælland, Samsö and Fyn contain many shoals, and as ships became larger frequent changes of course became necessary. The Sound also had the markets of Skåne as an additional attraction. Köbenhavn lay immediately adjacent to one of the main channels through the Sound, and there are few ports in the world where the harbour lies as close to an important channel as Köbenhavn does to the route through the Sound (see Fig. 66).

During the fourteenth and fifteenth centuries the trade and commerce of the port grew, and about 1430 the harbour became the naval base of the Kingdom. In 1443, after several unsuccessful attempts, the kings of Denmark made Köbenhavn the capital of the country because by this time Denmark had become a maritime power and Köbenhavn was the best harbour and lay on the most important sea route. The kings of Denmark fostered their country's trade. In 1475 and 1477 Christian I prohibited foreign merchants from wintering in the country and these 'sojourners' were obliged to take out their freedom and use Danish money in their business. This released Köbenhavn from entire dependence on the German commercial towns and gave it a measure of independence in its commercial life.

During the sixteenth century the power of the Hanseatic League declined, and as the influence of its towns waned that of Köbenhavn waxed. In 1547 Köbenhavn was granted the monopoly of trade with Iceland but was forced to relinquish it ten years later on account of disputes with merchants from Hamburg and England and with the Icelanders themselves. During the latter half of the sixteenth century the Westmann Islands and the Faroe Islands were frequently mentioned as the destinations of vessels from Köbenhavn and there is evidence of trade with Riga, Reval and Narva. In 1619 Köbenhavn acquired again the complete monopoly of the Icelandic trade.

In 1618 Köbenhavn received a large immigration of foreign merchants who, on account of the Thirty Years War, used Denmark as a base for carrying out their trading activities. A number of companies were formed but most of these were failures. At the beginning of the seventeenth century the harbour, which had been practically confined to Slotsholm for centuries, was considerably enlarged by Christian IV and the citadel was built to guard the entrance to it, just as Absalon's castle had stood guard over the medieval harbour. He also laid out Christianshavn on the Amager side of the harbour and completed its fortifications; in 1624 Rosenborg was completed. A chart of 1794 shows a 40 m. channel with least depths of 5.6 m. (18½ ft.) extending from Bomløbet to the modern Knippelsbro and depths of up to 3.1 m. (10 ft.) alongside the quays on both sides. The fires of 1728 and 1795 and the British bombardment of 1807 destroyed most of the old town which was gradually rebuilt.

The golden age of Danish commerce opened towards the middle of the eighteenth century when Denmark did the carrying trade while most of the European countries were at war, but, although the warehouses of trading companies increased and the harbour was improved

at intervals, it was not extended until the middle of the nineteenth century when industrial development began. In 1857 the abolition of the Sound dues (see p. 134) freed Köbenhavn from what was virtually a tariff on the use of its harbour and helped to establish the port as the *entrepôt* for the Baltic lands. A request for the establish-



Fig. 81. The growth of Köbenhavn (Copenhagen), c. 1500–c. 1700

Based on maps in D. Bruun, *Danmark: Land og Folk*, Bind II, pp. 90–1 and 98–9 (Köbenhavn and Kristiania, 1919).

The stippled area indicates water; the built-up area is in black. The present outline of the port is indicated by a broken black line. The island called Slotsholm, on which Absalon built his castle, can be seen lying off the nucleus of the city on the map showing the town, c. 1500. The city was surrounded by a moat and later by fortifications. The modern harbour area was then a wide shallow sound. The harbour lay between Slotsholm and the mainland. Growth was small before the seventeenth century. In 1618, Christian IV laid out Christianshavn on Amager, and the site of the citadel at the entrance to the enlarged harbour, and extended the fortifications of the city to include it. By the end of the seventeenth century settlement had spread northwards towards the citadel and the harbour was beginning to acquire its modern outlines on the Sjælland (Zealand) side.



Fig. 82. København (Copenhagen) in 1850

Based on a map in D. Bruun, *Danmark: Land og Folk*, Bind II, Bog. 3, p. 116 (København and Kristiania, 1919).

The nucleus of the city was still within the ramparts and a large area had been filled in north of Amager, but settlement had spread beyond the ramparts and the lakes on the Sjælland (Zealand) side. The main outline of the city plan remained little changed in spite of rebuilding after large fires in 1728 and 1795, and the bombardment of 1807.



Fig. 83. København (Copenhagen) in 1888

Based on a map in D. Bruun, *Danmark: Land og Folk*, Bind II, Bog. 3, p. 117 (København and Kristiania, 1919).

Population increased rapidly during the latter half of the nineteenth century (see Fig. 50). The ramparts have been demolished and converted into boulevards, and settlement has spread well beyond them. The Free Port was built in the shallows north of the citadel, after 1892, and the South Harbour was laid out mainly between 1900 and 1920.

ment of a free port in the harbour had been made as early as 1770, but nothing was done until Germany started to build the Kiel canal in 1888. In April of that year the government appointed a commission: in 1892 a concession was granted for building the free port which was opened to traffic in November 1894. In 1903 the harbour was extended considerably by the building of a dam and lock at the southern end of the narrow channel to control the flow of water through the harbour. This became necessary because the progressive deepening of the harbour by dredging had caused the flow of water through the harbour to be so violent during stormy weather as to cause serious inconvenience to shipping. These improvements were followed by several others which affected not only the channels and water-basins in the harbour but also the port facilities and dockside equipment, because at the end of the nineteenth century the port was in danger of becoming antiquated. Kalkbrænderihavn was built in 1893-5, Gasværkshavn in 1895-7 and in the following year the quays of Havnegade, Kristiansgade and Kalvebod Brygge were built while the South Customs quay and Larsens Plads were rebuilt in 1898-1901. Between 1901 and 1920 Søndre Havn was constructed. During the years 1915-17 the free port was extended so as to increase its quayage by one-third and its warehouse capacity by over a half, Kronløbsbassin and Redmole were built and in 1919-21 the 10 m. Bassin was laid out.

Among the more recent improvements were those carried out at Langelinie kaj during the years 1933-5 by widening and dredging alongside, and the building of an oil harbour at Prøvesten which, it is intended, shall handle all the inflammable fluids that enter the port. This harbour was opened in 1936, but further extension was planned in 1937. The yacht harbour, north of Kalkbrænderihavn, was constructed in 1937-8.

Trade

The trade of Köbenhavn is small in comparison with that of ports such as Hamburg, Antwerp and London. It suffers from the disadvantage that while its imports are largely bulky raw materials its exports are manufactured goods and food products. Consequently many ships must leave without cargo.

In 1938 about 40% of the foreign trade and 24% of the domestic trade of Denmark, measured by weight of cargoes discharged and loaded, passed through Köbenhavn. A total of 16,494 ships, of approximately 7 million register tons, laden with some 5 million tons

of goods, entered the port, but the outgoing cargoes weighed only 1.4 million tons which were carried in 15,206 ships totalling 5.2 million register tons. Approximately 72 % of both incoming and outgoing traffic by tonnage of vessels and weight of cargoes was handled by the customs port.

Of the ships which entered Köbenhavn with cargo in 1938, 58 % by number and 86 % of the cargo by weight were from foreign lands. Two-fifths of these foreign cargoes were consigned from British ports and a tenth were from German ports. The Netherlands, Sweden, and the United States each contributed 4-6 % of the cargoes and Poland and Danzig supplied 3 %.

Over half of the ships and the cargoes cleared were destined for foreign lands. Exports in large quantities were shipped to relatively few countries, and since many Danish exports are best marketed fresh, or are manufactured goods with limited markets, they were not sent very far. There was also a considerable re-export of cargoes to Baltic ports. 28 % of the cargoes shipped abroad from Köbenhavn went to Sweden and 22 % went to Britain: 11 % were consigned to Germany. Norway, Finland, Poland and Danzig and the Netherlands each took between 5 and 8 % of the cargoes.

Rather more than two-fifths of the incoming cargoes consisted of coal and coke, the great bulk of which was discharged in the Customs Port. The Free Port, on the other hand, handled nearly all the fodder stuffs which formed 4 % of all incoming cargoes, but cargoes of fodder stuffs almost as large as those imported were redistributed to other Danish ports, and there was also an appreciable re-export to other Baltic ports. About two-fifths of incoming cargoes were classed as general goods and bulk cargoes which were handled in large quantities by both the Free Port and the Customs Port. Timber and cereals each comprised about 3 % of incoming cargoes, but whereas nearly all the timber was imported through the Customs Port, the Free Port with its facilities for discharging and storing grain handled about three-fifths of the cereals, about half of which were redistributed to Danish and foreign ports.

Nearly two-thirds of outgoing cargoes were classed as general goods, more than half of which were consigned abroad and about three-quarters of which were sent from the Customs Port. Fodder stuffs were the next most important item and formed 16 % of all outgoing cargoes, but three-quarters of these were dispatched to home ports. Cereals, which formed 8 % of outgoing cargoes, were mainly re-exports from the Free Port.

Industries

Denmark imports nearly all her industrial raw materials, and many of her industries cater primarily for the home market. Köbenhavn is the chief port, the centre of commercial life and the largest market for industrial goods, since it contains almost a quarter of the total population of the country. It has become, therefore, almost inevitably, the most important industrial centre in Denmark. Its industries cover nearly the whole range of those carried on in the country, and they vary from shipbuilding and heavy machinery to the manufacture of porcelain and pencils. The chief concerns have already been mentioned in Chapter XIII. Shipbuilding and marine engineering, electrical engineering, motor-car assembly, constructional engineering, the manufacture of machine tools, cement-making machinery, and agricultural and dairy machinery stand out as the most prominent activities, but the manufacture of textiles, light metal ware, paper, chemicals, soap, sugar, cattle fodder and many others are also represented.

The industries are grouped mainly on the east side of Yderhavn and Inderhavn, on the west side of Søndre Havn, and in an arcuate belt which extends from Søndre Havn to Kalkbrænderihavn in the north and lies close within the girdle of railways which lies between the older part of the city and the recent suburban growth on its western margins (see Fig. 80).

Communications

The deep-water quays in the customs port have railways, usually double-track, which are in direct communication with the State Railways. The goods station is close west of Kalvebod Brygge. The quay railways in Frihavn communicate with the Österport station. From the town, main lines run (a) north to Helsingör and so by train ferry to Hälsingborg in Sweden, (b) south to Gedser whence is a train ferry to Warnemünde in Germany, (c) west to Korsör and thence by train ferry across the Great Belt to Nyborg and so across the Little Belt Bridge to Esbjerg (see p. 479). A train ferry runs three or four times a day, from berths in Frihavn, to Malmö in Sweden. Regular services run to Bornholm and most Danish ports. A large number of shipping lines normally maintain regular services to most parts of the world, especially to Far Eastern, north-west European and North American ports. There were air services to several countries (see Chapter XVI and Appendix VII).

The arterial roads issuing from Köbenhavn run north to Helsingör, west to Roskilde and thence to Kalundborg and to Korsör, and south

through Köge and across the Storström bridge to the southern islands and Gedser. Main roads also run north-west to Frederikssund and Frederiksværk. Access to the Helsingør road lies along Österbrogade which skirts the northern end of the line of lakes lying west of the boulevards. Nørrebrogade and Gyldenløvesgade, which cross the lakes, both lead to the Frederikssund road while Vesterbrogade lying close south of the lakes leads to the Roskilde road. Vesterbrogade also leads to the road to the southern islands. The main road crossing the city from north to south is Öster Voldgade and its continuation Nørre Voldgade, which run along the eastern side of the boulevards and link the main roads outwards from the city.

AALBORG-NÖRRE-SUNDBY

57° 03' N, 9° 56' E. Population 55,280 in 1935

The twin towns of Aalborg-Nørre-Sundby lie astride the eastern and narrower part of Limfjord. They rank as the second port of Denmark on the basis of number and tonnage of ships entered and of the tonnage of goods loaded and discharged, but they are less important than Aarhus as a centre of economic and commercial life. Apart from being the main commercial centre of north Jylland, the towns acquire much of their importance and traffic from the fact that they are the centre of the cement industry of the country.

The distance to the towns along the main fairway through the fjord, from Hals at the Kattegat entrance, is 30 km. (18½ miles), while to Tyborön, at the North Sea entrance to the fjord, the distance along the main fairway is about 140 km. (87 miles). The difficulties of navigating the western part of the fjord are such that Aalborg-Nørre-Sundby stand at the effective limit of navigation by fairly large ships, which can enter only from the Kattegat since the Tyborön channel at the North Sea entrance is shallow and shifting. The towns also stand on the most direct land route and narrowest crossing to the northernmost part of Jylland and they control the main crossing of Limfjord by road and rail. Aalborg is on the south bank of the fjord, while Nørre-Sundby, on the north bank, is an industrial suburb with a population of 7,148 in 1935.

Approach and Access

The fjord is approached, from the Kattegat, along Haa Dyb whence a dredged channel 56 m. (184 ft.) wide, and with a depth of 7.2 m.

(23½ ft.) at mean low water, leads across Hals bar. The channel through the fjord from Hals to Aalborg has steep-to sides bordered by shoal water under 1 m. (3¼ ft.) deep. The depth and least width of this channel are equal to those of the channel across the bar.

Aalborg-Nörre-Sundby can also be approached from the North Sea by small ships. The channel at Tyborön is normally 5.2 m. (17 ft.) deep but is subject to frequent changes. The fairway from Tyborön to Aalborg has normally a depth of 4 m. (13 ft.), but depths are liable to change and the water level is affected by winds, so that the western part of Limfjord is of small importance except for local navigation. In winter, navigation stops when the broads become frozen, although fixed ice never lies in the main channel.

The main channel through the port has a least depth of 11 m. (36 ft.) over a least width of about 85 m. (280 ft.), but the maximum depths alongside the wharves and quays is 7.5 m. (24½ ft.). The least depths alongside are 3.8 m. (12¼ ft.). The largest ship known to have entered the port was of 10,413 gross tons. Turning space is adequate. The total length of quayage is about 4 km. (2½ miles), and the height of the quays above mean water level ranges between 1.6 and 2.0 m. (5¼–6½ ft.).

Two bridges span the fjord in the western part of the port. The road bridge has a central double-bascule span with a navigable width of 30 m. (98 ft.). The headway under the lifting span, when the bridge is closed, is 10 m. (32¾ ft.) and varies from 4.4 to 8.2 m. (14–26½ ft.) under the fixed portions. The navigable width through the swinging portions of the new railway bridge is believed to be equal to that of the road bridge.

The difference between mean high water and mean low water is 0.3 m. (1 ft.). Westerly winds can raise the water level by 1 m. (3¼ ft.) and easterly winds can lower it by 0.5 m. (1¾ ft.).

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 84, Plate 72)

The port consists of three basins, namely *Östre Havn*, *Teglgaards-havn*, and *Vestre Havn* which lies west of the railway bridge, an oil harbour, a jetty known as *Ströbergs Bro*, and a considerable length of quays and wharves along both sides of the fjord. North-east of the port, and on the south bank of the fjord, are the Rördal cement works

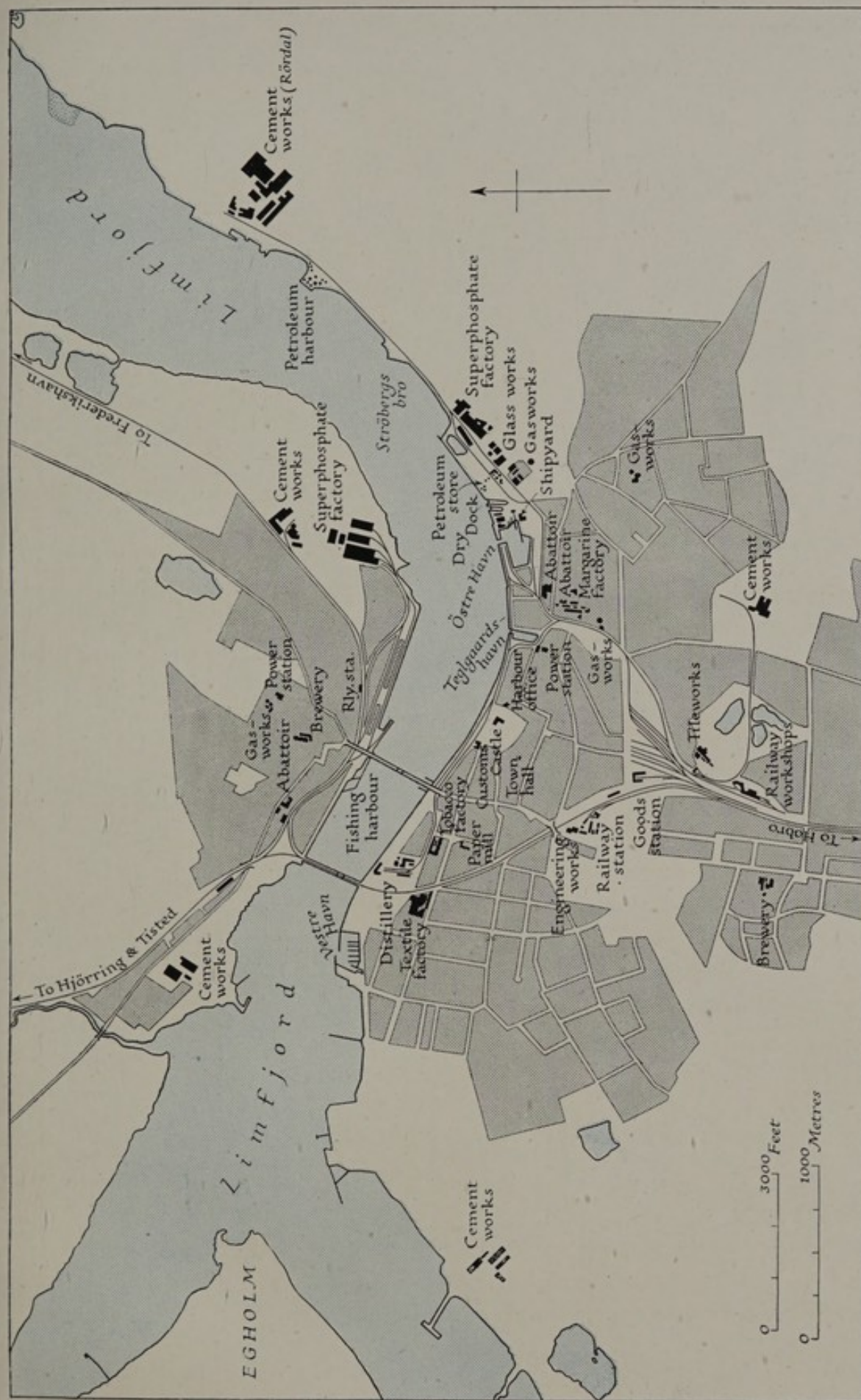


Fig. 84. The port of Aalborg-Nørre-Sundby



Fig. 85. The port of Aarhus
The numbers of the basins are shown in Roman numerals.

which are served by three short piers flanked on the east by wharves. The details of quayage and depths are:

	Quayage		Depth	
	m.	ft.	m.	ft.
Östre Havn	365	1,200	6.2	20½
Teglgaardshavn	305	1,000	3.8-4.3	12½-14
Vestre Havn	?	?	3.0-4.0	9½-13
Petroleum Harbour	70	230	7.5	24½
Ströbergs Bro	—	—	5.9	19½
Quays and wharves along fjord:				
South side	1,920	6,300	6.2-7.5	20½-24½
North side	1,050	3,440	4.7-7.5	15½-24½
Rördal cement works:				
Loading piers	137	450	3.8-6.3	12½-20½
Wharves	445	1,460	5.3-7.5	17½-24½

On the east side of Östre Havn is a shipyard which is flanked on the east by a dry dock, close east of which are storage tanks for petroleum products. Close west of the road bridge, on the Nörre-Sundby side, is a fishing harbour with depths of 1.5-3.1 m. (4¾-10 ft.). The two cement works west of the towns have their own piers. The pier of the works on the north side of the fjord has depths of 4.7-8 m. (15½-26 ft.) and that on the south side has depths of 5.9-7.8 m. (19½-25½ ft.).

Port Facilities

The shipyard in Östre Havn has two building slips (see p. 285), two patent slips and one dry dock. The details of the patent slips and dry dock are:

	Extreme length		Breadth at entrance		Depth on sill or on keel blocks		Lifting power
	m.	ft.	m.	ft.	m.	ft.	
Patent slip	182	596	—	—	2.1	6¾ (F.)	1,000
Patent slip	110	361	—	—	4.9	16 (A.)	175
Dry dock	116	382	19	62½	1.8	6 (F.)	—
					3.0	10 (A.)	
					5.4	17¾	

In addition, there is in Vestre Havn a slip with a lifting power of 175 tons which will take ships of up to 32 m. (105 ft.) long.

The port contains a swinging crane to lift 20 tons in Östre Havn, several coaling cranes of 4-6 tons capacity, and one electric grab, on the Aalborg side. At Nörre-Sundby there is one electric coaling

crane. The shipyard contains a machine shop and can undertake repairs. Nørre-Sundby contains two machine shops. Railways run on the quays as shown in Fig. 84.

The Town

The town of Aalborg is on low land and extends about 4 km. from north-west to south-east and about 2 km. from north to south. The old town lies around and behind the castle, close south-west of which is the old market place with the town hall. Three main thoroughfares cross the old town from east to west. These are: Nyhavnsgade and Borgergade, lying immediately behind the harbour front; Aldgade and Nørregade, lying across the centre; and Danmarksgade, lying across the southern fringes of the town. They all pass into the Österbro which leads into the main road to Hadsund in the east, while on the west they join Vesteraagade which runs south from the road bridge across the fjord and leads into the main road to Hobro.

The kernel of the old town lies between Algade and the castle and contains the cathedral, Budolphi Kirke, which dates from the end of the fourteenth century, the old and new market places and 'Renaissance' houses of the seventeenth century along Österaagade. Beyond the old town lie the suburbs of Hasseris and Vejgaard.

Aalborg, the third largest town in Denmark, has naturally many administrative functions. It is the seat of a bishop and the centre of a postal inspectorate for north Jylland and of a police district. The consulates of several European countries are normally maintained in the town.

History

Aalborg is one of Denmark's oldest towns; its municipal privileges date from 1342. The position of the town near the centre of northern Jylland and on a through waterway between the North Sea and the Kattegat has meant that it has always been an important centre for water transport. In 1550 work was begun on the building of piers into the fjord, and in order to meet the expenses the magistrates obtained permission from the king to charge dues on vessels. The port was the chief centre of trade with Norway during the period when Denmark and Norway were joint kingdoms, and it also had a considerable herring-fishing industry. After the separation of the two kingdoms in 1814 the trade between Aalborg and Norway declined, but towards the end of the nineteenth century the town was industrialized, and became the centre of the cement industry of the

country and the site of important oil-pressing factories. In 1883-9 a 31 m. wide channel was dredged to a depth of 5.3 m., and in 1908 it was widened and deepened to its present dimensions. Teglgaards-havn was opened in 1869 and Östre Havn, with its shipyard and slips, in 1902. The quays on the Nörre-Sundby side were laid out in 1874 and extended between 1908 and 1917. More recently the port has been modernized. The old timber piers were replaced by others built of reinforced concrete and were fitted with modern handling equipment. In 1932 an oil port, equipped for the use of tankers, was built. About 1927 proposals were being considered for the establishment of a free port at Aalborg in order to counteract the overwhelming importance of Köbenhavn and its tendency to draw new industries to the eastern side of the country. The plans placed the site of the proposed Free Port on the southern side of the fjord between the Rördal cement factory and the superphosphate factory. These proposals were followed by the economic depression of the early thirties and were therefore never put into effect.

Trade

In 1938 Aalborg-Nörre-Sundby handled 9% of the foreign trade and a similar proportion of the coastwise trade of Denmark. Cargoes discharged in the port weighed just over a million tons and were carried in 2,844 ships of 1,134,000 register tons. Eighty-eight more of these ships were engaged in coastwise trade than in foreign trade, but they represented only 38% of the total tonnage and carried only 17% of the weight of cargo discharged.

Although outgoing cargoes were loaded into 4,636 ships, the tonnage employed was only 804,000 and the weight of cargoes was only about three-fifths of those imported. Of the tonnage employed 40% carried rather more than half the cargoes to foreign ports.

Two-fifths of the cargoes from foreign ports came from Britain, 14% from Germany and 8% from North Africa. Danzig and Poland, Spain and the United States each contributed 4% of the cargoes.

A quarter of the cargoes shipped abroad were consigned to the United States, Mexico and Central America; 18% went to Germany and a similar amount to Britain; 12%, mainly cement, went to Eire, and 11% was consigned to Sweden.

Two-fifths of the weight of imports consisted of coal and coke; a quarter was grain and feeding stuffs from abroad and 16% was stone and chalk from Danish ports. Forty-six thousand tons of fertilizer and 21,000 tons of timber, from overseas, comprised the

chief other imports apart from general goods and unspecified bulk cargoes.

The importance of Aalborg-Nørre-Sundby as the centre of the cement industry dominates her export trade; three-fifths of the weight of cargoes consisted of cement. Fifty thousand tons of fertilizers from its factories and a similar amount of grain and feeding stuffs were distributed almost entirely to Danish ports. Six thousand tons of livestock and 15,000 tons of bricks and tiles, shipped abroad, were the only other significant exports. Only 60% of the cement exports were shipped abroad direct, but much of that shipped to Danish ports would be redistributed to foreign destinations.

Industries

The five cement works (see p. 293) dominate the industrial activity of the town. Other important industries are constructional engineering, shipbuilding and marine engineering on a small scale and the manufacture of agricultural, dairying and light machinery, foundry goods, chemicals, chemical fertilizers, soap, tiles, glass, margarine, textiles and clothing. There is also a wide range of industries dependent on agricultural produce. These include distilling, flour milling, tanning, manufacture of oil cakes and meal, and the packing of dairy produce. On the southern borders of the town are railway workshops and engine sheds.

Communications

The main roads and the railways of north-east Jylland converge on Aalborg-Nørre-Sundby for the crossing of Limfjord. Two single-track railways leave the town for Hjörning and Frederikshavn, and two separate single-track routes lead south to Randers. Road communications enter and leave the town by two separate routes which give access to other roads leading in all directions. In normal times regular steamship services ran to Leith, Newcastle, Hamburg, Antwerp, Lübeck, Stettin and Danzig.

AARHUS

56° 09' N, 10° 13' E. Population 90,898 in 1935

Aarhus is on a large sheltered bay which has communication with the open sea along deep, wide channels and lies adjacent to the main route to the Great Belt (see Fig. 66). Its situation is central, since it



Plate 72. The port of Aalborg-Nørre-Sundby

The view has been taken looking east towards Egholm which can be seen in the background. In the foreground is the road bridge (see p. 449) and behind it is the old railway bridge, which has since been replaced by a new structure. The factory on the left, between the two bridges, is the distillery and that in the top left corner is a cement works.



Plate 73. The port of Aarhus

In the foreground is the outer part of Sydhavn and behind it are Basins I and II. The breakwater on the north side of Basin II has since been removed and replaced by a mole (cf. Fig. 85).

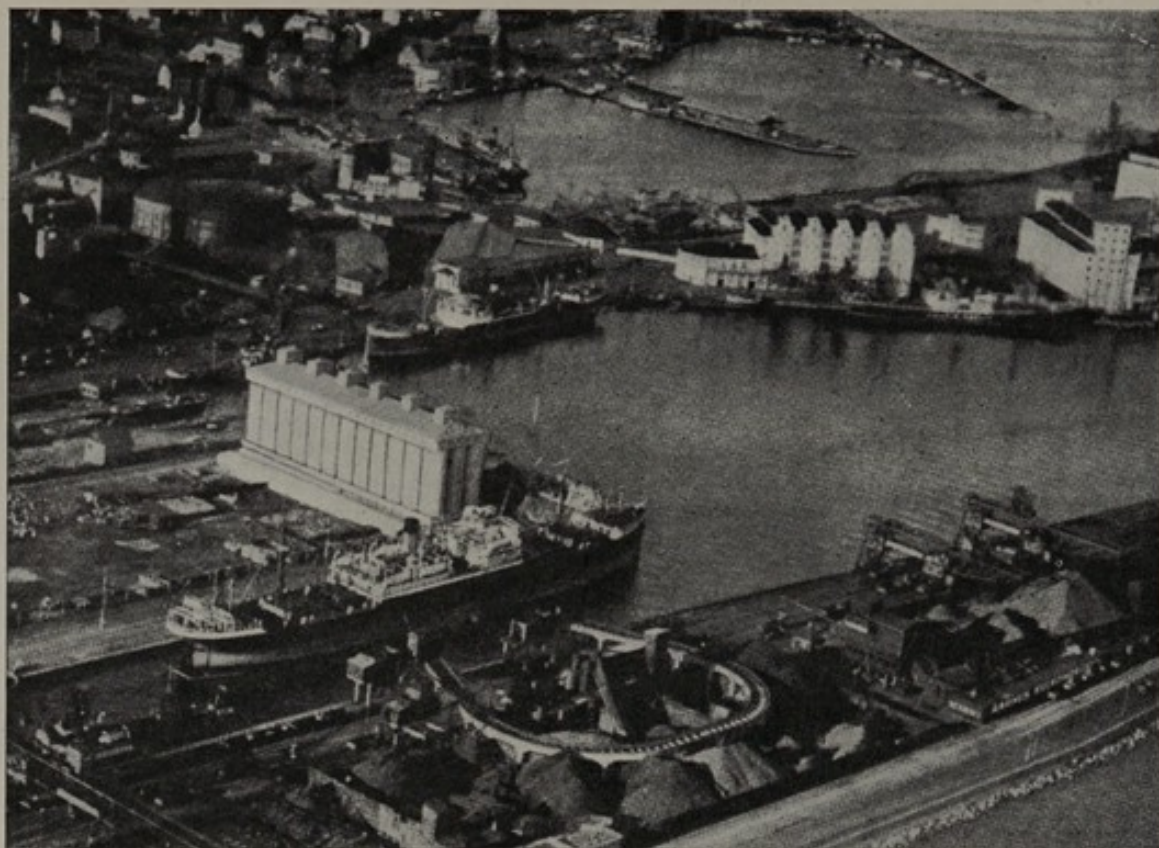


Plate 74. Slippen and Basin III, Aarhus

In the foreground are the coal dumps and unloading plant along the east quay of Slippen. The silos are used for storing oil seeds; the port factory of the Aarhus oil mills is to the left, off the picture. In the background are Basins I and II.



Plate 75. The east quay of Trafikhavn, Esbjerg

The ship in the foreground is the *Gunny* of about 1,500 tons.

lies, not only near the centre of the east coast of Jylland but also in a nodal position between the peninsula of Jylland and the Danish archipelago. Sea routes give it easy communications with Fyn and Sjælland, and, through the Great Belt and the Sound, with lands beyond, while its land communications connect it with all parts of Jylland. It is the shipping and commercial centre for Jylland and is the second city and third port of Denmark.

The port is sheltered and practically tideless. It has 7 km. ($4\frac{1}{2}$ miles) of quays and a water area of 59 ha. (146 acres). The height of the quays above mean water level is 1.8–2.3 m. ($6-7\frac{1}{2}$ ft.). The difference between mean high water and mean low water is 0.7 m. ($2\frac{1}{4}$ ft.), but west and north-west winds may raise the water level by 1.2 m. (4 ft.) and south-east winds may lower it by a similar amount.

Approach and Access

Approach from Aarhus Bugt is easy. The port is entered between a breakwater on the south-east and a mole, which enclosed a yacht harbour, on the north-west. This entrance is about 650 m. (710 yd.) wide and has a least depth of 7.8 m. ($25\frac{1}{2}$ ft.) in the fairway. It gives access to the outer part of the port which consists of a spacious water area, near the centre of which is a detached interior breakwater. This outer harbour has a least depth of 7 m. ($22\frac{3}{4}$ ft.) except towards the west and north-west, where it shoals to less than 4 m. (13 ft.) on the outer side of the mole. On either side of the interior breakwater lie the entrances to the inner part of the port and the basins. Sydhavn is approached through a channel which lies between this interior breakwater and the end of an arm which projects from the eastern mole. This entrance is about 90 m. (300 ft.) wide and 10 m. ($32\frac{3}{4}$ ft.) deep. The entrance to Nordhavn is about 60 m. (200 ft.) wide and 7.7 m. ($25\frac{1}{4}$ ft.) deep.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 85, Plates 73–4)

The port of Aarhus comprises an outer harbour and an inner harbour. The outer harbour is flanked on the north-west by a yacht harbour, which has quays and railways on its landward side, and on the south-east by a tanker harbour which lies between two arms that project from the eastern mole. The entrance to the yacht harbour is 35 m. (115 ft.) wide and 4 m. (13 ft.) deep. The tanker harbour has a width of 50 m. (165 ft.). The inner harbour consists of five basins

which lie in two groups of intercommunicating basins on either side of a central mole. Entrance to Basins I and II is made between a western quay and an arm which projects from the central mole. Since 1938 the arm that enclosed the fishing harbour in the north angle of Basin II has been removed and replaced by a quay which projects south-eastwards. Basin II is separated from Basin I by Midtermole. The channel between these two basins is about 70 m. (230 ft.) wide and 7 m. ($22\frac{3}{4}$ ft.) deep. The Aarhus river empties into the south end of Basin II. Along its lower course lies the old harbour which is narrow and is crossed by three fixed bridges.

Sydhavn, which consists of three basins, is the newer part of the port. Basin IV is separated from Basin III by a tapering mole which leaves an entrance about 80 m. (260 ft.) wide and 8.5 m. ($27\frac{3}{4}$ ft.) deep between it and the eastern mole. Basin III gives access into a long narrow basin, about 330 m. (360 yd.) long and about 45 m. (147 ft.) wide, named Slippen. Details of the quays are:

	Quayage		Depth alongside	
	m.	ft.	m.	ft.
Basin I	665	2,180	6.5-7.5	$21\frac{1}{4}$ - $24\frac{1}{2}$
	215	700	5.3	$17\frac{1}{4}$
Basin II	425	1,400	7.5	$24\frac{1}{2}$
	610	2,000	5.3-7.5	$17\frac{1}{4}$ - $24\frac{1}{2}$
Basin III	1,400	4,550	7.5-8.5	$24\frac{1}{2}$ - $27\frac{3}{4}$
Slippen	716	2,350	6.9	$22\frac{1}{2}$
Basin IV	718	2,355	9.0-10.0	$29\frac{1}{2}$ - $32\frac{3}{4}$
Tanker harbour	—	—	7.5	$24\frac{1}{2}$
Yacht harbour	650	2,130	2.0-4.0	$6\frac{1}{2}$ -13

Since Sydhavn was constructed to serve particular needs, it shows more specialization in function than does the older part of the port. That part of the eastern mole which flanks Basin IV on the south is taken up by oil depots, while that part of the mole which flanks Basin III and Slippen is occupied by coal depots and carries several coaling cranes. The mole which lies between Basins III and IV is concerned primarily with grain and has a large six-storey grain warehouse, with a capacity of about 7,000 cu. m. (24,720 cu. ft.), on its south-east side. Behind the inner end of Basin III and adjacent to Slippen are the port factory and storage tanks of the *Aarhus Oliefabrik* which possess another factory in the town. In the south-west angle of Basin III is a slip while on the west side of this basin, and behind Basin I, are the gasworks and electricity plant.

Port Facilities

The port has a machine shop which can undertake repairs to ships and machinery. There are two ordinary slips; the one in the yacht harbour is 71 m. (235 ft.) long and can take ships of up to 100 tons and 3 m. (10 ft.) draught, while that in Basin III is 106 m. (347 ft.) long and can take ships of up to 300 tons and 3.7 m. (12 ft.) draught. Early in 1939 the port had one fixed electric crane capable of lifting 25 tons, one movable 5-ton crane, eleven movable $2\frac{1}{2}$ -ton electric cranes, and four movable electric cranes to lift $1\frac{1}{2}$ tons. Private discharging facilities include eight coaling plants with capacities of 50–100 tons per hour and nine pneumatic elevators, with capacity up to 100 tons per hour for handling grain and oil-seeds, in addition to four other elevators.

The port includes, in addition to the large grain warehouse mentioned above, five grain warehouses with a total capacity of 77,000 cu. m., and modern warehouses with a total floor space of over 10,000 sq. m., apart from older buildings.

Railways run on to all quays and have direct connexion with the state railway system.

The Town

Aarhus combines the characteristics of a long-established civic centre with those of a modern industrial town and port. The old town lies on low ground west of Nordhavn and is surrounded by wooded hills, on to the slopes of which the modern suburban growth has spread. Industrial development has taken place mainly to the west of Sydhavn, in the angle between it and the estuary of the Aarhus Aa. The kernel of the old town, with narrow crooked streets, lies on the north bank of the river and invests two large squares which contain the cathedral, town hall, theatre and the post and telegraph offices.

The town extends about 5 km. from north to south and about 2 km. from east to west. The main thoroughfares from north to south are: (a) along Kystvejen, Havnegade and Dynkarken which lead north to the main road to Grenaa and south to the main road to Odder and Horsens; (b) Ryesgade and Söndergade which lead from the railway station to the town centre from which Volden and Studsgade give access to Nörrebrogade which leads to the main road to Randers. Southwards from the town centre Frederiksgade and Frederiksalle lead to the main road to Skanderborg. The chief east to west roads are Sönderalle and Aa-boulevard which lead into

Vesteralle which gives access to the main roads to Silkeborg and Viborg. Nørrealles joins the Randers road to the Skanderborg and Viborg roads along the fringes of the old town and so affords a by-pass from the north to the south and west.

Aarhus has the only university in Denmark outside Köbenhavn. The State Library in the town is the third largest in Denmark, and the observatory commemorates the name of Ole Römer, a distinguished Danish astronomer of the seventeenth century. *Den Gamle By*, placed among the botanic gardens on the west side of the town, is an open-air museum which preserves the character of a Danish market town of the seventeenth and eighteenth centuries. The town has several hospitals, institutions and barracks of the Danish army. Normally the consulates of many countries are maintained and the town performs numerous administrative functions such as the inspectorates of postal and customs districts.

History

The earliest record of Aarhus as a town dates from the twelfth century, and it has been the seat of a bishop since at least that time. Its municipal privileges date from 1441, but before 1836 the port consisted of only the estuary of the Aarhus Aa along which wharves and quays, totalling some 500 m., had been built. In that year they began building a breakwater, but the growth of the modern port did not begin until after the coming of railways to the town in 1862 when the line to Randers was completed. In 1865 Basin I was completed, with maximum depths of 5 m., and was linked to the railway system of Jylland; the line from Aarhus to Fredericia was completed in 1868. The completion of Basin I gave the port a total quayage of 1,000 m. In 1873 the eastern breakwater was begun and Basin II was finished in 1885 when the total quayage amounted to 2,500 m. The outer harbour was laid out between 1883 and 1890. At the turn of the century an extension of the port to the south was planned and in 1905 work on Basin III was started. This basin was opened in 1920, and in the previous year Basin IV was planned and work on it started in 1925. The completion of these two basins brought the total length of quayage to 5,100 m. In 1933 the yacht harbour was opened. Further improvements were made in 1938 when the arm projecting from the eastern mole was extended about 180 m. and another arm was built at right angles to it, while the mole from which they project was being widened. In the same year the south-eastern breakwater was built outwards from the mole arm which had previously formed the boun-

dary of the port on this side, and the oil harbour was laid out in the area enclosed by these two structures. The interior breakwater within the outer part of the harbour was also completed in 1938. In 1939 the construction of a new concrete quay to replace the old pier on the western side of the entrance to Basin II was well forward and the old pier has since been removed. The development of the port in terms of area, quayage and depth is summarized in the following table:

	1900	1922	1935	1938
Water area (ha.)	15	25	42	59
Maximum depth of water (m.)	7.5	8.3	10.0	10.0
Length of quayage (km.)	2.4	4.4	5.9	7.0
Ground area (ha.)	13	32	56	56

Trade

In 1938 Aarhus handled 8% of the foreign trade and 6% of the domestic trade of Denmark, measured by weight of cargoes discharged and loaded. The weight of cargo discharged was 1,175,940 tons, which was carried in 3,845 ships with a total register tonnage of 1.1 million. Outgoing cargoes were only 18% of the weight of imports, and these were carried in 2,263 ships of 558,000 register tons.

Four-fifths of the weight of cargoes discharged were consigned from foreign ports. Fifty-nine out of every hundred ships which entered the port were engaged in coastwise trade, but they formed only a third of the total tonnage of ships entering the port. Of the cargoes consigned from foreign countries, 38% were from Britain and 14% were from Germany. South-east Asia and Africa contributed 16 and 4% respectively of cargoes discharged and sent oil-bearing seeds and nuts to provide the oil-pressing mills in the town. The remainder of the cargoes were mainly from Sweden, U.S.S.R., Poland and Danzig, the Netherlands and the U.S.A., each of which contributed 3-4% of the total weight of cargoes landed.

Two-thirds of the weight of cargoes shipped were consigned to foreign ports. Britain, Germany and Finland each took about 17% and Sweden took 20% of these cargoes. The remainder went mainly to south-west Asia, Argentina, Poland and Danzig, the Netherlands and Norway in approximately equal proportions, and slightly smaller quantities were shipped to France and Belgium.

One-third of the cargoes discharged were classified as general goods and bulk cargoes. Slightly more than one-third consisted of coal and

coke. Fodder stuffs, stone, chalk and cement, and cereals comprise 9, 8 and 7% respectively of imports.

On account of the importance of Aarhus as an oil-pressing centre, fodder stuffs which are prepared from the pulp are a prominent feature among its exports. They comprised 28% of the total weight of outgoing cargoes and nearly nine-tenths of them were consigned to foreign ports. General goods and unspecified bulk cargoes accounted for 60% of exported cargoes, but while the bulk cargoes were almost all consigned to foreign lands more than a half of the general cargoes went to other Danish ports. Other exports are of relatively small account and consist mainly of cereals and re-exported coal.

Industries

The chief industries of Aarhus are oil pressing for the preparation of edible and technical oils, margarine, fats and soap, the manufacture of animal feeding cake, and the building of Diesel engines and locomotives (*Frichs*), of refrigerating and air-conditioning plant (*Sabroe*) for land and marine use, and of cranes, grabs and discharging and screening plant (*Aarhus Maskinfabrik*). The Frichs works are on the north bank of the Aarhus Aa and about 1 km. due west of the goods station. The town also carries on a good deal of light engineering, including the manufacture of machine tools, meters and gauges, wood-working machinery, agricultural and dairying machinery, as well as food packing and the manufacture of rubber ware, glass, paper, textiles and clothing. The State Railway workshops employ over a thousand workers and the town has several small foundries.

Communications

Aarhus is on the main line which runs north behind the east coast of Jylland, through Randers and Aalborg, to Frederikshavn, and south through Horsens and Vejle to Fredericia, where it meets the main route between Esbjerg and København; between Randers and Fredericia the line is double-track. It also has single-track lines to Viborg and Herning. The town is served by an electric tramway system.

Arterial roads run to Grenaa, Randers, Silkeborg and Herning, and Horsens. Car ferries run to København and, *via* Kolby Kaas in Samsø, to Kalundborg in Sjælland.

ESBJÆRG

55° 27' N, 8° 26' E. Population 30,714 in 1935

Esbjærg is the only port of importance on the North Sea coast of Denmark. Unlike the other Danish ports it has no long history and its existence is not due to the natural advantages of the harbour. The port was constructed during the nineteenth century to serve the expanding trade between Denmark and Britain, and it was considerations which served this purpose that determined its location.

Esbjærg is situated therefore between the dune-fringed coast, which extends along the whole length of western Jylland north of Blaavands Huk, and the sunken marsh-fringed coast which extends southwards to the frontier between Denmark and Germany. It stands on the only area of firm ground which reached the North Sea coast within Danish territory as it was between 1864 and 1920, that is, while northern Slesvig was part of Germany. The firm ground was important not only in providing a stable shoreline but also for ease of road and rail communications eastwards across Jylland and towards the islands, and it so happened that this site lay in almost exactly the same latitude as the easiest, and almost the shortest, crossing from Jylland to Fyn. On the seaward side the advantages were the presence of an old submarine glacial channel, Graadyb, which reduced the amount of dredging necessary in a generally shallow area and which curved parallel to the shoreline, while the island of Fanö offers some protection when the North Sea is running high. Esbjærg is essentially the outlet for Danish farm produce to eastern and southern England, but it is also an important passenger port for Denmark generally, as well as for Köbenhavn, to which there is a train-ferry service across the Great Belt. It is also the chief fishing port of Denmark, and has a small number of industries which, from the nature of its trade, are chiefly concerned with the preparation and packing of food. It is the fifth largest town in Denmark and ranks fifth among Danish ports in order of tonnage of goods handled, but it holds the fourth place by tonnage of ships entered. The port is owned by the state.

Approach and Access

Esbjærg is approached through Graadyb, along which a channel with a least width of about 200 m. (220 yd.) has been dredged across

the bar. Within the bar the channel to Esbjerg is about 200–400 m. (1–2 cables) wide between shallow sandbanks, while south of the harbour it divides into several shallow and drying channels. The least depth in the channel across the bar is 7.5 m. (24½ ft.) at M.H.W. and 6.2 m. (20¼ ft.) at M.L.W.S. The depth is affected by winds: continuous west and south-west raise the level of the water and easterly winds lower it. Outside the channel the depths are 5.1 m. (16½ ft.) at M.H.W. and 3.8 m. (12¼ ft.) at M.L.W.S. Within the bar the least depth in the channel is 7.5 m. (24½ ft.).

Tides. The difference between M.L.W.S. and M.H.W.S. is 1.5 m. (5 ft.), that between M.L.W.S. and M.H.W.N. is 1.2 m. (4 ft.) and that between M.L.W.S. and M.H.W. is 1.3 m. (4¼ ft.). M.L.W.N. is 0.3 m. (1 ft.) above M.L.W.S.

The entrances to the several basins lie adjacent to the main channel. Fiskerihavn, Trafikhavn and Færgehavn have each a separate entrance between breakwaters. In the south of the port, Östre Forhavn and Dokhavn are entered from Søndre Forhavn. The depths in these entrances are:

	Depth (M.H.W.)		Depth (M.L.W.S.)	
	m.	ft.	m.	ft.
Fiskerihavn	5.7	18½	4.4	14¼
Trafikhavn	8.0	26	6.7	21¾
Færgehavn	5.6	18¼	4.3	14
Søndre Forhavn	7.0	22¾	5.7	18½

Depths* in the basins range from 4.3 m. (14 ft.) in Færgehavn to 7.5 m. (24½ ft.) alongside the 320 m. (350 yd.) of quay which form the northern half of the east side of Trafikhavn. The basins are all tidal except Dokhavn, which is entered from Søndre Forhavn through a lock which is 15.9 m. (52 ft.) wide to a depth of 3.1 m. (10 ft.) below M.H.W. and then narrows gradually to 12.5 m. (41 ft.) at 6 m. (19½ ft.) below M.H.W. The depth on the sill is 5.6 m. (18¼ ft.). The total quayage is 20 km. (12½ miles) and the height of the quays above M.H.W. is 2–2.2 m. (6½–7¼ ft.) except in Trafikhavn where it is 2.8 m. (9 ft.)

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 86, Plates 75–7)

The port consists of six basins which lie adjacent to one another from north to south. The following table gives the quayage and depths

* The depths given throughout are those at M.L.W.S.



Fig. 86. The port of Esbjerg

The coarse black stipple indicates banks which dry at M.L.W.S.

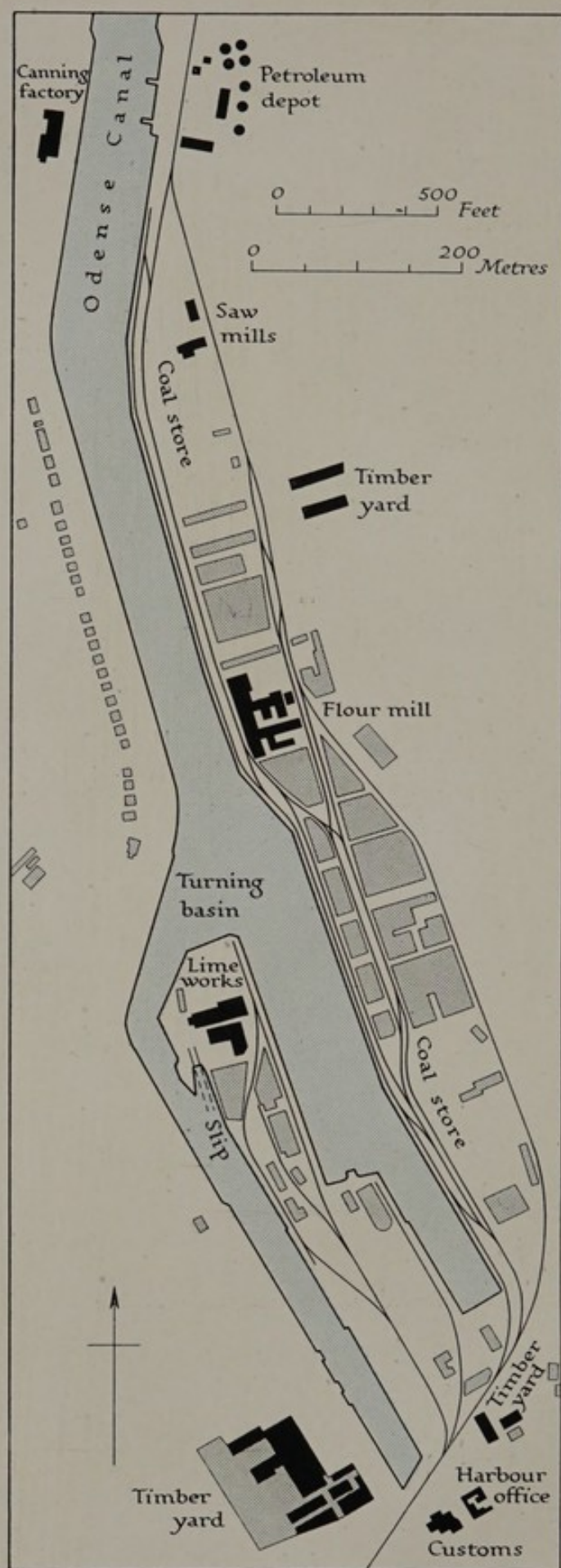


Fig. 87. The port of Odense

The Odense shipyard lies on the east bank of the canal, just off the northern border of the plan. The nucleus of the town of Odense lies about $1\frac{1}{2}$ miles south of the harbour. The railway lines serving the port run south to the main town station and north to the limits of the port.

in the several basins and indicates their arrangement from north to south:

	Quayage		Depths (M.L.W.S.)*	
	m.	ft.	m.	ft.
Fiskerihavn	3,048	10,000	3·2-4·4	10½-14½
Trafikhavn	900	2,900	6·3-7·5	20½-24½
Færgehavn	640	2,100	4·3	14
Dokhavn	792	2,600	6·0	19½
Søndre Forhavn	320	1,050	5·7	18½
Östre Forhavn	427	1,400	5·7	18½

* The difference between M.L.W.S. and M.H.W. is 1·3 m. (4½ ft.).

Fiskerihavn is a rectangular area enclosed by breakwaters which leave an entrance 48 m. (160 ft.) wide. The basin is divided within into inner and outer parts. The inner part consists of four basins, separated from each other by T-shaped piers and each basin having a separate entrance. The outer part has several wooden jetties projecting at right angles to the breakwater. On the landward side of the three northernmost basins are boat yards and north-east of the harbour are four oil tanks.

Trafikhavn is separated from *Fiskerihavn* by a broad mole and has an entrance about 90 m. (300 ft.) wide. In the western angle is a tanker pier which, with another pier, encloses a small basin the quay of which carries oil tanks; a pipe-line leads from the pier to the tanks. The tanker berth can accommodate ships of up to 135 m. (455 ft.). Straight ahead of the entrance is the main quay which carries a grain warehouse, with an elevator, opposite the entrance, a large fish-packing house near its centre and a coal-storage space at its south end. The south-east part of *Trafikhavn*, between the outer breakwater and the interior pier, is shallow.

Færgehavn is a long, narrow dog-leg basin which has an entrance 45 m. (150 ft.) wide and is divided within by two short moles. At its north end are boat slips, and at its north-west angle is a small basin at right angles to the main basin. This smaller basin is occupied by slips and is backed by a boat yard.

Close south of *Færgehavn* is the 100 m. (325 ft.) wide entrance to *Søndre Forhavn* which is marked off, but not enclosed, by a detached breakwater. *Søndre Forhavn* is flanked by *Dokhavn* and *Östre Forhavn*. These basins are separated by a large triangular quay area along the south and east sides of which is *Englands Kaj* which was used almost exclusively for traffic to England. *Dokhavn* is about

245 m. (800 ft.) long and varies from 60 to 245 m. (200–800 ft.) in width.

Port Facilities

The boat yards in Færgehavn and Fiskerihavn can repair wooden ships only. They include, in all, seven slips for repairing ships of up to 500 tons displacement. The port equipment includes eight cranes with capacities ranging from 2 to 15 tons. Railways run on to all quays and have direct communication with the Jylland system. Dokhavn has two grain elevators with capacities of 30–40 tons per hour. The grain elevator in Trafikhavn has a capacity of 100 tons per hour. There are coaling depots in Dokhavn and in the south-east angle of Trafikhavn.

The Town

Esbjærg has the characteristic rectangular street pattern of a new town. The main part of the town lies behind the older part of the port, from which it is separated by a line of gardens. On the east side of the town and about 1,200 m. ($\frac{3}{4}$ mile) from the quays is the railway station with a marshalling yard for handling the normal traffic to Britain.

History

In 1860 the population of Esbjerg numbered thirty. An Act of 1868 gave authority for the construction of this western outlet for the growing trade with Britain, and in 1869 the actual building of the harbour began. The original plans provided for a dock harbour, with a depth of 4.1 m. and entered through a lock 3.8 m. deep, and two moles and a quay 160 m. long with depths of 4.7 m. alongside. These works, which formed the nucleus of the southern part of the modern harbour, were completed in 1879. Railway connexion with Fredericia had been completed in 1874. During the years which followed, the harbour was almost continually enlarged until in 1909 another Act provided for an extension of the harbour works by the construction of a new commercial basin and a fishing harbour north of the older works. These works were carried out between 1909 and 1922.

Trade

Esbjærg handled $3\frac{1}{2}\%$ of the coastwise trade and $4\frac{1}{2}\%$ of the foreign trade of Denmark in 1938. Unlike other Danish ports the weight of exports was only some 76,000 tons less than its imports

which totalled 384,693 tons. This arises from the importance of Esbjerg as an outlet for rapid transit of food cargoes to Britain, for which it receives goods by rail from almost all parts of the country. During the year, 963 ships of 975,000 register tons unloaded cargoes at the port and the exports were loaded in 681 ships of 743,000 register tons.

Esbjerg is of small importance in coastwise trade. The west coast of Jylland lacks considerable ports, and transport to Denmark's Baltic ports is easier by rail than around the Skaw. Only 10,000 tons, or 3%, of its imports came from Danish ports, and of its exports less than 1% were consigned to home ports.

Nine-tenths of exported cargoes and three-quarters of outgoing ships were destined for British ports, 6% went to Belgium, 3% to Germany, and only small quantities were shipped to other parts. 94% of the exports were classed as general goods and consisted largely of dairy produce and bacon.

More than half the ships which entered the port with cargoes came from British ports, but they carried only 36% of the total weight of imports of which Germany provided 23% and the Netherlands provided 8%. The United States supplied 7% of the imports and Argentina sent another 5½%. Nearly two-fifths of the imports consisted of coal and coke and approximately one-sixth were fodder stuffs. Cereals and fertilizers comprised 8 and 4% respectively of the weight of incoming cargoes.

Industries

The activities of Esbjerg centre around the packing and transport of food and the handling and packing of fish. It has three small iron foundries, a tileworks, and an oil mill (see p. 282) with the attendant manufactures of soap and margarine. Several large exporting firms, dealing with butter, eggs and bacon, have warehouses in the port and there are large slaughter-houses for the export trade.

Communications

Esbjerg is the western terminus of the main railway across Jylland, Fyn and Sjælland to København; the line is double track except between Bramming and Lunderskov. Single-track lines run north to Ringkøbing, whence there is connexion with the line which crosses Limfjord by the Oddesund bridge. At Bramming the line to København joins the single-track line that runs south across the German frontier which it crosses close south of Tønder.

Normally there was a daily steamship service to Harwich. Services ran to Antwerp and Dunkirk and to London once a week and to Grimsby twice a week.

An arterial road runs east through Kolding and across the Little Belt bridge to Fyn, and another runs north to Varde. Both these roads join the arterial road which runs behind the whole length of the west coast of Jylland.

ODENSE

55° 24' N, 10° 23' E. Population 76,116 in 1935

Odense, the chief town and port of the island of Fyn, lies 22 km. (13½ miles) from the open sea but communicates with it through the almost land-locked Odense Fjord and along the canal, which was cut in 1797-1804 to link the town with the fjord; the canal was deepened five times between 1876 and 1921 and new quays were built between 1908 and 1919. The fjord and the canal provide a waterway which penetrates a long distance towards the centre of the island and so makes Odense important for the importation of raw materials, not only for the various industries in the town but also for distribution to other parts of the island. It stands on a low, almost flat, plain and is the focus of all the main roads and railways in the island. The town lies close south of the harbour. The old town grew on the north bank of the Odense Aa about 1 km. south of the harbour, but modern suburbs have spread along both banks of the river and on the south-east side of the harbour. Odense, the birthplace of Hans Andersen, is the third largest town in Denmark and ranks fourth among Danish ports in order of tonnage of goods handled.

Approach and Access

The entrance channel into Odense Fjord lies between the peninsula of Skoven and the point of Enebærodde. Thence a narrow crooked channel, dredged to a least depth of 7.5 m. (24½ ft.) over a least width of 25 m. (82 ft.), leads through shallow banks to the entrance of the Odense canal. The canal, which is 9 km. (5½ miles) long, has a least width of 60 m. (197 ft.) on the surface and 22 m. (72 ft.) on the bottom, but on the bends the corresponding widths are 65 m. (213 ft.) and 32 m. (105 ft.); the depth of the canal is the same as that of the channel through the fjord. About half-way along the canal, where it turns south, the Odense shipyard lies on the east bank, and close



Plate 76. The quays in Søndre Forhavn and Östre Forhavn, Esbjerg

The photograph shows the Englandskej. The two ships alongside the south quay are the *Jylland* (left) and the *Alexandra*. The *Jylland* is a sister-ship of the *Esbjerg* (see Plate 63); the *Alexandra*, which is also owned by the United Steamship Co., is of 1,463 gross tons. The north-east angle of Dokhavn can be seen in the left background.



Plate 77. The fishing harbour (*Fiskerihavn*) at Esbjerg

Note the motor cutters, which are used in the North Sea fisheries (cf. Plate 46).



Plate 78. The Odense canal

The view has been taken looking north towards Odense Fjord. In the background can be seen the entrance from the fjord to the canal. In the foreground is an oil depot and behind it, on the bend of the canal, is the Odense shipyard where there are three hulls on the building slips and a tanker in the fitting-out berth (see Plate 52).



Plate 79. The port of Odense (cf. Fig. 87)

south of it is a petroleum depot with a depth of 5 m. (16½ ft.) alongside the head of its jetty. The canal leads straight into the port and has no locks. Where the canal opens into the basins is a turning space which is 90 m. (295 ft.) wide in its broadest part and has a least depth of 7 m. (23 ft.). This turning space, together with the adjoining fairway, makes it possible to turn ships of up to 150 m. (490 ft.). The largest ship known to have used the port was of 5,525 net register tons. The maximum depths in the port are 7.5 m. (24½ ft.), but in the western basin they decrease to 4.0 m. (13 ft.). The difference between high and low water varies between 0.3 and 0.5 m. (1-1½ ft.), but gales from between north-west and north-east may raise the water level by 1.8 m. (6 ft.), while gales from between south-east and south-west may lower the level by 1.5 m. (5 ft.).

The total length of quays is 2.3 km. (1½ miles), of which 1.4 km. have depths of 7.5 m. (24½ ft.) alongside and the remainder has depths between 4 and 6 m. (13-19½ ft.). The height of the quays above water level ranges from 1.3 m. (4¼ ft.) to 1.9 m. (6 ft.) in different parts of the port.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 87, Plates 78-9)

The port consists of the inner part of the canal which has a quay on its eastern side, and two basins which lie on either side of a wide central mole. At the north end of the port area is a petroleum harbour with two short jetties, having depths of 6 m. (19½ ft.) alongside their heads. On the quay along the east side of the canal the coal-storage areas are served by three coaling cranes and the flour mill by two grain elevators.

The eastern basin, which is 400 m. (1,300 ft.) long and 45-80 m. (150-260 ft.) broad, is backed on its east side by grain silos which have four grain elevators on the quay, and farther south by coaling depots equipped with three coaling cranes. The western basin is narrow and has railways and quays on its east side only. It contains one slip. The central mole carries a lime works and a silo in addition to warehouses for general goods. Details of depth and quayage in the two basins are:

	Quayage		Depths	
	m.	ft.	m.	ft.
Eastern basin and east side of canal	1,646	5,400	5.0-7.5	16½-24½
Western basin	594	1,950	4.0-4.5	13-14½

Port Facilities

The shipyard north of the port does not undertake repairs (see p. 285), but the western basin contains a slip with a cradle 41 m. (134½ ft.) long and there are, in the port, machine shops which can carry out repairs to hulls and machinery. In 1938 the port contained two fixed cranes with capacities of 10 and 5 tons respectively, two movable electric cranes with capacities of 2½ and 5 tons, seven coaling cranes with capacities of 50–100 tons per hour, one apparatus for discharging oil cake, and six grain elevators, four of which are pneumatic and have capacities of 50–150 tons per hour while the others are chain elevators with capacities of 15 and 40 tons per hour respectively. There is one ice-breaking tug.

Trade

In spite of its inland position, Odense's share in both the coastwise and foreign trade of Denmark is slightly greater than that of Esbjerg. The trade of Odense is mainly one of imports, which weighed 625,000 tons in 1938 and were carried in 2,281 ships of 480,000 register tons. Slightly more than a half of these ships were engaged in foreign trade, but they represented about 80% of the tonnage entered and of the weight of cargo discharged.

Britain and Germany supplied over two-thirds of Odense's imports from foreign lands, but Britain provided twice as much as Germany. Sweden, Holland, Finland, Poland and Danzig and Argentina each supplied 3–6% of incoming cargoes.

The weight of cargoes exported was rather less than one-sixth of that imported, since Odense distributes much of its manufactures by rail and a good deal of the agricultural produce from the districts which it provides with raw materials is dispatched from other ports. Only 814 ships of 151,000 register tons were needed to carry these exports, rather more than half of which were consigned to foreign ports.

Three-fifths of the cargoes exported were consigned to Britain, nearly a quarter went to Germany and 8% went to Poland. The remainder went in relatively small quantities to Belgium, Sweden and Holland.

Of imported cargoes, 43% consisted of coal and a further 22% were general goods and unspecified bulk cargoes. Cereals and fodder stuffs accounted for 11 and 8% respectively of incoming cargoes, 7% consisted of timber, and 6% of cement and stone which came mainly from other Danish ports.

Four-fifths of the outgoing cargoes were general goods and unspecified bulk cargoes which went in approximately equal quantities to home and foreign ports. Cereals made up 15% of the cargoes: nearly all this grain was shipped to foreign ports.

Industries

The electrical engineering firm of Thomas B. Thrige and the ship-building firm of A. P. Möller are the chief industrial concerns in Odense (see pp. 285, 287). Other firms manufacture belting, light machinery, foundry goods, agricultural machinery, woollen textiles, chemical products, glass and soap. Since the town is the chief centre of the prosperous farmland of Fyn, it has a wide variety of food industries such as brewing, milling, sugar refining and food packing; it manufactures margarine and supplies fertilizers and fodder stuffs. It is an important market centre for cattle and pigs and has large abattoirs and several tanneries. Saw-milling and the making of furniture and other wooden goods are also important activities.

Communications

The town is on the main railway between Esbjerg and København which has a double track across the entire breadth of Fyn. It is the focus of single-track railways from ports such as Nyborg, Svendborg, Faaborg and Assens. The railway station is about $\frac{3}{4}$ km. (800 yd.) due south of the east basin of the port. Eight main roads radiate from the town to all parts of the island.

FREDERIKSHAVN

57° 26' N, 10° 33' E. Population 10,500 in 1935

Frederikshavn is at the southern end of Aalbæk Bugt which lies on the east side of the long peninsula that forms the northernmost part of Jylland. It lies almost opposite Göteborg in Sweden, and near the entrance from the Skagerrak to the Kattegat. The port is owned by the state and was laid out in its modern form between 1882 and 1894.

Approach and Access

North of the harbour the shore bank extends about 3 km. (2 miles) east from the shore and invests the islands of Deget and Hjellen. On the shore bank depths decrease to less than one fathom

and the bank has also several reefs. About $1\frac{1}{2}$ km. (8 cables) south-east of the entrance into the harbour are several small shoals with least depths of $1\frac{3}{4}$ fathoms. Two channels into the port lie on either side of these shoals and have least depths of 8 m. (26 ft.). The entrance into the port, between the ends of the breakwaters, is about 80 m. (260 ft.) wide and 8 m. (26 ft.) deep. Normally ships of up to 7.7 m. ($25\frac{1}{4}$ ft.) draught can enter the port, but with gales from seaward, and low water, ships of more than 7 m. ($22\frac{3}{4}$ ft.) draught cannot enter.

The port has a total water area of 40 ha. (99 acres) and some 1,740 m. (5,700 ft.) of quayage. The maximum depth alongside the quays is 8 m. (26 ft.) in the basin in *Östre Inderhavn*, but elsewhere alongside quays the depths range between 3.8 and 6.4 m. ($12\frac{1}{4}$ – $20\frac{3}{4}$ ft.). The outer harbour provides ample turning space in depths of 8 m. (26 ft.), and the inner harbour also offers adequate turning space in similar depths.

The difference between M.H.W. and M.L.W. is 0.3 m. (1 ft.). Westerly gales can raise the water level by 1.2 m. ($3\frac{3}{4}$ ft.), while east or south-east gales can lower it by 0.8 m. ($2\frac{3}{4}$ ft.).

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 88, Plate 80)

The harbours are enclosed by stone breakwaters which have sloping sides and wooden wave-traps. The water area enclosed by the breakwaters is divided into inner and outer harbours by two interior breakwaters built of stone and which have berths for tankers along their inner sides. The inner harbour is divided into two parts, *Östre Inderhavn* and *Vestre Inderhavn*, by a broad central mole which has quays on its north-east and south-west sides but is otherwise occupied by the shipyard and its dry docks.

The outer harbour (*Forhavn*), which is about 18 ha. (59 acres) in area, has depths of 8 m. (26 ft.) over most of its area, but depths decrease to 4.4 m. ($14\frac{1}{4}$ ft.) towards the sides of the breakwater. The channel between the outer and inner harbours is about 90 m. (330 ft.) wide over depths of 8 m. (26 ft.).

Östre Inderhavn consists of one long rectangular basin with 275 m. (900 ft.) of quayage, half of which has depths of 8 m. (26 ft.), and, north-east of it, two small basins which are enclosed by jetties and have depths of 3.0–3.8 m. ($9\frac{3}{4}$ – $12\frac{1}{4}$ ft.). These basins, which are used by fishing boats and yachts, are fronted by a detached breakwater. The north-east side of this harbour has 275 m. (900 ft.) of quays

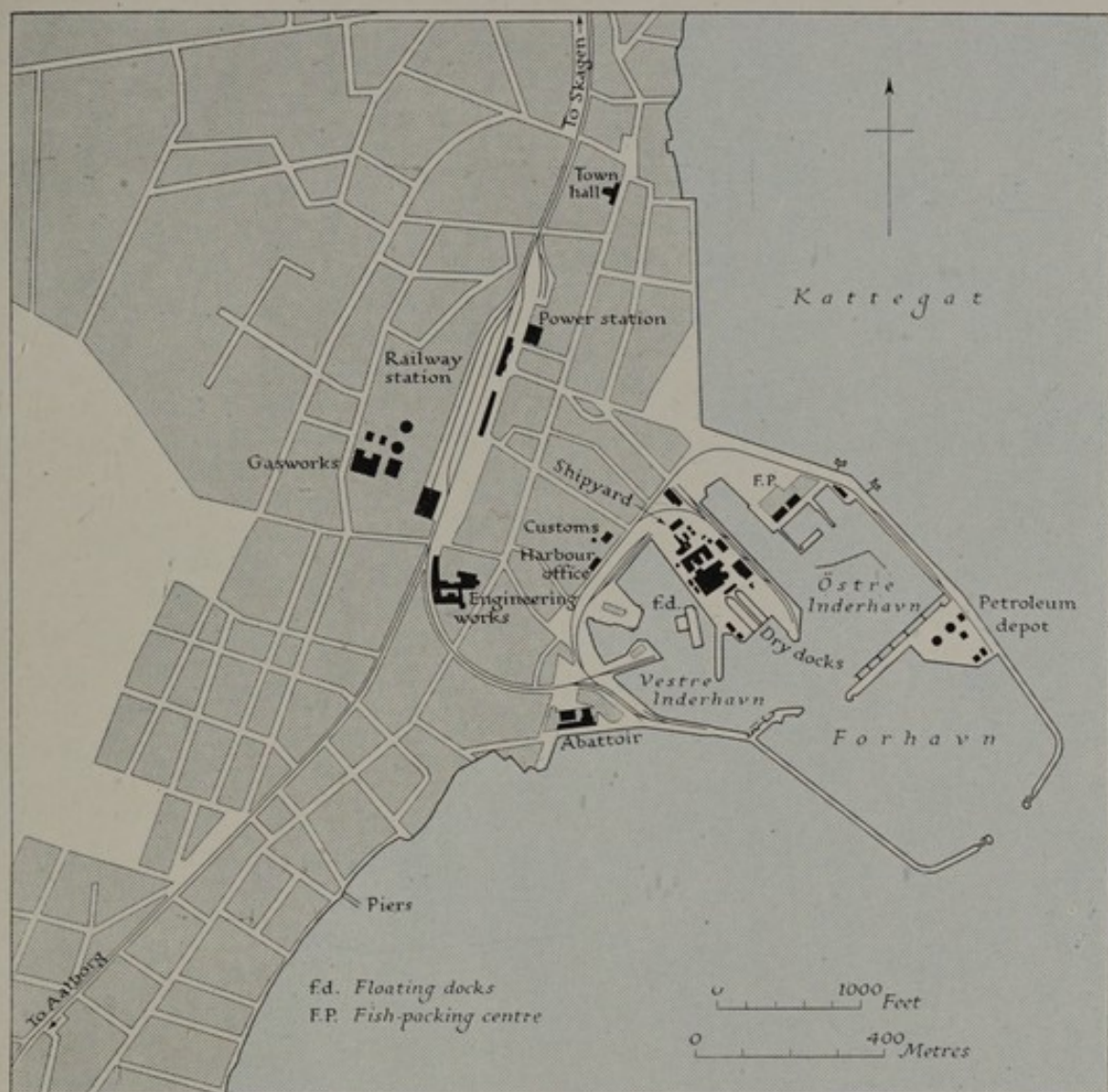


Fig. 88. The port of Frederikshavn

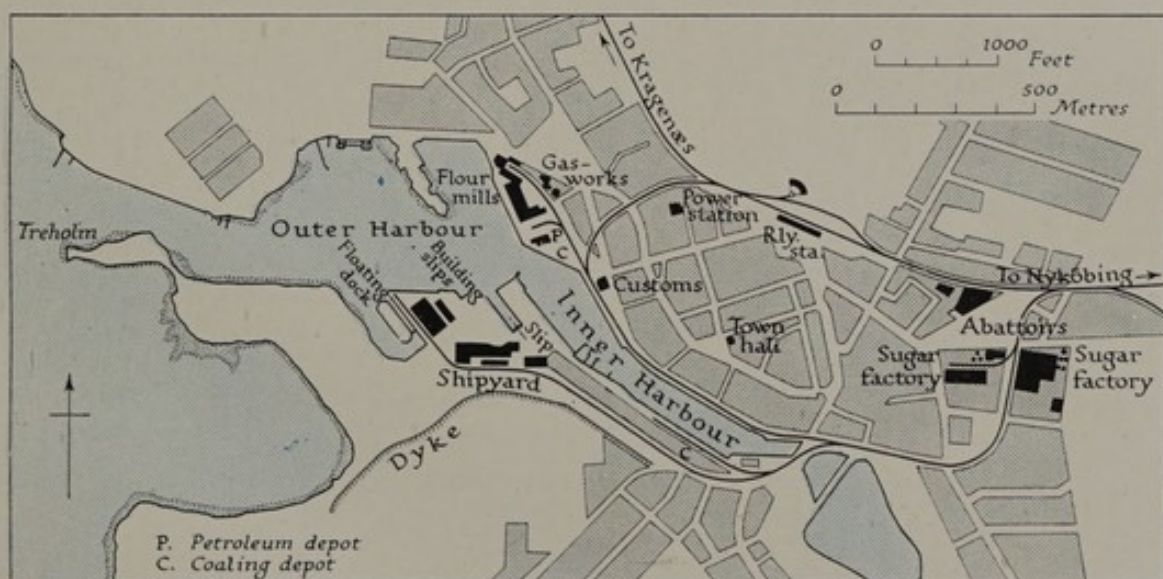


Fig. 89. The port of Nakskov



Fig. 90. The port of Korsör

with depths of 5 m. (16½ ft.) alongside, and off them are dolphins to which ships can make fast.

Vestre Inderhavn has depths of 6.4 m. (21 ft.) alongside 275 m. (900 ft.) of quays in its outer part. The northern angle of this harbour has depths of 4.4–5.6 m. (14½–18½ ft.), and in the eastern part of the harbour are two floating docks. West of the floating docks is a small basin with depths of 4 m. (13 ft.).

Port Facilities

The shipyard can execute repairs to ships and machinery. It has five slips, two dry docks and two floating docks. The slips can take ships of 60–120 tons. The dry docks and floating docks have the following dimensions:

	Extreme length		Breadth at entrance		Depth on keel blocks		Lifting power
	m.	ft.	m.	ft.	m.	ft.	tons
Dry Dock: No. 1	91	298	15.0	50	3.3	11	—
No. 2	93	305	18.0	60	4.2	14	—
Floating Dock: No. 1	95	310	16.3	53½	4.5	15	2,500
No. 2	30	98	17.7	54	3.6	12	800

The dry docks are used only for building ships. There is a large machine shop in the town.

The shipyard has two cranes to lift 10 and 25 tons respectively, and the port has one coaling crane to lift 2 tons.

Railways run on the quays on the north-east side of Östre Inderhavn, on the north side of the central mole between Östre Inderhavn and Vestre Inderhavn, and on the west and south sides of Vestre Inderhavn.

Trade

In 1938 Frederikshavn handled 99,000 tons of incoming cargo and 9,000 tons of outgoing cargo discharged from and loaded into some 1,200 ships totalling 420,000 register tons. Four-fifths of the weight of incoming cargo came from foreign ports and two-thirds of the outgoing cargoes were shipped abroad. Half of the incoming cargoes consisted of coal and coke and over one-fifth was feeding stuffs and grain. Outgoing cargoes were unspecified general goods.

Industries

Frederikshavn builds ships and fishing boats (see p. 285), marine and stationary diesel engines (see p. 286), heavy oil and petrol engines,

motors for fishing vessels, and marine equipment such as pumps and winches. It is the chief fishing port on the east coasts of Denmark and has a considerable fish-curing and packing industry (see p. 267).

Communications

Single-track railways run north to Skagen, west to Hjørring and Hirtshals and south to Aalborg. The arterial road from Skagen to Aalborg and the south passes through the town and another such road runs west to Hjørring which is the main focus of roads in north Jylland. There are car-ferry services to Larvik in Norway and to Göteborg in Sweden. Regular services were also maintained to København and to Oslo.

NAKSKOV

54° 50' N, 11° 08' E. Population 14,522 in 1935

Nakskov, the chief port of the island of Lolland, is at the head of the wide, shallow Nakskov Fjord which occupies a large part of the west coast of the island. It is on the east side of Langelands Bælt which, with Femer Bælt, connects the Great Belt with the Baltic.

Approach and Access

Nakskov Fjord is almost completely filled by shallow flats with depths under 1 m. (3 ft.), but two dredged channels lead into the port. The main channel is fairly straight and passes south of the island of Enehøj. It is 6.3 m. (20½ ft.) deep and has a least width of 30 m. (98 ft.) along the bottom. The other channel diverges from the main channel near the south end of Enehøj and passes north of the island of Slotö to rejoin the main channel near Barneholm. It is narrow and crooked and has a least depth of 5 m. (16¼ ft.). The main channel continues into the inner part of the port as a marked channel and is flanked by shallower areas which give access to the quays and basins that lie north and south of it in the outer part of the port.

The water area in the port is 1,300 m. (4,250 ft.) long and varies between 70 and 170 m. (230–560 ft.) in width outside the basins. There is adequate turning space, over depths of 6.3 m. (20½ ft.), at the entrance to the inner harbour. The port has 2,500 m. (8,200 ft.) of quayage, of which about 830 m. (2,720 ft.) have depths of 6.3 m. (20½ ft.), 1,280 m. (4,200 ft.) have depths of 4.4–5.0 m. (14¼–16¼ ft.) and the remainder have least depths of 2.5 m. (8 ft.). The quays are 1.6–2.1 m. (5¼–6¾ ft.) above water level.

The difference between M.H.W. and M.L.W. is very small, but gales from between north-east and east can raise the water level by 1.5 m. (5 ft.), and those from between south-west and west can lower it by 1 m. (3¼ ft.).

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 89, Plate 81)

The port consists of an inner and an outer harbour. The *outer harbour* is a spacious water area lying north of the shipyard and has quays only around its north-eastern angle, alongside which the depth is 6.3 m. (20½ ft.). The basin lying close west of the shipyard is occupied by a floating dock, while that lying east of the yard leads to a repair slip. Elsewhere outside the main channel through the outer harbour and north of the shipyard, where depths of 5 m. (16¼ ft.) are maintained for launchings, the water area shoals to the shore from which piers for fishing boats extend into deeper water along the north-west shore.

The *inner harbour* consists of quays built along the side of the fjord and extends as far east as the fixed road and railway bridges which cross the inner end of the fjord. The northern third of the quays on the north-east side and the southern third of those on the south-west side have depths of 6.3 m. (20½ ft.). Elsewhere alongside the quays of the inner harbour the depths are between 4.4 and 5 m. (14¼–16¼ ft.) except inside the boat piers which occupy the central part of the west side of the inner harbour and the quays on the north side close west of the road bridge. In these two areas the depths are 2.5 m. (8 ft.).

The shallow bay south of Treholm was being reclaimed by in-filling before the war. An official plan of 1936 indicates an intention of building quays on the north side of the inner harbour and on the west side of the basin which is now occupied by the floating dock.

Port Facilities

The shipyard has one patent slip and a floating dock, in addition to its building slips, and can undertake all repairs (see p. 285). The details of the patent slip are: extreme length 140 m. (460 ft.), length of cradle 40 m. (130 ft.), draught on keel blocks 3 m. (10 ft.) aft, lifting power 600 tons. The steel floating dock is 125 m. (410 ft.) long, 23½ m. (77 ft.) wide at its entrance and has a depth of 6 m. (19½ ft.) on the sill; its lifting power is 6,800 tons. The port contains a crane to lift 60 tons, another to lift 5 tons, and a grain silo with a capacity

of 4,000 tons. In the town is an engineering works with a foundry and two large machine workshops. Railways run along the entire length of the quays on the east side and on the quays lying south of the boat piers on the south-west side of the inner harbour.

Trade

In 1938 the port handled 2,000 ships, of 254,000 register tons, which discharged 181,000 tons of cargo. Two-thirds of the weight of cargoes came from foreign lands and half of this consisted of coal and coke. Twenty-five thousand tons of grain and feeding stuffs were imported from abroad, and, with 7,000 tons of fertilizer and 4,000 tons of timber, formed the bulk of the specified foreign imports. The coastwise trade was concerned mainly with stone, lime and cement, general goods and bulk cargoes, but some 6,000 tons of fertilizers and of grain and feeding stuffs were also received from Danish ports.

Outgoing cargoes were only about half the weight of those imported, but they were loaded into some 1,550 ships of 220,000 register tons. Two-fifths of the weight of cargoes was consigned abroad; over a half of this consisted of grain and the remainder mainly of agricultural produce. The cargoes moving coastwise were unspecified except for some 10,000 tons of grain and feeding stuffs.

Industries

The chief industry is shipbuilding which confines itself largely to the construction of hulls. The town has several industries arising from agricultural produce, such as sugar refining, malting and brewing, flour milling, tanning and the preparation and packing of dairy and livestock produce.

Communications

Three single-track railways run to Bandholm, Rødbyhavn and Nykøbing (Falster). Main roads run to Bandholm, Nysted and, through Maribo and Sakskøbing, to Nykøbing. A ferry crosses to Spodsbjærg on the east coast of Langeland.

KORSÖR

55° 20' N, 11° 08' E. Population 9,671 in 1935

Korsör stands astride the two peninsulas which enclose the shallow embayment of Korsör Nor. Its position on the west coast of Sjælland, opposite Nyborg and where the Great Belt is narrowest, has made it



Plate 80. The port of Frederikshavn, from the south-east (cf. Fig. 88)



Plate 81. The inner harbour, Nakskov

The view has been taken looking north-west and shows almost the whole length of the quays on the north-east side of the inner harbour.



Plate 82. The port of Korsör

The view shows almost the entire port. On the right is the bridge across the entrance to Korsör Nor. In the top centre are the berths of the train ferry to Nyborg. In front of these berths is the castle, flanked on the west by moats. To the left of the castle is the boat harbour and still farther to the left a ship lies alongside the main quay on the south side of the outer harbour (cf. Fig. 90).



Plate 83. The port of Nyborg

Nyborg is the sister-port of Korsör on the opposite side of the Great Belt. In the foreground are the train-ferry berths; to the right of these are the engine sheds and some of the buildings of the State Railways workshops (cf. Fig. 91).

the eastern terminus of the train-ferry route across this channel. The harbour is sheltered and spacious.

Approach and Access

Korsör is approached between the shore-banks, shoals, rocks and reefs which lie west of the entrance to Korsör Nor. The shoals are at depths of 5 m. ($2\frac{3}{4}$ fathoms), and the reefs have some rocks above water but others lie at least depths of 1 m. ($3\frac{1}{4}$ ft.). The channel through the shoals and into the port is 8 m. ($26\frac{1}{4}$ ft.) deep. The port is entered between two breakwaters which leave a channel 104 m. (340 ft.) wide and 8 m. deep between them. This depth is carried along the main fairway through the port as far as the bridge across Korsör Nor, beyond which it decreases to 6 m. ($19\frac{1}{2}$ ft.). A depth of 8 m. ($26\frac{1}{4}$ ft.) occurs over a large area within the breakwaters, where there is ample turning space, and also over a total length of 735 m. (2,410 ft.) alongside the main quays on the east and south sides of the main harbour. A total quayage of 880 m. (2,900 ft.) has depths of 6 m. ($19\frac{1}{2}$ ft.), but alongside some 250 m. (820 ft.) of quays the depths are only 3.5 m. ($11\frac{1}{2}$ ft.). The total length of quayage in the port is about 2,790 m. (9,150 ft.). The port is 1,460 m. (1,600 yd.) long and varies between 95 and 185 m. (310–607 ft.) in width. The height of the quays above mean water level is between 1.7 and 2.3 m. ($5\frac{1}{2}$ – $7\frac{1}{2}$ ft.).

The difference between M.H.W. and M.L.W. is 0.3 m. (1 ft.), but gales between north-west and north-east raise the water level by 0.9 m. (3 ft.), and those from the south lower the water level by 0.6 m. (2 ft.).

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 90, Plate 82)

The harbour consists of five parts, namely, the outer harbour, which includes the ferry harbour and a boat harbour, the main harbour, and an inner harbour. The *outer harbour* lies immediately within the breakwaters and is a large water area which is, however, shallow in parts. A channel 55 m. (180 ft.) wide and 3.5 m. ($11\frac{1}{2}$ ft.) deep has been dredged across it to the petroleum quay on its southern side where the same depths occur alongside; this quay carries storage tanks. On the west side of the outer harbour is a jetty with a depth of 8 m. ($26\frac{1}{4}$ ft.) alongside its head from which a pipe-line runs to the storage tanks on the south quay. In the north-eastern part of the outer harbour are three train-ferry berths with depths of 5.0–5.6 m.

(16½–18½ ft.) and which are flanked on the south by a triangular quay near the head of which the ships to Lohals, in Langeland, berth. On the opposite side of the main channel to the inner harbour lies the boat harbour which is enclosed by two moles and has a depth of 2.5 m. (8½ ft.).

Entry into the *main harbour* is made between the triangular quay area on the east side of the ferry berths, and the head of the southern peninsula on which the castle stands out as a conspicuous feature. Between the castle and the boat harbour is a shipyard. The main harbour lies north–south and extends as far as the bridge which spans the entrance to Korsör Nor. The eastern and the southern parts of this harbour have depths of 8 m. (26½ ft.), but elsewhere in it the depths range between 4.3 and 6 m. (14–19½ ft.). In the angle between the northern and eastern quays is the berth of the car ferry to Nyborg. The eastern quay and the quays which lie south of the castle are the oldest part of the modern port and carry most of the warehouses and silos. They both have coaling wharves and mechanical coaling apparatus. Behind the warehouses on the eastern quay are fuel oil tanks. The bridge across Korsör Nor serves to mark off the main harbour from the inner harbour. This is a swing bridge.

Immediately within the *inner harbour* and on both its northern and southern sides lie quays which have depths of 6 m. (19½ ft.) alongside. East of the quays on the northern side lies the Lilleö shipyard, beyond which the harbour passes into the broad and shallow Korsör Nor.

Port Facilities

The port includes one 6-ton travelling crane, one 10-ton fixed electric crane, six travelling coal cranes and four grain elevators. The shipyards build boats and wooden ships only. There is a slip for ships up to 70 tons in the boat harbour and another with a lifting capacity of 450 tons at the shipyard in Korsör Nor; the latter slip has an extreme length of 109 m. (357½ ft.) with draught on keel blocks of 2 m. (6½ ft.) fore and 4 m. (13 ft.) aft. Railways run on to all quays except those around the castle and boat harbour.

Trade

During 1938 a total of 1,512 vessels of 267,000 register tons discharged 243,000 tons of cargo in the port. Nine-tenths of this cargo was brought from foreign ports by 545 ships of 162,000 register tons. By contrast, three-quarters of the export trade was carried on with Danish ports and was loaded in a thousand ships of 106,000 register

tons. The 145 ships which carried exports to foreign ports carried 11,000 tons of cargo.

Approximately half the imports were coal and coke, one-tenth were fodder stuffs, another tenth consisted of cereals, while fertilizers formed $5\frac{1}{2}\%$ of the weight of imports. These imports came almost entirely from foreign lands. The only considerable imports from home ports were 6,920 tons of fodder stuffs and 8,472 tons of stone, chalk and cement.

Rather more than half the weight of exports consisted of unspecified bulk cargoes, virtually all of which were sent to Danish ports. Nine thousand tons of cereals were the only other prominent feature of the export trade, and about two-thirds of this was consigned to home ports.

The ferry service between Korsör and Nyborg carried some 480,000 tons of cargo each way in 1938.

Industries

Korsör builds mainly small wooden ships and boats, manufactures tiles and margarine, and has the usual food industries such as milling and the preparation and packing of farm produce. Some light machinery is manufactured.

Communications

A double-track railway runs east to Köbenhavn via Ringsted where the line from Gedser joins it. In addition to the train ferry to Nyborg across the Great Belt, a car-ferry service runs to Lohals in Langeland. There is only one highway out of the town, but Slagelse, about 18 km. by road to the north-east, is a centre of roads and railways to all parts of Sjælland.

NYBORG

55° 19' N, 10° 48' E. Population 9,479 in 1935

Nyborg is at the head of Nyborg Fjord which lies towards the centre of the east coast of Fyn and opens southwards into the Great Belt. It is the western terminal of the train ferry across the Great Belt and so stands where the route across Jylland and the islands crosses the water route through this channel. The harbour is safe and sheltered.

Approach and Access

The port is approached along Nyborg Fjord which is about 3.7 km. ($2\frac{1}{4}$ miles) long and has a dredged channel, 40 m. (130 ft.) wide and 7.5 m. ($24\frac{1}{2}$ ft.) deep, leading into the port. This channel is flanked by shoal flats with depths of less than a fathom. Entrance to the port lies between the ferry berths on the east and a short mole which extends from the quay separating the main part of the harbour from the fishing harbour. The depth in this channel is 7.5 m. ($24\frac{1}{2}$ ft.) over a width of 40 m. (130 ft.) lying close east of the mole, but towards the ferry berths it decreases to 5.6 m. ($18\frac{1}{4}$ ft.). The maximum depth alongside the quays in the port is 7.5 m. ($24\frac{1}{2}$ ft.) which occurs over a length of about 350 m. (1,150 ft.) in Vesterhavn. About 850 m. (2,800 ft.) of quayage has depths of between 3 and 5.6 m. (10 – $18\frac{1}{4}$ ft.). The height of the quay above mean water level is between 1.8 and 2 m. (6 – $6\frac{1}{2}$ ft.).

The difference between M.H.W. and M.L.W. is 0.3 m. (1 ft.), but gales from the west or north-west can raise the water level by 1 m. ($3\frac{1}{4}$ ft.) and gales from the south or south-east can lower it by 0.7 m. ($2\frac{1}{4}$ ft.).

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 91, Plate 83)

The port consists of a ferry harbour which has three train-ferry berths, Österhavn, Vesterhavn and a fishing harbour, which are separated by moles built out from the head of the fjord. The southernmost two *ferry berths* have depths of 5.6 m. ($18\frac{1}{4}$ ft.); the other has a depth of 5 m. ($16\frac{1}{4}$ ft.). A broad mole separates the ferry harbour from Österhavn which is used by small steamers and has about 400 m. (1,300 ft.) of quays with depths of 5.5 m. (18 ft.) alongside. On the west side of the main port is Vesterhavn which has some 350 m. (1,150 ft.) of quays with depths of 7.5 m. ($24\frac{1}{2}$ ft.) alongside. Vesterhavn is separated from Österhavn by a southward-projecting mole, and in the angle between this mole and Vesterhavn is the 5 m. deep berth of the car ferry to Korsör on the other side of the Great Belt. The *fishing harbour* is separated from Vesterhavn by a broad mole on which are public warehouses and a small grain silo. The south face of this mole has depths of 3.4–5 m. (11 – $16\frac{1}{4}$ ft.). Depths in the fishing harbour are between 2.5 and 3 m. (8 – $9\frac{3}{4}$ ft.).

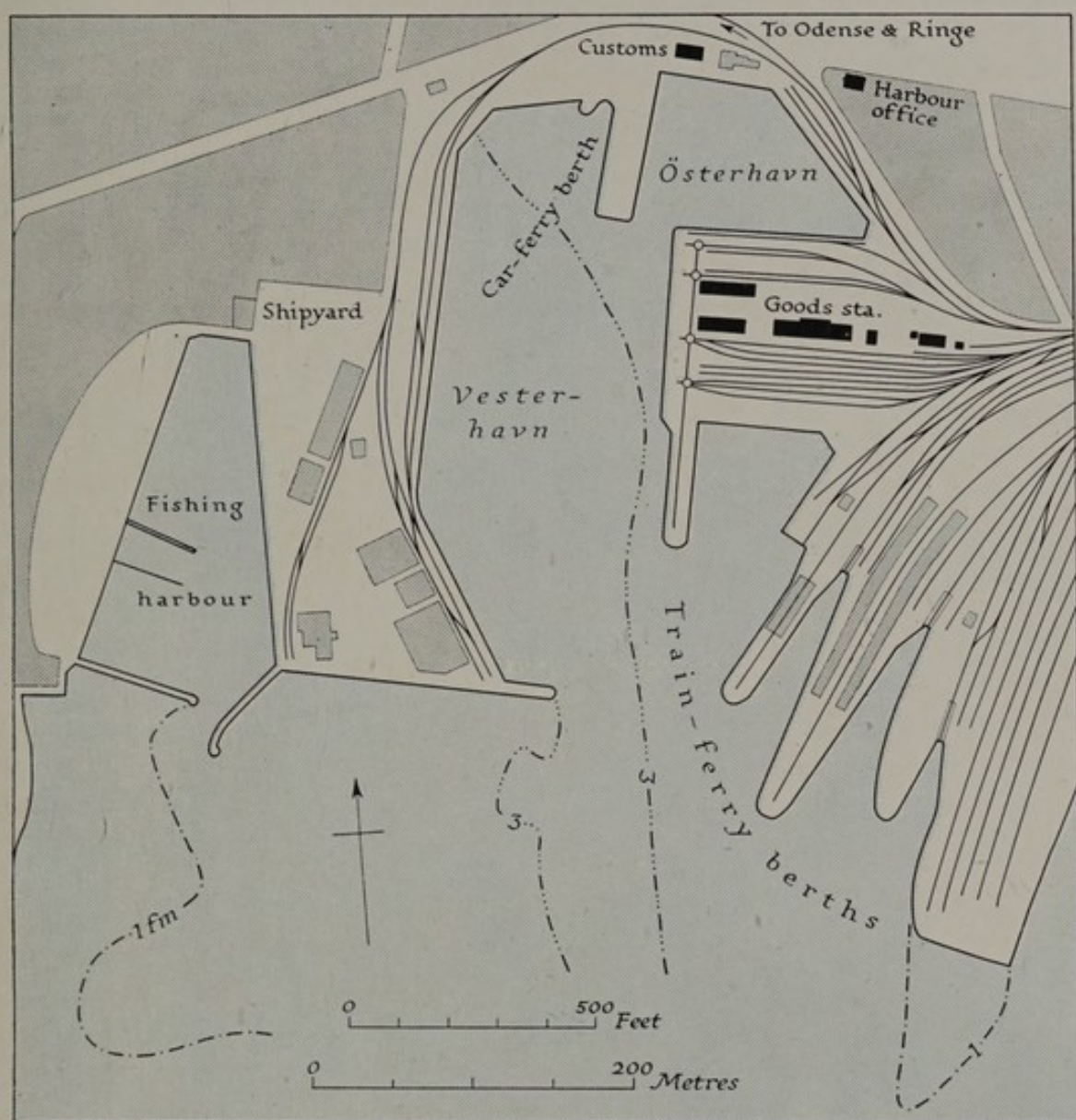


Fig. 91. The port of Nyborg

The workshops of the State Railways lie close south-east of the sidings behind the train-ferry berths.

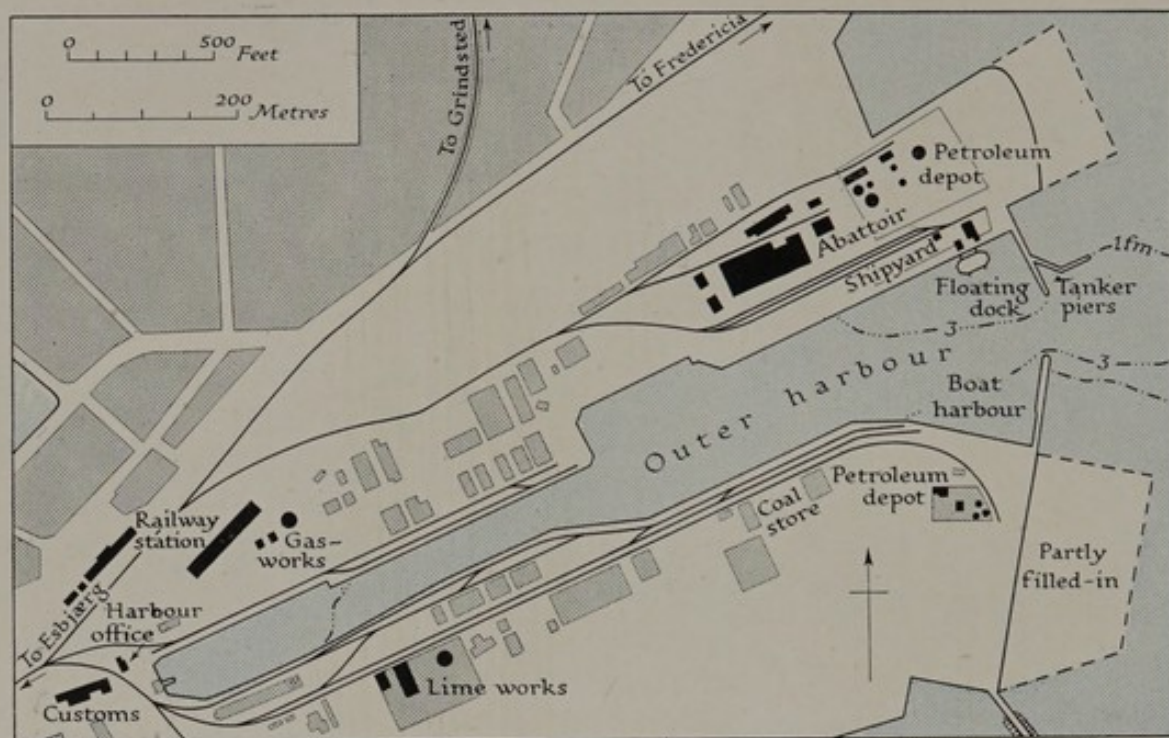


Fig. 92. The port of Kolding

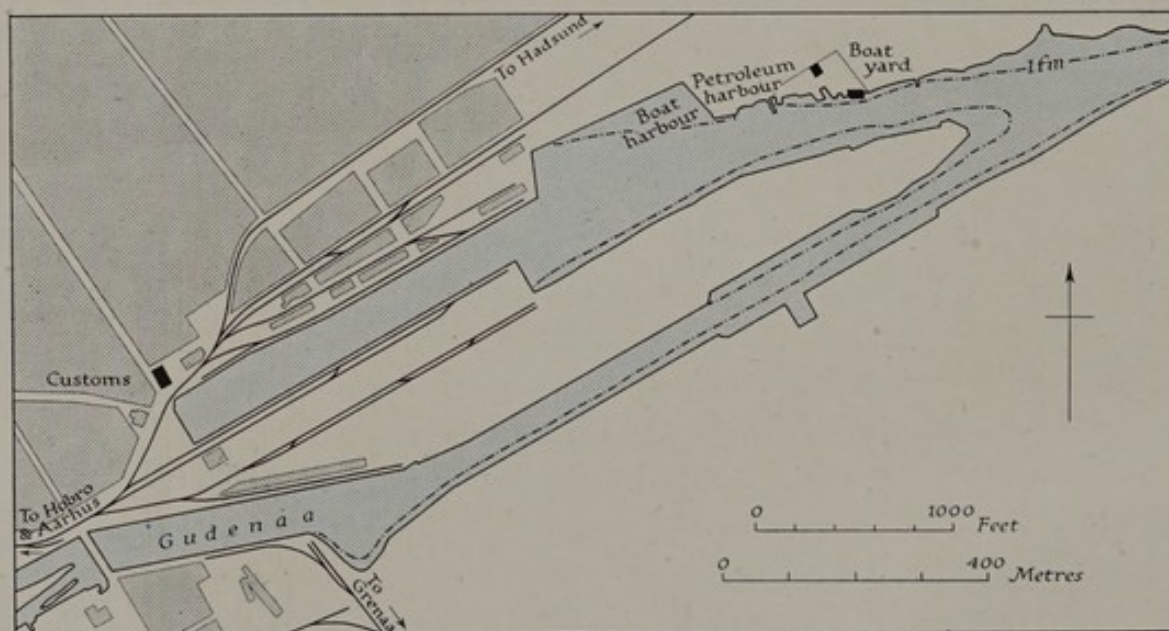


Fig. 93. The port of Randers

Port Facilities

The port contains a very small shipyard, a machine shop and a foundry and also the works of the State Railways, which are east of the sidings behind the ferry harbour. Railways, in direct communication with the State Railway system, run on to all quays. There are two cranes to lift 2 and 5 tons respectively.

At Avernakke point, about 600 m. (650 yd.) south of the entrance to the port and on the west bank of the fjord, is a large petroleum installation with a pier, 65 m. (215 ft.) long and 10 m. (33 ft.) broad, for tankers. Large tankers of 14,000 deadweight tons have frequently used this pier. Depths alongside the pier are 5 m. (16½ ft.) on the east side, 6 m. (19½ ft.) on the west side and 9 m. (29½ ft.) at its head. The installation has direct rail communication with the port.

Trade

Apart from ferry traffic, 475 ships of 207,000 register tons unloaded 327,000 tons of cargo in the port during 1938. Only 167 of these ships were from foreign ports but they brought 97% of the weight of cargoes discharged. By contrast, 427 of the 441 ships which loaded cargoes took all but 2,810 tons, out of a total export of 222,000 tons, to home ports. Over three-quarters of the imports were unspecified bulk products. The only appreciable other imported cargoes consisted of coal and coke which made up 15% of the total weight of incoming cargoes. Almost all the exports went as bulk cargoes.

Industries

In addition to food industries and distributive activities, Nyborg is one of the chief centres for repairs to heavy railway rolling stock. The workshops deal especially with carriages and wagons.

Communications

A double-track railway runs west across Fyn and over the Little Belt bridge to Jylland and Esbjerg. Single-track railways run to Svendborg and Faaborg. A train-ferry service and a separate car ferry crosses to Korsør on the opposite side of the Great Belt.

Three major roads leave the town. Two are arterial roads to Middelfart (via Odense) and Faaborg respectively; the other runs south to Svendborg.

KOLDING

55° 29' N, 9° 30' E. Population 23,520 in 1935

Kolding is at the head of the Kolding Fjord which extends westwards from the constricted part of the Little Belt between Jylland and Fyn.

Approach and Access

The outer part of the fjord has a least depth of 9.1 m. (29¾ ft.) and a dredged channel, about 3.7 km. (2¼ miles) long, 25 m. (82 ft.) wide and 7 m. (22¾ ft.) deep, extends along the inner part of the fjord, between shore banks, to the harbour.

The maximum depth in the port and alongside the quays is 7 m. (22¾ ft.). The port is 1,030 m. (3,380 ft.) long and varies between about 45 and 137 m. (145–450 ft.) in width; it includes some 2,135 m. (7,000 ft.) of quays which are between 1 and 2 m. (3¼–6½ ft.) above water level. The port is practically tideless, but easterly winds may raise the water level by up to 1.4 m. (4½ ft.) and westerly winds may lower it by 0.9 m. (3 ft.).

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 92, Plate 84)

The port lies within two breakwaters which flank an entrance 60 m. (197 ft.) wide and 7 m. (22¾ ft.) deep. It consists of an outer harbour and turning basin which leads into a long, narrow, inner harbour. On the seaward side of the breakwater which flanks the entrance on the north a pier provides a tanker berth, 7 m. (22¾ ft.) deep, which serves the storage depot behind the quay. In the north-east angle within the entrance is a shipyard with a floating dock. The south-east angle within the entrance is used as a fishing and yacht harbour. The depths in both these angles is 3.5 m. (11¼ ft.). The quays on the south side of the outer harbour have depths of 7 m. (22¾ ft.) alongside and are occupied by petroleum and coal-storage depots. On the north side of the outer harbour, depths are between 3.5 and 5 m. (11¼–16¼ ft.).

The inner harbour is of approximately similar length to the outer harbour and depths in it range between 5 and 7 m. (16¼–22¾ ft.).

Port Facilities

The floating dock is 39 m. (128 ft.) long, 12.6 m. (41¼ ft.) wide and is capable of lifting 450 tons; the maximum depth over the blocks



Plate 84. The port of Kolding

The view has been taken looking north-east. The rectangular area beyond the petroleum depot is being filled in. On the right of it is the entrance to the port (cf. Fig. 92).

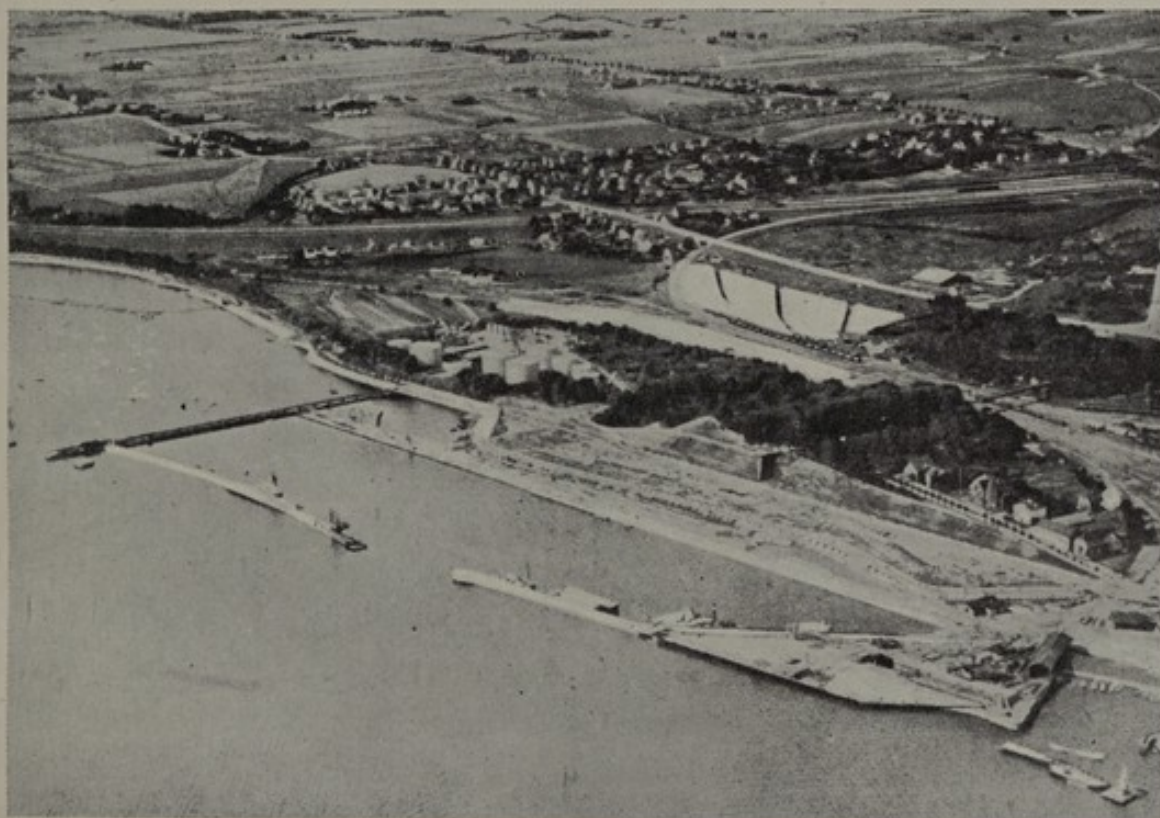


Plate 85. The new Trafikhavn, Fredericia

The photograph was taken in 1938 while the basin was under construction. On the left is the old Möllebugt oil pier (see pp. 409-10).



Plate 86. The port of Svendborg, from the south-west

In the foreground is Frederiksö with shipyards on its south and north sides. In front of the southern shipyard are the two floating docks, both occupied; behind them are the building slips. In the southern angle between the causeway and the shore are the ferry berths (cf. Fig. 100).

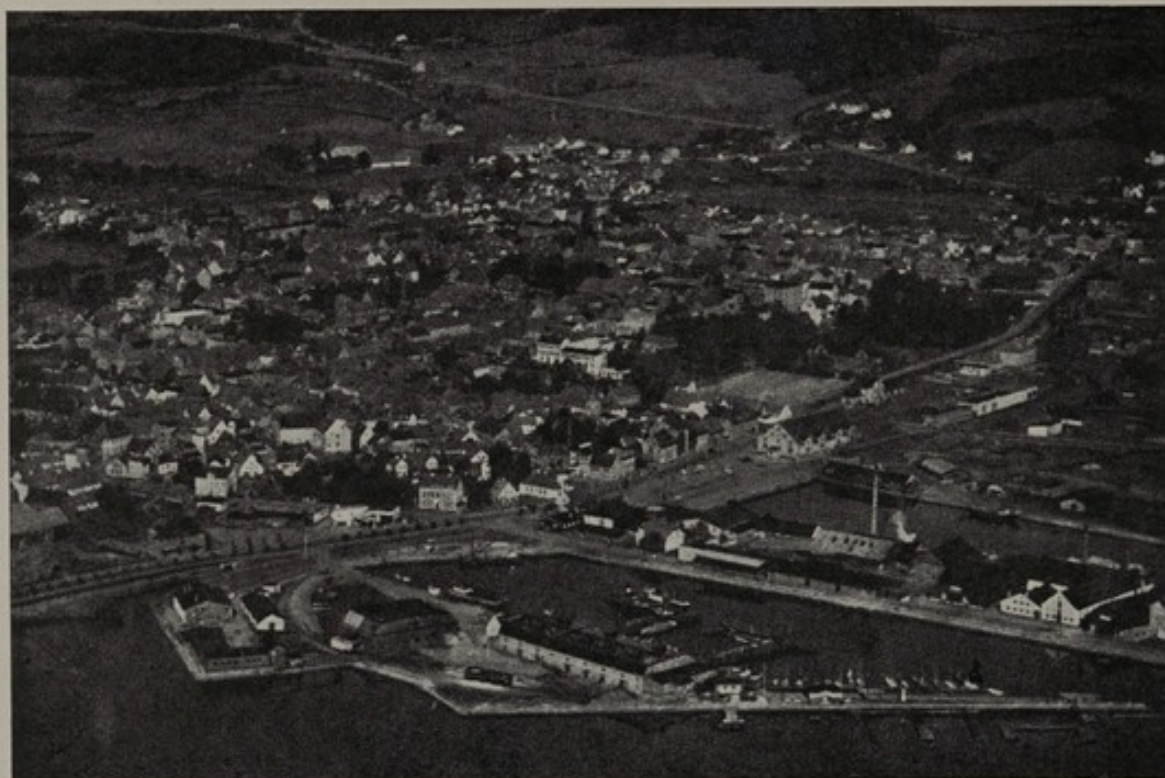


Plate 87. The port of Aabenraa

The photograph shows Sydhavn, in the foreground, and Gammelhavn (cf. Fig. 103).

is 3.5 m. (11¼ ft.). The port contains one mobile crane, with hook and grab, to lift 2½ tons, and one grab of 2 tons capacity for unloading coal. In the town are one large machine shop and several smaller ones. Railways run on to all the main quays.

Trade

During 1938 a total of 1,705 ships, of 258,000 register tons, discharged 208,000 tons of cargo in the port. About 55 % of this cargo came from foreign ports and was carried in 898 ships of 162,000 register tons. A quarter of the imports were coal and coke and some 28,000 tons consisted of fodder stuffs, about two-thirds of which came from foreign ports. Fertilizers and cereals contributed 13,000 tons each, virtually all of which came from abroad. Nineteen thousand tons of stone and cement were received from other Danish ports, part of which provided for the needs of a firm which manufactures mill-stones; over 9,000 tons of timber came from foreign lands. The remainder of the imports consisted of general goods and unspecified bulk cargoes.

Outgoing cargoes were carried in 741 ships of 145,000 register tons. Of these ships 273, of 56,000 register tons, carried nearly three-fifths of a total export of 65,418 tons to other Danish ports. Virtually all these cargoes were classed as general goods and unspecified bulk cargoes.

Industries

The chief industries of Kolding are food packing and the manufacture of dairy machinery. It also has some light engineering especially the manufacture of electrical meters, and has several agricultural activities, such as supplying fodder and fertilizers, milling and brewing, besides the manufacture of soap, textiles, leather, furniture and clothing, on a small scale.

Communications

The main railway between Esbjerg and København passes through the town and connects it, via Fredericia and Lunderskov, with the trunk line which runs behind the east coast of Jylland from the German frontier to Frederikshavn. Like the other fjord ports of south-east Jylland it is a focus of roads in all directions.

RANDERS

56° 27' N, 10° 03' E. Population 30,254 in 1935

Randers is at the head of the fjord of that name and on the estuary of the Gudenaas. The fjord penetrates the east coast of Jylland in a southerly direction from the south part of Aalborg Bugt. About 16 km. (10 miles) from its entrance the fjord turns west and continues for about 11 km. (7 miles) to the port.

Approach and Access

The entrance to the fjord is obstructed by a sandbank with depths of 0.3–0.6 m. (1–2 ft.). A dredged channel with a least width of 22 m. (72 ft.) and a least depth of 7 m. (22¾ ft.) leads across the bar and through the fjord to Randers. Outside the channel the depths are small and the fjord in its east–west portion is little more than a canalized stream flowing across meadowland.

The port has maximum depths of 7 m. (22¾ ft.) and least depths of 3 m. (9¾ ft.) alongside the quays. The water area is about 10 ha. (25 acres) and is lined by some 1,900 m. (6,200 ft.) of quays; the height of the quays above water level is 1.75–1.5 m. (4¾–5¾ ft.). The difference between M.H.W. and M.L.W. is 0.3 m. (1 ft.), but north winds may raise the water level by 1.5 m. (5 ft.) and south winds may lower it by 1 m. (3½ ft.).

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 93)

The port consists of two long and narrow water areas lying on either side of a low tongue of land. The northern part is lined with quays in its inner part; the depths alongside the quays is 7 m. (22¾ ft.) except along the innermost third of the north side where they decrease to 5 m. (16¼ ft.). In its outer part this water area has, on its north side, a yacht harbour with depths of 1–5 m. (3¼–16¼ ft.), a petroleum quay and pier with depths of 3 m. (9¾ ft.), and a boat yard.

The southern part of the port is the canalized estuary of the Gudenaas which has depths of 6 m. (19½ ft.). It is lined in its inner part with quays which have depths of 3–6 m. (9¾–19½ ft.) alongside.

Port Facilities

The port contains machine and boiler works which can repair hulls and machinery, and in addition it has several foundries and small engineering works. There are a grain elevator, two coal cranes, and storage tanks for oil, benzine and molasses. Railways run on all quays. The port has a powerful tug which is also used as an ice-breaker.

Trade

During 1938 a total of 1,024 ships of 249,000 register tons unloaded 258,682 tons of cargo in Randers. Half the ships, comprising nearly two-thirds of the total tonnage, were engaged in foreign trade and brought almost three-quarters of the cargoes discharged. Coal and coke made up one-third of the weight of cargoes and one-tenth consisted of cereals, mainly from abroad. Imports of fodder stuffs weighed 54,585 tons, over two-thirds of which were consigned from foreign ports. Fifteen thousand tons of fertilizers and 7,000 tons of timber, of foreign origin, were also imported. The remainder of the incoming cargoes consisted almost entirely of unspecified bulk cargoes and general goods which came in approximately equal quantities from Danish and foreign ports.

Exports weighed rather less than one-tenth of the imports and were loaded in 382 ships, of 81,000 register tons. About 55% of the exports were carried to foreign ports in 154 ships of 20,000 register tons. Apart from 2,725 tons of cereals, 2,146 tons of coal and coke and 2,641 tons of live animals, the exports were general goods and unspecified bulk cargoes.

Industries

Randers manufactures agricultural machinery, radiators, oil and gasoline engines, pumps, light machinery for food industries, tiles, cement goods, soap, furniture, textiles, and light silver and plated ware. It has the usual food-packing industries. The *Scandia* works, half a kilometre north-east of the boat harbour, are among the most important builders of railway carriages, tramcars and gasoline- and diesel-driven railcars. One of the distilleries of *De danske Spritfabrikker A/S* is situated in the town.

Communications

A double-track railway runs south to Fredericia, and single-track lines run north through Aalborg to Frederikshavn and east to Grenaa.

The town is an important focus of roads from all parts of east-central Jylland.

FREDERICIA

55° 34' N, 9° 45' E. Population 21,463 in 1935

Fredericia is on the east coast of Jylland and stands on a broad tongue of land that projects south-eastwards at the northern entrance to the Little Belt which is here rather less than $1\frac{1}{2}$ km. wide. Although the construction of the Little Belt bridge farther south, across a still narrower part of the channel, has reduced the importance of Fredericia as a point of transit and has curtailed its activities as the ferry port of Fyn, its strategic position at the head of the Snevringeren channel and adjacent to the shortest crossing from Jylland to the islands still remains. The railway from Esbjerg to København passes through the town and the port has considerable sea-transit activities, both between Jylland and Fyn and between southern Jylland and other parts of the country. The nucleus of the town lies within a quadrant of moats and ramparts which mark the line of the old fortifications that existed here when the town was an important fortress guarding the crossing to the islands; sieges, fires and bombardments have made necessary frequent rebuilding.

The roadstead has in parts a rocky bottom which makes anchorage insecure, and it also suffers from short irregular seas and a considerable swell when winds are from the north-east.

Approach and Access

Approach is direct from the main fairway through the Little Belt and is easy, since the 20 m. (10 fathoms) line follows the outline of the coast at a distance of only about 150 m. (164 yd.) while the 6 m. ($19\frac{1}{2}$ ft.) line follows the line of the breakwaters and quays. East of Skanseodde, the tip of the point on which Fredericia stands, the shore bank extends about $\frac{1}{2}$ km. (3 cables) offshore with depths of $4\frac{1}{2}$ m. ($1\frac{1}{2}$ fathoms).

The basins lie adjacent to one another and have separate entrances. The maximum depth in the port is 9 m. ($29\frac{1}{2}$ ft.). The total length of quayage in the port is about 1,500 m. (4,900 ft.). The difference between M.H.W. and M.L.W. is 0.4 m. ($1\frac{1}{4}$ ft.), but northerly and easterly winds raise the water level by up to 1.4 m. ($4\frac{1}{2}$ ft.) and south or south-west winds may lower the water level by 1.6 m. ($5\frac{1}{4}$ ft.).

For Ice Conditions see Appendix IV.



Fig. 94. The port of Fredericia

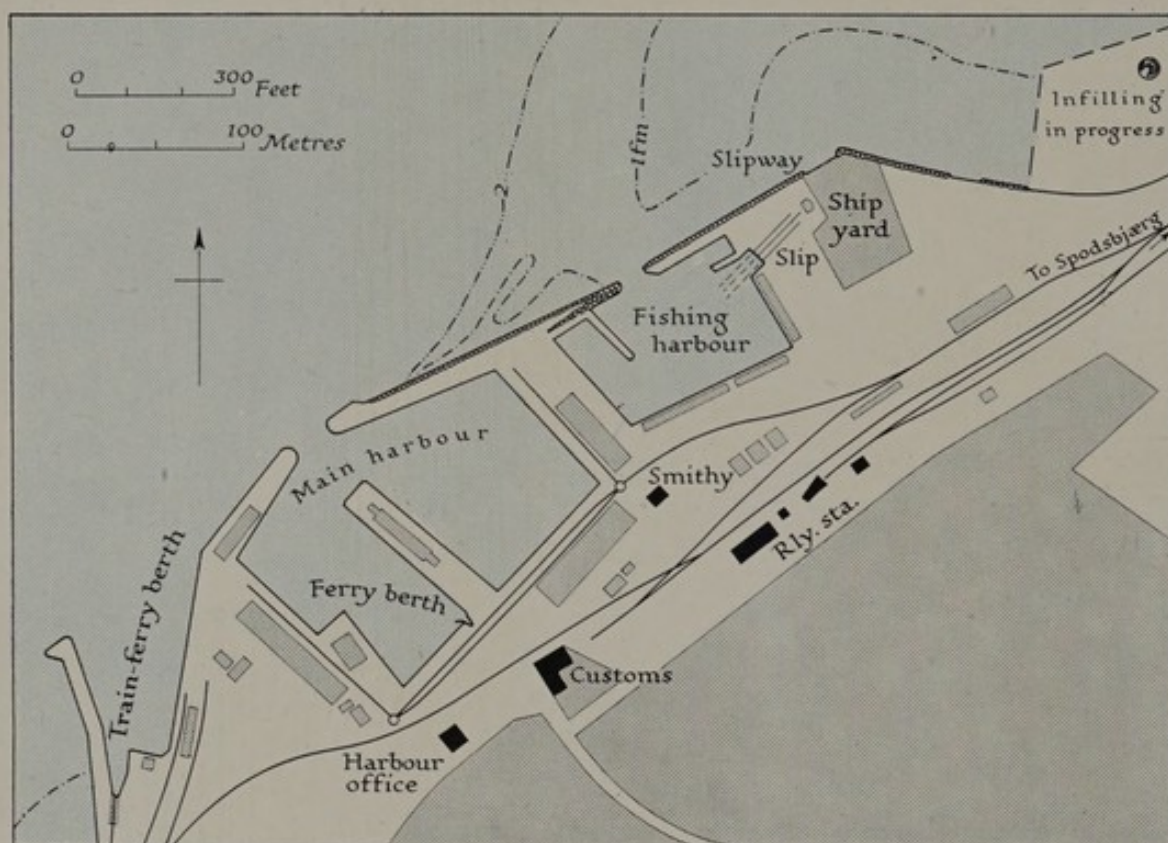


Fig. 95. The port of Rudköbing

Detailed Description (Fig. 94, Plate 85)

The port consists of four basins, namely, Kastelshavn, Handelshavn, Fiskerihavn and Trafikhavn, which are arranged in this succession from east to west.

Kastelshavn, which was laid out between 1914 and 1918, lies between a mole on the south-east and a tanker pier on the north-west, between which is a wide entrance with a depth of 9 m. (29½ ft.). The basin has some 210 m. (690 ft.) of quay, alongside which the depths range between 6.5 and 6.9 m. (21¼–22½ ft.); along the inner side of the mole the depths are 3.4 m. (11 ft.). The quays are 2.1 m. (6¾ ft.) and the mole is 1.9 m. (6¼ ft.) above water level. Behind the quays is a large sulphuric acid and superphosphate factory, and on the east side of the basin, between it and the castle which dominates the point of Skanseodde, is a petroleum depot, which is served by the tanker pier at the north-west end of the basin. This T-shaped pier has five mooring berths with depths of 9.0 m. (29½ ft.) alongside.

Handelshavn is the old harbour and is aligned from south-west to north-east in its outer part and from north to south in its inner part. The entrance is 24 m. (80 ft.) wide and 6.4 m. (21 ft.) deep, but the basin widens to 45 m. (150 ft.) in its north-south section; the depth alongside the quays is 5.6 m. (18¼ ft.); the quays are 630 m. (2,065 ft.) long and 1.7 m. (5½ ft.) above water level.

Fiskerihavn is 3.2 m. (10¼ ft.) deep in its entrance and between 1.8 and 2.7 m. (5¾–8¾ ft.) deep within. It is enclosed, and divided within, by moles. Formerly the west half of the basin was the train-ferry harbour, but since the completion of the Little Belt bridge the ferry berths have been removed and the tracks taken up. On the north side of the eastern part of the basin is a small shipyard.

Trafikhavn was started in 1936 and was still under construction in 1938; it may still be incomplete in details, especially since the filling in of the area west of the pier and the construction of quays along the water-front were projected. No work on this project had been started in the spring of 1943. The basin is enclosed by two moles which leave an entrance 60 m. (197 ft.) wide and 9 m. (29½ ft.) deep. It has 670 m. (2,200 ft.) of quays of which about 300 m. (985 ft.), lying centrally along the north side of the basin and opposite the entrance, have a depth of 9 m. (29½ ft.) alongside. Elsewhere alongside the quays the depths are 7 m. (22¾ ft.), but on the inner sides of the moles depths are between 5 and 5.5 m. (16¼–18 ft.).

The west side of the basin is formed by what was formerly known as the Möllebugt oil pier. This pier is 232 m. (760 ft.) long, has a depth of 9.1 m. (29 $\frac{3}{4}$ ft.) at the pier head, and was formerly owned by an oil company. This company also owns the oil tanks behind the pier. West of the pier head are two detached mooring berths.

Port Facilities

Handelshavn contains one crane capable of lifting 8 tons and one coal-discharging crane.

Kastelshavn has one electric crane. There is a slip which will take ships of up to about 100 tons, but the shipyard builds only wooden ships. The town has a machine shop and a foundry. Railways run on all quays and wharves except those in Fiskerihavn.

Trade

During 1938 a total of 745 ships of 242,000 register tons discharged 252,596 tons of cargo in the port. Of these ships 211, of 147,000 register tons, were engaged in foreign trade and discharged 230,741 tons of cargo. Of the 569 ships which loaded cargo in the port only ninety-two, of 8,724 register tons, left for foreign ports, and their cargoes weighed 13,022 tons out of a total export of 32,838 tons.

Rather less than a quarter of imported cargoes consisted of coal and coke and nearly half consisted of general goods and unspecified bulk cargoes which include petroleum products for which the port is a major centre of distribution. The only other imports of consequence were some 8,000 tons of fertilizers and 3,000 tons of timber. Exports were almost entirely general goods and unspecified bulk cargoes.

Industries

Fredericia manufactures agricultural machinery, fertilizers, hardware and, on a small scale, cutlery, silver and electro-plated goods, glass, footwear and furniture. It weaves cotton textiles, manufactures clothing, refines vegetable oils and makes soap and margarine. It has several food industries and is a centre for some fishing activities.

Communications

The main railway route between Esbjerg and København passes through the town, and about 6 km. to the south is the Little Belt bridge to Fyn. A double-track railway runs north through Vejle,

Horsens and Aarhus to Randers. A ferry service runs to Strib on the opposite shore of the Little Belt.

The main road which leaves the town in a southerly direction joins the arterial road from Esbjerg to Nyborg. The main road issuing westwards from the town leads to an arterial road which runs behind the east coast of Jylland, from the German frontier to Aarhus, and links all the ports at the heads of the fjords of east Jylland.

RUDKÖBING

54° 56' N, 10° 43' E. Population 4,191 in 1935

Rudköbing is the chief port and town of the island of Langeland. It is roughly midway along the west coast of the island and lies adjacent to the narrow crossing between Langeland and the island of Taasing. Although it is off the main channel through the Great Belt, it has easy communication with Svendborg and the islands south of Fyn.

Approach and Access

Rudköbing is approached from the north along a channel which has been dredged, mostly in straight reaches, through the shallow banks which lie between the islands of Taasing and Langeland. This channel has a least breadth of 30 m. (98 ft.) and is 5 m. (16½ ft.) deep. From the south a dredged channel of similar breadth, but only 3.5 m. (11¼ ft.) deep, leads across the banks which surround the islands south of Fyn.

The streams in the narrow channel between Taasing and Langeland turn regularly every 6 hr. and have a strength of about 2 knots, but in unsettled weather the streams run in the same direction for several days and sometimes attain a strength of 5 knots. North-westerly winds cause a south-going current and north-easterly winds cause a north-going current.

The main harbour is entered in depths of 5 m. (16½ ft.) between the ends of two moles which are about 20 m. (65 ft.) apart. Depths alongside the quays in the main harbour are 3.4–5 m. (11–16½ ft.). The quays are 1.7–2 m. (5½–6½ ft.) above water level. The difference between M.H.W. and M.L.W. is 0.1 m. (0.3 ft.), but winds between north-west and north-east can raise the water level by 0.6 m. (2 ft.) and winds from the south and south-west can lower it by twice this amount.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 95)

The port consists of a fishing harbour, a main harbour and a train-ferry harbour, which lie in this order from north to south. The *fishing harbour* is a rectangular basin enclosed by two breakwaters and has depths of 3.1 m. (10 ft.) in its entrance and of 2.5–3.1 m. (8–10 ft.) within. On its north side is a boatyard with one slip.

The *main harbour* has an area of about 18,000 sq. m. (215,000 sq. yd.) and about 815 m. (2,670 ft.) of quayage. It is divided into two basins by a mole, the end of which is in direct line with the entrance. The northern basin has depths of 5 m. (16½ ft.); the southern basin has similar depths in its outer part, but in its narrower inner part they decrease to 3.4–3.7 m. (11–12 ft.). In the eastern angle of this basin is the berth of the ferry to Vemmenæs in Taasing.

The *train-ferry harbour* is a funnel-shaped area which has quays on its landward side and is flanked seawards by a mole. The berth of the train ferry to Svendborg is where the mole joins the shore. Depths in this ferry harbour are 4.5 m. (14¾ ft.), but the quays on the landward side have depths of 4–5 m. (13–16½ ft.) and can be approached from the main channel into the port.

Port Facilities

The boatyard builds wooden ships of up to 300 register tons. The slip can take vessels up to 175 tons, but there are no facilities for repairing iron ships. Railways run on the quays around the main harbour and to the south side of the ferry harbour.

Trade

During 1938, 3,403 ships of 226,000 register tons brought 63,544 tons of cargo into the port. Of these ships, 241 were engaged in foreign trade, but their cargoes formed two-fifths of the weight of imports. A quarter of the weight of imported cargoes consisted of coal and coke. Another quarter consisted of general goods which came almost entirely from Danish ports. The remaining imports were mainly fodder stuffs, fertilizers, stone, chalk and cement, and bulk cargoes, which were imported in quantities of 5,000–8,000 tons and were almost entirely from home ports.

Exports were carried in 2,892 ships of 217,000 register tons, that loaded 31,183 tons of cargo of which about 70% was consigned to Danish ports. More than half the exports were classed as general goods, but 38% consisted of cereals which were exported in approximately equal quantities to Danish and foreign ports.

Communications

Car ferries run to Svendborg in Fyn, to Korsör in Sjælland, to Vemmenæs in Taasing and to Marstal in Ærö. A train-ferry service runs to Svendborg. Single-track railways run to Bagenkop near the south tip of the island and to Spodsbjærg on the east coast, whence a ferry service runs to Nakskov in Lolland. Main roads run from Rudköbing across the island to Spodsbjærg, and another road runs south to Bagenkop and north to Lohals whence there are ferries to Lundeborg in Fyn and to Korsör in Sjælland.

HORSENS

55° 51' N, 9° 52' E. Population 29,856 in 1935

Horsens, like the other Danish fjord ports, lies at the head of its fjord and is a focus of road and rail communications behind the coast. The fjord opens westwards from the east coast of Jylland and is adjacent to the northern approach into the Little Belt.

Approach and Access

Two lowlying islands, Alrö and Hjarnö, lie in the entrance to the fjord and are surrounded by shoal water. The approach lies southwest of Hjarnö where a channel between 15 and 20 m. (8–11 fathoms) deep leads into a dredged channel 7.5 km. (4½ miles) long, 32 m. (105 ft.) wide and 6.9 m. (22½ ft.) deep. This channel is straight and gives direct access, between two short breakwaters, into the port. This entrance is 61 m. (200 ft.) wide and 6.9 m. (22½ ft.) deep.

The maximum depths in the port and alongside the quays are 6.9 m. (22½ ft.), and the minimum depths are 3 m. (9¾ ft.). The water area is 1,220 m. (4,000 ft.) long, varies between 18 and 204 m. (60 and 670 ft.) in width and has 1,370 m. (4,500 ft.) of quayage; the quays are between 1.3 and 1.6 m. (4¼–5¼ ft.) above mean water level. Ships up to 152 m. (500 ft.) long can turn in the port.

Since the fjord is broad and opens off the Kattegat, it has regular ebb and flow. In calm weather the difference between M.H.W. and M.L.W. is 0.4 m. (1¼ ft.), but gales cause considerable difference.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 96)

The port lies between the north bank of the fjord and a broad tongue of land, formed by in-filling, which projects eastwards from the head of the fjord. It consists of an outer part which has a yacht harbour, a fishing harbour, a petroleum pier and a boatyard which lie adjacent to one another from east to west on the north side; a main harbour, known as Nyhavn, leads into the inner and older Gamle Havn. The yacht harbour has depths between 1.8 and 3.1 m. ($5\frac{3}{4}$ –10 ft.), the fishing harbour is 4.3 m. (14 ft.) deep, while the depth off the head of the petroleum pier is 3.5 m. ($11\frac{1}{4}$ ft.). Elsewhere alongside the north side of the outer harbour the depths are between 3.0 and 3.5 m. ($9\frac{3}{4}$ and $11\frac{1}{4}$ ft.). Nyhavn is about 274 m. (900 ft.) long, 183 m. (600 ft.) wide, and has depths of 6.9 m. ($22\frac{1}{2}$ ft.) alongside its north quays (much of which is occupied by coal-storage areas) and 6.3 m. ($20\frac{1}{2}$ ft.) elsewhere. Near its centre is a rectangular filled-in area around which depths decrease to 5 m. ($16\frac{1}{4}$ ft.). Gamle Havn is about 320 m. (1,050 ft.) long and 46 m. (150 ft.) wide but narrows to less than half this width in its innermost part. The quays on its south-west side have depths of 6.3 m. ($20\frac{1}{2}$ ft.); those on the opposite side have 4 m. (13 ft.) of water alongside, but in the innermost part the depths decrease to 3.5 m. ($11\frac{1}{4}$ ft.).

Port Facilities

On the east side of the boatyard is an ordinary slip with the following dimensions: extreme length 60 m. (200 ft.); length of cradle 18 m. (60 ft.); draught on keel blocks 1.5 m. (5 ft.) fore and 2.1 m. (7 ft.) aft; lifting power 100 tons. The port contains two fixed electric cranes of 5 and 15 tons capacity respectively, two electric cranes of $1\frac{1}{2}$ and $2\frac{1}{2}$ tons capacity respectively, four coaling cranes with capacity of 800–1,000 tons per hour, one pneumatic grain elevator with a capacity of 50 tons per hour, and another grain elevator with a capacity of about 35 tons per hour. The town has a machine shop which can undertake repairs to machinery. Railways run on all quays in Nyhavn and Gamle Havn.

Trade

The import trade of Horsens is more than ten times as large as its export trade, measured by weight of cargoes. In 1938 a total weight of 238,000 tons of cargo were discharged from 1,152 ships of 202,000 register tons, but only 418 ships of 59,000 register tons loaded cargo

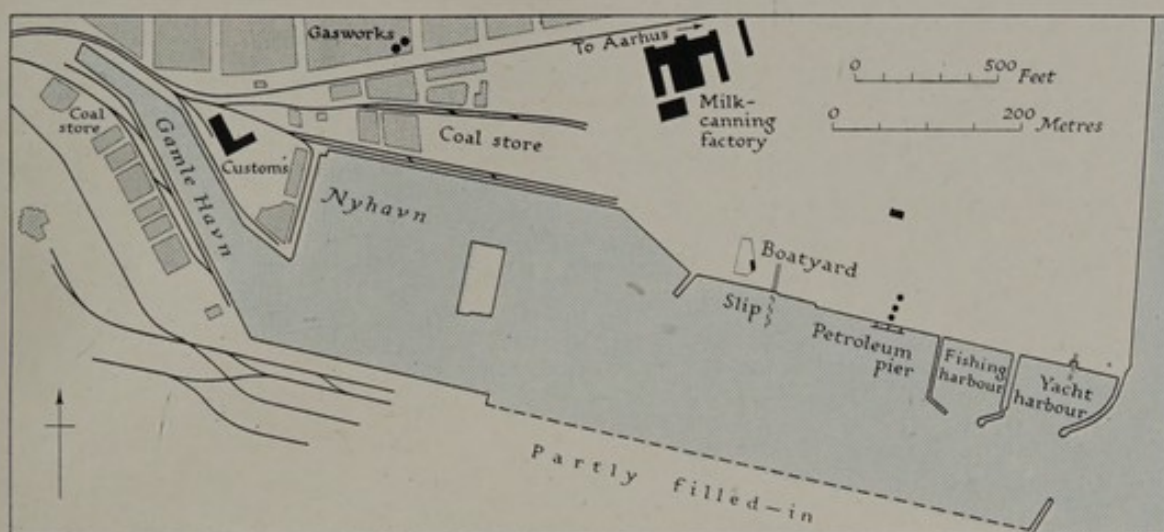


Fig. 96. The port of Horsens

The railways serving the port run west to the town railway station which lies on the main line behind the east coast of Jylland (Jutland) and gives connection with Aarhus, Vejle and beyond.

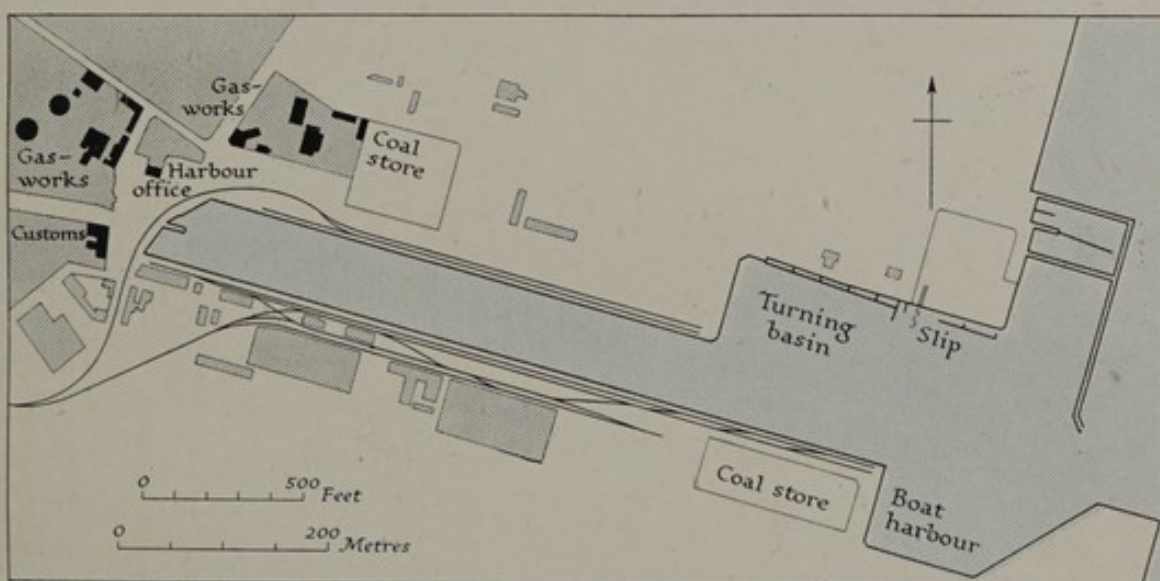


Fig. 97. The port of Vejle

The railways serving the port run to the town railway station which lies on the main line behind east coast of Jylland (Jutland) and gives communication with Horsens, Kolding and beyond.

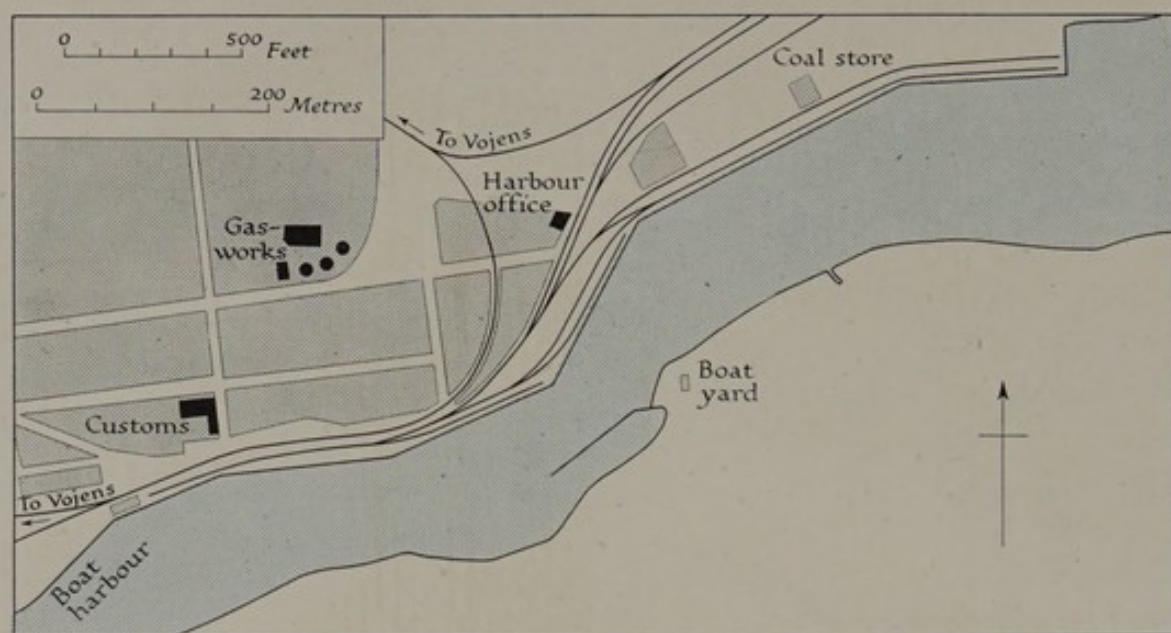


Fig. 98. The port of Haderslev

The fjord opens eastwards into the Little Belt. The fjord narrows westwards to a stream which runs through the town and connects the fjord with a shallow inland lake known as Haderslev Dam, which once formed part of the fjord.

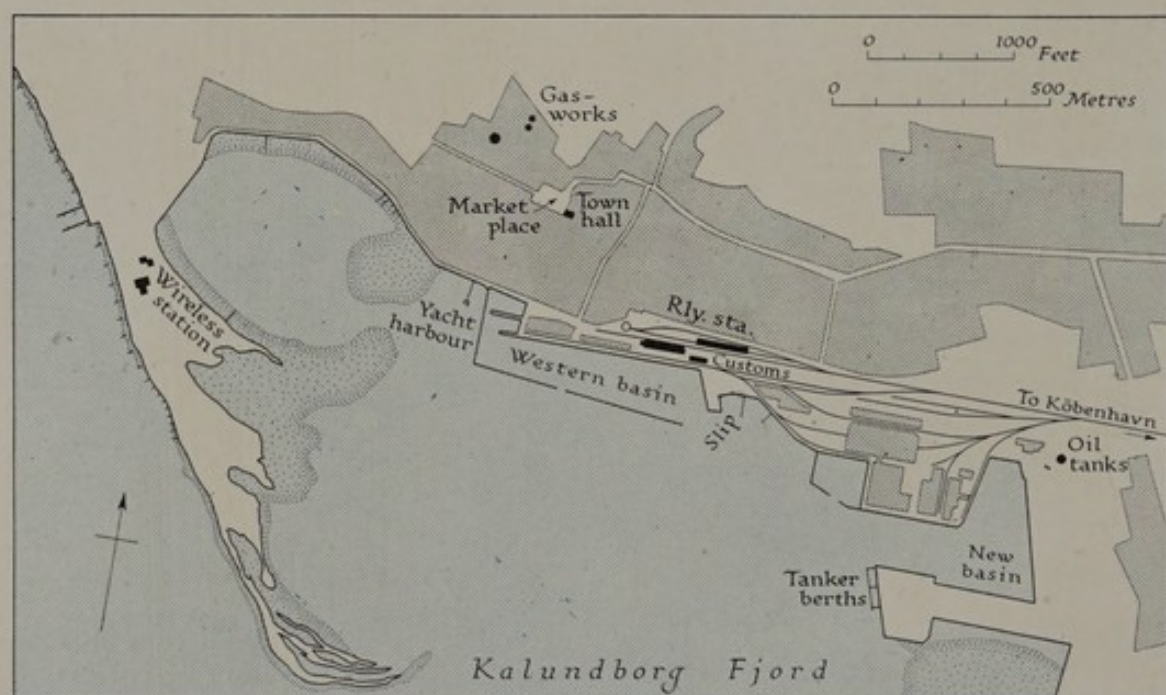


Fig. 99. The port of Kalundborg

in the port. Less than half the ships which entered with cargo were engaged in foreign trade but they carried four-fifths of the weight of cargoes discharged. On the other hand, three-quarters of the weight of outgoing cargoes was carried by 303 ships engaged in coastwise trade.

Two-fifths of the weight of imports consisted of coal and coke. Fodder stuffs and cereals formed another one-fifth, in approximately equal proportions. Imports of fertilizers, stone and cement, and timber were 19,398, 13,526 and 9,109 tons respectively, nearly all of which, except cement and stone, came from foreign ports.

Industries

Horsens manufactures Diesel engines, dairy machinery and implements, assembles bicycles and does some light engineering such as pumps for viscous fluids, radio and cycle accessories, telephones and telephone-exchange supplies. It is an important centre, among Danish towns, for spinning and weaving cotton and for linen and wool textiles and has the usual food industries such as the packing of dairy and livestock produce, brewing and the manufacture of margarine.

Communications

The town is on the main double-track railway between Randers and Fredericia and single-track railways connect it with Hov, Silkeborg and Brande. Six main roads leave the town and lead in all directions.

VEJLE

55° 42' N, 9° 34' E. Population 24,354 in 1935

Vejle is on the low ground at the head of Vejle Fjord which leads west, between fairly high and wooded banks, from the northern part of the Little Belt. The fjord and port are approximately midway between those of Horsens and Kolding.

Approach and Access

The fjord is wide and clear of dangers between the shore banks which are narrow except in the innermost part of the fjord. The fjord has depths of 14.5–16.5 m. (8–9 fathoms) at its entrance, and although depths decrease gradually within, the whole of the fjord is anchorage

ground. From opposite Tyrsbæk a dredged channel, about 5.5 km. ($3\frac{1}{2}$ miles) long, 31.5 m. (103 ft.) broad and 6.9 m. ($22\frac{1}{2}$ ft.) deep, leads into the port which lies between two quays that have been built out from the head of the fjord. The entrance is flanked on the north by an L-shaped breakwater which encloses a swimming pool. The entrance is 32 m. (105 ft.) wide and 6.9 m. ($22\frac{1}{2}$ ft.) deep.

The water area is 915 m. (3,000 ft.) long, varies between about 70 and 150 m. (230 and 490 ft.) in width and has 1,430 m. (4,700 ft.) of quays which are 1.7 m. ($5\frac{1}{2}$ ft.) above water level. The maximum depths alongside the quays is 6.9 m. ($22\frac{1}{2}$ ft.), and although least depths alongside the main quays do not fall below 5.6 m. ($18\frac{1}{4}$ ft.) they decrease to 2.5 m. (8 ft.) in the peripheral parts of the outer harbour. The difference between M.H.W. and M.L.W. is 0.6 m. (2 ft.). The highest observed water level, which occurs with gales from between north-west and north-east, is 1.7 m. ($5\frac{1}{2}$ ft.) above mean water level; the lowest water level, which occurs with south-westerly gales, is 1.5 m. (5 ft.) below mean water level. Winds from between north-west and north-east raises the water level, which falls when winds are southerly.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 97)

The port consists of a basin 558 m. (1,830 ft.) long and 69 m. (225 ft.) broad. The quays on the north side have depths of 6.3–6.9 m. ($20\frac{1}{2}$ – $22\frac{1}{2}$ ft.) alongside, while those on the south side have depths of 5.6–6.9 m. ($18\frac{1}{4}$ – $22\frac{1}{2}$ ft.). The northern quays have a large coal-storage depot served by a coaling crane. The eastern part of the southern quays is also used for storing coal and has a coaling crane, but their western half is occupied by warehouses which are served by three grain elevators. East of the northern quays is a turning basin 137 m. (450 ft.) wide and 5.6 m. ($18\frac{1}{4}$ ft.) deep, while east of the southern quays is a boat harbour with depths of 3.0–4.5 m. ($9\frac{3}{4}$ – $14\frac{3}{4}$ ft.).

Port Facilities

The port contains one slip for boats of up to 15 tons and 1.9 m. (6 ft.) draught. Three machine-shops and foundries can undertake small repairs. On the south quay is a crane of 5 tons capacity and on the north quay is one of 10 tons capacity in addition to the coal transporters. Railways run on both the main quays.

Trade

The volume of both exports and imports is very similar to those of Horsens, although fewer ships entered and left with cargoes in 1938. From foreign ports, 444 ships of 138,000 register tons brought 182,000 tons of cargo, while 488 ships of 96,500 register tons brought 52,000 tons of cargo from Danish ports. Exports weighed only 19,561 tons and were carried in 298 ships of which 190 took nearly two-thirds of the weight of cargo to Danish ports.

Nearly two-fifths of the weight of imports consisted of coal, rather more than a quarter consisted of cereals, and one-tenth was fodder stuffs. Fertilizers and timber each contributed about 10,000 tons of cargo. The remainder of the imports was unspecified. Some 2,000 tons of coal and 15,000 tons of general goods and bulk cargoes made up almost the whole of the exports.

Industries

Vejle manufactures agricultural machinery and implements, elevators, cranes and discharging plant, foundry-goods especially stoves, insulating materials, tiles and cement goods, margarine and soap. In addition to the usual food industries, cotton and wool spinning, tanning and wood trades are prominent activities.

Communications

A double-track railway runs north through Horsens and Aarhus to Randers, and south to Fredericia where it joins the Esbjerg-Köbenhavn line. It is an important focus of main roads.

HADERSLEV

55° 15' N, 9° 30' E. Population 16,108 in 1935

Haderslev lies astride Haderslev Fjord 13 km. (8 miles) west of the shores of the Little Belt.

Approach and Access

The fjord is approached between the banks which surround the islands of Linderum and Aarö. From the mouth of the fjord a winding dredged channel, 6 m. (19½ ft.) deep and with a minimum width of 26 m. (85 ft.) along the bottom, leads west into the port. Outside this channel the depths in the fjord are less than 2 m. (6½ ft.).

The water area is 1,000 m. (3,300 ft.) long and varies from 50 to 120 m. (165-400 ft.) in width and is lined with 900 m. (3,000 ft.) of quays. The depths alongside the quays range between 6.5 and 3.5 m. ($21\frac{1}{4}$ - $11\frac{1}{4}$ ft.). The difference between M.H.W. and M.L.W. is very small (c. 0.2 m.), but east winds can raise the water level, and west winds can lower it, by 1.3 m. ($4\frac{1}{4}$ ft.).

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 98)

The port consists of wharves built along the north side of the fjord. The outermost part of the port has depths of 6.5 m. ($21\frac{1}{4}$ ft.) alongside some 380 m. (1,245 ft.) of wharf and over a water area which is about 400 m. (1,300 ft.) long and 90 m. (295 ft.) wide in its narrowest part. On these wharves are coal-storage depots with facilities for unloading coal. Eastwards the width of the dredged area decreases gradually to about 40 m. (130 ft.) in the innermost part of the port. The depths in the dredged area and alongside the wharves also decreases from 5.5 m. (18 ft.) in the NNE-SSW section to 4.5 m. ($14\frac{3}{4}$ ft.) in the east-west section and to 3.5 m. ($11\frac{1}{4}$ ft.) alongside the westernmost wharves.

Port Facilities

The port contains two electric coaling cranes with capacities of about 100 and 50 tons per hour, and one fixed crane to lift 6 tons. The town contains several machine shops, and on the south bank of the fjord is a small boatyard. Railways run on all the wharves and are in communication with the State Railways. There are storage tanks for petroleum, fuel oil and benzine.

Trade

During 1938 a total of 2,980 ships of 170,000 register tons discharged 124,000 tons of cargo in the port. Less than one-tenth of the number of ships and one-quarter of the total tonnage were from foreign ports, but they brought nearly two-thirds of the total weight of goods discharged. Nearly a half of the cargoes consisted of coal and coke. Twenty thousand tons of fertilizers, mainly from overseas, and 14,000 tons of stone, lime and cement from Danish ports were the chief other specified cargoes.

Cargoes loaded weighed 36,000 tons, of which rather less than a third were consigned to foreign ports. Exports to foreign ports were mainly agricultural produce, while coastwise trade was concerned

mainly with unspecified bulk cargoes and with redistributing stone, lime and cement.

Industries

Haderslev is a centre for the collection and packing of agricultural produce, has a small malting industry, and manufactures clothes and wool textiles.

Communications

A single-track railway runs west to Vojens where it joins the main north-south line behind the east coast of Jylland. The arterial road which runs through the fjord towns of east Jylland to Aarhus and north to Skagen passes through the town which is a focus of roads crossing Haderslev Fjord.

KALUNDBORG

55° 40' N, 11° 05' E. Population 7,620 in 1935

Kalundborg is at the head of its fjord which lies between the peninsulas of Rösnaes and Asnaes in west Sjælland and on the east side of the entrance to the Great Belt.

Approach and Access

The fjord is wide and free from dangers between the shore banks west of Gisseløre Point; ships can anchor anywhere in depths of 16.5 to 11 m. (9-6 fathoms). About 3.7 km. (2¼ miles) south-west of Gisseløre Point is a rocky shoal with least depths of 5 m. (16¼ ft.). East of this point the water shoals rapidly and a dredged channel which is about 9 km. (5½ miles) long, 40 m. (130 ft.) wide and 9 m. (29½ ft.) deep leads to the port. It includes a turning basin in which ships of up to 42 m. (140 ft.) can swing.

Abreast the port the dredged channel bifurcates. One branch with depths of 8 m. (26 ft.) leads alongside the south face of the eastern quays; the other, which is 7 m. (23 ft.) deep, leads into the entrance to the western basin which is enclosed by a breakwater. This entrance is about 60 m. (197 ft.) wide. There is another entrance about 18 m. (60 ft.) wide and 2.8 m. (9.2 ft.) deep near the middle of the southern arm of this breakwater.

The maximum depths alongside the quays is 8 m. ($26\frac{1}{4}$ ft.), and while depths are 5 m. ($16\frac{1}{2}$ ft.) and over alongside the main quays and wharves they decrease to 1.8 m. (6 ft.) in the innermost part of the west basin. The port has some 900 m. (2,950 ft.) of quays and wharves which vary in height from 1.6 to 1.9 m. ($5\frac{1}{4}$ – $6\frac{1}{2}$ ft.) above water level. The largest ship to visit the port in 1939 was a tanker of 17,000 tons.

The difference between M.H.W. and M.L.W. is 0.3 m. (1 ft.), but gales from the north-west may raise the water level by 1.3 m. ($4\frac{1}{4}$ ft.) and gales from the south-east may lower it by 0.9 m. (3 ft.). The quays and wharves are between 1.6 and 1.9 m. ($5\frac{1}{4}$ – $6\frac{1}{4}$ ft.) above mean water level.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 99)

The port consists of a small yacht harbour, a western basin, an eastern quay and a small basin, enclosed by breakwaters, on the west side of the eastern quay. In addition a new basin lying close east of the eastern quay was completed in 1941. The *western basin* is about 500 m. (1,640 ft.) long and from 88 to 130 m. (288–430 ft.) wide and has a wharf about 425 m. (1,400 ft.) long on its north side. This wharf has depths between 5 and 7 m. ($16\frac{1}{4}$ – $22\frac{3}{4}$ ft.) alongside, while the quay on its east side is 102 m. (311 ft.) long and has depths of 5.6 m. ($18\frac{1}{4}$ ft.) alongside. Leading off the north-west angle of the basin is a small harbour subdivided within by a jetty. Close east of the quay which bounds the basin on the east is a boatyard.

The *eastern quay* is 215 m. (705 ft.) in length along its southern face which has depths of 8 m. ($26\frac{1}{4}$ ft.) alongside, and 165 m. (540 ft.) in length along its east face which has depths of 7 m. ($22\frac{3}{4}$ ft.) alongside. The quay is used mainly by the sulphuric acid and superphosphate factory which stands on it. East of the quay are oil tanks. The small basin close west of the quay has depths of 4.3–5 m. (14 – $16\frac{1}{2}$ ft.).

New basin. East and south of the eastern quay a large L-shaped basin with 600 m. (1,970 ft.) of quays along its east and south sides were completed in 1941. The west face of the southern quay has four tanker berths with pipe-lines to storage installations. The depth alongside these tanker berths is 9 m. ($29\frac{1}{2}$ ft.).

Port Facilities

The boatyard builds wooden craft and has a slip to take ships of up to 1.9 m. ($6\frac{1}{4}$ ft.) draught, but the town contains a works which

builds marine machinery including Diesel engines. The port contains one crane of 25 tons capacity and one smaller crane. Railways run behind the north wharf of the western basin and along the east side of the eastern quay.

Trade

In 1938 the incoming traffic at Kalundborg was almost entirely from foreign ports whence 235 ships brought some 20,000 tons of cargo as compared with 6,000 tons in 209 ships from home ports. Over a thousand ships loaded 113,000 tons of cargo in the port. Two-thirds of this cargo was consigned in 900 small ships for distribution to home ports.

Half the incoming cargoes were classed as stone, lime and cement from foreign ports and a quarter consisted of coal and coke, while feeding stuffs and fertilizers formed the bulk of the remainder. Exports consisted mainly of 74,000 tons of fertilizer from the local works, almost all of which was distributed to home ports. The only other significant exports were 10,000 tons of cereals and 27,000 tons of unspecified bulk cargoes.

Industries

The chief industries, apart from those arising from the agriculture of the surrounding region, are the manufacture of chemical fertilizers and of Diesel engines for land and marine use.

Communications

Single-track railways run east to Holbæk and thence via Roskilde to Köbenhavn, north to Nyköbing and south to Slagelse.

Two main roads leave the town. One is the arterial road through Holbæk and Roskilde to Köbenhavn. The other runs south-east and bifurcates, one branch leading to Sorö and the other to Slagelse which is an important road-centre.

A car-ferry service runs to Aarhus in Jylland calling at Kolby Kaas in Samsö.

SVENDBORG

55° 03' N, 10° 37' E. Population 19,161 in 1935

Svendborg is on the south coast of Fyn and on the north side of Svendborg Sund which separates the small island of Taasing from the larger island. It is the second largest town and third largest port

in Fyn and serves as a link between it and the islands to the south.

Approach and Access

The port can be approached through Svendborg Sund, from either the east or the west, by ships of 7 m. ($22\frac{3}{4}$ ft.) draught. The western approaches to the sound lie between the islands and shoals which fringe the coast between Faaborg and the island of Taasing. The deepest channel (12.8 m.) is between the north of Avernakö and the islets called Lyö and Björnö. Farther south a narrow channel 3.7 m. (12 ft.) deep leads between Avernakö and Drejö and a dredged channel, 3.2 m. ($10\frac{1}{2}$ ft.) deep, between Drejö and Hjortö, and Skarö and Taasing, gives access to Svendborg Sund. The channel through Svendborg Sund is flanked by steep-to, and almost dry, banks on each side and has been dredged in two places to allow the passage of ships of 7 m. ($22\frac{3}{4}$ ft.) draught.

The channel into Svendborg Sund from the east passes between Turö and Taasing island. This channel is tortuous and is narrow where shoals occur; it has a least depth of 7 m. ($22\frac{3}{4}$ ft.).

The maximum depths in the port are 7 m., but they decrease to 3.4 m. (11 ft.) in the innermost part. The port has a water area of $15\frac{1}{2}$ ha. (38 acres) and 1,935 m. (6,350 ft.) of quays ranging in height from 1.4 to 2 m. ($4\frac{1}{2}$ – $6\frac{1}{2}$ ft.) above water level. The difference between M.H.W. and M.L.W. is between 0.3 and 0.6 m. (1–2 ft.). Gales from the north and north-east may raise the water level by 1.6 m. ($5\frac{1}{4}$ ft.) while those from the south and south-west may lower it by the same amount.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 100, Plate 86)

The port lies in a northward bend of Svendborg Sund. Within this bend is a low islet, Frederiksö, which is connected, on the west, with the mainland by a fixed bridge. The islet and bridge divide the port into two parts, the main harbour which lies north and north-east of the islet, and the south harbour which is west of the islet and south of the bridge.

The *main harbour* consists of inner and outer parts which are separated by a triangular quay that projects from the north-east side of the harbour. The harbour has a total area of about 12 ha. (30 acres) and a total quayage of 1,500 m. (4,900 ft.). The outer part of the harbour is a rectangular basin 103 m. (340 ft.) wide and has

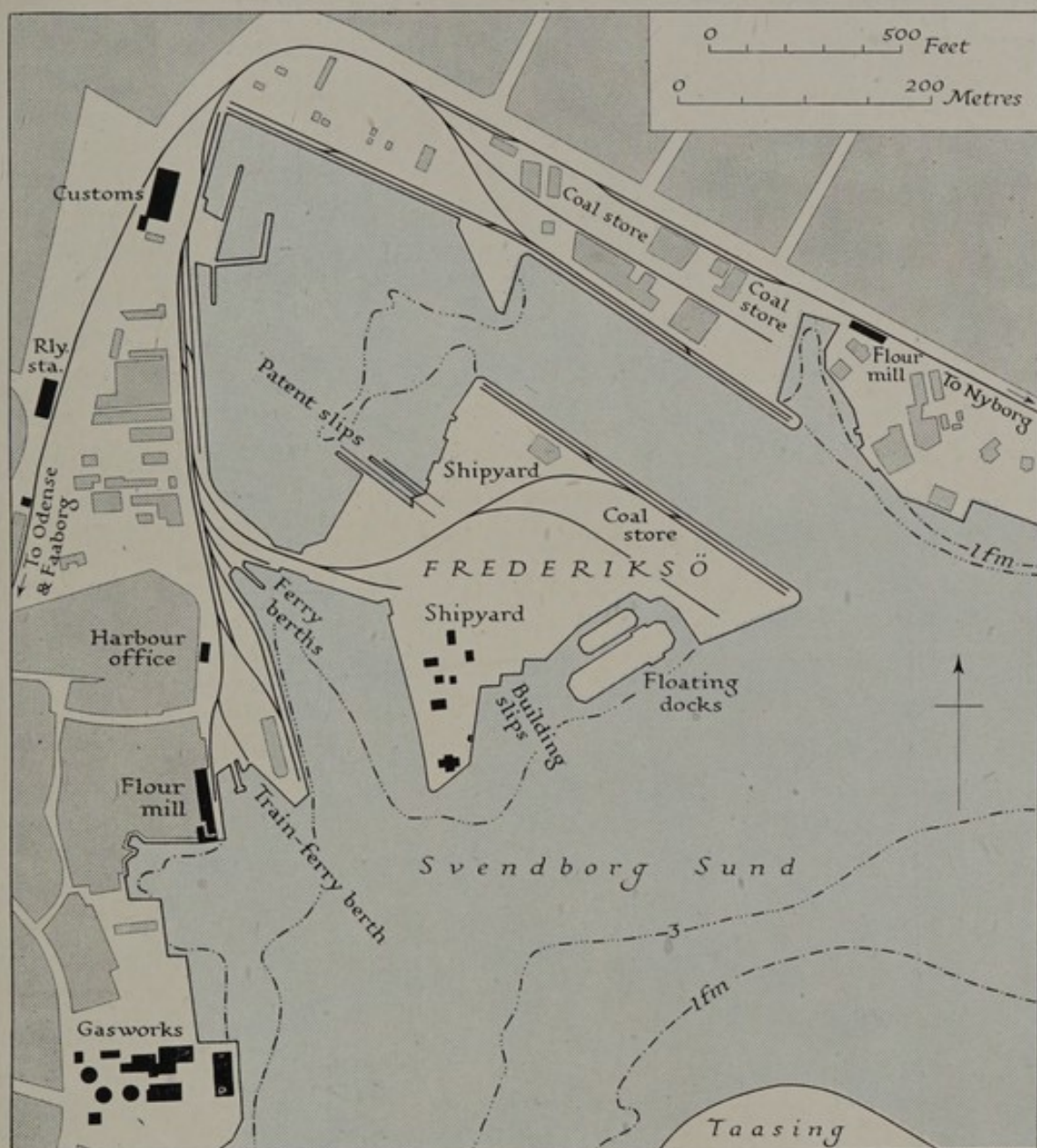


Fig. 100. The port of Svendborg

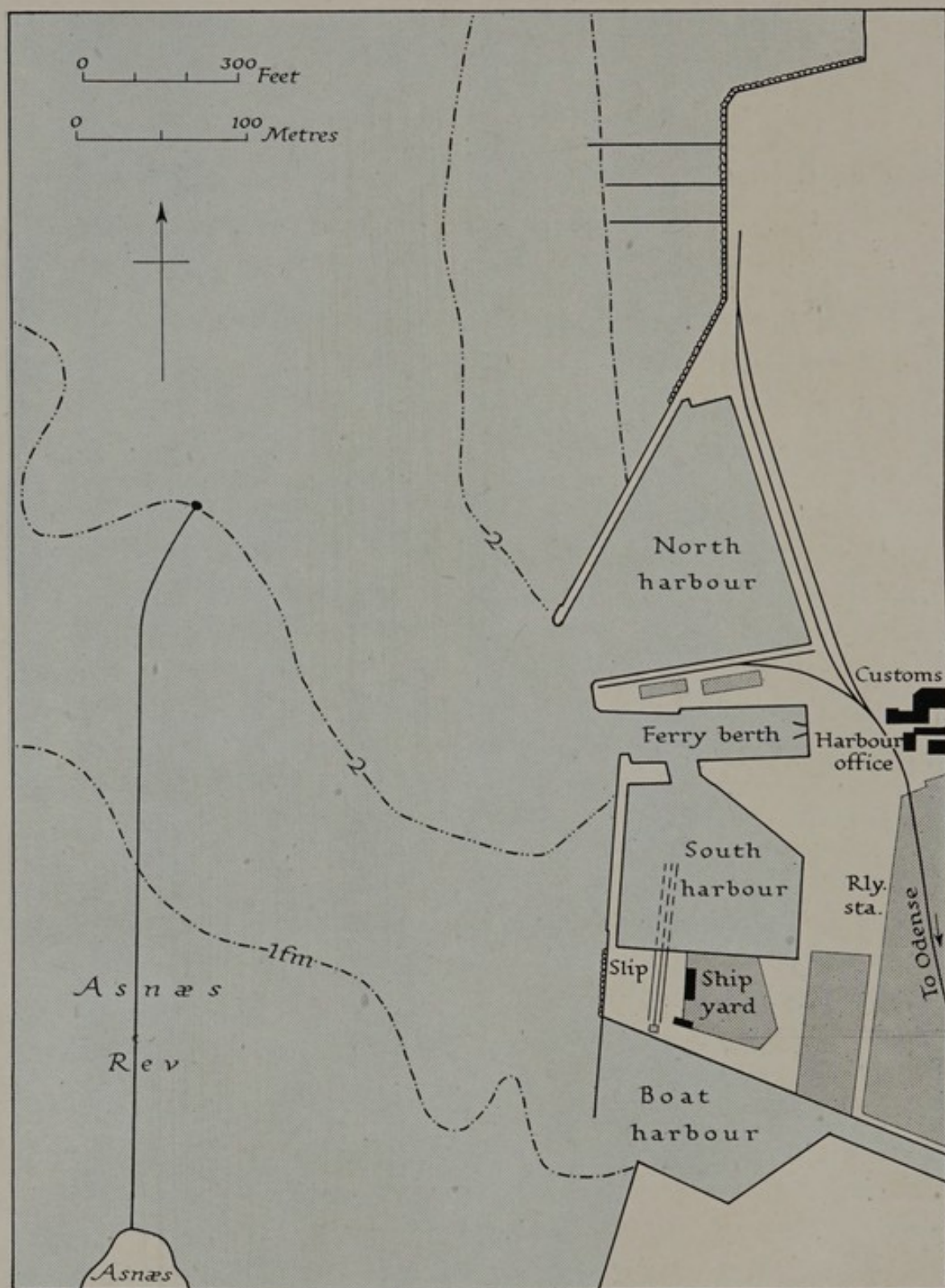


Fig. 101. The port of Assens

depths of 6.9 m. ($22\frac{1}{2}$ ft.) alongside its quays. At the east end of the northern quay is a small basin with depths of 3.1–4.7 m. (10 – $15\frac{1}{4}$ ft.).

The entrance into the inner part of the main harbour is about 50 m. (165 ft.) wide and 6.5 m. ($21\frac{1}{4}$ ft.) deep. This inner basin is of roughly triangular form and has, on its west side, three short jetties which enclose small water areas with depths of 3.4–4.3 m. (11 – 14 ft.). The quays on the north side of the basin have depths of 5.3 m. ($17\frac{1}{4}$ ft.) alongside, while those on the west side have depths of 4.3 m. (14 ft.). The north side of Frederiksö is occupied by a shipyard.

The *south harbour* has a total water area of about 3 ha. (8 acres) and a total quayage of 440 m. (1,450 ft.). It is used, not only by the ferry boats to Rudköbing on Langeland and Ærösköbing on Ærö, but also by the regular coasting ships. One berth of the train ferry which runs to Rudköbing is on the west side of the entrance to the south harbour and is 4.3 m. (14 ft.) deep. The other, and that of the ferry to Ærösköbing, are in the north-west angle of the south harbour and are 6.2 m. ($20\frac{1}{4}$ ft.) deep, which is also the depth alongside the quays on the west side of the harbour. Close south of the southern berth of the train ferry are private wharves with depths of 0.9–2.8 m. ($2\frac{3}{4}$ –9 ft.), but the quay fronting the gasworks has depths of 4.7 m. ($15\frac{1}{4}$ ft.).

The south-east side of Frederiksö is occupied by a shipyard off which are two floating docks. About 700 m. (765 yd.) south of the south harbour is a short pier, along the northern side of which is the berth of the ferry to Vindeby on the other side of Svendborg Sund; this berth is 2 m. ($6\frac{1}{2}$ ft.) deep. Close south of it is an old yacht harbour which has been superseded by a newer circular harbour, lying adjacent to it and with depths of 3 m. ($9\frac{3}{4}$ ft.) in its outer part and 2.4 m. ($7\frac{3}{4}$ ft.) in its inner part.

Port Facilities

The two floating docks have the following dimensions:

Length		Breadth		Depth on sill		Lifting power
m.	ft.	m.	ft.	m.	ft.	tons
97.0	318	18.0	59	5.5	18	1,800
52.5	172	12.0	$39\frac{1}{2}$	4.0	13	800

There are two patent slips in the northern shipyard. One of these can take ships of up to 300 deadweight tons and the other has the following dimensions: extreme length 100 m. (330 ft.), length of cradle 33 m. (110 ft.), draught on keel blocks 2.1 m. (7 ft.) forward and

4.5 m. (15 ft.) aft, lifting power 450 tons. The two shipyards can repair hulls as well as boilers and machinery. Railways run on all quays and wharves of the main harbour and south harbour. The shipyard has a crane to lift 40 tons.

Trade

In 1938 a total of 1,902 ships of 136,000 tons discharged 152,000 tons of cargo in the port. Over two-thirds of the total tonnage of the ships was made up by 406 ships which entered from foreign ports and discharged 103,000 tons of cargo. Half the weight of cargoes from foreign ports consisted of coal and coke and one-third consisted of grain and feeding stuffs, which also comprised nearly a half of the cargoes from home ports.

Outgoing cargoes weighed 33,000 tons, of which about three-quarters was consigned to home ports in 1,508 ships of 33,000 tons. Ships sailing to foreign ports numbered 117 and totalled 12,000 tons. Their cargoes were classed mainly as general goods. The ferry to Rudköbing carried 62,000 tons of cargo and that to Ærösköbing carried 12,000 tons.

Industries

Svendborg builds ships (see p. 286) and manufactures foundry goods, light machinery and electrical goods, but its main activities are the collection, preparation and packing of agricultural produce, which gives rise to flour milling, tanning and malting as well as the manufacture of cheese and butter and the curing of bacon.

Communications

The railways which reach Svendborg from Odense, Nyborg and Faaborg are all single-track private railways. A train-ferry service runs to Rudköbing in Langeland and car ferries run to Ærösköbing on Ærö and to Vemmenæs and Rudköbing.

Four main roads leave the town for Faaborg, Odense, Kerteminde and Nyborg.

ASSENS

55° 16' N, 9° 53' E. Population 4,827 in 1935

Assens is approximately midway along the east side of the Little Belt and almost opposite the entrance to Haderslev Fjord. It is the fourth port of the island of Fyn.

Approach and Access

The approach is direct from the Little Belt along a dredged channel, 32 m. (105 ft.) wide and 7 m. ($22\frac{3}{4}$ ft.) deep, which lies between the shore banks and Asnæs Rev, a bank of sand and weed. The roadstead is sheltered, except from northerly winds, and there is anchorage in depths of 6.5 m. ($3\frac{1}{2}$ fathoms).

The maximum depth in the port is 7 m. ($22\frac{3}{4}$ ft.) in the north harbour; in the south harbour they decrease to 2.4 m. ($7\frac{3}{4}$ ft.). The quays are 1.2–1.9 m. ($3\frac{3}{4}$ – $6\frac{1}{4}$ ft.) above water level and have a total length of about 480 m. (1,570 ft.). The difference between M.H.W. and M.L.W. is very small, but gales from the north-east and east may raise the water level by 1.6 m. ($5\frac{1}{4}$ ft.) while those from between north-west and south-west may lower it by the same amount.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 101)

The port consists of three basins and a boat harbour. The *north harbour* is triangular and lies between a breakwater and a mole which leave an entrance 29 m. (95 ft.) wide and 7 m. ($22\frac{3}{4}$ ft.) deep. The quays are 265 m. (870 ft.) long and the depths alongside are equal to those in the entrance channel, but off the inner side of the breakwater the depths decrease to 2.2 m. (7 ft.).

The *middle harbour* is a rectangular basin which is 25 m. (82 ft.) wide at its entrance and has 213 m. (700 ft.) of quays with depths of 4.1–5.0 m. ($13\frac{1}{4}$ – $16\frac{1}{4}$ ft.). At its east end is the berth of the ferry to Aarörsund on the opposite side of the Little Belt.

From the south side of the middle harbour a narrow entrance 3.5 m. ($11\frac{1}{2}$ ft.) deep leads into the *south harbour* which has a shipyard on its south side. Depths in this harbour are between 2.4 and 3.5 m. ($7\frac{3}{4}$ – $11\frac{1}{2}$ ft.). The boat harbour is in the estuary of a stream to the south of the shipyard. It has depths of 3 m. ($9\frac{3}{4}$ ft.).

Port Facilities

The shipyard has a patent slip with the following dimensions: extreme length 112 m. (367 ft.), length of cradle 42 m. (138 ft.), draught on keel blocks 3 m. ($9\frac{3}{4}$ ft.) fore and 4.6 m. (15 ft.) aft; it can take vessels of up to 450 tons. The shipyard can repair wooden ships only, but a machine shop can effect minor repairs. The middle harbour has one 6-ton crane. Railways run on the quays of the north harbour only.

Trade

The trade of Assens is predominantly coastwise. In 1938 only 148 ships of 14,000 register tons entered with cargoes from foreign ports as compared with 2,547 ships of 110,000 register tons engaged in coastwise trade; two-thirds of the weight of cargoes discharged were from home ports and were described as unspecified bulk cargoes. Foreign cargoes consisted mainly of coal and coke and also of fertilizers and timber.

Of the 2,506 ships which loaded cargoes in the port, only twenty-nine sailed to foreign ports and carried less than 8,000 tons of cargo as compared with 26,000 tons of unspecified bulk cargoes carried to home ports.

Industries

Assens refines sugar, manufactures tiles, and prepares and packs dairy produce.

Communications

The only railway from the town is a single-track line north-east to Tommerup where it joins the main double-track line across the island from the Little Belt bridge to Nyborg. Three main roads run north and east from the town to Middelfart, Odense and Svendborg. A car ferry crosses the Little Belt to Aarösund.

MIDDELFART

55° 30' N, 9° 44' E. Population 8,219 in 1935

Middelfart is on the east side of the narrowest crossing of the Little Belt. It has long been important as the chief centre on the Fyn side of this crossing, and although the former train-ferry service crossed from Fredericia to Strib, farther north, it remained the western focus of rail and road communications. The building of the Little Belt bridge has restored its position as the town on the crossing.

Approach and Access

The port is small and fronts the Little Belt from which there is direct access to the wharves along the shore. The old harbour lies behind a mole and has an entrance 13.7 m. (45 ft.) wide and 4.3 m. (14 ft.) deep.

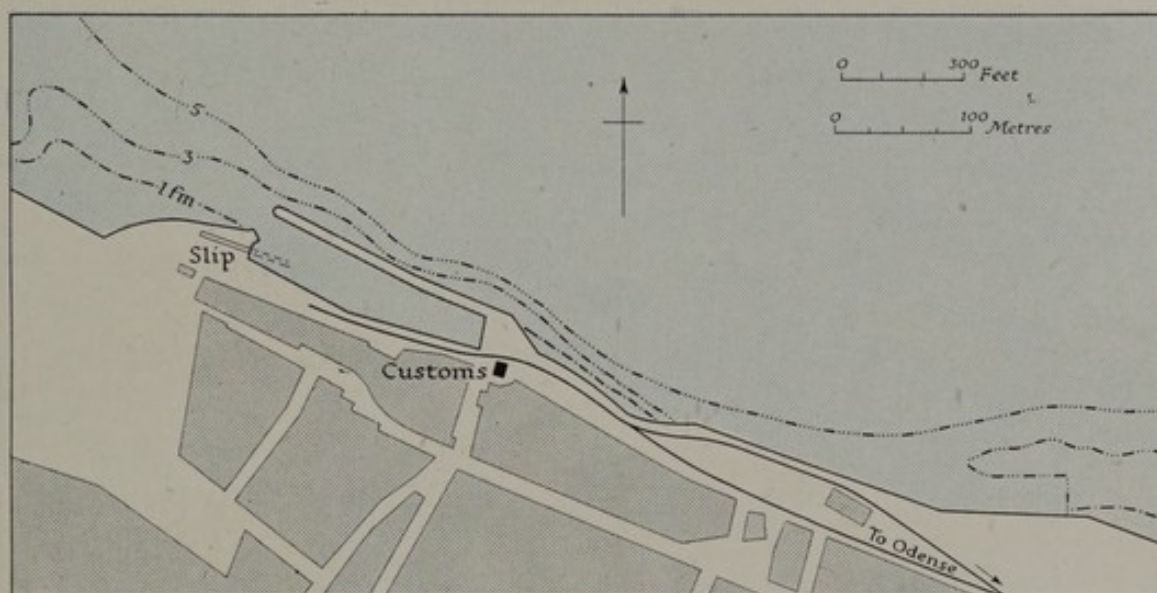


Fig. 102. The port of Middelfart

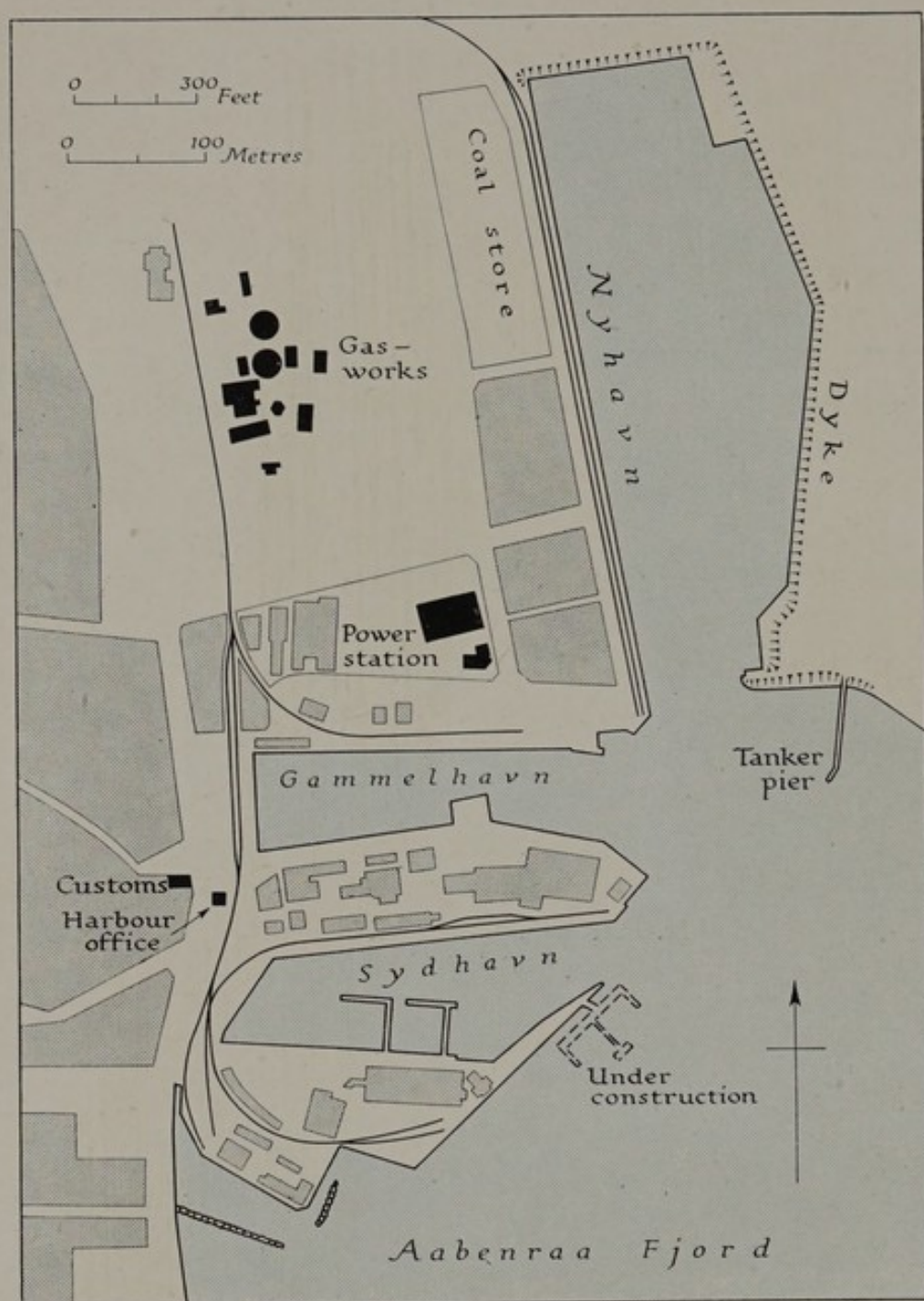


Fig. 103. The port of Aabenraa

South-east of Sydhavn, a new landing stage appeared to be under construction during the summer of 1943.

The port comprises 413 m. (1,355 ft.) of quays and wharves, alongside which depths range between 2.5 and 7.5 m. (8–24½ ft.). The quays and wharves are 1.6–1.9 m. (5¼–6¼ ft.) above mean water level. The difference between M.H.W. and M.L.W. is 0.3 m. (1 ft.). Gales from the east and north-east may raise the water level by up to 1.2 m. (4 ft.) and those from west and south-west may lower it by 1 m. (3½ ft.).

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 102)

The port consists of a basin with 113 m. (370 ft.) of quays, and 300 m. (984 ft.) of wharves lying east of the basin. The mole which encloses the basin has a wooden deck. The basin has depths of 4.3–4.7 m. (14–15¼ ft.) alongside the quays, but on the inner side of the mole they decrease to 3.4 m. (11 ft.). In the western angle of the basin is a boatyard.

The wharves along the coast of the Little Belt form the newer part of the port and have depths of 5.6–7.5 m. (18¼–24½ ft.) alongside; the deepest section is on the west.

Close east of Middelfart wharves are the quays of the *Nordiske Kabel- og Traadfabrik* which are on the north and east sides of a filled-in area which juts into the Little Belt. The north quays are 100 m. (328 ft.) long, 2 m. (6½ ft.) high and have depths of 7 m. (22¾ ft.) alongside. On the east side is a quay 75 m. (245 ft.) long and 2 m. (6½ ft.) high with depths of 4 m. (13 ft.) alongside.

Port Facilities

The boatyard has an ordinary slip with the following dimensions: extreme length 56 m. (184 ft.), length of cradle 25 m. (82 ft.), draught on keel blocks 2.3 m. (7½ ft.) fore and 5 m. (16¼ ft.) aft, lifting power 150 tons. The port contains one crane to lift up to 10 tons. Railways run on the quays and the wharves.

Trade

Middelfart handles mainly imports from foreign ports. Such cargoes weighed 55,000 tons in 1938 and consisted of some 27,000 tons of coal and coke, some 3,000 tons of timber, and the remainder was mainly unspecified bulk cargoes. Cargoes from Danish ports weighed only 9,000 tons, of which stone, lime and cement formed the bulk.

Cargoes loaded weighed less than 4,000 tons of which more than a half were consigned abroad as unspecified bulk cargoes. More than half the ships entered left without taking on cargo.

Industries

The *Nordiske Kabel- og Traadfabrik* manufactures cables, wire, screws and nails. The town has one foundry which manufactures domestic goods such as stoves and grates and small factories which make furniture, soap and leather goods. Brewing, tanning and the handling of agricultural produce are the chief other activities.

Communications

The main double-track railway and the arterial road between Esbjerg and København pass through the town. Two separate single-track lines run east to Odense and two other main roads run to Bogense and Assens. The railway station is at the eastern end of the town.

AABENRAA

55° 03' N, 9° 26' E. Population 10,184 in 1935

Aabenraa is the southernmost of the series of fjord ports along the east coast of Jylland. It is at the head of Aabenraa Fjord which leads westwards from the Little Belt, north of the island of Als.

Approach and Access

The fjord is wide and free from dangers outside the shore banks except for shoals with least depths of $3\frac{1}{2}$ m. (11 ft.) in its innermost part. Thence two dredged channels lead into the port. The main channel, which is the more western, has a least width of about 60 m. (195 ft.) along the bottom and a depth of 8.5 m. ($27\frac{3}{4}$ ft.); it leads north into the newer part of the port. The other channel lies immediately east of the main channel and is 5 m. ($16\frac{1}{4}$ ft.) deep.

The port has some 1,420 m. (4,650 ft.) of quayage of which 150 m. (500 ft.) have a depth of 8.5 m. ($27\frac{3}{4}$ ft.), 380 m. (1,245 ft.) have depths between 6.0 and 7.5 m. ($19\frac{1}{2}$ – $24\frac{1}{2}$ ft.), and the remainder have depths between 2.3 and 5.5 m. ($7\frac{1}{2}$ –18 ft.). At the outer end of the three basins which form the port is a turning basin where ships up to 150 m. (490 ft.) long can turn over a depth of 8.5 m. ($27\frac{3}{4}$ ft.).

The difference between M.H.W. and M.L.W. is generally 0.6 m. (2 ft.), but in changeable weather it may increase to about 1 m. ($3\frac{1}{4}$ ft.). North-easterly winds, especially after north-westerly gales, may raise the water level by 1.3 m. ($4\frac{1}{4}$ ft.), while north-westerly gales may lower it by the same amount.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 103, Plate 87)

The port consists of three basins, Nyhavn, Gammelhavn and Sydhavn. *Nyhavn*, the northernmost of the basins, lies north-south and was constructed during the twenties of this century. It is about 475 m. (1,560 ft.) long, and the dredged portion, both in the entrance and within the basin, is about 50 m. (165 ft.) wide and lies adjacent to its west side along which is a quay. The southernmost third of this quay has depths of 8.5 m. ($27\frac{3}{4}$ ft.), the middle third has depths of 7.5 m. ($24\frac{1}{2}$ ft.), and the northernmost third has depths of 6.5 m. ($21\frac{1}{4}$ ft.) alongside. The north and east sides of the basins are backed by dykes and fronted by shallow water 0.3–0.6 m. (1–2 ft.) deep. Close east of the entrance to the basin is a pier for tankers which has a depth of 8.5 m. ($27\frac{3}{4}$ ft.) alongside its head.

Gammelhavn, the oldest basin, lies east-west, close south of the entrance to Nyhavn. It is about 280 m. (920 ft.) long and about 50 m. (165 ft.) wide except towards its middle, where part of the southern quay projects north and reduces the width of the basin to about 25 m. (80 ft.). The total quayage is 640 m. (2,100 ft.), of which 75 m. (250 ft.) along the western end of the basin have depths of 6 m. ($19\frac{1}{2}$ ft.). The quays along the south side of the basin have depths of 5.2–5.6 m. (17 – $18\frac{1}{4}$ ft.) alongside, while alongside the quays on the north side the depths decrease to 2.4 m. ($7\frac{3}{4}$ ft.).

Sydhavn, built in 1897–9, lies adjacent to Gammelhavn from which it is separated by a broad mole. It is of similar length to Gammelhavn and is about 35 m. (115 ft.) wide in its entrance but narrows slightly within, where two L-shaped jetties project north from the south side of the basin. The depths in the entrance and alongside the northern and western quays, which are 320 m. (1,050 ft.) long, are 5.5 m. (18 ft.). Along the south side of the basin the depths decrease to between 1.3 and 3.4 m. ($4\frac{1}{4}$ –11 ft.).

Port Facilities

Nyhavn contains two coal-discharging plants and two grain elevators, and Gammelhavn has one coal-discharging plant and one

grain elevator. A machine shop can carry out repairs to hulls and machinery. Railways run on all quays.

Trade

Aabenraa was used by more, if smaller, ships and handled nearly three times as much cargo as Middelfart in 1938. Of the cargoes discharged 70% were from foreign ports, although three ships out of every five entered were from home ports. Coal and coke comprised half the total imports, 33,000 tons were grain and feeding stuffs almost entirely from foreign ports, while the chief cargoes from home ports were bulk cargoes and stone, lime and cement.

Less than half of the ships entered, loaded cargoes which totalled 13,000 tons and were consigned in approximately equal quantities to home and foreign ports. Livestock to Germany and grain were the main exports abroad, while the coastwise trade consisted mainly of grain and general goods.

Industries

Aabenraa manufactures heavy-oil engines, marine motors and agricultural machinery, and also margarine and woollen goods in a small way, but the main activities are the handling of agricultural produce and the providing of agricultural supplies.

Communications

A single-track railway runs west to join the main line which runs south from Lunderskov to the German frontier. The arterial road behind the east coast of Jylland passes through the town from which two main roads run west to Skærbæk and Tönder where they join the north-south arterial road behind the west coast of Jylland.

KÖGE

55° 27' N, 12° 12' E. Population 6,952 in 1935

Köge is on a large bay of the same name and which lies between the island of Amager on the north and the cliff-edged Stevns peninsula on the south. Apart from København, it and Helsingør are the only ports of importance along the east coast of Sjælland. The port is old, and although it has never been important as a ferry terminus it has long served as the port of Ringsted. The harbour suffers from silting and is exposed to easterly winds.

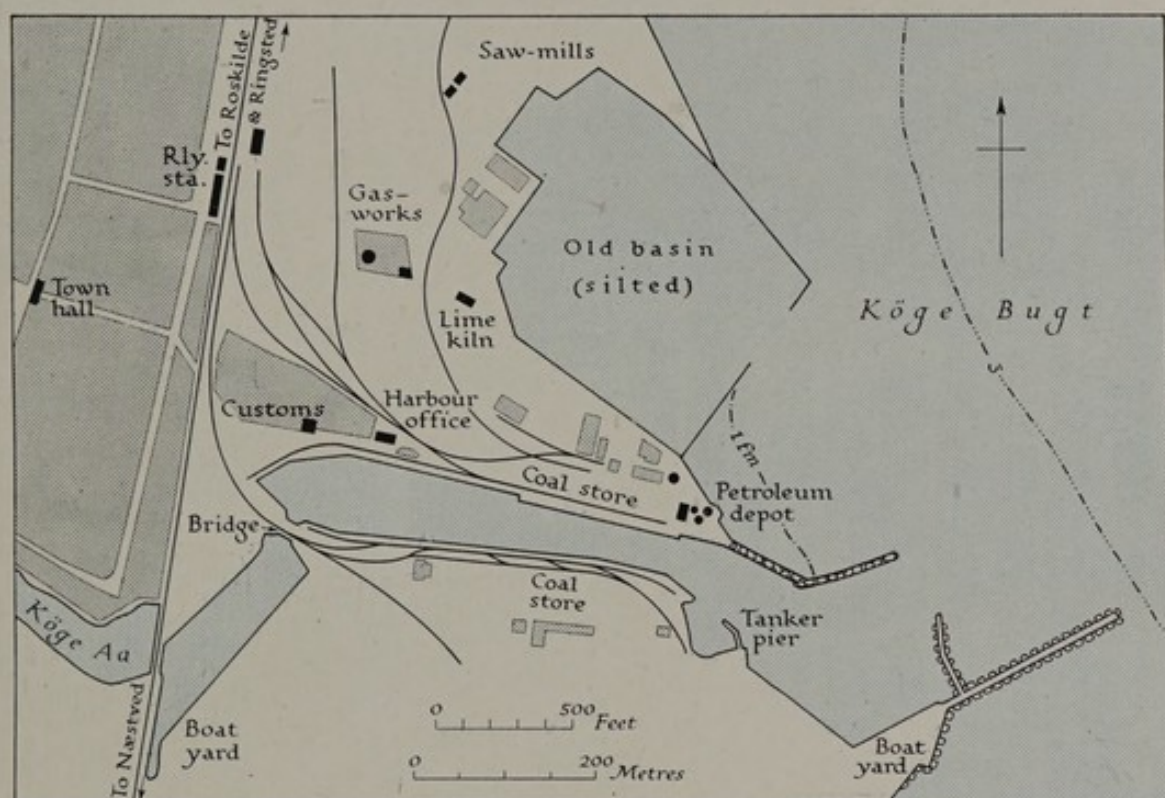


Fig. 104. The port of Køge

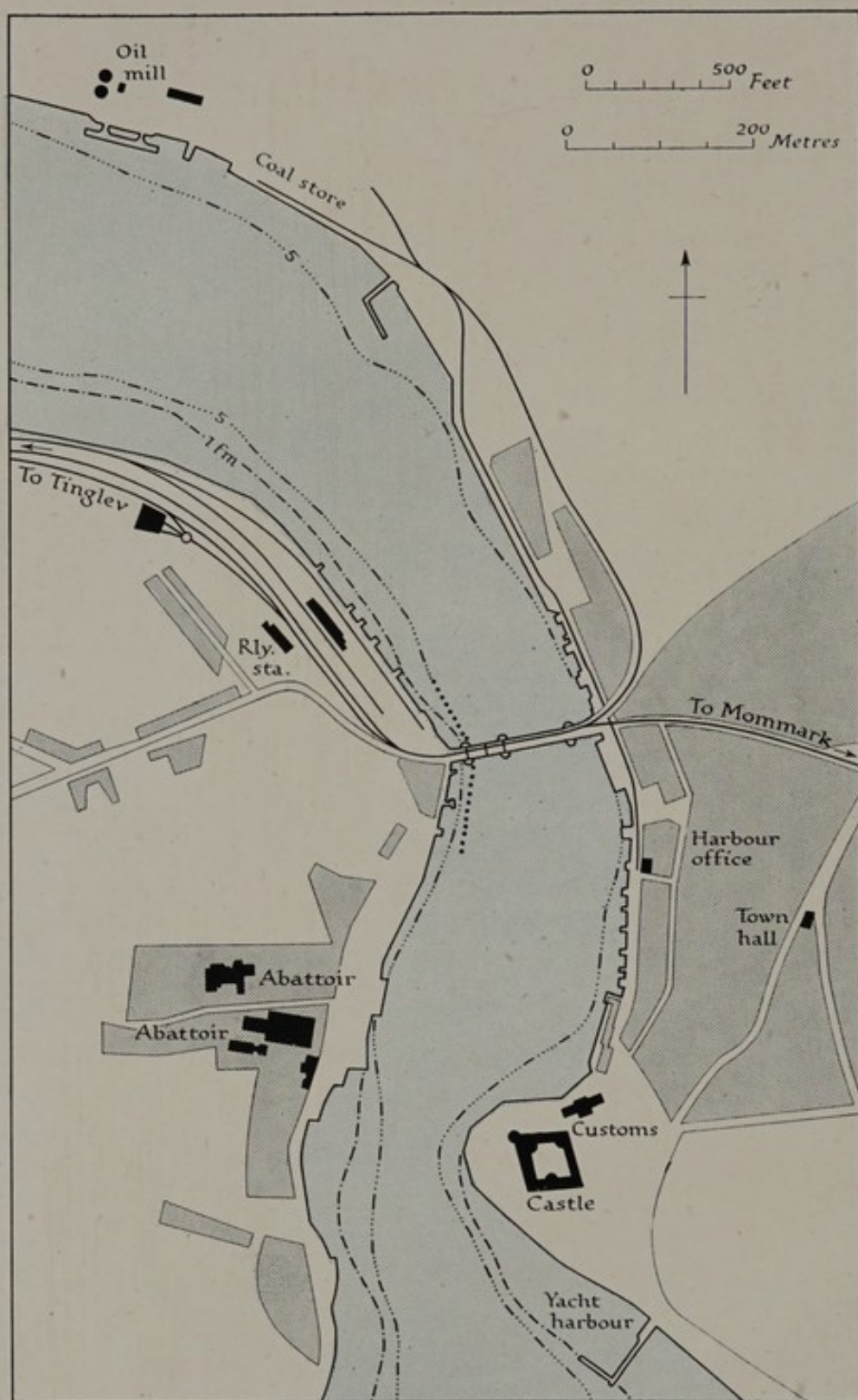


Fig. 105. The port of Sønderborg

Approach and Access

The approach is direct from Köge Bugt and is easy, although the bay contains some shoal patches where depths decrease to 6 m. ($3\frac{1}{4}$ fathoms). A dredged channel 7 m. ($22\frac{3}{4}$ ft.) deep leads across the shore banks into the harbour which lies within two breakwaters. The entrance channel between the breakwaters is about 50 m. (164 ft.) wide.

The port has a total quayage of 885 m. (2,900 ft.) of which 275 m. (900 ft.) have depths of 7 m. ($22\frac{3}{4}$ ft.) and 610 m. (2,000 ft.) have depths of 5 m. ($16\frac{1}{2}$ ft.) alongside. The quays are between 1.6 and 2 m. ($5\frac{1}{4}$ – $6\frac{1}{2}$ ft.) above mean water level. West of the bridge across the Köge Aa the depths decrease to 3.5 m. ($11\frac{1}{2}$ ft.). Close west of the breakwaters which flank the entrance to the port is a turning basin with depths of 7 m. ($22\frac{3}{4}$ ft.) over a width of about 120 m. (394 ft.).

The port is practically tideless, but winds from between north and east may raise the water level by 1.6 m. ($5\frac{1}{4}$ ft.) and westerly winds may lower it by 0.9 m. (3 ft.).

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 104)

The port consists of outer and inner harbours and, in addition, a portion of the Köge Aa, between the two bridges west of the inner harbour, has been dredged to 3.5 m. ($11\frac{1}{2}$ ft.).

The *outer harbour* is occupied mainly by the turning basin, to the south-west of which is a short jetty for tankers of up to 77 m. (254 ft.) long and 4.3 m. (14 ft.) draught. Westwards the outer harbour narrows to about 40 m. (130 ft.) between quays which have depths of 7 m. ($22\frac{3}{4}$ ft.) alongside. The quays on both the north and south sides are backed by coal-storage areas and, behind the north quay, is a storage depot for petroleum products.

The *inner harbour* is rather broader than the western part of the outer harbour, but depths in it are 5 m. ($16\frac{1}{2}$ ft.). On its south-west side the Köge Aa enters the harbour underneath a rail and road bridge. The reach of the river between this bridge and the railway bridge farther upstream can be used by small vessels. Close east of the railway bridge and on the south bank is a boatyard. North of the harbour is a basin, enclosed by breakwaters, which was formerly available to ships of 5.5 m. (18 ft.) draught but has become disused and silted up.

Port Facilities

The port contains three small boatyards and a slip for ships of up to 150 tons. The town contains four machine shops. Railways run on all quays.

Trade

In 1938, the tonnage of ships which brought cargo into the port was 88,000, and four-fifths of this tonnage was accounted for by 347 ships entered from foreign ports. The 288 ships which entered from Danish ports brought rather less than one-fifth of the weight of cargoes discharged. Outgoing cargoes weighed 73,000 tons and were carried in 468 ships of 35,000 tons. Three-fifths of the cargoes were dispatched to foreign ports in 225 ships of 25,000 register tons.

More than half the weight of cargoes discharged consisted of coal and coke. Timber, feeding stuffs and fertilizers, also from foreign ports, made up the bulk of the remainder. Four-fifths of the weight of outgoing cargoes consisted of stone and lime from neighbouring quarries; three-fifths of these cargoes were shipped to foreign ports. The other outgoing cargoes consisted mainly of grain and timber redistributed partly to other Danish ports and partly to nearby foreign ports.

Industries

The industries of Køge, apart from its port activities, are concerned mainly with wood working, fish curing, the manufacture of rubber articles, and the preparation and packing of agricultural produce.

Communications

Single-track railways run to Roskilde and Ringsted where they link with the main lines from København to Kalundborg and Esbjerg respectively. Another line runs south-west to Næstved where it joins the main line across the Storström bridge to Falster and Gedser. A private railway runs south to Fakse and Rødvig. The arterial road from København to Gedser passes through the town. Two other main roads leave the town, one westwards to Ringsted and the other southwards to Fakse and Rødvig.

SÖNDERBORG

54° 55' N, 9° 47' E. Population 12,115 in 1935

The port of Sønderborg is at the south end of Als Sund which separates the island of Als from the coast of south-east Jylland and connects the outer parts of Aabenraa and Flensborg Fjords west of the Little Belt.

Approach and Access

Approach lies through Als Sund which is entered from the north from the outer part of Aabenraa Fjord, and from the south from the outer part of Flensborg Fjord. Two shoals with least depths of 3.5 m. (11½ ft.) lie in mid-channel in the north part of Als Sund. Otherwise the channel is clear of dangers outside the shore-banks, but although it is much used by small ships, navigation by large ships is made difficult by the current which is usually north-going and tends to set ships towards the sides of the sound; it sometimes has a speed of 2½ knots. Large ships usually enter from the south.

The port consists of quays and wharves built along both sides of Als Sund. The total quayage is about 1,220 m. (4,000 ft.), of which about 1,000 m. (3,280 ft.) have depths between 4.5 and 7.5 m. (14¾–24½ ft.) and the remainder has depths of 2.5–5 m. (8–16¼ ft.). The least depth in the main channel through the port is 10 m. (32¾ ft.). The difference between M.H.W. and M.L.W. is about 0.6 m. (2 ft.). Winds from between north-east and south-east can raise the water level by 1 m. (3¼ ft.), and those from between south-south-west and west-north-west can lower it by the same amount.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 105, plate 88)

The port is divided into north and south parts by a bridge which carries road and railway across the sound. The bridge is a double-bascule bridge which has a navigable width of 30 m. (98 ft.).

The *north harbour*, lying north of the bridge, is about 200 m. (650 ft.) wide and has about 1,000 m. (3,280 ft.) of quayage; the quays on the east side of the channel have depths of 6.5–7 m. (21¼–22¾ ft.) alongside except for about 150 m. (490 ft.) south of the L-shaped pier, where the depths are 5 m. (16¼ ft.). On the west side of the channel the depths decrease to below 2 m. (6½ ft.).

The entrance to the *south harbour* is about 80 m. (260 ft.) wide, but the harbour broadens to about 200 m. (650 ft.). The depths alongside the quays and wharves, which are about 220 m. (720 ft.) long, range between 3.5 and 5 m. (11½–16½ ft.). Close south of the southern entrance and on the east side of the channel is a yacht harbour with depths of 2.8 m. (9 ft.).

Port Facilities

The port contains a boatyard and a machine shop which can undertake repairs to boats and motors. There is a slip for ships of up to 100 gross register tons. There is one electric crane to lift 2 tons and one hand crane to lift 20 tons. Railways run on all the quays on the east side of the port.

Trade

Over a half of the tonnage of ships entered and 70 % of the 100,000 tons of cargo discharged, in 1938, were from foreign ports. Half the weight of cargoes consisted of coal and coke, one-tenth was fertilizers and another tenth consisted of grain and feeding stuffs, all in approximately equal quantities from foreign and home ports. Five thousand tons of stone, lime and cement, and 11,000 tons of general goods, from Danish ports, comprised the bulk of the remaining cargoes.

The weight of exports was only 15 % that of imports; two-fifths of the total were consigned abroad, and twice as many ships and nearly twice as much shipping tonnage was involved in coastwise trade. Three-fifths of the exports were classed as general goods consigned in approximately equal quantities to home and foreign ports. A fifth of the cargoes consisted of grain redistributed to Danish ports.

Industries

Sønderborg refines vegetable oils and manufactures margarine. It handles agricultural produce and has a small wool-spinning and knitting industry.

Communications

Sønderborg controls the communications between Jylland and the island of Als. It is on the single line which runs west from Mommark to join the main east Jylland line at Tinglev, and on the arterial road across south Jylland from Mommark to Tønder.

NYKÖBING (FALSTER)

54° 46' N, 11° 52' E. Population 14,801 in 1935

Nyköbing, on the east side of Guldborg Sund which separates the islands of Lolland and Falster, is the chief town and port of Falster. Here the road and railway cross the 600 m. wide sound on two bridges which provide a direct link between the two islands.

Approach and Access

The port can be approached either from the north or from the south, along Guldborg Sund. The channel from the north lies between reefs and shoals which lie between Femö and the north-west end of Falster, but it is fairly wide and direct as far as Guldborg. South of Guldborg it is narrow and winding but has been dredged where necessary to a depth of 6.1 m. (20 ft.). The road bridge across the sound at Guldborg has a double-bascule opening with a navigable width of 30 m. (98 ft.).

The channel from the south is narrow, winding and difficult, but under normal conditions local pilots can take ships of 2.2 m. (7 ft.) draught through the southern part of the sound to Nyköping.

The two swing bridges which carry road and railway across the sound have each two navigable openings, one on each side of the central portion. The western opening in the road bridge (*Christian IX's Bro*) has a free width of 13.8 m. (45 ft.) and the eastern opening has a free width of 12.5 m. (41 ft.); both openings can be navigated by ships of 5.3 m. (17½ ft.) draught. The free width of both openings in the railway bridge is 15.3 m. (50 ft.) and they can be navigated by ships of 3 m. (9¾ ft.) draught.

The wharves and basins lie along the east side of the sound over a length of about 1 km. (½ mile). The port has about 1,000 m. (3,300 ft.) of wharves and quays with depths of between 4.5 and 6.3 m. (14¾–20½ ft.) alongside and two basins in which depths range from 2.7 to 5.3 m. (8¾–17¼ ft.) alongside some 850 m. (2,800 ft.) of quayage. The quays are between 1.7 and 2 m. (5½–6½ ft.) above mean water level.

The difference between M.H.W. and M.L.W. is 0.4 m. (1½ ft.), but gales from between north-west and north-east cause a south-going current and may raise the water level by 0.9 m. (3 ft.). Gales from between south-east and south-west cause a north-going current and may lower the water level by a similar amount.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 106)

The port consists of wharves lying along the east side of the sound between the two bridges, and quays and two basins lying north of the road bridge. The wharves are 630 m. (2,065 ft.) long and have depths of 5.1–5.3 m. (16½–17¼ ft.) alongside. North of the road bridge there are some 200 m. (655 ft.) of quayage with depths of 6.3 m. (20½ ft.) alongside. At the north end of this quay is the entrance to the older of the two basins. This entrance is 30 m. (100 ft.) wide and 5.3 m. (17¼ ft.) deep. The basin has some 500 m. (1,640 ft.) of quays with depths of 2.7–4.4 m. (8¾–14¼ ft.) alongside. The deepest berths lie on both sides of the basin close south of the entrance. Between the entrance to this basin and the new northern basin is a quay 315 m. (1,030 ft.) long with depths of 6.3 m. (20½ ft.) alongside its entire length.

The north harbour is enclosed on the north by an L-shaped breakwater which leaves an entrance 35 m. (115 ft.) wide. Its northern two-thirds is used as a harbour for yachts and fishing boats, and is 3 m. (9¾ ft.) deep. The commercial part of this harbour lies south of the entrance and consists of a short quay and one basin, which have a total quayage of 363 m. (1,190 ft.), all with a depth of 5.3 m. (17¼ ft.) alongside. The quay adjacent to the entrance is occupied by tanks for petroleum products.

Port Facilities

North of the town is a shipyard which can undertake minor repairs to wooden ships. The town contains two machine shops which can execute repairs to ships and machinery. Railways run on all the quays and wharves.

Trade

In 1938 the port handled some 1,100 ships totalling 87,000 register tons which discharged 136,000 tons of cargo. More than half the tonnage of ships and nearly two-thirds of the weight of cargoes were from foreign ports. Only some 600 ships of 32,000 tons loaded cargoes, which weighed 34,000 tons and were consigned in approximately equal quantities to home and foreign ports.

Nearly half of the imports consisted of coal and coke. Nineteen thousand tons of grain and feeding stuffs were imported from overseas and a further 14,000 tons were received from Danish ports. Nine thousand tons of fertilizer from abroad and 13,000 tons of stone, lime

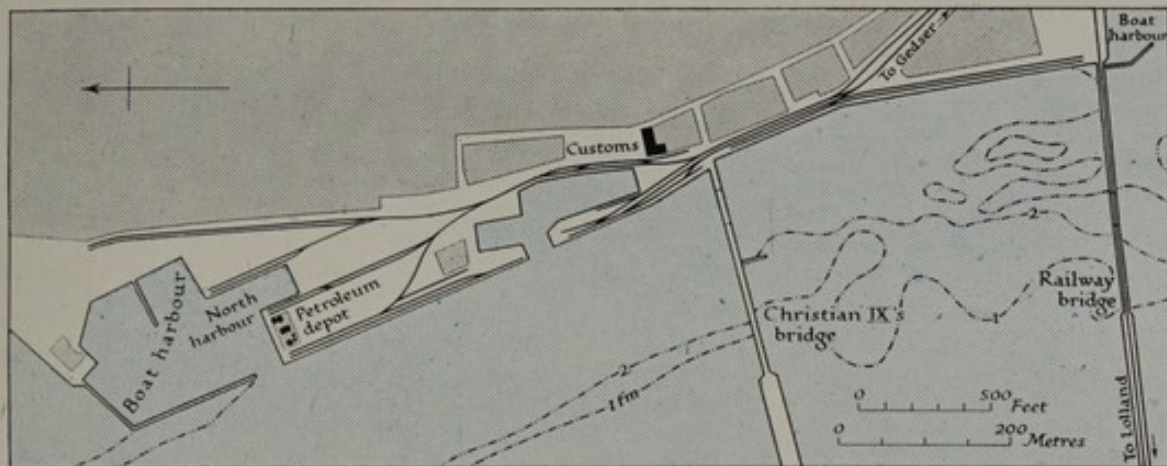


Fig. 106. The port of Nykøbing in Falster

The two bridges cross Guldborg Sund to the island of Lolland. The sound is about 550-700 m. (600-750 yd.) wide here.

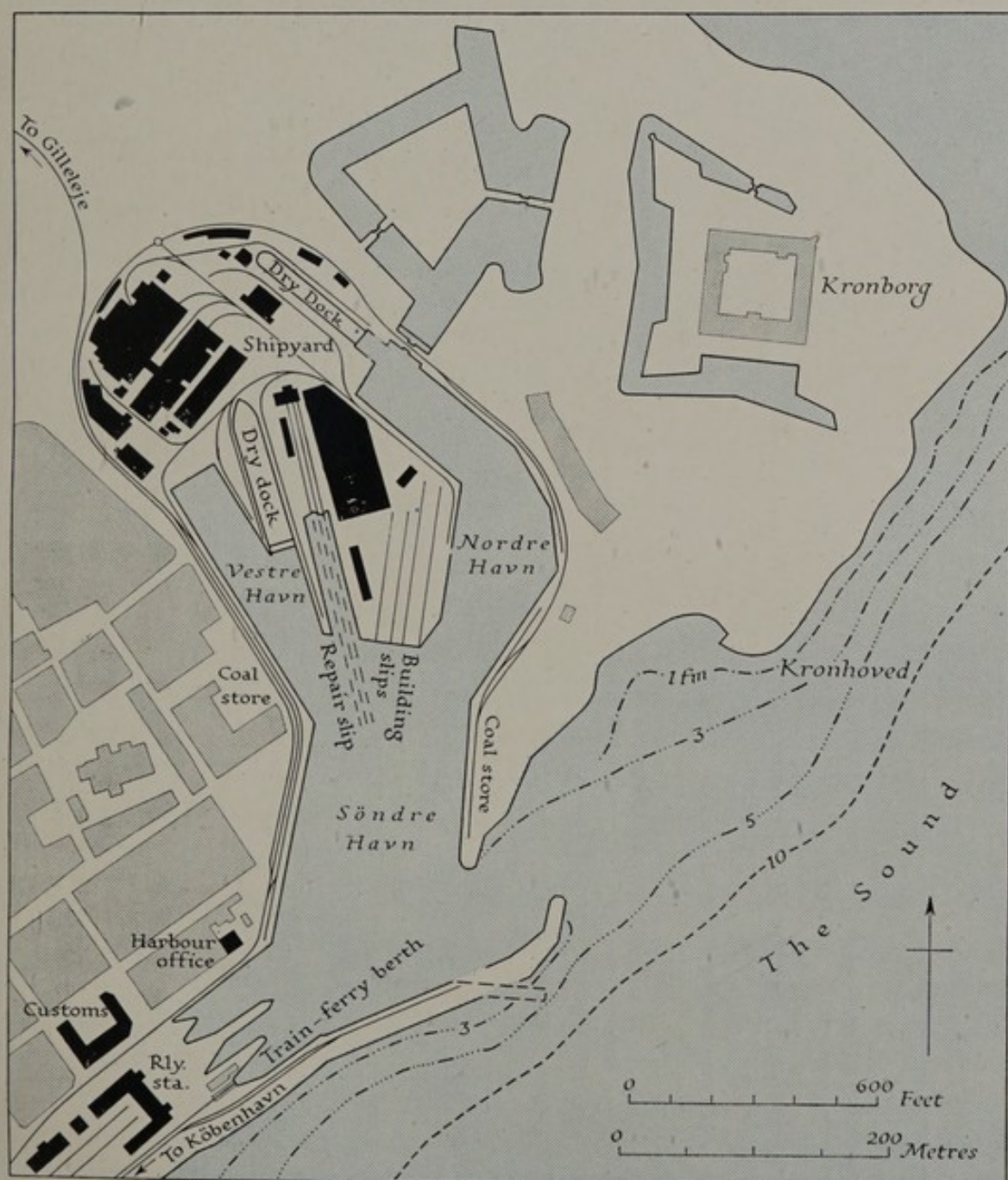


Fig. 107. The port of Helsingør (Elsinore)

The mole which flanks the entrance to the harbour on the south seemed to be in process of removal, and a new construction which would enlarge the entrance appeared to be under construction, during the summer of 1943.

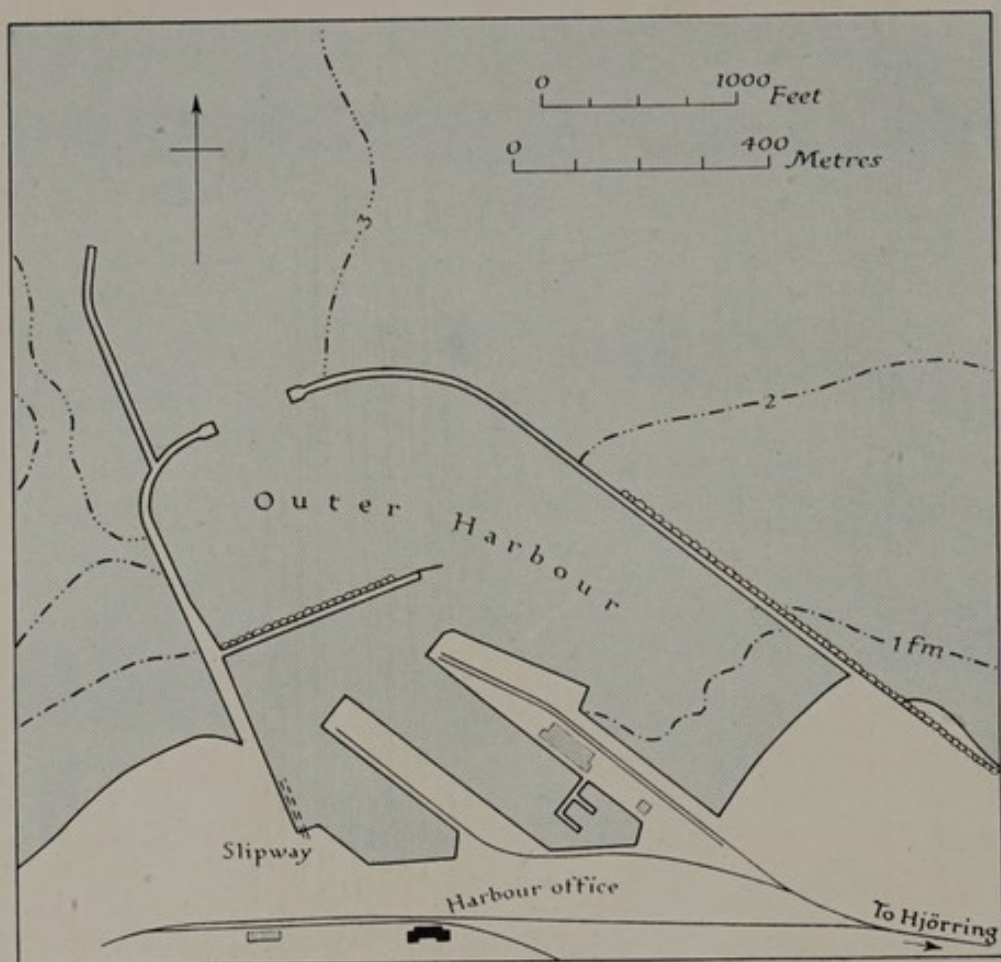


Fig. 108. The port of Hirtshals

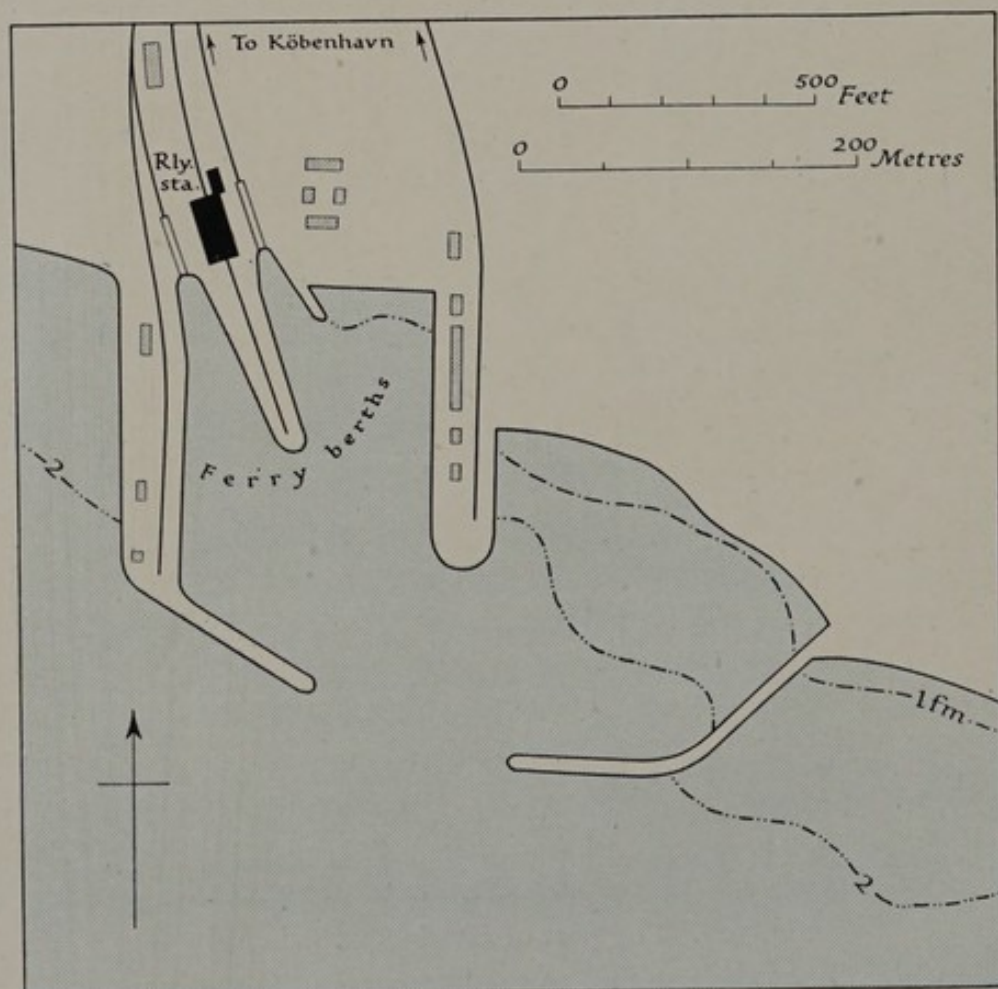


Fig. 109. The port of Gedser

and cement, and 3,000 tons of timber, all from Danish ports, were the chief other imports apart from general goods and unspecified bulk goods.

Exports consisted of 19,000 tons of grain consigned almost entirely to Danish ports and 3,000 tons of feeding stuffs distributed to Danish ports. The bulk of the remainder was classed as general goods consigned to home ports.

Industries

Nyköbing manufactures electrical motors and dynamos, wood-working machinery and wood-ware, and has numerous food industries such as flour milling, canning and packing of a large range of meats and meat products, and the preparation of dairy produce, margarine and condensed milk. On the southern margins of the town is a sugar factory and on the close north of the town is a tile works.

Communications

The arterial road and single-track railway from Gedser pass through the town and give communication across the Storström bridge with Sjælland and Köbenhavn. The single-track railway and the main road from Stubbeköbing to Nakskov, crosses Guldborg Sound at Nyköping.

HELSINGÖR (ELSINORE)

56° 02' N, 12° 37' E. Population 17,140 in 1935

Helsingör lies on the north-easternmost part of Sjælland and adjacent to the narrowest part of the Sound which separates Denmark and Sweden. The Sound is rather less than 5 km. wide at this point. Strategically, Helsingör possessed great potential importance since it could control the passage of the Sound, and it was after the sea route round the Skaw came into common use that the town developed. In 1429 the Sound dues were enforced and a castle, called Krogen, was built to enforce the payment of the dues and to serve as a royal residence and fortress. In 1533 this castle was partly destroyed, and between 1574 and 1585 Frederick II built the present castle of Kronborg. Since the decline of Danish naval power and the abolition of the Sound dues (1857), Helsingör has lost its former importance although its commerce was never large. It is now important chiefly as the ferry port for the shortest crossing to Sweden. The modern

harbour, which is state-owned, has no natural advantages and was built during the latter half of the nineteenth century. In 1882 a shipyard was established and now employs over 2,000 people.

Approach and Access

The port is approached from the Sound and entrance is complicated by currents. The north-going current is dominant and sets from the head of the south breakwater towards the shore west of Kronhoved and then round Kronhoved and Kronborg Pynt, at the same time forming an eddy which sets westward along the shore and turns southwards towards the harbour entrance. The south-going current sets from Kronborg Pynt along the shore and across the entrance to the port.

The entrance to the port is between the south point of the headland on which Kronborg stands, and a breakwater mole which projects north-east. The entrance is about 63 m. (205 ft.) wide and 8 m. (26½ ft.) deep and this depth occurs over the turning basin in the centre of Søndre Havn. In the summer of 1943 work was in progress, apparently designed to enlarge the entrance by removing a part of the breakwater mole and constructing a new end farther south (see Fig. 107). The harbour is about 120 m. (400 ft.) wide in its widest part.

The port has a water area of 7 ha. (17 acres) and some 1,675 m. (5,500 ft.) of quayage of which 745 m. (2,450 ft.) has depths of 7·8–8 m. (25½–26½ ft.) alongside and 930 m. (3,050 ft.) has depths of 6·3–6·9 m. (20½–22½ ft.). The quays are 1·6–2·1 m. (5¼–7 ft.) above mean water level. The difference between M.H.W. and M.L.W. is small, but winds from between west-north-west and north raise the water level, while gales from between east-south-east and south lower it.

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 107, Plates 53, 89)

The port consists of three basins, Søndre Havn, Vestre Havn and Nordre Havn. *Søndre Havn* lies ahead of the entrance to the port and has coaling quays on its east and west sides with depths of 8 m. (26½ ft.) and 7·8 m. (25½ ft.) respectively alongside. The south part of this basin is the ferry harbour. In its south-east angle, between the breakwater mole and a short quay lying parallel to it, is the berth of the train ferry to Hälsingborg in Sweden. In the south-west angle of the ferry harbour was the berth of the car ferry to Hälsingborg



Plate 88. The port of Sønderborg, from the south

In the foreground is the castle, at the entrance to the southern harbour. A part of the main quay of the north harbour can be seen beyond the bridge which joins the island of Als, on which Sønderborg stands, to Jylland. For details see p. 449.



Plate 89. Söndre Havn, Helsingör (Elsinore)

The view was taken looking north. One of the train ferries to Hälsingborg in Sweden, on the opposite side of the Sound, is entering its berth; another is approaching the harbour entrance. The rail tracks on the deck are shown clearly. Kronborg, which can be seen in the background, is famous as the setting of Shakespeare's *Hamlet*; to the left of it is a part of the shipyard (see Plate 53) and to the right are the coaling berth and crane.



Plate 90. The Sound at Helsingör (Elsinore)

The view was taken from the ramparts of Kronborg. In the distance is the Swedish coast. Kronborg was built to guard the entrance to the Sound and to collect the dues which Denmark formerly levied on all shipping passing through the Sound.

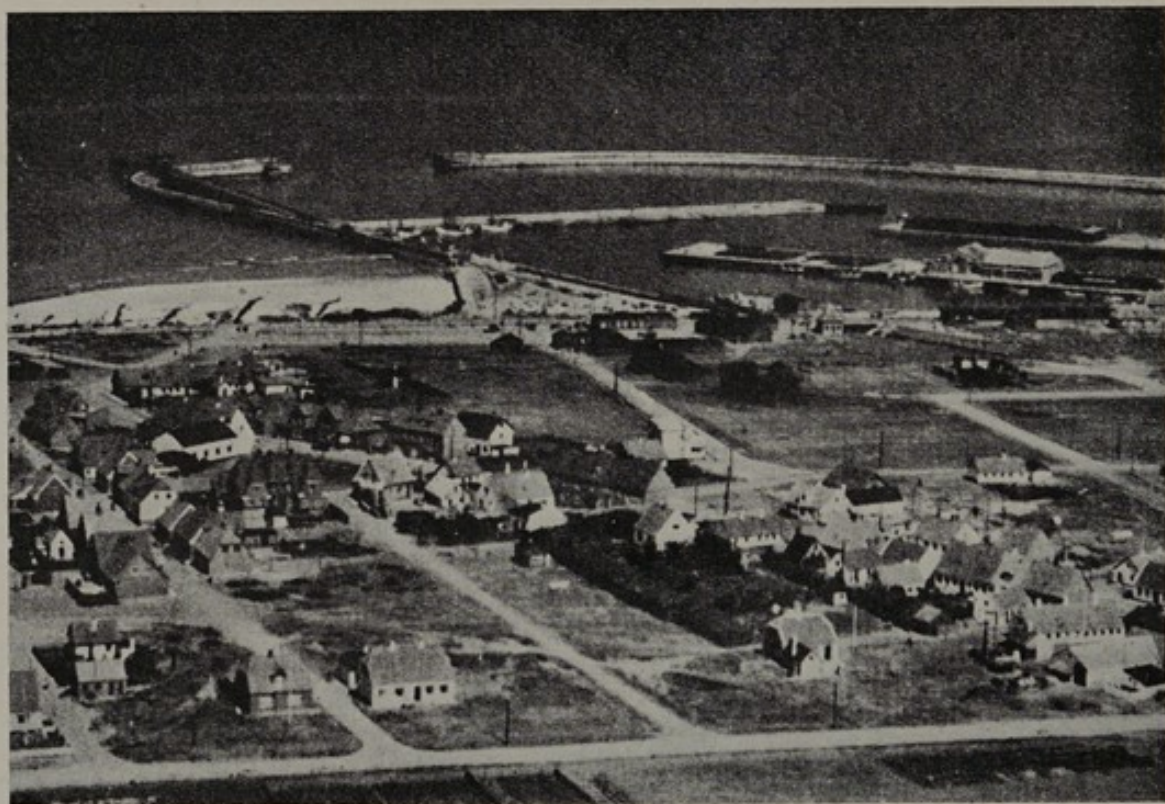


Plate 91. The port of Hirtshals

The view shows the two basins and the outer harbour. A port with a similar layout, but slightly larger, was under construction at Hanstholm in 1940, when work ceased. The western outer breakwater and about 100 yards of the eastern outer breakwater had been completed. The foundations of the western mole and over a half of those of the interior breakwater had also been laid.

and in this ferry harbour the depths were 6.9–7.8 m. ($22\frac{1}{2}$ – $25\frac{1}{2}$ ft.). Since 1942 work has been proceeding on two new train-ferry berths alongside the original one and in the spring of 1943 work was well advanced. The narrow part of the central mole is about 55 m. (180 ft.) long.

The north part of Söndre Havn gives access to both Vestre Havn and Nordre Havn which lie on each side of an area occupied mainly by the repair slip and building slips of the shipyard which lies close north-west of the two basins. *Vestre Havn* is a long rectangular basin with depths of 6.3 m. ($20\frac{1}{2}$ ft.) and a quay on its west and north-east sides; the remainder of the east side is occupied by a dry dock and repair slips. *Nordre Havn* lies south-west to north-east in its southern part and south-east to north-west in its northern half and has depths of 6.6–7.8 m. ($21\frac{1}{2}$ – $25\frac{1}{2}$ ft.) alongside its quays. At its north-east end is a dry dock.

Outside the port and on the coast of the Sound about $\frac{1}{2}$ km. (550 yards) north of Kronborg is a yacht and fishing harbour which is enclosed by two moles and is subdivided within to form three basins. Depths in this harbour, outside the shore banks, are 2.5–3.7 m. (8–12 ft.).

Port Facilities

The shipyard can carry out all repairs to hulls and machinery. It has one patent slip and two dry docks with the following dimensions:

Patent slip. Extreme length 85 m. (280 ft.). Draught on keel blocks 3.6 m. (12 ft.) forward and aft; lifting power 2,000 tons.

Dry docks	Extreme length		Breadth at entrance		Depth on sill	
	m.	ft.	m.	ft.	m.	ft.
1	104	340	13.2	$43\frac{1}{4}$	4.2	$13\frac{3}{4}$
2	116	380	16.6	$54\frac{1}{2}$	5.5	18

The shipyard has sheer-legs to lift 80 and 45 tons, and the port has one crane to lift 10 tons, one to lift 4 tons and three electric cranes for bunker coals; ships can be bunkered at the rate of about 50 tons an hour. Railways run on all quays.

Trade

The trade of Helsingör is small. Ships entering with cargo from home ports in 1938 numbered 193 and totalled 7,642 register tons. From foreign ports came 141 ships of 34,734 register tons and these

carried 84% of the 80,000 tons of cargo discharged. Fifty thousand tons of the incoming cargoes consisted of coal and coke and the remainder mainly of stone, lime and cement from home ports and bulk cargoes from abroad. Outgoing cargoes weighed only 2,708 tons and were carried in thirty-one ships totalling some 2,000 register tons. Nearly two-thirds of the weight of cargoes loaded was consigned to foreign ports.

Forty-six thousand tons of cargo were discharged, and 42,000 tons were loaded, by the ferries plying between Helsingör and Hälsingborg.

Industries

Helsingör is concerned mainly with shipbuilding (see p. 285) and the ferry traffic to Sweden, apart from general market-town activities such as brewing, milling, and the preparation and packing of animal and dairy produce. It has two textile factories, one foundry, and brickworks and timber yards.

Communications

A double-track electrified railway runs to Köbenhavn. Single-track railways run to Frederiksværk, Tisvilde and Gilleleje. The line to Frederiksværk joins another double-track railway to Köbenhavn at Hilleröd. A train ferry and two car ferries cross the Sound to Hälsingborg in Sweden (see p. 479).

In addition to the famous *Strandvej* or coast road, an arterial road runs slightly inland from the coast to Köbenhavn. Another arterial road runs west to Hilleröd which is the main focus of roads in north-east Sjælland.

HIRTSHALS

57° 36' N, 9° 58' E. Population 1,438 in 1935

Hirtshals is at the western end of Tannis Bugt which lies on the north-west side of the northern point of Jylland. The harbour has been developed recently from a fishing harbour in order to provide a port, which should be less impeded by ice, for the traffic with the west coast of Norway.

Approach and Access

The port is approached direct from the North Sea and there is no bar in front of the entrance. The harbour is enclosed by two break-

waters between the ends of which is an entrance about 80 m. (260 ft.) wide and 7 m. ($22\frac{3}{4}$ ft.) deep. The difference between M.H.W. and M.L.W. is normally 0.25 m. ($\frac{3}{4}$ ft.), but westerly gales may raise the water level by 1.5 m. (5 ft.) and easterly gales may lower it by 1 m. ($3\frac{1}{4}$ ft.).

Detailed Description (Fig. 108, Plate 91)

The port consists of an outer harbour and two basins flanked by quays. The passage to the basins is separated from the outer harbour by an interior breakwater. This passage has a minimum width of about 60 m. (195 ft.) and a depth of 5.5 m. (18 ft.).

Depths in the *outer harbour* are between 6 and 6.5 m. ($19\frac{1}{2}$ – $21\frac{1}{4}$ ft.) but they decrease to 4 m. (13 ft.) towards the inner sides of the breakwaters and to 2 m. ($6\frac{1}{2}$ ft.) on the west side of the interior breakwater. Eastwards to the shore the water shoals to less than 1 m. (3 ft.).

The *eastern basin* is separated from the outer harbour by a mole which has quays on its north and south sides. The depth alongside its north side is 6 m. ($19\frac{1}{2}$ ft.); along its south side the depth is 3.8 m. ($12\frac{1}{4}$ ft.). Alongside the quays on the north side of the mole which separates this basin from the western basin the depths are 5 m. ($16\frac{1}{4}$ ft.). The innermost part of the basin is marked off by jetties and is used as a boat harbour.

The *western basin* has quays on its north side only. Here the depth is 5 m. ($16\frac{1}{4}$ ft.), but elsewhere in the basin it is between 3.5 and 4 m. ($11\frac{1}{4}$ –13 ft.). In the south-west angle of the basin is a slipway.

Port Facilities

The slipway can take ships of up to 150 tons. There is a workshop for repairing motor-boats. Railways run along the middle of the north mole and along the quays on the south side of the south mole.

Trade

The trade of Hirtshals is, on account of its somewhat remote position, mainly with foreign lands, especially Norway. The goods are mainly imported coal and fertilizer.

Industries

The activities of Hirtshals are confined almost entirely to shipping, fishing and fish packing.

Communications

A single-track railway and an arterial road run south to Hjörning whence there are communications to Frederikshavn, Aalborg and all the chief centres in north Jylland. A car ferry runs to Kristiansand in Norway.

GEDSER

54° 34' N, 11° 56' E. Population 1,094 in 1935

Gedser, at the south end of the island of Falster, is the terminus of the train-ferry service to Warnemünde in Germany (see p. 480). The site of the port was chosen on account of its proximity to Germany rather than for any natural advantages which it offered to port construction. It lies on low peninsula, much of the interior of which is below sea level and is wet and boggy, while in front of the coast is a line of shoals with small depths.

Approach and Access

The port can be approached from seaward from the south or from the south-east. From the south a dredged channel, 150 m. (492 ft.) wide and 6.3 m. (20½ ft.) deep, leads across the shoals into the harbour. From the south-east the approach is along a narrow channel with steep-to sides, Kroghage Dyb, lying between the shoals and the shore banks; this channel has a least depth of 4 m. (13 ft.). The harbour is enclosed by a mole and a breakwater and has an entrance some 120 m. (390 ft.) wide and with a depth of 6 m. (19½ ft.) over a width of about 65 m. (210 ft.).

The harbour is about 250 m. (820 ft.) long and 70 m. (230 ft.) wide with 315 m. (1,030 ft.) of quays, alongside which the depths range from 4.3 to 6 m. (14–19½ ft.). The height of the quays above water level is 2.5 m. (8¼ ft.). The tidal range is imperceptible, but north-easterly winds may raise the water level by 1.8 m. (6 ft.) and south-westerly winds may lower it by 1.2 m. (4 ft.).

For Ice Conditions see Appendix IV.

Detailed Description (Fig. 109)

The port consists of a main harbour, lying between a western mole and a short interior mole, and a water area lying between the interior mole and the eastern breakwater. The main harbour is occupied

largely by two train-ferry berths with depths of 6 m. (19½ ft.), but there are quays with depths of 4.3–5 m. (14–16¼ ft.) along the inner side of the western mole and the west side of the interior mole. The water area east of the interior mole has depths of 4–5 m. (13–16¼ ft.) in its outer part but shoals gradually to the shore.

Port Facilities

The port has a coaling crane and another crane to lift 4 tons. Railways run on the western mole, the interior mole and the mole between the train-ferry berths. There are no facilities for repairing either ships or machinery.

Trade

The trade of Gedser in 1938 was entirely with foreign ports from which sixteen ships of 9,000 register tons brought 22,000 tons of cargo, consisting entirely of coal and coke except for 700 tons of grain. In addition, fifty ships of 13,000 register tons, sailing from Danish ports, called at Gedser and took on board cargoes of live animals weighing some 3,000 tons and consigned abroad, probably to Germany. The ships which entered from foreign ports left without loading any cargo.

The ferry service brought 193,000 tons of cargo into the port and loaded 68,000 tons.

Communications

An arterial road and a single-track railway lead north, through Nykøbing and across the Storström bridge, to Sjælland and København. Train-ferry services run to Warnemünde in Germany.

Chapter XVIII

ROADS

The Road System: Bridges: Ferries: Road Transport

Denmark presents to road building no barriers of high hills or of hard rocks. Although road-making material was not always readily available in this land of soft young rocks and glacial clays and gravels, problems of road engineering were few. The chief roads thus have long straight stretches and are undulating in profile with no long steep gradients, although sharp slopes occasionally occur in the regions of morainic hills. On account of the absence of long steep slopes and the moderate precipitations, either as rain or snow, roads do not become washed out or blocked by snow although drifts may cause hindrance occasionally. The road communications are interrupted by the fjords which penetrate the land and by the straits which separate the islands, so that long bridges and car ferries are characteristic of the country.

THE ROAD SYSTEM

The Danish roads are surface treated and are well kept. On the principal roads the surfaces are of well-laid paving, macadam or concrete. The secondary roads are usually gravelled and the surface, although sometimes loose, is usually good. The secondary roads are sometimes rather narrow, especially in south-east Jylland where they have numerous turnings and are generally bordered by hedges. The rule of the road is: Drive on the right, give way on the right, overtake on the left.

Denmark had 7,867 km. of main roads and some 44,000 km. of by-roads in April 1939. Two-fifths of the total length of the main roads are constructed of surface-dressed macadam, 35 % is of water-bound macadam, 10 % is stone-paved, 4 % is built of concrete or of asphalt, and the remainder consists mainly of thin surfaces of various kinds. Four-fifths of the paved roads are in Jylland, especially in Ringkøbing Amt which has a third of the total length of such roads in Denmark, while over a half of the concrete roads are in Sjælland and the remainder are mainly in the counties of

Haderslev, Aarhus, Vejle and Odense. The distribution of road surfaces by counties is illustrated in Fig. 110.

South-west Jylland has large areas of marsh and the roads follow the lines of firm ground. In west Jylland the roads cross flat, mono-

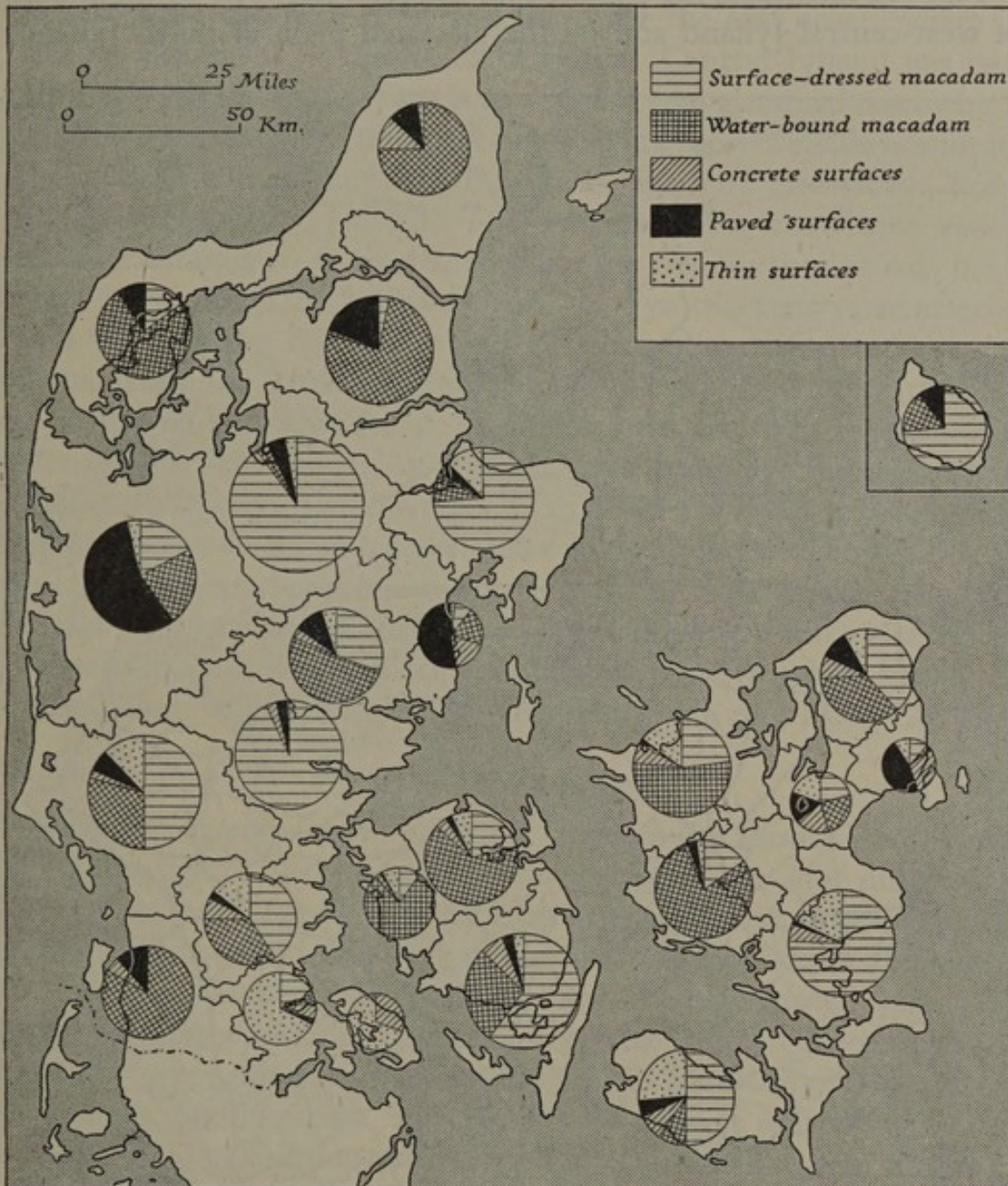


Fig. 110. Road surfaces in Denmark, by counties

Based on statistics in *Vej-tidsskrift* (Köbenhavn, 1939).

tonous, heathland on which plantations and shelter belts are common, but otherwise the country is open and has few hedges. The non-metalled roads are dry and dusty in summer, but rain converts them into soft muddy tracks. In east Jylland and the islands the road

profiles are more undulating, hedges are much more common, and short steep gradients and sharp curves sometimes occur. For example, the road from Kolding to the Little Belt bridge is winding and rather hilly.

Fig. 111 illustrates the openness of the road network on the heaths of west-central Jylland and on the glaciated plain of north Jylland,

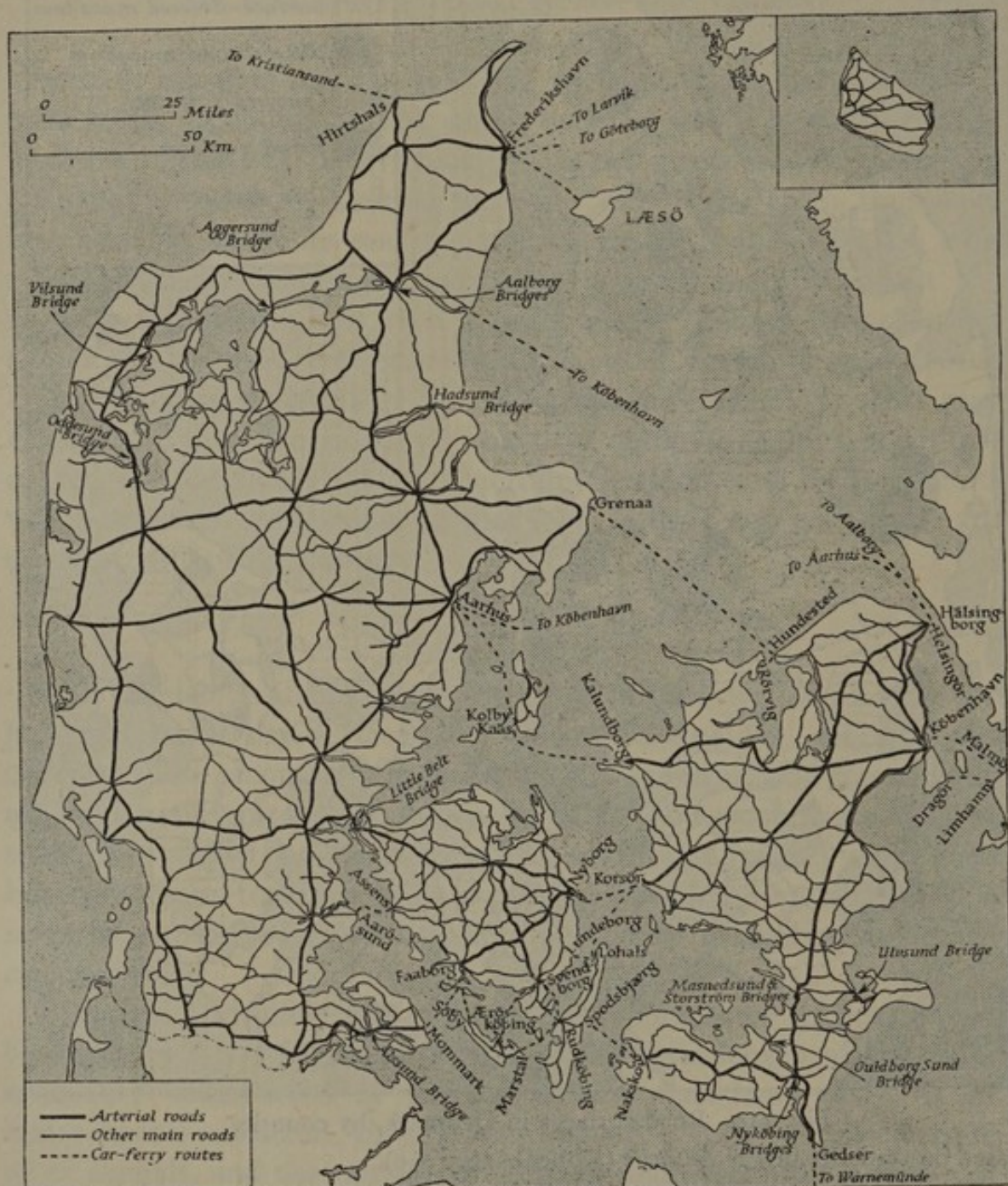


Fig. 111. The road system, chief bridges and car-ferry routes in Denmark Based on *Geodætisk Institut's* 1 : 520,000 map (København, 1937) with later additions.

The numbers of the arterial roads are printed on the folder-map at the end of this volume.

while the richer and more densely populated lands of east Jylland and the islands, with their focal towns and ports, require a denser network to serve the ports and their hinterlands alike.

The arterial roads are numbered from 1 to 18 and are shown in Fig. 111. In Jylland the essential pattern consists of two coast roads, one following the west coast and the other the east coast, where it links up the towns at the heads of fjords. Central Jylland has two additional arterial roads. One is an accessory longitudinal road which runs roughly parallel to the coast roads where the peninsula is widest. The other is a diagonal road connecting Vejle and Holstebro. Four arterial roads cross Jylland. The two southern transverse roads continue across Fyn to Sjælland, while the two northern roads have direct ferry connexion with Sjælland. In Fyn two transverse arterial roads connect the ferry terminals between it and Sjælland on the one hand and the Little Belt bridge and the Faaborg-Mommark ferry to Jylland on the other hand. A longitudinal arterial road connects Odense and Svendborg. In Sjælland two transverse arterial roads connect Kalundborg and Korsör with Köbenhavn. The road from Korsör also connects with an arterial road from Roskilde to Helsingör which gives ferry communication across the Sound with Sweden. Behind the east coast of Sjælland a longitudinal road links Helsingör, Köbenhavn and Vordingborg and crosses the Storström bridge to Falster where it links with the arterial road which runs along Lolland.

BRIDGES

Until recent years communication between the Danish islands and across the fjords was mainly by ferry. Since the late nineteenth century several large bridges have been built across straits so as to speed up communication and to render transport across the water areas independent of navigational difficulties in winter when ice hindered, and sometimes stopped, communication. Since 1930 an imposing programme of bridge building has been completed, as can be seen in the list on pp. 449-50, which includes only bridges that carry roads. The locations of the chief bridges are shown in Fig. 111.

An ambitious project for road and railway bridges across the Great Belt between Halskov and Knudshoved, and across the Sound between Köbenhavn and Malmö, using the islands of Amager and Salt-holm, was drawn up and published by a group of private firms in Denmark in 1936. Other bridges under consideration were one across Svendborgsund between Fyn and Taasing and another across Siö Sund between Taasing and Langeland.

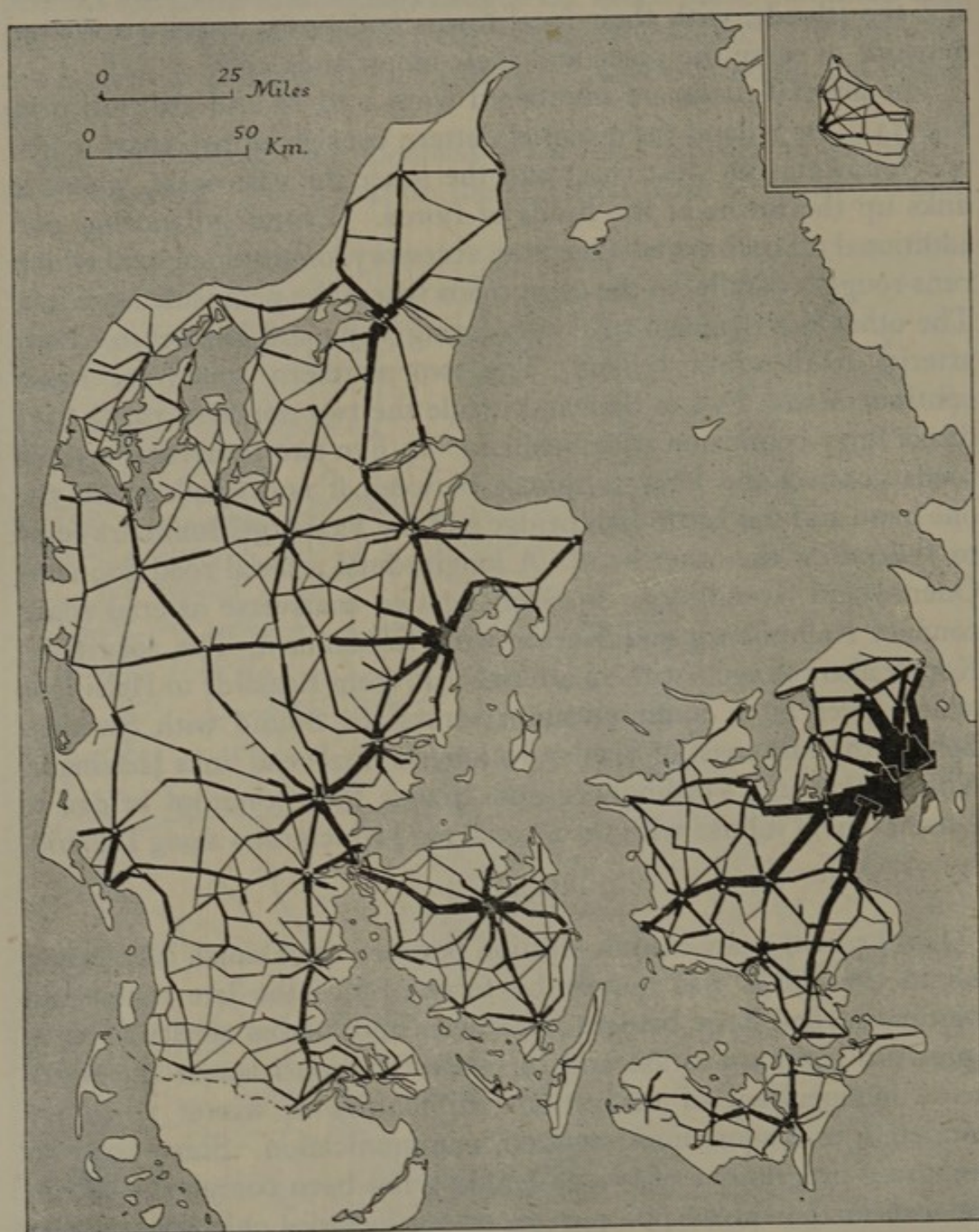


Fig. 112. The volume of traffic on main roads in Denmark

Based on a map prepared by the *Dansk Vejlaboratorium* and published in *Motorveje med Broer over Storebælt og Øresund* (København, 1936).

The map is based on the traffic statistics for 1934 but it serves to show the prevailing volume of traffic on the chief roads. The thickness of line is proportional to the volume of traffic carried.

Road Bridges built in Denmark since 1930

Bridge	Location	Date of opening	Length in metres*	Details
Alssund	Between Jylland and the island of Als at Sønderborg	1930	185	Road and railway bridge. Single-track railway, 5.6 m. carriageway, 2 m. footway. Height above water 7.5 m. Double bascule with free navigable width of 30 m. Width of middle fixed span = 75 m.
Limfjord	Between Aalborg and Nørre-Sundby	1933	400	Road bridge. Six spans and a central swinging span with navigable width of 30 m. Height above water 10 m. under swinging span and 4-8 m. under fixed portions
Guldborgsund	Between Lolland and Falster at Guldborg	1934	c. 150	Three-span ferro-concrete bridge with a central double bascule having navigable width of 30 m. Height above water 4 m.
Little Belt	Between Jylland and Fyn at Snohøj and close west of Middelfart	1935	825	Fixed road and railway bridge. Five-span steel-girder bridge with reinforced concrete piers. Clear head room 33 m. Distance between piers in central and main channel is 210 m. and elsewhere 155 m. Two railway tracks, roadway and footway. Assumed loads: Railway tracks, two 120-ton electric Diesel engines followed by coaches; roadway, a 20-ton steam roller followed by a 20-ton trailer (Plate 93)
Storström	Between Sjælland and Falster from Masnedø to Orehoved	1937	3,211	Fixed plate-girder bridge carrying single-track railway, a concrete carriageway 5.6 m. wide, and an asphalt footway and cycle track 2.5 m. wide. Fifty spans including three central spans of bowstring construction, of which two are used for navigation and have widths of 95 and 125 m. and clear head room of 25-26 m. (Plate 92)

* Lengths do not include approaches and are approximate in some cases.

Road Bridges built in Denmark since 1930 (cont.)

Bridge	Location	Date of opening	Length in metres*	Details
Masnedsund	Between Sjælland and Masnedö, north of above bridge	1937	c. 175	Plate-girder bridge of six spans, including one bascule span, carrying single-track railway, carriageway and footway. Navigational opening 25 m. wide. Clear headroom of 5 m. when bridge is closed (Plate 92)
Oddesund	West part of Limfjord, north of Struer	1938	472	Ten-span plate-girder bridge with bascule span on north side of three central spans which are of bowstring construction. Carries single-track railway, 5.6 m. concrete carriageway and a 2.5 m. asphalt footway and cycle track. Clear headroom when closed, 5 m. Width of bascule span, 30 m. (Plate 94)
Vilsund	Across branch of Limfjord, between Mörs island and north Jylland	1938	c. 500	Five-span bridge with bascule span having navigable width of 30 m.
Aggersund	Central part of Limfjord, north-north-east of Løgstør	1939	240	All ferro-concrete bridge carrying 6 m. carriage-way and 2 m. footway. Two 90 m. spans with a double bascule opening, having a navigable width of 30 m., between them. Clear headroom when closed, 5 m.
Ulvsund	Between Sjælland and Mön at Kalvehave	1943	750	Ferro-concrete road bridge with 6 m. wide carriage-way. Central navigation span of bowstring construction. Height of bridge above water level, 26 m. (Plate 95)

* Lengths do not include approaches and are approximate in some cases.

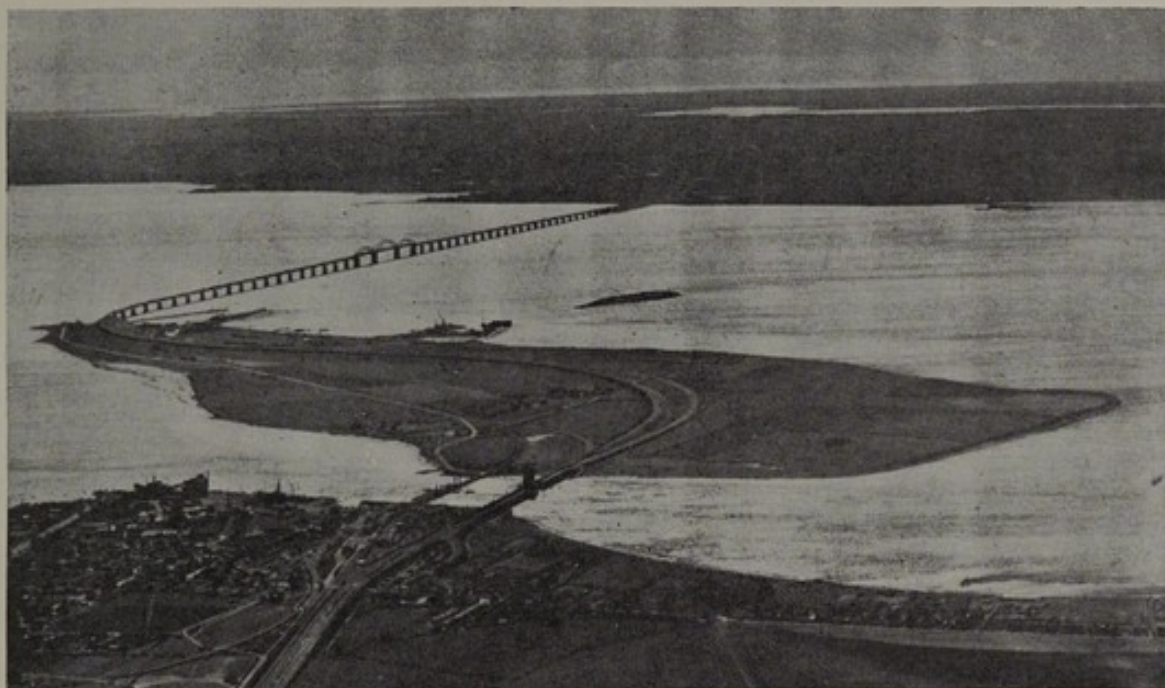


Plate 92. The Storström and Masnedsund bridges

The Masnedsund bridge joins Sjælland (Zealand) to Masnedö and can be seen in the foreground alongside the old bridge which it replaces. The Storström bridge joins Masnedö to Falster (for details see pp. 449 and 450).

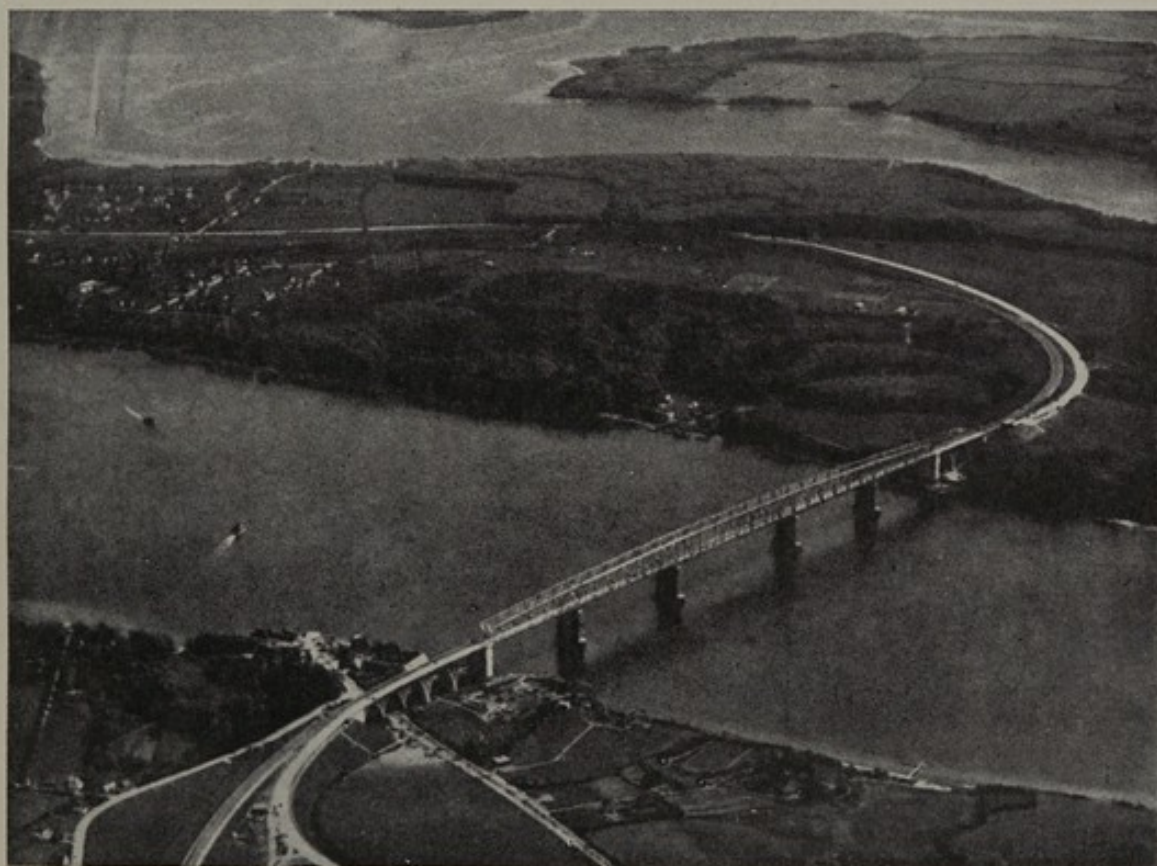


Plate 93. The Little Belt bridge

The bridge is seen from the Jylland (Jutland) side, looking across to Fyn (Fünen). For details see p. 449.



Plate 94. The Oddesund bridge across Limfjorden
For details see p. 450.

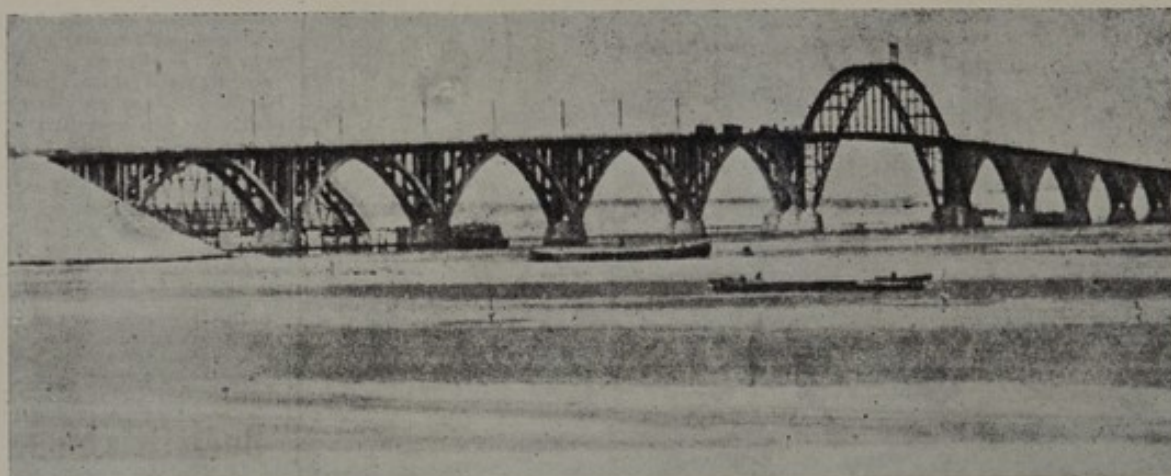


Plate 95. The Ulvsund bridge
For details see p. 450.

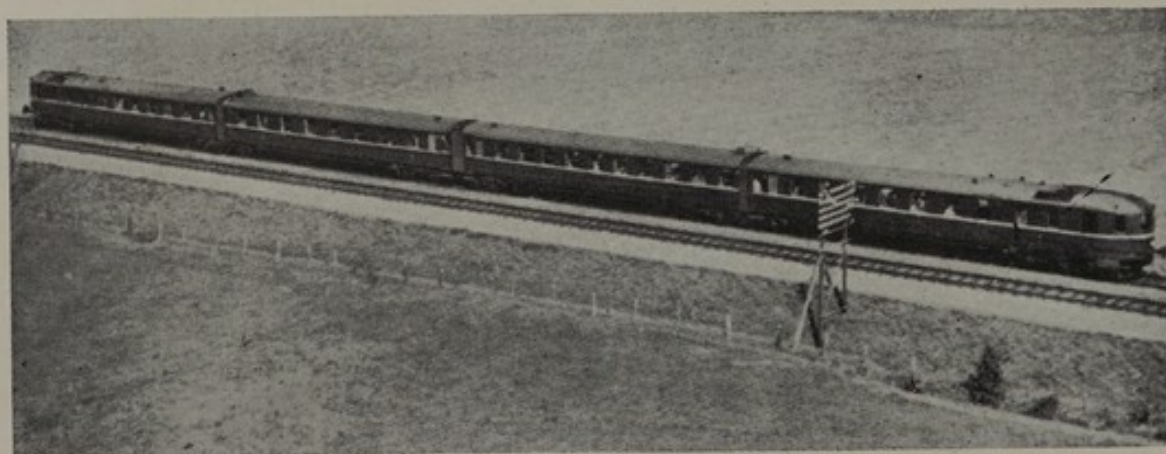


Plate 96. A 'Lyntog'
A high-speed, Diesel-electric train consisting of four articulated coaches. These trains were first introduced in 1935 on the København (Copenhagen)-Esbjærg line and were later extended to other provincial services.

FERRIES

Ferries remain an essential feature of Danish communications. In addition to the train ferries, all of which take cars, a large number of ferries take cars only. The vessels used vary in size from fair-sized ships to small craft which can carry only a few vehicles. Most of these services are operated by private companies. The regular car ferries are listed below and are illustrated on Fig. 111.

Esbjærg-Nordby (Fanö)	Faaborg-Söby (via Lyö and Avernakö)
Limfjord:	Svendborg-Vindeby (Taasing)
Across Næs Sund	Svendborg-Ærösköbing (Ærö)
Across Feggesund	Svendborg-Rudköbing (Langeland)
Nyköbing-Glyngöre	Vemmenæs-Rudköbing (Langeland)
Across Hvalpsund	Rudköbing-Marstal (Ærö)
Hirtshals-Kristiansand (Norway)	Spodsbjærg (Langeland)-Nakskov
Frederikshavn-Larvik (Norway)	Lundeborg-Lohals (Langeland)
Frederikshavn-Göteborg (Sweden)	Lohals-Korsör
Aalborg-Köbenhavn	Nyborg-Korsör
Grenaa-Hundested	Hundested-Rörvig
Aarhus-Köbenhavn	Helsingör-Hälsingborg (Sweden)
Aarhus-Kolby Kaas (Samsö)-Kalund-	Köbenhavn-Malmö (Sweden)
borg	Dragör-Limhamn (Sweden)
Fredericia-Strib	Gedser-Warnemünde (Germany)
Aarösund-Assens	
Mommark-Faaborg	

ROAD TRANSPORT

In 1940 there were in Denmark 118,350 motor cars, 44,200 lorries, 1,800 omnibuses and 30,100 motor cycles. These figures give averages of about 31 motor cars and 8 motor cycles per 10,000 inhabitants. It is estimated that one person in every four has a bicycle. The number of motor vehicles (including motor cycles) per head of population is among the highest in Europe, as the following figures, which are for the year 1938, show:

Number of Inhabitants per Motor Vehicle

U.S.A.	4	France	19	Norway	32	Netherlands	56
New Zealand	6	Britain	20	Belgium	37	Finland	75
Canada	8	Denmark	25	Germany	39	Italy	99
Australia	9	Sweden	29	Switzerland	44	U.S.S.R.	217

Source: *Statistisk Aarbog* 1939, p. 281 (Köbenhavn, 1939).

In a country like Denmark, where distances are small, where there is a close network of good road, and where the population is well distributed over the countryside, road transport by public vehicles

is highly developed. On 15 May 1939 there were 864 omnibus routes in operation. These routes covered a total length of 22,361 km. of road and were served by 1,265 motor vehicles. The details for different parts of the country were:

	No. of routes	No. of buses	Length of routes in km.
Köbenhavn	25	63	269
Remainder of Sjælland ...	166	234	4,832
Lolland-Falster	36	33	750
Fyn	62	94	1,617
Jylland	552	829	14,095
Bornholm	23	12	798

Source, *Statistisk Aarbog* 1939, p. 106 (Köbenhavn, 1939).



Plate 97. The train-ferry *Helsingborg* entering Helsingør (Elsinore) harbour
The ship is of 530 gross tons and has one rail track. She is used for both the train and car ferry services between Helsingør and Hålsingborg.



Plate 98. A Danish main road
Cycle tracks are common on Danish roads. On the newer roads they are specially built and not merely marked off as in this case.

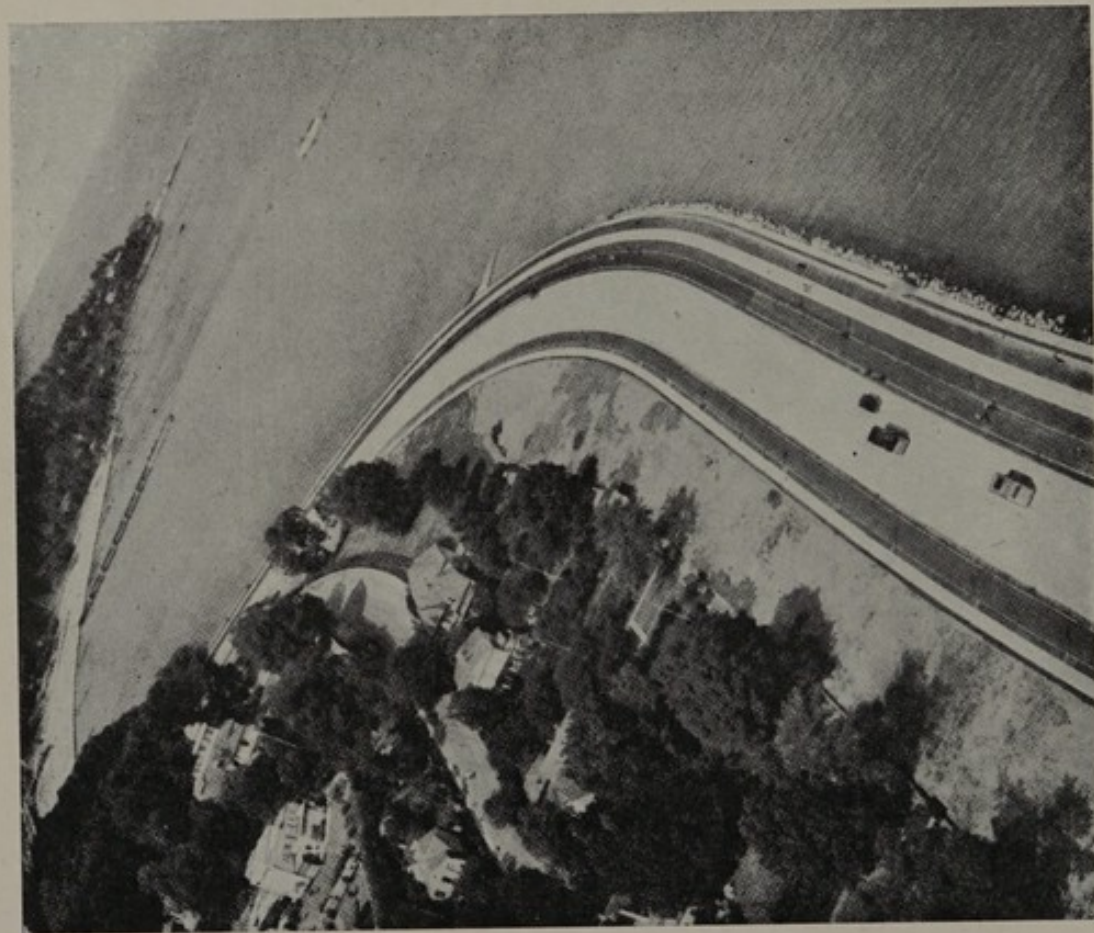


Plate 99. The coast road between København (Copenhagen) and Helsingör (Elsinore)

The *Kystvej* has separate cycle tracks and footways on each side of the carriage way.

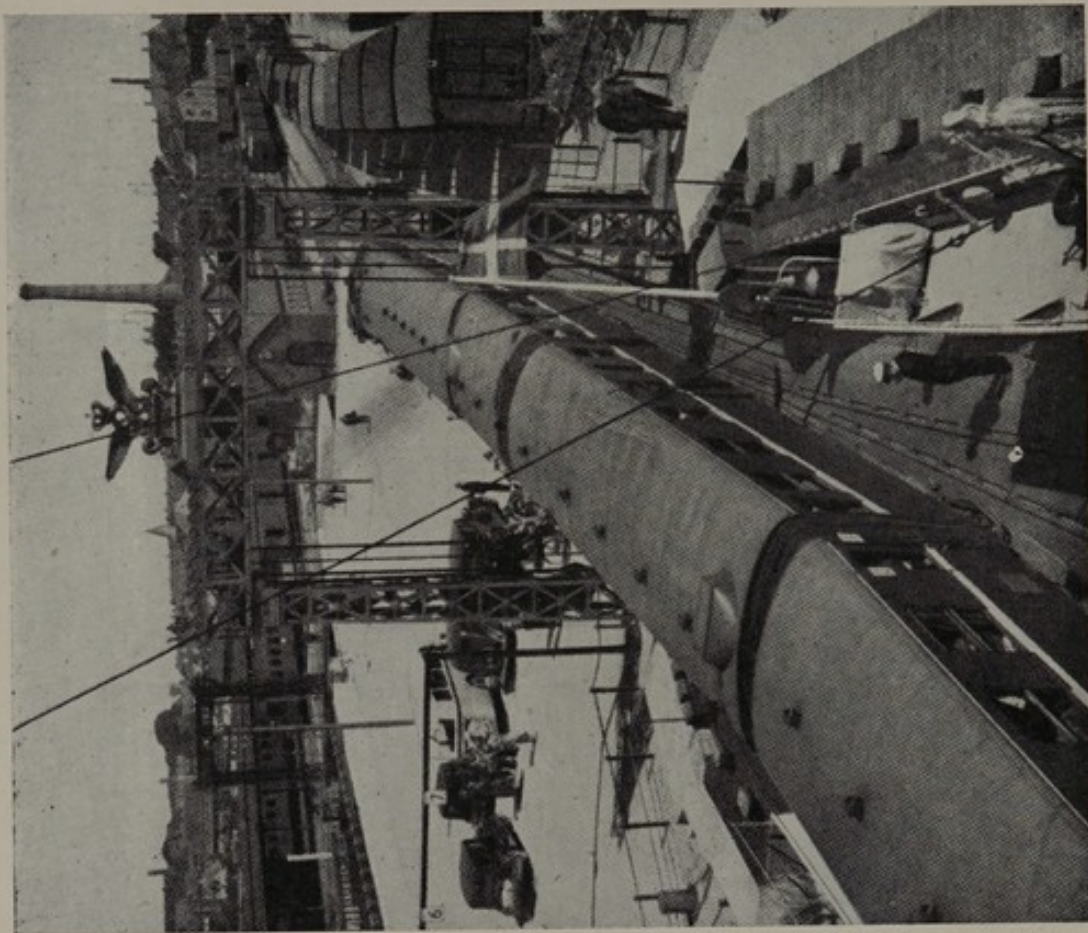


Plate 100. A train-ferry berth at Nyborg

The ship is in the southernmost berth at Nyborg (see Plate 83). The picture shows the ferry terminal which can be raised or lowered according to the level of the water. The train is being shunted on to one of the three tracks which the ship carries.

Chapter XIX

RAILWAYS

Historical Background: State and Private Railways: Geographical Description: Electrified Lines: Traction other than Steam: Locomotive Sheds and Works: Marshalling Yards: Axle-loads and Permissible Speeds: Traffic: Train Ferries: The Railways of Köbenhavn: Works in Progress and Projected

With upwards of 5,000 km. of railway, Denmark is well supplied. The following table compares the relation between railways, area and population in Denmark, its neighbours and Great Britain. The figures relate to the year 1938, since when the closing of several private railways in Denmark had reduced the total length of line to about 4,750 km. at the end of 1941.

Country	Km. of railway	Km. of railway per 1,000 sq. km.	Km. of railway per 1,000 inhabitants
Denmark	5,010	117.7	1.35
Norway	3,998	12.4	1.38
Sweden	16,886	37.4	2.67
Germany	61,328	130.0	0.88
Great Britain	32,316	131.9	0.68

For a predominantly agricultural country, the density of the rail network is considerable. This partly explains the intensity of passenger traffic, which compares favourably with that of neighbouring Scandinavian countries. The absence of mineral wealth, however, and the inconsiderable development of heavy industry render freight traffic small in comparison with those same countries, and almost insignificant when measured alongside that of industrial Britain and Germany.

The table on p. 454 presents some further comparisons, relating as before to the year 1938.

Any statistics which relate to the railways of Denmark as a whole mask the vital difference between the State system and the privately owned lines, for the former comprises all the main lines and so has the heaviest traffic, while the latter are merely branch lines, and though mostly of standard gauge, often have the character of light railways. This difference is illustrated below, p. 464.

The geographical make-up of Denmark gives the railway system certain characteristic features. The first and most obvious of these is the development of train ferries to connect the islands with each

other and with the neighbouring countries. The desire to avoid the loss of time caused by these ferries, however, has led to a second feature, namely, the construction of imposing bridges across the sea and inland water channels. One of these, over the Storström, is the largest bridge in Europe and is an impressive engineering achieve-

	Denmark	Norway	Sweden	Germany	Great Britain
Employees	17,507	17,099	44,468	846,559	581,401
Employees per km. of line	3.5	4.5	2.6	11.9	18.0
Locomotives* per km. of line	0.23	0.15	0.13	0.39	0.67
Coaches per km. of line	0.46	0.29	0.23	1.25	1.39
Goods wagons per km. of line	3.15	3.08	2.88	10.42	41.9
Passengers, number (millions)	61.66	21.61	46.7†	2041.7	1244.1
Passenger-km. per km. of line (thousands)	329	186	291†	999	1055
Freight, million tons	7.55	12.5	21.1†	547.0	351.7
Freight-km. per km. of line (thousands)	130	214	452†	1523	865

* Includes steam, electric and Diesel locomotives, also various forms of railcars.

† State Railways only; details are not available for private lines.

Source: *Statistique internationale des Chemins de Fer* 1938 (Paris 1939).

ment. A third feature is the result of the entire lack of fuel in Denmark. With a free choice between the importation of coal and of oil, it is not surprising that the development of the Diesel engine within the last two decades should have been accompanied by the supersession of the steam locomotive by the heavy oil engine to a greater extent than in any other country in Europe. Fourthly, although the altitudinal range in Denmark is not great, the surface is undulating, and consequently the gradient profiles of the railway lines are more accidented than might at first be expected. This does not mean, however, that steep gradients are common, or indeed present at all. It is seldom that the gradient exceeds 10‰ (1 in 100), and on many sections of line it does not exceed 6.7‰ (1 in 150) (see Fig. 119).

HISTORICAL BACKGROUND

(a) 1847-1867

The first railway line within the present territory of Denmark was opened in 1847, but before this, in 1844-5, several lines had been

constructed in the duchies of Slesvig and Holstein, which at that time formed part of the Danish realm. The chief of these ran from Altona to Kiel, with a branch to Rendsburg.

Despite the comparative flatness of Denmark, the obstacles to railway building were manifold. The physical discontinuities made for short railway lines separated by sea passages, and the frequency of sea inlets meant considerable bridge building. Moreover, the country lacked mineral resources and industrial development which

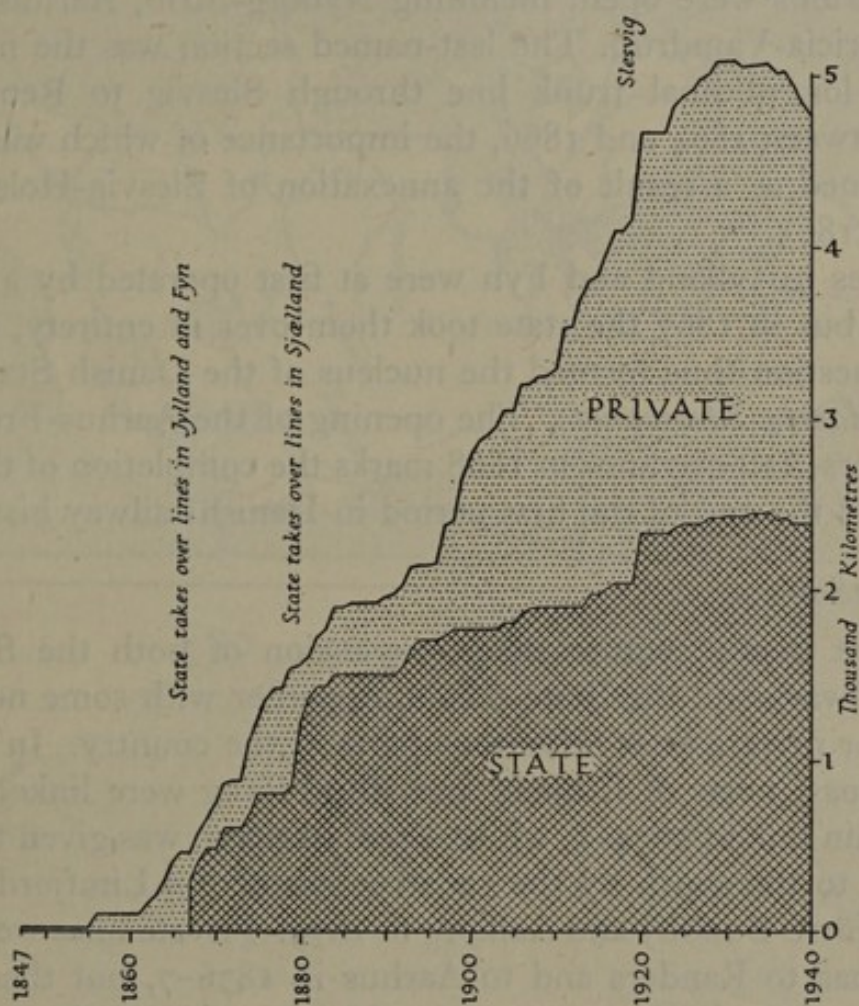


Fig. 113. The growth of the Danish railways

would provide both the materials to build railways and the traffic to ensure their financial success.

The first proposal came in 1840, for a line from Köbenhavn to Roskilde; the Köbenhavn Industrial Union obtained a concession in 1844, and the line was opened by the Sjælland Railway Company (*Sjællandske Jernbaneselskab*) in 1847. Expenditure upon it was on a lavish scale—it was the most costly line ever built in the country—and consequently its financial success was not immediate. Gradually, however, it gathered momentum, and its extension in 1856, with state

financial aid, to Korsör, marks the real beginning of the railway age in Denmark. Public interest was now aroused, and in the early sixties numerous concessions were granted for lines to be built in various parts of the kingdom. On the island of Sjælland, the Sjælland Railway Co.'s line from Köbenhavn via Hilleröd to Helsingör was authorized in 1861 and opened in 1863-4. In 1861, also, concessions were granted to an English firm for the construction, on behalf of the state, of some 500 km. of railways in Jylland and Fyn; by 1867 several sections were open, including Nyborg-Strib, Aarhus-Struer and Fredericia-Vamdrup. The last-named section was the northern end of a longitudinal trunk line through Slesvig to Rendsburg, opened between 1864 and 1866, the importance of which was somewhat lessened as a result of the annexation of Slesvig-Holstein by Prussia in 1865.

The lines in Jylland and Fyn were at first operated by a private company, but in 1867 the state took them over in entirety, and the lines in question thus formed the nucleus of the Danish State Railways (*De danske Statsbaner*). The opening of the Aarhus-Fredericia and Randers-Aalborg lines in 1868 marks the completion of the 1861 scheme and the end of the first period in Danish railway history.

(b) 1868-1880

The next decade witnessed an expansion of both the Sjælland private railways and the State system, together with some new concessions for private lines in various parts of the country. In Jylland the west coast ports of Esbjerg and Ringköbing were linked to the eastern main line in 1874-5, whilst Frederikshavn was given through connexion to the south by the construction of the Limfjord bridge between Nörre-Sundby and Aalborg in 1879. Private lines were built from Grenaa to Randers and to Aarhus in 1876-7, but these were incorporated into the State system in 1881. The Sjælland system was extended by important branches from Roskilde to Kalundborg and to Masnedsund, at the western and southern extremities of the island; the increased traffic thus engendered on the Köbenhavn-Roskilde section necessitated the provision of a second track.

The most noteworthy private lines constructed during this period were the *Østsjællandiske* (East Sjælland), running southwards from Köge; the *Sydfynske* (South Fyn), from Odense to the port of Svendborg; and the Lolland-Falster. The last-named had two lines across the island of Lolland, crossing at Maribo, and a third on the island of Falster. The line in Falster was linked to Lolland by a bridge

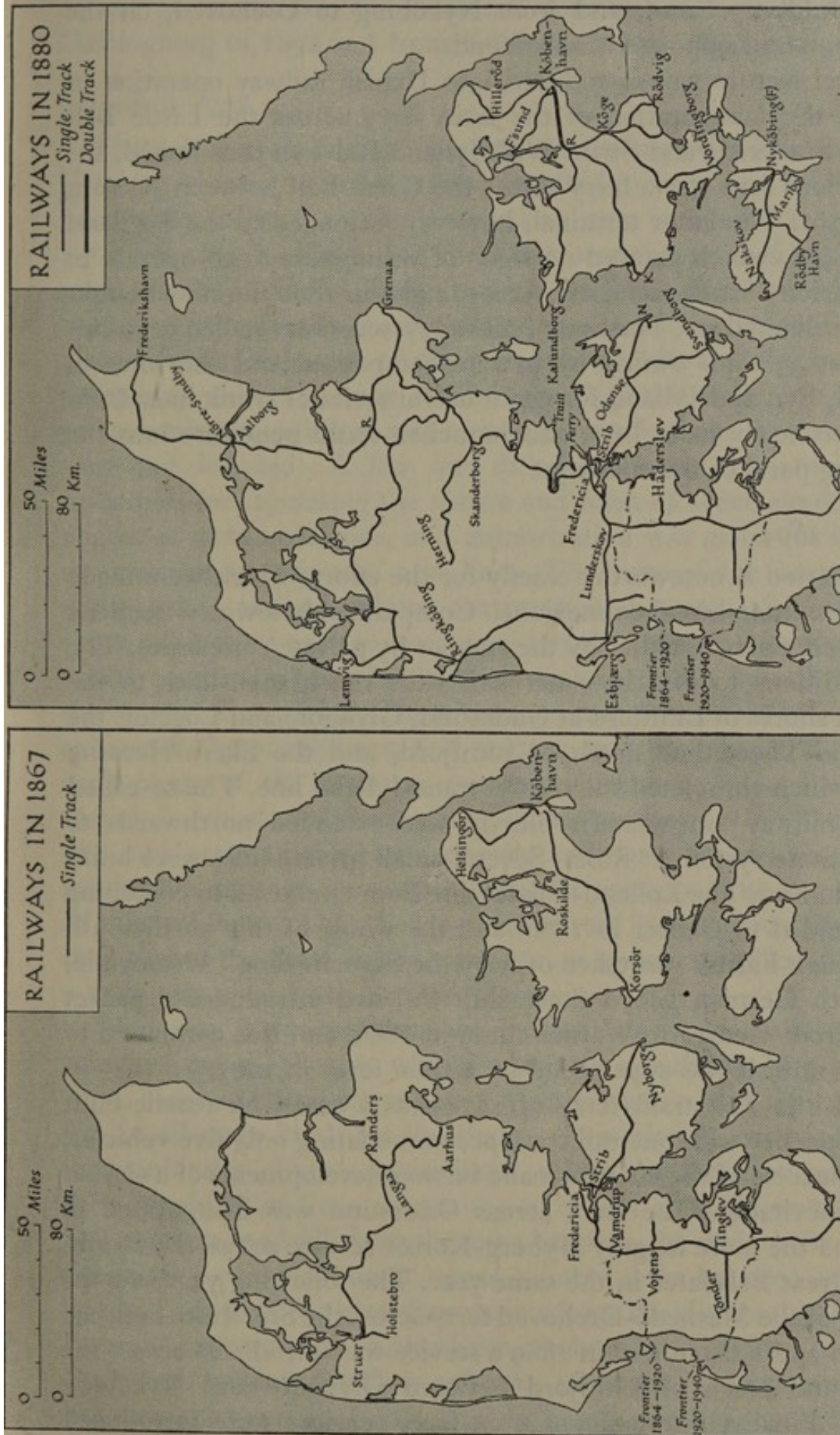


Fig. 114. The railway network in 1867 and in 1880

Based on dates of opening given in Danish State Railways annual statistical volume (*De danske Statsbaner: Beretning om Virksomheden* 1937-8, København, 1938).

Note. In this series of historical maps (Figs. 114-16), in order to avoid congestion, place-names are, in general, included only on their first appearance as termini or junctions.

across Guldborg Sund, and from Nyköbing to Orehoved, on the Storström strait opposite Masnedsund.

A novel feature was introduced into Danish railway operation in 1872 by the inauguration of the train ferry across the Little Belt between Fredericia and Strib. With Jylland and Fyn thus linked, the next obvious step was a ferry across the Great Belt between Nyborg and Korsör. The latter terminal, however, belonged to the Sjælland Railway Co., which showed no signs of willingness to co-operate in the provision of such facilities. Accordingly, in 1880 the state bought up the Sjælland lines. The State Railway system now totalled 1230 km. as against 338 km. owned by private companies, and the lines in Sjælland, Fyn and Jylland formed a useful series of trunk lines from which secondary main lines and branches could penetrate into the remaining parts of the country.

(c) 1881-1894

This period is noteworthy chiefly for the efforts which were made to improve inter-island connexions. Comparatively few new sections of line were opened, either by the state or by private companies. The chief additions to the State network were the branch-lines to the southern shores of Limfjord at Oddesund, Glyngöre and Lögstör, the Oddesund-Tisted line north of Limfjord, and the Skern-Herning section which completed the central trans-Jylland line. The so-called 'marsh railway' in western Slesvig was extended northwards to join the State system at Ribe. Several small private lines were built, notably in Fyn. The Lolland-Falster line from Orehoved to Nyköbing was extended to Gedser in 1886, and the whole of this north-south line through Falster was taken over by the State in 1893. Meanwhile, the North German Lloyd Steamship Co. had introduced a packet service from Gedser to Warnemünde in 1886, and this continued to function until it was superseded by a train ferry in 1903.

The Little Belt train ferry of 1872 was a small Newcastle-built paddle steamer with one rail track accommodating only five vehicles, but the success of the venture made further developments of a similar nature inevitable. The ferry across Oddesund was inaugurated in 1883, and the more lengthy Nyborg-Korsör service across the 26 km. of the Great Belt later in the same year. The following year saw the opening of the Masnedö-Orehoved ferry across the Storström between Sjælland and Falster, and in 1889 a service was introduced across the Sallingsund reach of Limfjord between Glyngöre and Nyköbing (Mors). Finally, international train-ferry services were introduced

across the Sound between Denmark and Sweden, from Helsingör to Hälsingborg in 1892 and from Köbenhavn to Malmö in 1895.

(d) 1894-1920

The year 1894 marked the opening of a new period in Danish railway history. About 42% of the total eventual mileage had by this time been built; railways totalling 2,155 km. were in operation, of which 1,710 km. (80%) comprised the State system and 446 km. (20%) were privately owned. Thenceforward, however, the relation between State and private railways underwent a progressive change (Fig. 113). The slow development of the previous decade and the increasing prosperity of the country resulted in a considerable urge towards private railway building, and numerous applications for concessions were put forward. A law was therefore passed introducing new principles for regulating the nature and form of concessions and the degree of state assistance, and authorization was given for the construction of twenty-nine new lines. The turn of the century thus witnessed a spate of railway construction; between 1897 and 1906 some 900 km. of private lines were opened, scattered over all parts of the country, whilst the State network increased by only 150 km. during the same period. These twenty-nine concessions by no means exhausted the possibilities, and many more were granted during the early years of the century; construction proceeded apace, and a further batch of concessions in 1908, authorizing no less than forty-two new sections of private railway and some State lines as well, resulted in another spurt of building in 1910-11. The net result of all this was that by 1917 the length of private lines was actually greater than that of the State lines—2,055 km. as against 2,048 km. Scarcely a town remained without railway connexion.

With very few exceptions the private lines were constructed on standard gauge, though with a relatively unsubstantial permanent way. None of them covered very great distances, and their function was in all cases local, for the State system already included all the geographically obvious main lines. Almost without exception too they consisted of lines originating at places already served by the State system, and filling in the gaps between the various State lines. Often they provided useful cross-country links between one State line and another. In size they varied from the diminutive Lyngby-Nærum railway near Köbenhavn, only 9 km. in length, to the *Sydfynske* system, totalling 218 km., of which 142 km. were built between 1897 and 1916; the average length was less than 50 km.

State railway building between 1894 and 1920 falls into three phases. Between 1904 and 1908 some important links in central Jylland were completed, which gave focal importance to Herning and facilitated SW-NE communication across the peninsula. There still remained a large gap in south-central Jylland, however, between Herning and the Esbjerg-Fredericia line, and this was remedied between 1914 and 1920 partly by the construction of the Herning-Vejle line and the Bramming-Grindsted-Funder line, and partly also by the opening of the privately owned Vejle-Grindsted, Trolldhede-Kolding and Varde-Grindsted lines. The result of this was to give Grindsted a focal position unrivalled by any other locality in the country, except Odense. The third locality to benefit during this period was København, the railway pattern of which underwent some modification. In 1909, to cater for the increasing freight traffic, a new goods station was opened in the city and linked to the Roskilde main line by a double track passing through the southern outskirts of the urban area, via Valby gas works, to Vigerslev. In 1911 a new central passenger station (*Hovedbanegaard*) was opened, and in 1917 a double-track line was built between this and the eastern station (subsequently known as *Österport*) running for the most part in a shallow tunnel beneath the Voldgade boulevard. At the same time the connexion between the central station and Frederiksberg was severed (see Fig. 124).

Lastly, during this period two more inter-island services were opened. The State Railways started a steamboat service (but not a train ferry) between Kalundborg and Aarhus in 1914, and a private company established a train ferry between Svendborg, on Fyn island, and Rudköbing, on Langeland, about 1911.

(e) 1920-1940

The plebiscite of 1920 gave northern Slesvig to Denmark. In this territory there were about 450 km. of railways, of which about 250 km., representing the two main north-south lines and their branches, were incorporated into the State system whilst the extensive metre-gauge *Haderslev Amts* railway, totalling 202 km., was left as a private undertaking. The latter had been built for the most part between 1899 and 1910.

The post-war boom and depression did not affect Denmark so seriously as it did the industrial countries which had been engaged in the fighting, and railway building suffered but a slight set-back for a few years. Between 1924 and 1929 over 300 km. of private lines

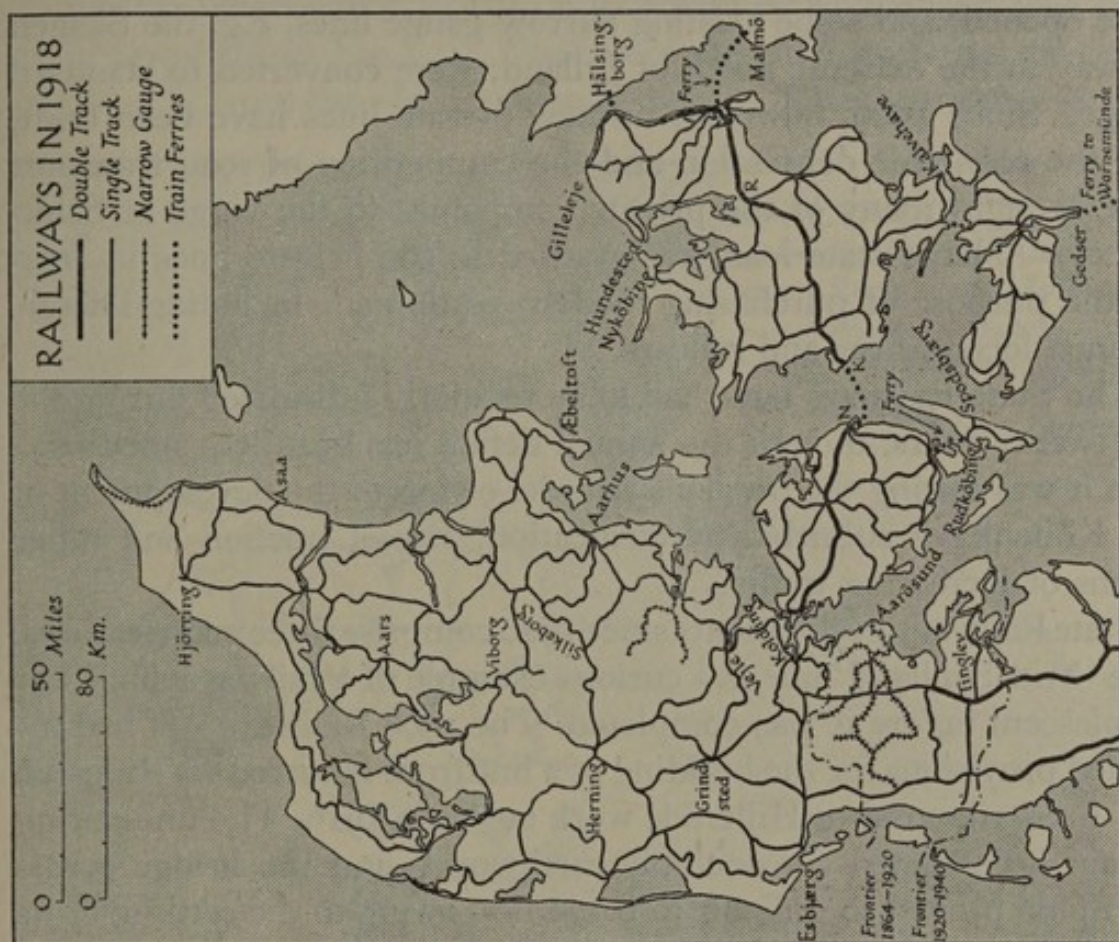
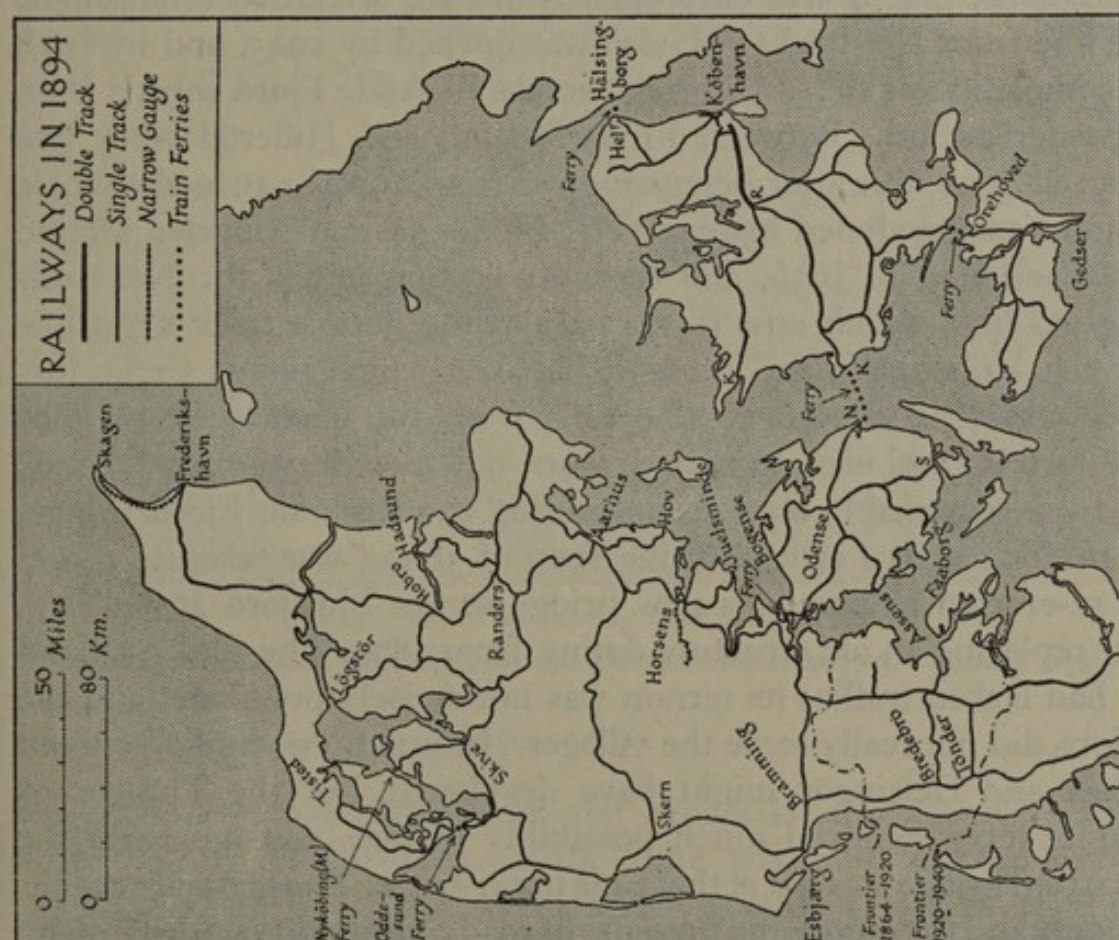


Fig. 115. The railway network in 1894 and in 1918

Based on dates of opening given in Danish State Railways annual statistical volume, op. cit.

were opened, and some existing narrow-gauge lines, e.g. the Skagen railway in the extreme north of Jylland, were converted to standard gauge. Since 1929, however, no new private lines have been built, and the economic depression and the competition of road transport have brought many of the private companies to the verge of bankruptcy. A large state loan was granted to the private lines in 1930 for the purpose of purchasing modern equipment including Diesel-engined locomotives and railcars.

The State Railways have had to be regularly subsidized during the last twenty years, though the annual deficit has been less since 1934 than it was during the previous decade, owing to the development of the Köbenhavn suburban electrification, Diesel traction and other means of increasing traffic.

State Railway developments since 1920 comprise three main features. The 'Mid-Sjælland' line is a curious example of a railway which was obsolescent before it was completed. The 1908 Railways Act had included provisions for the building of a line from Næstved via Ringsted and Frederikssund to Hilleröd; work began in 1916. The undulating terrain necessitated considerable earthworks, and the bridge across the Susaa proved so difficult to construct, owing to the settling of its foundations, that it was only opened in 1924 after two rebuildings. The line from Næstved to Hvalsö was opened by 1925, and by 1928 the completion of the large bridge across Roskilde Fjord carried it on to Frederikssund. Between Frederikssund and Hilleröd work was begun in 1922, but after being stopped from 1927 to 1929 the whole section was abandoned in 1932. The Frederikssund-Ringsted section was abandoned in 1936, and the only section left is the Næstved-Ringsted line, which now forms part of the double-track main line between Köbenhavn and Gedser, between which points traffic formerly travelled via Köge. The rails from the abandoned sections were torn up and used to replace worn-out track in western Jylland; and by a remarkable feat of engineering the Roskilde Fjord bridge, 227 m. long with a central lifting span of 38 m., was taken to pieces and re-erected as part of a new bridge across Limfjord at Aalborg, there replacing an old structure dating from 1879. The mid-Sjælland line had lacked traffic; its terrain was not densely populated and the stations did not really serve the villages. International traffic between Gedser and Helsingör might have developed, but the Trälleborg-Sassnitz ferry removed much possibility of that, and moreover the Storström bridge was not at that time in existence. The general need for economy and the increasing pressure of road competition settled its fate.

Further amelioration of the railway plan of København took place about 1929-30 (see Fig. 124). The last of the old lines across the centre of the city, from the old northern station to Nørrebro with a spur to

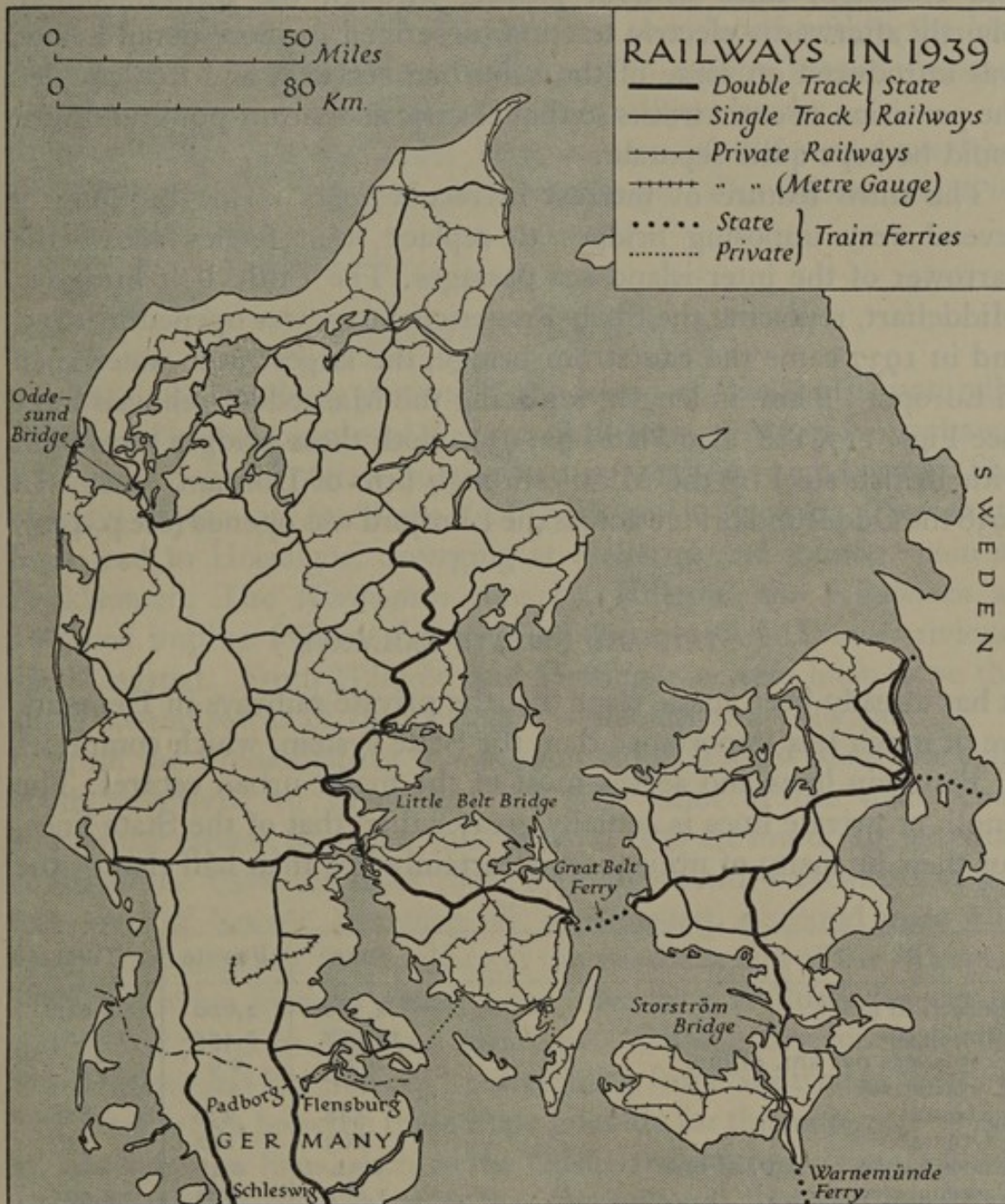


Fig. 116. The railway network in 1939

Based on information contained in the Danish State Railways annual report for 1938-9, *op. cit.*

For additional place-names see Figs. 114-15.

Frederiksberg, was abandoned, and Frederiksberg station became a terminus. A double-track 'girdle' line was built on the western outskirts, from Valby gas works and Vigerslev to a new station at

Nørrebro adjacent to the Slangerup private line terminal, and this girdle was connected by spurs to the Roskilde and Frederikssund lines. Through working thus became possible between the Roskilde and Helsingør lines without passing through the central station. Shortly afterwards electric traction, described in more detail below, was introduced on some of the suburban services, and this entailed the provision of extra tracks so that electric and steam-powered traffic could be kept quite separate.

The third feature of interest in recent years is the building of several very imposing bridges to replace train ferries across the narrower of the inter-island sea passages. The Little Belt bridge at Middelfart, replacing the Strib-Fredericia ferry, was opened in 1935, and in 1937 came the Storström bridge, the largest over-water span in Europe, 3.2 km. in length, replacing the Masnedø-Orehoved ferry (see Figs. 117, 118, also Plates 92, 93). Both these bridges were built with British steel by the Middlesbrough firm of Dorman, Long. In 1938 the Oddesund bridge across the Limfjord was opened (see p. 450).

STATE AND PRIVATE RAILWAYS

It has already been made clear that the private railways in Denmark are of much less importance than the State system, which comprises all the main lines and serves most of the major urban centres. The length of private lines is actually greater than that of the State lines, but their intensity of utilization is certainly less than half that of the

	State	Private	Total
Length in km.	2,390	2,620	5,010
Employees	15,052	2,455	17,507
Employees per km. of line	6.3	0.9	3.5
Locomotives:			
Steam	588	230	818
Others*	165	192	357
Locomotives per km. of line	0.32	0.16	0.23
Passenger coaches	1,882	623	2,505
Coaches per km. of line	0.72	0.24	0.46
Goods wagons	11,462	4,347	15,809
Goods wagons per km. of line	4.67	1.66	3.15
Passengers (millions)	51.01	10.65	61.66
Passenger-km. per km. of line (thousands)	576	72	329
Freight (million tons)	5.13	2.32	7.45
Freight-km. per km. of line (thousands)	243	21	130
No. of snow ploughs	66	117	183

* Includes Diesel and Diesel-electric locomotives, and Diesel, Diesel-electric, petrol-motor and petrol-electric railcars; also electric motor-coaches.

State Railways, and their receipts and expenditure amount to only one-fifth or one-sixth of the corresponding figures for the State system. The private lines are in general in a weak financial position. Many of them are being maintained only by municipal or State subsidies, while some have already been abandoned within the last few years. Of the total share capital of 156 million kroner invested in private railways, the State holds 75.5 million kroner.

The above table illustrates, in a number of different ways, the contrast between State and private railways. The figures relate to the year 1937-8.

GEOGRAPHICAL DESCRIPTION

Sjælland. The railway pattern of the island of Sjælland is naturally dominated by the peripheral position of the capital city of København, from which lines radiate to the north, north-west and west. The railways of the city itself are dealt with below (p. 480). Two State lines lead to Helsingör, diverging at Hellerup and joining again at Snekkersten. The *Nordbanen* runs via Hilleröd, the *Kystbanen* as its name implies follows the coast of the so-called 'Danish riviera' via Rungsted. From Hilleröd and Helsingör private lines serve the small coastal towns of Hundested, Tisvildeleje and Gilleleje.

From the Frederiksberg terminus in København a State line runs north-westwards to Frederikssund. The chief of the main lines leaving the capital, however, runs westwards to the important junction of Roskilde. Here the main route continues south-westwards to the ferry port of Korsör, throwing off, at Ringsted, a second main line which runs south to Vordingborg at the northern end of the Masned-sund-Storström bridge. Other lines, diverging at Roskilde, run to Kalundborg, and to Næstved via Køge. A secondary line links the Vordingborg and Kalundborg lines, running from Næstved to Værslev. The areas left in between these State lines are for the most part served by small private lines, such as the Odsherreds railway from Holbæk to Nyköbing (Sjælland), and the Östsjælland line south-east of Køge.

The island of *Mön* has no railway; it is served by a ferry from Kalvehave, which is linked by private line with Masnedsund.

Falster. The State line which crosses the Storström bridge runs due south through the island via Nyköbing (F.) to Gedser at the southern end, whence a train ferry crosses to Warnemünde in Germany. The only other railway on the island is a private line from

Stubbeköbing, via Nyköbing, to Nysted on Lolland, crossing the Guldborg Sund by a bridge at Nyköbing.

Lolland is served by only private railways, of which the chief runs from Nyköbing (F.) to Nakskov, sending a branch from Maribo southward to the small port of Rødbyhavn.

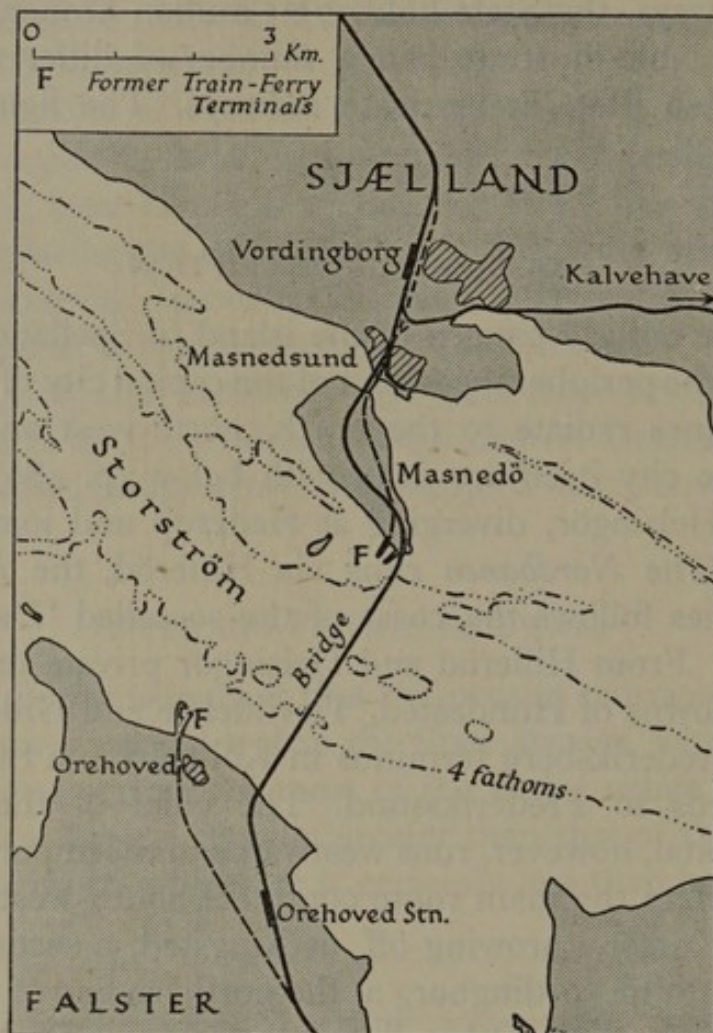


Fig. 117. The location of the Storström bridge

Based on a map in the Danish State Railways annual report for the year 1937-8, op. cit.

The broken lines are abandoned sections. See Plate 92.

Fyn. Fyn is linked to Sjælland by the Korsør-Nyborg train ferry, and the main State line across the island is part of the trunk line linking København with Jylland, running from Nyborg through Odense to the Little Belt bridge just beyond Middelfart. Apart from the Tommerup-Assens branch this main line is the only State railway on the island, the rest of the network, consisting largely of lines radiating from Odense, being privately owned. Three lines serve north

Fyn, running to Middelfart, Bogense and Martofte, whilst the southern half of the island is served by the various lines of the *Sydfynske* railway, the chief terminals of which are the ferry ports of Faaborg and Svendborg.

The ferry from Svendborg leads to Rudkøbing on *Langeland* island, which has a private railway running to Spodsbjærg on the east coast and to Bagenkop at the southern end.

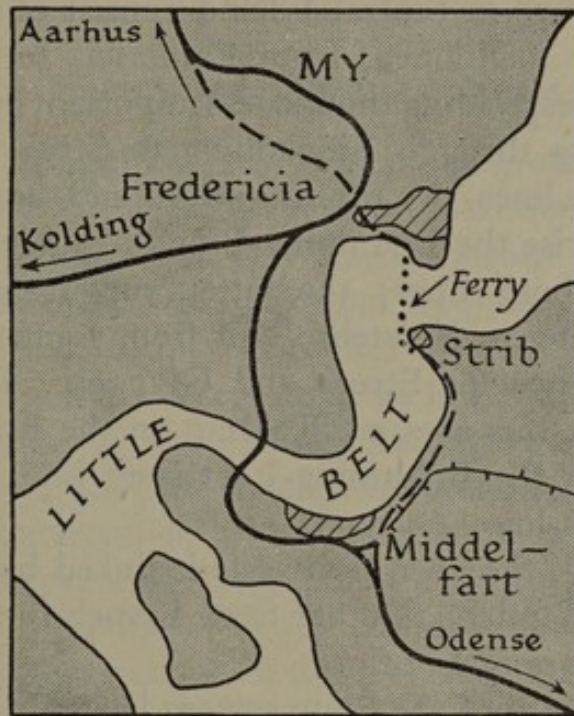


Fig. 118. The location of the Little Belt bridge

Scale 1 : 230,000 (1 cm. = 2.3 km.). Thick lines = State Railways; broken line = abandoned sections; barbed line = private railway to Bogense. MY is the new Fredericia marshalling yard. The ferry still operates for passengers and road vehicles. See also Plate 93.

Jylland. The Little Belt bridge gives connexion between Fyn and the peninsula of Jylland. Fredericia is the point of divergence of the two main lines, one running westwards to the packet port of Esbjerg, the other pursuing a general northerly course, though with numerous windings round the heads of several large coastal indentations, through Vejle, Horsens, Aarhus, Randers and Aalborg to Frederikshavn on the north-east coast.

South of the Esbjerg main line are the two north-south lines through Slesvig, the main international line diverging at Lunderskov and crossing the German frontier at Padborg, running thence to Hamburg, and a secondary line running southwards from Bramming

and crossing the frontier just beyond Tönder, running thence to Husum and Hamburg. Apart from two small branches the only other State line in Slesvig is the transverse route from Tönder via Tinglev and Sønderborg to Mommark on *Als* island, whence a ferry crosses the Little Belt to Faaborg on Fyn. The central portion of the Slesvig isthmus was served by an extensive system of metre-gauge private lines, the *Haderslev Amts* railway, but the whole of this system has now been abandoned.

The State railways in central Jylland consist of the main north-south line already mentioned, from Fredericia to Aalborg, on the eastern side, a corresponding though less important line on the western side, from Esbjerg through Ringköbing to Struer and Oddesund, and four transverse lines, two running SW-NE and the other two NW-SE. The former comprise the Bramming-Brande-Funder-Lavrbjærg and Skern-Herning-Viborg lines; the latter run from Vejle through Brande and Herning to Holstebro and from Langaa to Viborg and Skive, forking thence for Struer and Glyngöre. The chief foci of private railways in this area are Kolding on the Fredericia-Esbjærg line, Grindsted on the Bramming-Lavrbjærg line, and Horsens on the main east coast line.

In north Jylland, the port of Grenaa is linked by State lines with Aarhus and with Randers; another State branch runs from Hobro to Lögstör on the shore of Limfjord.

North of the Limfjord the State system has only two lines; one is the northern end of the main east coast line, from Aalborg to Frederikshavn, and the other crosses the new Oddesund bridge and continues to Tisted. For the rest the area is served by private lines, which focus on Hjørring and on the Aalborg-Nörre-Sundby bridge, and serve several small ports including Hirtshals, Skagen, Sæby and Asaa.

Within Limfjord the island of *Mors* has no railway, but its chief town, Nyköbing, is connected by ferry with Glyngöre, the terminus of a State branch from Skive.

ELECTRIFIED LINES

At the outbreak of war in 1939 there were 38 km. of electrified railway in Denmark, and the completion in 1941 of the Valby-Vanløse section has raised the total to nearly 42 km.

Parliamentary sanction for the electrification of the Köbenhavn suburban lines was given in 1930, and the bulk of the work was completed in sections during the years 1934-6. In order to ease the traffic

problem which would be created by the addition of an intensive suburban service on lines already well occupied by passenger and goods trains, the 13 km. from Klampenborg to the Central station were quadrupled, two extra tracks being laid for the electric trains.

Current at 1500 V. d.c. is obtained mainly from municipal power stations, and overhead collection is employed. The current consumed in 1938-9 amounted to 25 million kWh. A train interval of 10 min. can be maintained during the rush hours.

TRACTION OTHER THAN STEAM

The severe road competition which began to grow during the 1920's made the improvement of rail services on both State and private lines a vital necessity, and for several reasons steam traction could not easily provide the increased speed and frequency of services which were required to regain the lost traffic. In the first place, although Denmark may in general be regarded as lowland, its surface, and so the gradient profile of the railway lines, is distinctly undulating (Fig. 119). Only 34 % of the mileage is horizontal (cf. Norway 26 %, Sweden (State Railways) 30 %) and 26 % is on gradients of between 5 per mille and 10 per mille (1 in 200 to 1 in 100). As a result, faster trains would entail the use of larger and more powerful locomotives. The general light construction of the track, however, prohibited this, and consequently other modes of traction had to be sought. Secondly, the absence of coal or any other form of fuel in Denmark meant that there was no influential movement to foster the use of national fuel supplies, and hence coal and oil, both of which had to be imported, could be considered on their relative merits alone, such as cost per ton and ease of handling. Thirdly, the frequent interruption of the main lines by ferries, which resulted in considerable loss of time owing to the necessity of splitting up steam trains into sections for transfer to the ferryboat, with remarshalling at the end of the sea passage, rendered advisable the use of railcars and short but speedy oil-driven trains. Fourthly, the oil-driven railcar is a much more manœuvrable and economic unit than the steam train on such lines as the majority of the Danish private railways or the branches of the State system.

It was in 1923 that the first rival to the steam locomotive appeared; one of the private railways purchased a Diesel locomotive. Two years later the State Railways introduced petrol-driven railcars for use on branch lines. Diesel railcars followed on a private line in 1926, and the State Railways between 1927 and 1929 introduced Diesel-electric

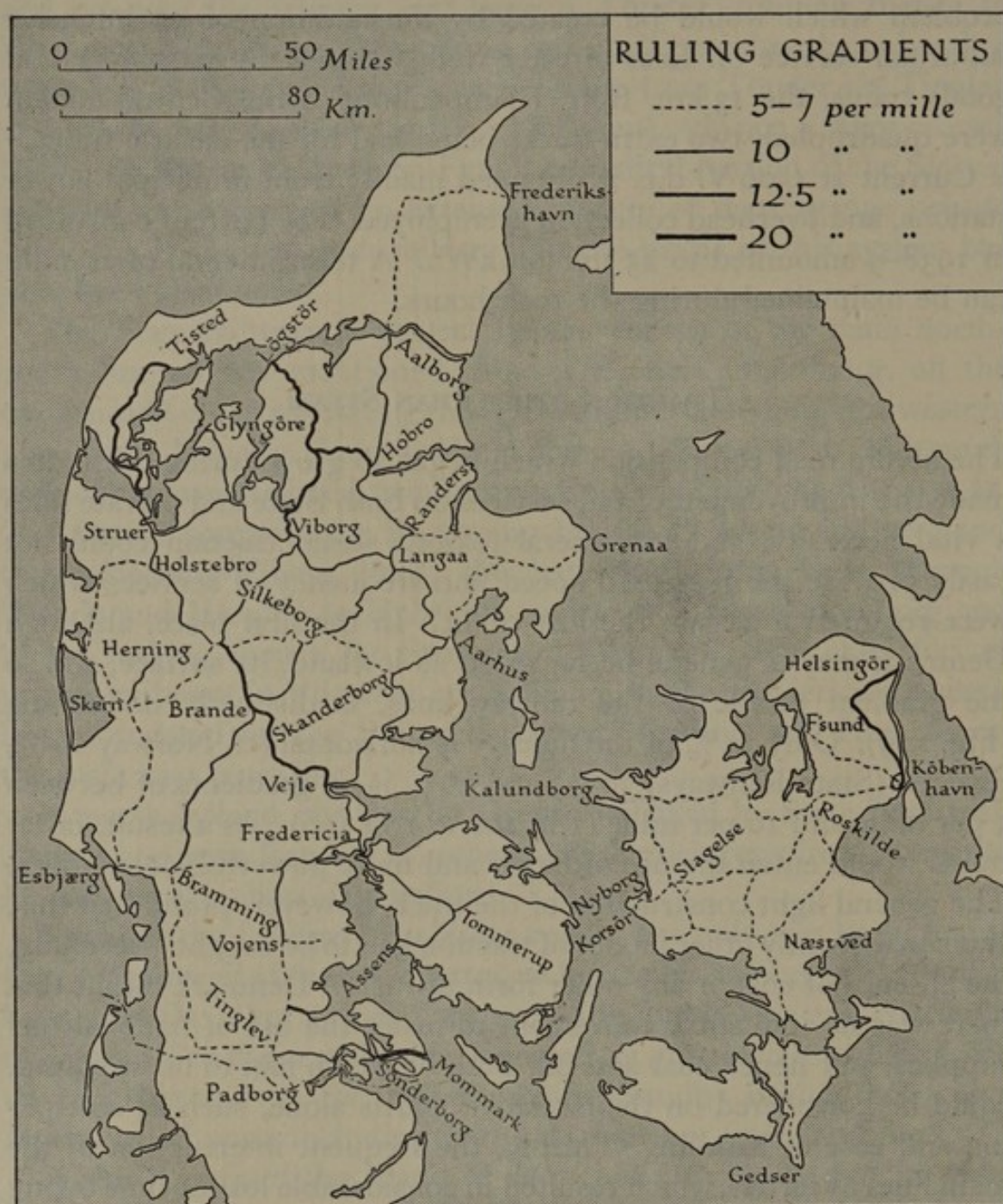


Fig. 119. Ruling gradients on the Danish State Railways

Based on data given in Danish State Railways annual report for 1938-9, *op. cit.* Details are not available for the private lines.

This map should be compared with a physical map (Fig. 1). It is clear that the lines with the lowest gradients are those in western Jylland (Jutland) (the region of the 'hill islands' and outwash plains), in Jylland north of the Limfjord, and on the flat glacial plains of Sjælland (Zealand). Steeper gradients are found in central and eastern Jylland, where the lines have to cross the belts of moraines; this is especially marked in the case of the Vejle-Herning line which runs direct across the grain of the country. In northern Jylland the lines running northwards to Tisted and Løgstør have to cross the east-west morainic belts, and so also have relatively steep gradients. In Fyn (Fünen), although the centre of the island is fairly flat, the lines running to the east and west coasts have to cross a belt of hillier morainic country; and in Sjælland the slightly rougher relief of the north-eastern section of the island results in steeper gradients on the Helsingør (Elsinore) lines.

locomotives, Diesel-electric railcars and petrol-electric railcars; the railcars catered for fast local and main-line traffic. Finally, in 1935, the first of a series of eight Diesel-electric train-sets or 'rakes', streamlined and articulated, for fast express work, was introduced. These trains became known as 'lyntogs' (lightning trains), and their introduction, coinciding as it did with the opening of the Little Belt bridge, brought about a revolution in Danish train services. With point-to-point speeds of about 100 km./hr. (60 m.p.h.)—timings impossible with existing steam locomotives owing to the constantly changing gradients—it was possible to cut the journey time from København to Esbjerg by almost $2\frac{1}{2}$ hr., and to Aarhus by a little more than this. Business journeys to and from the capital and many of the major towns of the country became possible in one day for the first time. The 'lyntogs' were subsequently extended beyond Esbjerg to Ringkøbing, and beyond Aarhus to Struer and to Frederikshavn. The effect of the 'lyntogs' on the time-table is well illustrated by the fact that whereas in 1930 the State railways had but one long start-to-stop run timed at as high a speed as 70 km. per hr. (44 m.p.h.), in 1938 there were fourteen such runs timed at over 100 km. per hr. (60 m.p.h.), all worked by Diesel-electric traction.

The steam locomotive has thus been playing a diminishing role in Danish rail transport, as the following figures show:

Danish State Railways

Train services (thousand passenger-train km.)

Traction	1931-2	%	1933-4	%	1935-6	%	1937-8	%
Steam locomotives	15,078	83.4	14,457	81.6	14,461	67.2	12,847	55.7
Electric (Copenhagen suburban)	Nil	—	Nil	—	1,472	6.9	2,238	9.8
'Lyntog' (Diesel-electric)	Nil	—	Nil	—	687	3.1	1,725	7.4
Diesel-electric railcars	343	1.9	530	2.9	2,412	11.2	4,052	17.5
Petrol-electric railcars	1,100	6.1	1,134	6.4	1,005	4.7	968	4.2
Petrol railcars	1,555	8.6	1,626	9.1	1,490	6.9	1,259	5.4
Total	18,076		17,747		21,527		23,089	

Based on official sources.

Although in 1937-8 steam locomotives were responsible for over half the mileage run by passenger trains, and of course for almost all the goods-train mileage, the fuel consumption by weight is out of all proportion to this figure, and this helps to explain why oil fuel is becoming increasingly important. In that year 341,000 tons of coal,

mainly British, were burnt by steam locomotives, compared with 15,000 tons of heavy oil and 4,000 tons of petrol consumed by the railcars. Thus it is not surprising that in 1938 the State Railways announced that their policy would be to concentrate on Diesel-electric traction. On the private lines the decline of steam has reached an even greater degree. In the year 1936-7 for example, although there were but 184 Diesel and petrol railcars and locomotives as compared with 230 steam locomotives, the former worked no less than 83 % of the train-km.

Thus, finally, it may be noted that in 1939 practically every kilometre of railway in Denmark, on State and private lines alike, was served partly, and in many cases entirely, by railcars or locomotives using power derived from petrol or heavy oil. The construction of such engines and vehicles has provided useful contracts for Danish manufacturers. Whereas all steam locomotives had to be imported from abroad, chiefly from Germany, the new locomotives and railcars have been built entirely at home, mostly by Frichs of Aarhus or by Burmeister and Wain of Köbenhavn, with assistance in body-building by the Scandia works at Randers and in electrical equipment by the Titan works at Köbenhavn.

The growth of private road competition made state participation in the road haulage business a natural consequence. In 1930 there were nearly 1,200 omnibuses in Denmark, serving some 600 routes, and about 30,000 lorries and vans; many of these vehicles must have been running in direct competition with the railways, though doubtless to a certain extent they acted as feeders as well. During the next few years the State railways took over many passenger road routes and created some new ones, and by 1933 some 1,900 km. of bus routes were in operation. By 1937 this figure had increased to 2,730 km., and 220 vehicles were in use. The private railways have also been developing road services, partly as substitutes for trains, and on at least a dozen lines in 1939 motor omnibuses or coaches were supplementing steam-train or railcar services.

LOCOMOTIVE SHEDS AND WORKS

Since the number of locomotives of all types in Denmark is under 1,200, and there are no great centres or regions of heavy mineral and industrial traffic, the provision of facilities for housing and repairing engines does not need to be on the same scale as in northern France or western Germany, for example, where sheds accommodating 200

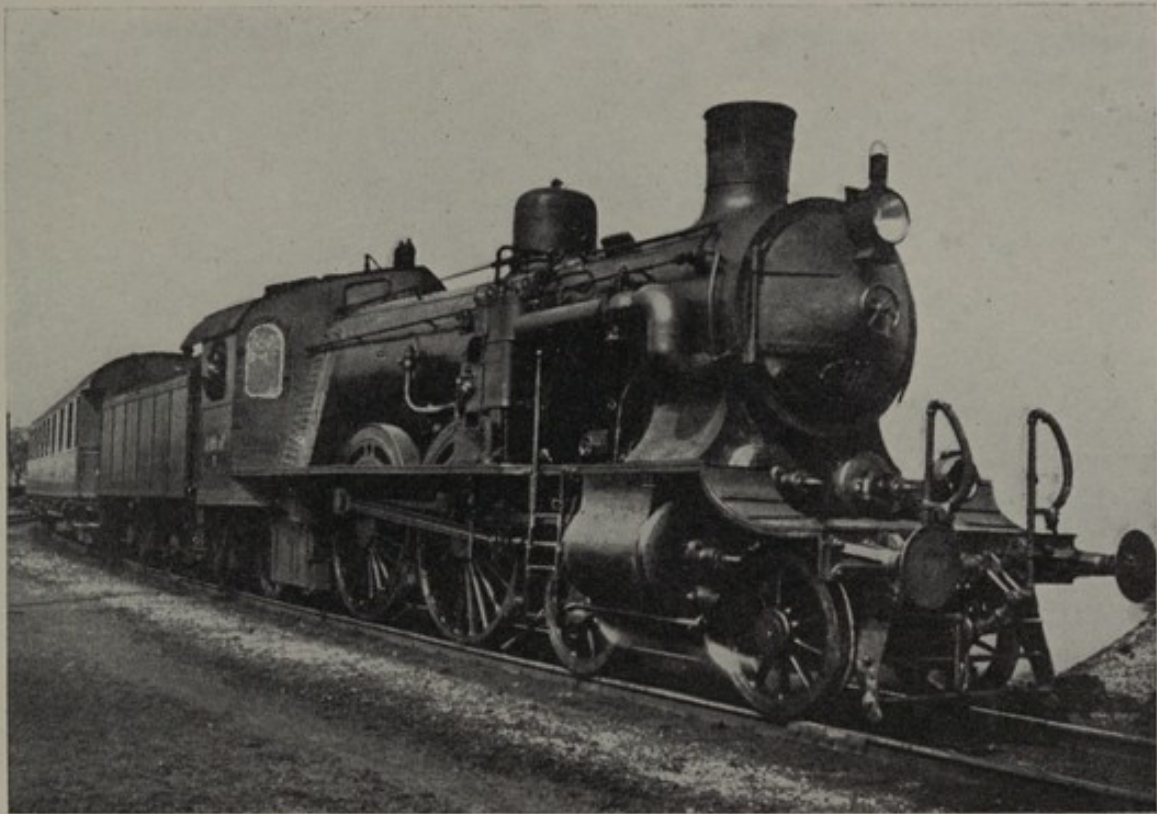


Plate 101. A main line locomotive (4-4-2 (Atlantic) type) on the Danish State Railways

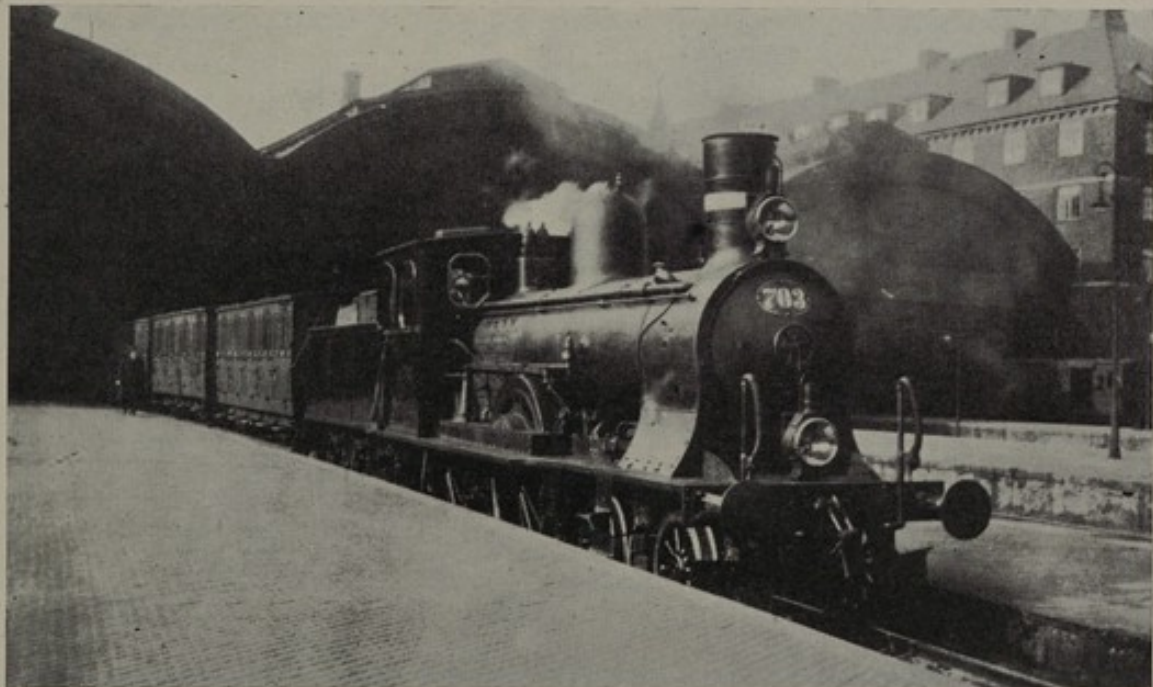


Plate 102. A local train hauled by a light 4-4-0 locomotive
Danish locomotives are of simple appearance, unlike those of many continental countries.

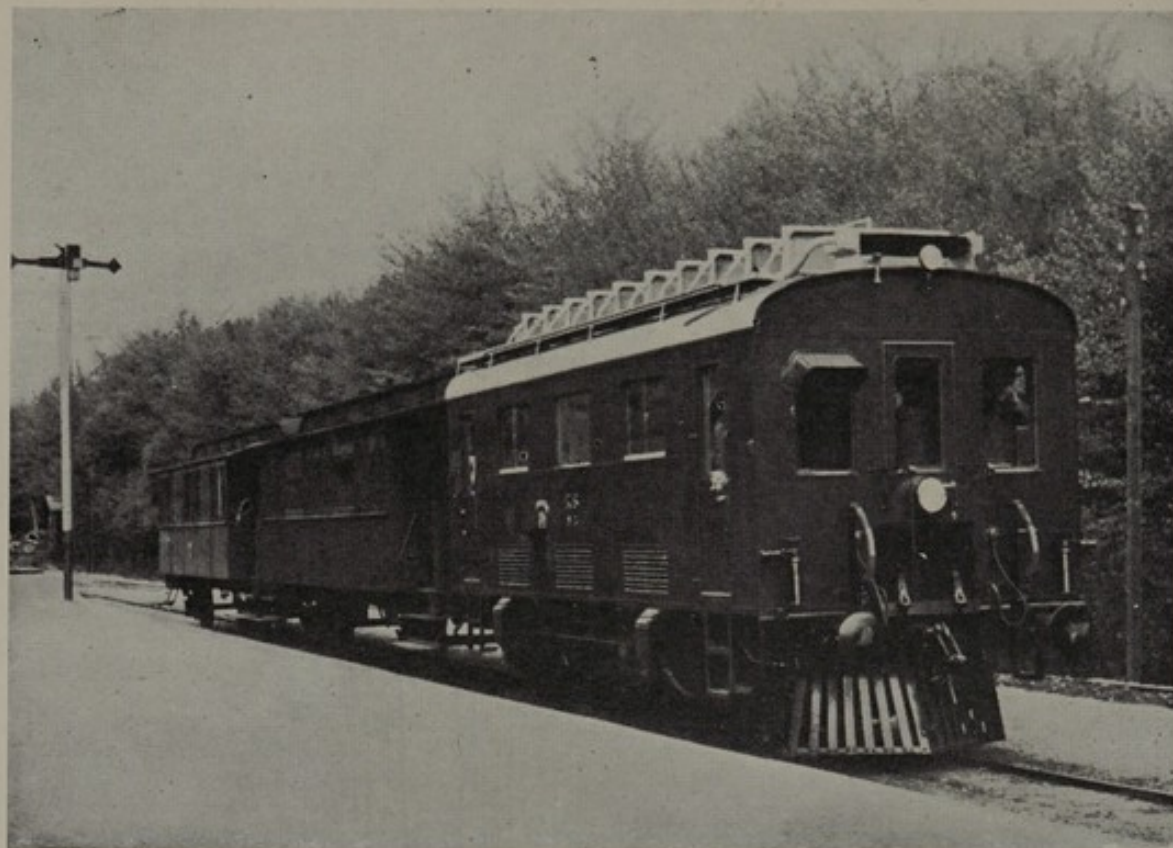


Plate 103. Diesel traction on local lines

A typical train on a private line—the *Kolding Sydbaner*. It consists of two small coaches and a Diesel locomotive built by Burmeister and Wain in 1933.



Plate 104. The central station at Köbenhavn (Copenhagen)

The view was taken looking north-east and shows the main line in its sunken track between the central station and the tunnel under Voldgade. Part of the main station appears on the right border of the picture (cf. Fig. 124).

engines are common. Locomotive sheds are widely dispersed—there are probably about fifty or more on the State Railways alone—and with a few exceptions are small. The largest is the main depot at Köbenhavn (Fig. 79); other large ones are at Aarhus (Fig. 85), Odense, Fredericia (Fig. 94) and Herning.

When railcars were first introduced it was the practice, and still is for most part, to maintain them in steam locomotive sheds; but recently (in 1938) a special depot for railcars and 'lyntogs' was built at Svanemöllen, in Köbenhavn, alongside the electric car sheds, and a similar installation was projected at Aarhus.

The main workshops for heavy rolling stock repairs are at Köbenhavn (Fig. 79), Odense, Aarhus and Nyborg, the last-named dealing especially with carriages and wagons.

MARSHALLING YARDS

Again owing to the absence of heavy industry and mining, and to the comparatively low annual total of freight traffic, the provision of elaborate marshalling yards is unnecessary. There are, however, three main yards, each located, naturally, at a key point in the railway system—Köbenhavn (Fig. 124), Fredericia and Aarhus. Outside these three yards, there is nothing, except perhaps at Esbjerg, which deserves to be described as more than a sheaf of sidings.

AXLE-LOADS AND PERMISSIBLE SPEEDS

The permissible axle-load on a railway track depends partly on the weight per unit length of the rails, partly on the nature of the sleepers and ballast and partly on the strength of bridges over which the line passes. The Danish State Railways employ for the most part home-produced beech and fir sleepers, and use rails varying in weight from 22.5 kg. per m. on a few of the less important branch lines to 45 kg. per m. on some of the main lines. An axle-load of 20 tons is allowed on the lines from Köbenhavn to Randers, Esbjerg, Padborg and Gedser (Fig. 120), which are laid with 45 kg. per m. rails. Most of the secondary main lines, with rails 37 or 41 kg. per m., allow 16 tons, whilst branch lines, with lighter rails, generally allow 12–15 tons per axle. The private railways are all of lighter construction; on no section is an axle-load of more than 15 tons permitted, and most of the lines allow only 10–13 tons.

The maximum attainable speed on any line will depend partly on the gradient profile and partly on the motive power available, but the maximum permissible speed depends partly on the curvature of the track and largely on the strength of the permanent way. Accordingly, it is found (Fig. 121) that a map showing train speeds bears a con-

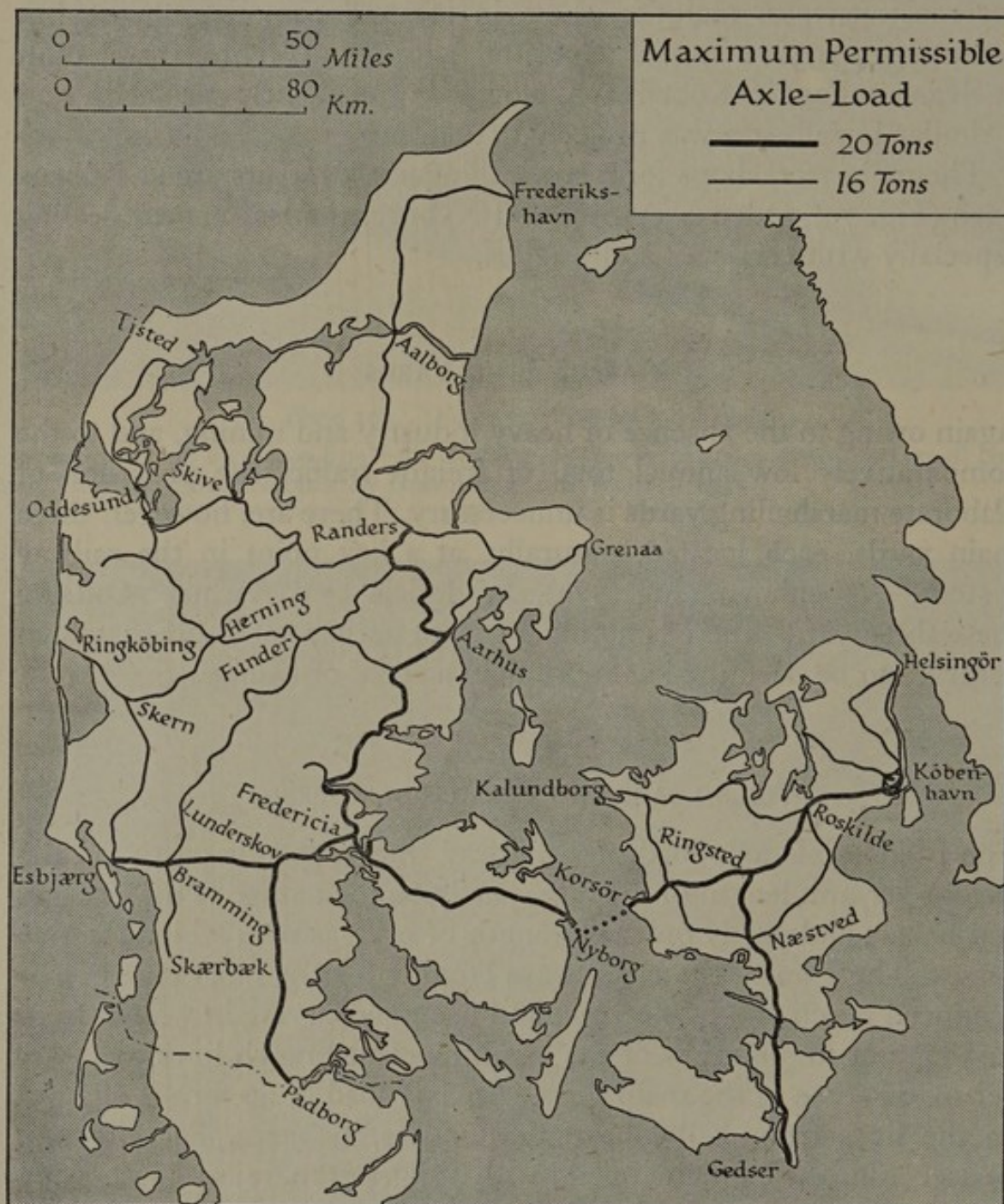


Fig. 120. Axle-loads on the Danish railways

Based on data contained in *Achsdruckverzeichnis* (Berlin: Verein Mitteleuropäische Eisenbahnverwaltungen, 1939).

All lines *not* shown on this map (including all the private lines) have permissible axle-loads of under 16 tons.

siderable resemblance to that showing axle-loads. The sections which allow the 20-ton axle-load also allow a maximum speed of 120 km. per hr. (75 m.p.h.) unless, as for example on the Ringsted-Gedser or Fredericia-Lunderskov sections, bridges and curves make a lower maximum necessary. On the 16-ton lines the maximum speed is

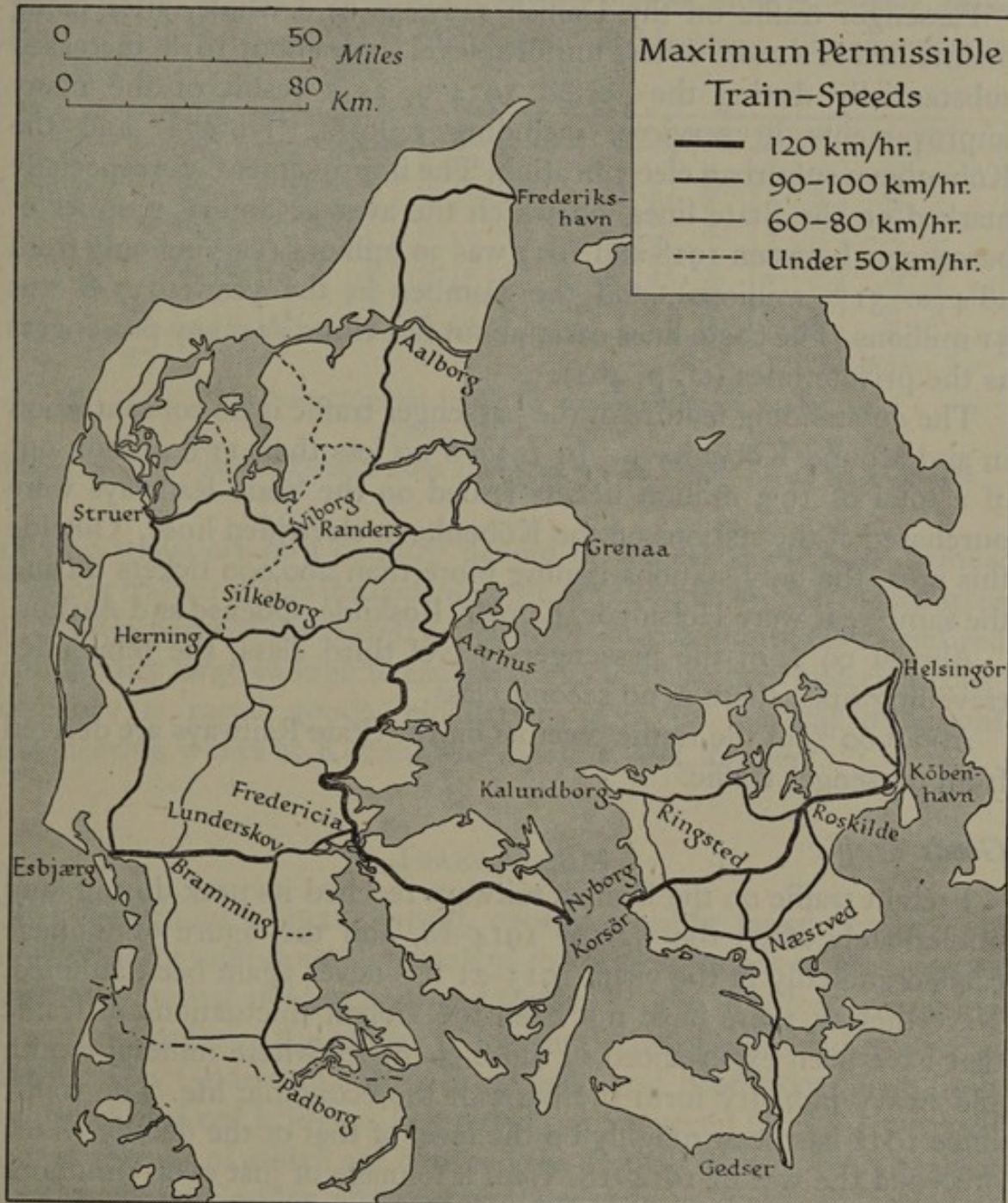


Fig. 121. Maximum permissible train-speeds on the State Railways

Based on data contained in the Danish State Railways annual report for 1938-9, op. cit.

No details are available for the private lines, but on none of these is the permissible speed likely to exceed 80 km./hr.

generally between 70 and 100 km. per hr., whilst on the lines of lighter construction the limit may sometimes be as low as 45 km. per hr. (28 m.p.h.).

TRAFFIC

Passenger Traffic

Passenger traffic on the Danish railways as a whole, after being maintained at a more or less uniform level since about 1918, increased substantially during the period 1934-9, as a result of the many improvements in services, including railcars, 'lyntogs' and the Köbenhavn suburban electrification. The improvement was especially marked on the State lines, on which the average annual number of passengers between 1918 and 1933 was 30 millions (varying only from 28.4 to 31.8 millions), and the number in the year 1937-8 was 51 millions. The State lines carry about five times as many passengers as the private lines (cf. p. 464).

The outstanding feature of the passenger traffic is its concentration in and around Köbenhavn. In 1937-8 no less than 11.8 million out of a total of 19.3 million tickets issued on the State Railways were purchased at the stations on the Köbenhavn electrified lines. Outside this area, the only stations issuing more than 200,000 tickets during the same year were Helsingör, Korsör, Roskilde, Odense and Aarhus.

Almost 99% of the passengers travel third class, the remainder travelling first; there is no second class.

About 60% of the traffic receipts on the State Railways are derived from passenger traffic.

Goods Traffic

Freight traffic on the Danish railways reached its peak during, and immediately after, the war of 1914-18, and the figure of tonnage carried annually in the years 1915-21 has never again been attained. Nevertheless, there have not been the violent fluctuations in traffic that have been experienced in those countries where mineral wealth and heavy industry form the basis of the economic life. The traffic since 1932 has been roughly on the level of that of the decade which preceded the war of 1914-18. With a tonnage of just over 5 millions in 1937-8 the State Railways carried about twice as much freight as the private lines (cf. p. 464).

As no details are available for the latter, Figs. 122 and 123 relate to the State Railways only. The bulk of the traffic is provided by a comparatively few commodities, which fall into three main groups,

agricultural commodities, building materials and fuels. The agricultural commodities could be subdivided into those concerned with the furtherance of production, such as manures, fertilizers and animal fodder, and the produce itself—crops, dairy produce and meat. Building and constructional materials figure large in the total because so much of the country is poorly supplied, so that the distribution of what resources there are is an important matter, and, moreover, these materials are more suited to rail than to road haulage. The importance

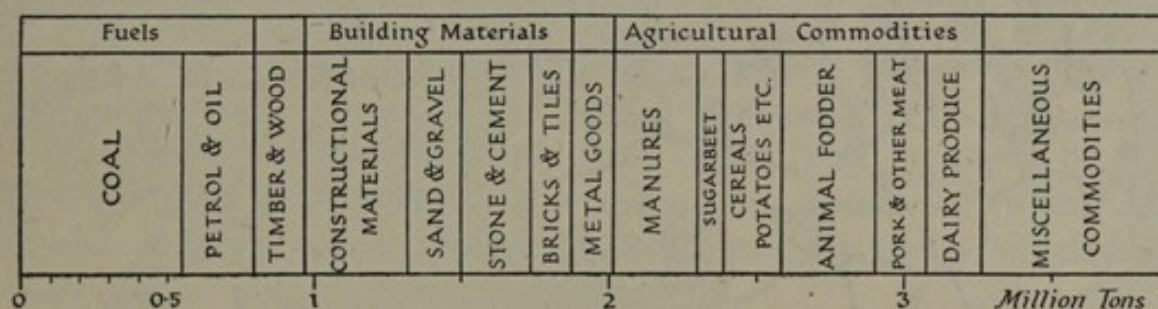


Fig. 122. Freight traffic by commodities, 1937-8
(State Railways only)

Based on data given in Danish State Railways annual report for 1937-8, *op. cit.*

of fuel transport in a country devoid of mineral wealth is obvious. Timber traffic reflects the considerable development of forest resources in certain parts of the country, whilst the one and only manufactured commodity large enough to escape relegation into the 'miscellaneous' category is metal goods, emanating from the several important engineering works at København, Aarhus, and Randers.

TRAIN FERRIES

No other country in the world, except possibly Japan, lends itself more readily than does Denmark to the establishment of train ferries for both internal and international traffic. Yet the time lost in crossing the straits nullifies the efforts to increase train speeds, and so several ferries, e.g. Oddesund, Strib-Fredericia, and Storström, have been replaced by fixed bridges. There still remain seven train-ferry routes however, four of which are between the Danish islands, two between Denmark and Sweden and one to Germany.

(a) *Inter-island ferries*

(1) *Korsør-Nyborg (Great Belt)*. This ferry, operated by the State Railways, is the most important of all, forming as it does a link in the



Fig. 123. Freight traffic by stations, 1937-8 (State Railways only)

Based on data given in Danish State Railways annual report for 1937-8, op. cit.

Only stations handling more than 40,000 tons of traffic are shown; circles are proportional in area to amount of traffic. No data are available for the private lines, none of which, however, is likely to have a station worthy of inclusion on the above basis.

In an 'average' town the outwards traffic in agricultural produce and manufactures will balance the inwards traffic in different types of the same two general categories of commodity. Stations which have a large excess of 'outwards' traffic fall into three

major route connecting København with Fyn and Jylland. The 25 km. sea passage is traversed in 1 hr. 20 min., and the ferry is operated by four three-track ferry-boats and four smaller vessels. The train ferries can carry road vehicles, but there is also a special car ferry. In 1938-9, 1.6 million passengers crossed the Great Belt, together with 760,000 tons of goods and 174,000 cars.

(2) *Glyngöre-Nyköbing, Mors (Sallingsund)*. This ferry occupies a curious terminal position, since there is no railway on the island of Mors. The passage is 3.75 km. in length, and takes 17 min. The service is provided by one motorship belonging to the State Railways. In 1938-9 it carried 130,000 passengers, 34,000 tons of goods and over 12,000 cars.

(3) *Faaborg-Mommark (Little Belt)*. This ferry, operated by the Fyn Ferry Co. of Mommark, traverses 24 km. between Fyn and Als islands in 1 hr. 20 min. There is one Diesel ferryboat, which can carry cars as well as railway vehicles.

(4) *Svendborg-Rudköbing*. One ship, owned by the South Fyn Steamship Co., operates this ferry across the 18 km. of sea which separates the island of Langeland from Fyn.

(b) *International Ferries*

(5) *Helsingör-Hälsingborg (The Sound)*. This service is operated by the Danish State Railways with two one-track ferry-boats and a car ferry. It is only 5 km. long, and the passage occupies 22 min. In 1938-9 it carried 974,000 passengers, 42,000 tons of goods and 35,000 cars.

(6) *Köbenhavn-Malmö (The Sound)*. Operated jointly by the Danish and Swedish State Railways, this ferry, with one Danish and one Swedish ship, crosses the 25 km. of the Sound, passing to the north of Saltholm island; the passage takes 1½ hr. In 1938-9 some 208,000 passengers, 121,000 tons of goods and 1,400 cars passed between Denmark and Sweden by this route.

classes: (i) the major industrial towns, which have a considerable outward movement of manufactured produce, e.g. Aalborg (cement and fertilisers), Aarhus (oil, oil-cake, engineering products), Vejle (engineering and textiles), Randers (engineering), Kolding (engineering); (ii) the fishing ports, which are often also centres of distribution for animal produce, e.g. Kalundborg, Næstved, Korsör, Köge, Struer; (iii) the Frihavn in København, which distributes imported goods. Stations which have an excess of 'inwards' traffic are also of three kinds: (i) certain stations in København which receive large quantities of foodstuffs; (ii) the port of Esbjerg, which receives agricultural produce destined for export, mainly to Britain; (iii) small provincial towns which have slaughter-houses and animal produce industries and so are collecting centres for the 'raw material' of these industries.

(7) *Gedser-Warnemünde (Mecklenburg Bay)*. This is operated jointly by the Danish and German State Railways, with three ships, of which one is Danish. The passage of 44 km. occupies 2 hr. 10 min. In 1938-9, passengers numbered 196,000, goods weighed 251,000 tons, and in addition 7,800 cars were carried.

Further reference to the car ferries which operate in addition to the above is made in Chapter XVIII.

Train ferryboats are of course useless without the appropriate terminal facilities. The terminals of the Danish ferries consist of lifting bridges, the outer end of which is raised or lowered to the deck level of the vessel. Fortunately, the Baltic tides have a very small amplitude—less than 1 m.—and hence the terminal apparatus is not so elaborate or costly as that which had to be provided, for example, at Harwich or Dover. The general principle of all the terminals is the same, but dimensions of terminals and of ferryboats differ, and there is little possibility of transferring vessels from one service to another except in certain cases.

Winter ice is seldom an obstruction to the working of the ferries (see p. 529). In normal years such coastal ice as does form can be penetrated with or without the aid of an ice-breaker. In January and February of 1940, however, the intensity of the winter cold caused considerable dislocation of traffic. The Great Belt was completely frozen over, and for a fortnight in February the only ferry able to operate was that between Helsingör and Hålsingborg.

From 1903 to 1935 the State Railways owned some thirty vessels, about twenty of which were train ferries and the remainder car ferries, packet boats and ice-breakers. The recent suppression of several ferries, however, reduced the total to nineteen at the outbreak of war in 1939. The early vessels were paddle-boats, the later ones are screw-driven. It was in 1927 that the first Diesel-engined ship was put into service, and this vessel, the *Korsör*, of 2,362 gross registered tons, was also the first to have three rail tracks. Almost all the ferryboats which have been used in and around Denmark have been built at the Burmeister and Wain shipyard in Köbenhavn (see p. 284).

THE RAILWAYS OF KÖBENHAVN

Several allusions have already been made to the main features of the railways of the capital city and its environs, and Fig. 124 illustrates these and other points, which may be summarized as follows:

(i) Much of the lay-out is of quite recent date—since 1929; the whole railway plan, in fact, has changed fundamentally since 1909. At that time the main lines out of the city ran from the old Central station via Frederiksberg, from the old Nordbane station via Nørrebro, and northwards out of Østerport. The inconvenient lines at street

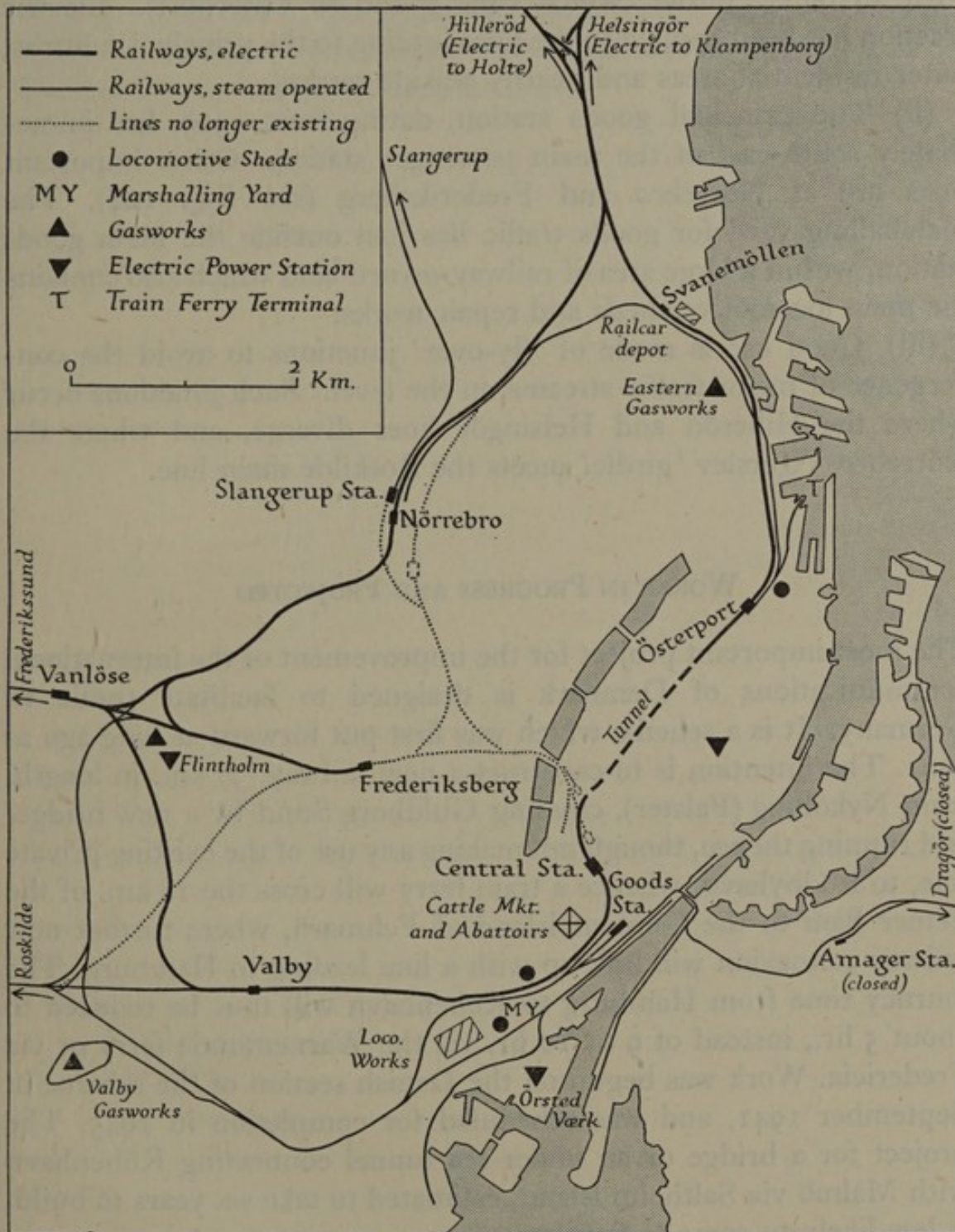


Fig. 124. The railways of København

Based on numerous Danish official maps, plans and aerial photographs.

level through the middle of the city, dating from 1847 and 1863, have been removed; two new outlets, one for passenger and one for goods traffic, have been provided on the southern side of the city, leading to the Roskilde and Frederikssund lines; the new Central and Österport stations have been linked, and finally a new goods 'girdle' line has been built from Vigerslev and Valby to Nørrebro (there linking with an older 'girdle' which runs round to Österport). Electric traction has been applied to the lines leading to the principal suburbs, outer residential areas and nearby seaside resorts.

(ii) The principal goods station, dating from 1909, lies immediately south-east of the main passenger station. Other important ones are at Nørrebro and Frederiksberg (see Fig. 124). The marshalling yard for goods traffic lies just outside the main goods station, within a large area of railway-owned land which also contains the main locomotive sheds and repair works.

(iii) Good use is made of 'fly-over' junctions to avoid the convergence of major traffic streams on the level. Such junctions occur where the Hillerød and Helsingør lines diverge, and where the Nørrebro-Vigerslev 'girdle' meets the Roskilde main line.

WORKS IN PROGRESS AND PROJECTED

The most important project for the improvement of the international communications of Denmark is designed to facilitate traffic to Germany. It is a scheme which was first put forward as long ago as 1921. The intention is to construct a new railway, 37 km. in length, from Nykøbing (Falster), crossing Guldborg Sund by a new bridge, and running thence, though not making any use of the existing private line, to Rødbyhavn, whence a train ferry will cross the 18 km. of the Femer Bælt to the German island of Fehmarn, where further new railway connexion will link up with a line leading to Hamburg. The journey time from Hamburg to København will thus be reduced to about 5 hr., instead of 9 or 10 hr. via the Warnemünde ferry or via Fredericia. Work was begun on the Danish section of the scheme in September 1941, and was scheduled for completion in 1945. The project for a bridge or an under-sea tunnel connecting København with Malmö via Saltholm island, estimated to take six years to build, is less likely to come to fruition.

Within Denmark, the chief works in progress in 1941 were the doubling of the remaining single-track sections of the main lines in

Jylland, between Randers and Aalborg and between Bramming and Vejen. The difficulty of obtaining fuel in wartime led to the construction in 1941 of a 10 km. length of track in central Sjælland to give access to the peat bogs of Aamose. There is a scheme for a bridge, 1,600 m. long, to connect Esbjerg with the island of Fanö.

The abandonment of uneconomic private lines continued during 1939-41. The last of the Haderslev metre-gauge lines was closed in 1939, the Varde-Nørre Nebel-Tarm railway in 1940-1, and the Maribo-Torrig line on Lolland in 1941.

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1. Two large works are of outstanding importance in the literature dealing with Denmark. They are D. Bruun, *Danmark: Land og Folk*, 5 vols. (Kjöbenhavn and Kristiania, 1919-22); J. P. Trap, *Beskrivelse af Kongeriget Danmark*, 10 vols. (4th ed. Köbenhavn, 1920-30).

The two works are similar in that they contain accounts, by Danish experts, of the main aspects of the geography, history, organization and economy of the country which are followed by similar accounts of counties, municipalities and parishes. Trap's work is naturally more exhaustive, especially for the parishes, with which Bruun deals in summary form. Both works are copiously illustrated with maps, photographs and line drawings.

2. The most compact and readable account of the geography of Denmark is M. Zimmermann's 'Danemark', in *Etats Scandinaves*, pp. 5-54 (Paris, 1933), which is tome III of the *Géographie Universelle* edited by P. Vidal de la Blache and L. Gallois. Another general account is: K. Hielscher, *Dänemark, Schweden, Norwegen: Landschaft, Baukunst, Volksleben* (Leipzig, 1932).

3. General descriptive works, of a more popular kind, in English are numerous. Many are little more than personal travelogues or guide books, while others, although lightly written, are based on wide knowledge and understanding. Among the best of these works are: G. Bröchner, *Danish Life in Town and Country* (London, 1903), and *A Wayfarer in Denmark* (London, 1932); M. Edelberg, *Denmark in Word and Picture* (Copenhagen, 1934); C. Holland, *Denmark, A modern Guide to the Land and its People* (London, 1927), and *Denmark, the Land of the Sea Kings* (London, 1928); P. Manniche, *Denmark: A Social Laboratory* (Copenhagen and Oxford, 1939); R. Nielsen, *Denmark* (Copenhagen, 1939); A. Rothery, *Denmark, Kingdom of Reason* (London, 1937); H. S. L. Weitemeyer, *Denmark: Its History and Topography, Language, Literature, Fine Arts, Social Life and Finance* (London, 1891).

Chapter I. *Geology and Physical Features*

1. The most useful account of the geology and land forms of Denmark in English is given in 'Summary of the Geology of Denmark', *Danmarks geologiske Undersøgelse*, 5. Række, Nr. 4 (Copenhagen, 1928), which is a symposium from leading Danish geologists, edited by V. Nordmann. The book contains an extensive bibliography. An account of the geological map of Denmark is given in J. P. J. Ravn, 'Geologisk Kort over Danmark' (text in French), *Danmarks geologiske Undersøgelse*, 3. Række, Nr. 22 (Köbenhavn, 1922). An interesting essay is H. Dewey, 'Studies in Danish Geology', *Proceedings of the Geologists' Association*, vol. XXXVII, pp. 117-61 (London, 1926). An account of the geology and relief is also given in E. G. Woods, *The Baltic Region* (London, 1932).

2. Summary accounts, in French and German respectively, are given in: N. V. Ussing, 'Dänemark', in *Handbuch der regionalen Geologie*, Bd. I, Abteilung 2 (Heidelberg, 1910), and M. Zimmermann, 'Danemark', pp. 5-54, in *Etats Scandinaves* (Paris, 1933), which is tome III of the *Géographie Universelle* edited by P. Vidal de la Blache and L. Gallois.

3. Perhaps the most useful popular account in Danish is S. A. Andersen, *Det danske Landskabs Historie* (Köbenhavn, 1933). Specialist papers, on particular aspects and regions, are scattered throughout *Meddelelser fra dansk geologisk Forening*, and the memoirs of *Danmarks geologiske Undersøgelse*, Række 1-5, and *Det kongelige danske Videnskabernes Selskab*, and in *Geografisk Tidsskrift*. The memoirs of *Danmarks geologiske Undersøgelse* have summaries in French or in English.

4. The geology of Bornholm is treated systematically in V. Milthers, 'Bornholms Geologi', *Danmarks geologiske Undersøgelse*, 5. Række, Nr. 1 (Köbenhavn, 1930), which also gives a bibliography of the more important publications. An interpretation by a veteran German geologist is A. Penck, 'Morphologische Eindrücke von Bornholm', *Geographische Zeitschrift*, Bd. XLIV, pp. 12-23 (Leipzig and Berlin, 1938). An important work is Karen Callisen, 'Das Grundgebirge von Bornholm', *Danmarks geologiske Undersøgelse*, 2. Række, Nr. 50 (Köbenhavn, 1934). Older general accounts, which are still useful, are: Gustav Braun, 'Studie über die Morphologie von Bornholm', *XI. Jahresbericht der Geographischen Gesellschaft zu Greifswald* (Greifswald, 1908-9); K. A. Reeps, 'Grundzüge einer Landeskunde von Bornholm', *Geographische Arbeiten*, VI (Stuttgart, 1910).

Chapter II. The Coasts

1. Descriptions of parts of the coasts are scattered through the literature cited for Chapter I.

2. Much detail is given in the *North Sea Pilot*, Part 4, 9th ed. (London, 1934, with supplements to February 1943) and the *Baltic Pilot*, vol. 1, 6th ed. (London, 1936, with supplements to 1939). Details of ports, piers, etc., are given in *Den danske Havnelods*, 12th ed. (Köbenhavn, 1936, with supplement to December 1937).

Chapter III. Climate

1. The most authoritative and comprehensive source of data on the climate of Denmark is *Danmarks Klima*, published by *Det danske meteorologiske Institut* (Köbenhavn, 1933). The book contains records of long-period observations, their mean values, and distribution maps, together with commentary in Danish. Additional data are given annually in *Meteorologisk Aarbog* (1873-1937) and *Nautisk-meteorologisk Aarbog* (1899-1938), both published by *Det danske meteorologiske Institut* (Köbenhavn).

2. A general account, in which the climate of Denmark is treated in relation to that of north-west Europe, is given in B. J. Birkeland and N. J. Föyn, 'Klima von Nordwesteuropa und den Inseln von Island bis Franz-Josef-Land', which is contained in W. Köppen and R. Geiger, *Handbuch der Klimatologie*, Bd. III, Teil I (Berlin, 1932).

3. General accounts, dealing particularly with coastal areas, are given in: *Weather in Home Waters and the North-eastern Atlantic*, vol. II, Part 5, The North Sea, published by the Meteorological Office, Air Ministry (London, 1940); *The North Sea Pilot*, Part 4, pp. 6-14 (London, 1934); *The Baltic Pilot*, vol. 1, pp. 4-10 (London, 1926).

4. Among papers dealing with specific topics the most useful are: L. Lysgaard, 'Nogle Undersøgelser over Nedborforholdene i Danmark', *Geografisk Tidsskrift*, Bind XXXVIII, pp. 168-80 (Köbenhavn, 1935); L. Lysgaard, 'Ændringer i Dan-

marks Klima i den nyeste Tid', *Geografisk Tidsskrift*, Bind XL, pp. 137-55 (København, 1937); Wilhelm Petersen, 'Bidrag til et Nedbørskort over Danmark' (with summary in French: 'Etude relatives à une carte de précipitations du Danemark'), *Geografisk Tidsskrift*, Bind XXXIII, pp. 209-15 (København, 1930); K. H. Soltau, 'Die geographische Verbreitung und Bedeutung des Nebels in Schleswig-Holstein und Dänemark', *Veröffentlichungen Schleswig-Holstein Univ. Ges.*, Bd. VII, pp. 1-40 (Breslau, 1927).

5. Ice conditions in the waters around Denmark are treated in: C. I. H. Speerschnieder, 'Om Isforholdene i danske Farvande i ældre og nyere Tid: Aarene 690-1860', with English summary: 'The state of the ice in Danish waters in former and present times'; C. I. H. Speerschnieder, 'Om Isforholdene i danske Farvande: Aarene 1861-1906', with English summary: 'The appearance of ice in the Danish waters'. These two works are Meddelelser Nr. 2 and 6 respectively of the publications of *Det danske meteorologiske Institut* (København, 1915, 1927); G. Prüfer, 'Die Eisverhältnisse in den deutschen und den ihnen benachbarten Ost- und Nordseegebieten', *Annalen der Hydrographie und maritimen Meteorologie*, Bd. LXX, Heft 2, pp. 33-50 (Berlin, 1942) (see p. 576 for content of maps).

A statistical summary of average ice conditions for the years 1906/7-1930/1 is given in *Nautisk-Meteorologisk Aarbog*, 1931, pp. xi-xiv (København, 1932).

Chapter IV. *Natural Vegetation*

1. A summary account of the distribution of natural vegetation in Denmark will be found in W. G. Smith, 'Notes on Danish vegetation', *Journal of Ecology*, vol. II, pp. 65-70 (London, 1914).

2. The vegetation of the coniferous plantations is discussed in M. Köie, 'The soil vegetation of the Danish coniferous plantations and its ecology', *Kongelige danske Videnskabernes Selskab Skrifter*, 9. Række, Bind VII, Nr. 2 (Kjøbenhavn, 1938), which publication contains many specialist studies. The forests are discussed further in H. Perrin, *Le Danemark forestier* (Nancy, Paris, Strasbourg, 1923), which is published in the *Annales de l'Ecole nationale des Eaux et Forêts*.

3. Studies of dune vegetation have been published in *Meddelelser fra Skalling-Laboratoriet*, 1. Bind, Nr. 6 (København, 1935).

Chapter V. *The People*

1. General accounts of the physical characteristics of the Danes are given in a large number of works dealing with the peoples of Europe. The most useful books in English are W. Z. Ripley, *Races of Europe* (London, 1900) and C. S. Coon, *The Races of Europe* (New York, 1939). Both works give extensive bibliographies. The specialist papers on Denmark occur mainly in *Meddelelser om Danmarks Antropologi* (København, 1907-).

2. A clear account of the relation of Danish to other north European languages is given in R. Pribsch and W. E. Collinson, *The German Language* (London, 1934) and in V. Dahlerup, *Det danske Sprogs Historie* (2nd ed. København, 1921).

3. A summary of the organization of the Danish Church may be found in *Kirkelig Haandbog* (Ecclesiastical Handbook) (København, 1935).

4. Data on the social and economic organization of Denmark is scattered throughout a large number of books of very unequal value. Among the most useful accounts

in English are: E. C. Branson, *Farm Life Abroad* (Chapel Hill, 1924); H. Jones, *Modern Denmark: its Social, Economic and Agricultural Life* (London, 1927); Peter Manniche, *Denmark: A Social Laboratory* (Köbenhavn and Oxford, 1939).

Important Danish sources are: E. Marstrand (editor), *Det danske Samfund*, 4th ed. (Köbenhavn, 1934); J. Warming, *Danmarks Erhvervs- og Samfundsliv* (Köbenhavn, 1930).

Chapter VI. *Historical Outline*

1. Of the excellent historical literature in Danish, little has been translated. J. Ottosen, *Nordens Historie* (5th ed., Köbenhavn, 1913), and P. Engelstoft and F. W. Wendt, *Haandbog i Danmarks politiske Historie fra Freden i Kiel til vore Dage* (Köbenhavn, 1934) outline the history to 1933. E. Holm, *Danmark-Norges Historie* (1720-1814), 7 vols. (Köbenhavn, 1891-1912), *Danmark-Norges indre Historie* (1660-1720), 2 vols. (Köbenhavn, 1885-6), cover the period 1660-1814.

2. Two great illustrated works, *Danmarks Riges Historie*, 6 vols. (Köbenhavn, 1897-1907), edited by J. Steenstrup and others, and *Det danske Folks Historie*, 8 vols. (Köbenhavn, 1926-9), edited by A. Friis and others, unite groups of Danish historians in surveys from the earliest times.

3. A. Linvald, *Kronprins Frederik* (1797-1807) (Köbenhavn, 1923), describes the decade of greatest historical interest to Britain.

4. Of the considerable literature dealing with the Slesvig-Holstein question the following are basic works: A. Friis, *Det nordslesvigske Spørgsmaal* (1864-79) (Köbenhavn, 1921); F. de Jessen, *Manuel historique de la Question du Slesvig* (Copenhagen et Paris, 1906); F. de Jessen, *Manuel historique de la Question du Slesvig*, 1906-38 (Copenhagen et Paris, 1939).

5. Among works in English, the following may be mentioned: R. N. Bain, *Scandinavia, 1513-1900* (Cambridge, 1905); J. H. S. Birch, *Denmark in History* (London, 1938); C. E. Hill, *The Danish Sound Dues and the Command of the Baltic* (Durham, N.C., 1926).

Chapter VII. *Government and Administration*

1. The text of the Danish constitution is printed in English in W. F. Dodd, *Modern Constitutions*, vol. 1, pp. 265-81 (Chicago, 1909), and a general description of the government and administration of the country is given in *Denmark*, published by the Royal Danish Ministry for Foreign Affairs and the Danish Statistical Department (Copenhagen, 1937). The system of local administration is described in G. M. Harris, *Local Government in Many Lands*, pp. 76-82 (2nd ed., London, 1933).

2. Danish constitutional law and the structure of the state are treated in K. Berlin, *Den danske Statsforfatningsret* (Köbenhavn, 1930-4), and E. Marstrand, *Den danske Stat* (2nd ed., Köbenhavn, 1933).

Chapter VIII. *Education*

1. The literature dealing with Danish education is considerable. Most general works on the country give some description. The most comprehensive and useful work in English is A. Boje, *Education in Denmark* (London, 1932), which deals with the development of education and its modern organization and aims.

2. The development and ideals of the Folk High School movement are described in H. Begtrup, H. Lund and P. Manniche, *The Folk High Schools of Denmark and the Development of a Farming Community*, 2nd ed. (London and Kjöbenhavn, 1929). Among accounts by outside observers are O. D. Campbell, *The Danish Folk School* (New York, 1928), and G. N. M. Davies, *Education for Life* (London, 1931).

Chapter IX. *Public Health*

1. Accounts of the various aspects of public health in Denmark are given in *Health Organisation in Denmark*, League of Nations, C.H./E.P.S. 49 (Geneva, 1926). A useful general account, which includes the reforms of 1933, is also given in *Denmark*, published by the Royal Danish Ministry for Foreign Affairs and the Danish Statistical Department (Copenhagen, 1937).

2. Rural hygiene is described in *Denmark*, which is a report prepared for the European Conference on Rural Life and published by the League of Nations, C. 113, M. 68 (Geneva, 1939).

3. Specialist studies of particular aspects of public health are conveniently summarized in the *Bulletin of Hygiene*, published by the Bureau of Hygiene and Tropical Diseases (London, quarterly), which is a good guide to the detailed literature on health, since the annual index classifies the contents by country, subject and author. An important report is J. Ostenfeld, N. Heitmann and J. Neander, *Tuberculosis in Denmark, Norway and Sweden*, published by the League of Nations, Doc. C.H. 957 (Geneva, 1931).

4. Statistical information is provided in *Sundhedsstyrelsens Aarsberetning*, which is the annual report of the National Health Service (Köbenhavn), and in the *Epidemiological Reports*, published by the Health Organization of the League of Nations (Geneva, annually).

Chapter X. *Distribution and Growth of Population*

1. The data of the earlier censuses are collected and analysed in 'Befolkningsforholdene i Danmark i det 19. Aarhundrede', *Statistisk Tabelværk*, 5. Række, Litra A, Nr. 5 (Köbenhavn, 1905). Later census reports, like the earlier reports, have been published in full in the *Statistisk Tabelværk* and *Statistiske Meddelelser*, published by the Statistical Department, Köbenhavn. A list of these publications is given on p. xxi of *Statistisk Aarbog*, 1939 (Köbenhavn, 1939), which also includes summary tables of the most recent censuses. Short-term reports covering births, deaths, marriages and migrations have been published annually, since 1931, in *Statistiske Meddelelser*, 4. Række (Köbenhavn, 1934-9).

2. General discussions of the new statistical methods occur in numerous recent works. The most authoritative and useful accounts are: R. R. Kuczynski, *The Measurement of Population Growth* (London, 1935), and *The Balance of Births and Deaths* (Washington, 1928); E. Charles, *The Menace of Underpopulation* (London, 1936); D. V. Glass, *Population Policies and Movements in Europe* (Oxford, 1940).

3. Population studies dealing specifically with Denmark are relatively few. The following are the more important papers: H. W. Ahlmann, 'Själlands landsbygd: En antropogeografisk Studie', *Ymer*, vol. XLIII, pp. 81-126 (Stockholm, 1924), and 'Om lagbundenhet i bebyggelsens utveekling i Italien, Danmark och Norge', *Ymer*, vol. XLVII, pp. 1-48 (Stockholm, 1928); P. Lauritsen, 'Om gamle danske Landsbyformer', *Aarbøger for nordisk Oldkyndighed og Historie* 1896, 2. Række, 2. Bind,

pp. 97-170 (Kjöbenhavn, 1896); R. Tack, 'Bornholms Besiedlung', *Geographische Arbeiten*, XII (Rostock, 1929); M. Vahl, 'The distribution of the population of Denmark', *Union Géographique Internationale: Second Report of the Commission on Types of Rural Habitation*, pp. 10-13 (Florence, 1930), which contains two distribution maps, showing (i) agricultural population per sq. km., and (ii) percentage of industrial population. Both maps are based on figures for 1906; M. Vahl, 'The urban settlement of Denmark', *Geografisk Tidsskrift*, 36. Bind, pp. 5-34 (Kjöbenhavn, 1933); M. Vahl, 'Types of rural settlement in Denmark', *Comptes Rendus du Congrès internationale de Géographie*, Paris, 1931, tome III, pp. 165-76 (Paris, 1934); M. Vahl, 'Rural settlement in the island of Falster', *Comptes Rendus du Congrès internationale de Géographie*, Paris, 1931, tome III, pp. 177-92 (Paris, 1934); E. Weymann-Munck, 'Fünen als Siedlungsraum, Siedlungsgeographie einer dänischen Landschaft', *Berliner Geographische Arbeiten*, Heft 10, p. 118 (Berlin, 1936).

Chapter XI. Agriculture

1. Danish agriculture has been the subject of study and example in most countries of western Europe, and there is a considerable literature in the form of articles scattered through various agricultural journals. Two basic studies in English summarize the essential facts. They are: E. Jensen, *Danish Agriculture; its Economic Development* (Copenhagen, 1937), which not only deals with the historical background but also gives much information on modern organization up to 1930; *Denmark, Agriculture*, published by the Agricultural Council (Copenhagen, 1935), is a symposium, from Danish experts, on various aspects of Danish farming.

2. The historical development of Danish agriculture is also treated in: A. Nielsen, *Dänische Wirtschaftsgeschichte* (Jena, 1933), which is one of the volumes of the *Handbuch der Wirtschaftsgeschichte*, edited by Georg Brodnitz; O. H. Larsen, *Landbrugets Historie og Statistik* (Kjöbenhavn, 1929).

3. The growth and function of the co-operative movement is described in: H. Faber, *Co-operation in Danish Agriculture* (London, 1931); C. L. Christensen, *Agricultural Co-operation in Denmark* (Washington, 1924); A. Drejer, *Den danske Andelsbevægelse* (Kjöbenhavn, 1934); F. C. Howe, *Denmark. A Co-operative Commonwealth* (London, 1922), and *Denmark: the Co-operative Way* (London, 1936).

4. An interesting account of observations in Denmark, which is still useful, is H. R. Haggard, *Rural Denmark and its Lessons*, 2 vols. (London, 1911).

5. A good and detailed account of the soils of Denmark is given in C. H. Bornebusch and K. Milthers, 'Jordbundskort over Danmark' (Soil Map of Denmark), *Danmarks geologiske Undersøgelse*, 3. Række, Nr. 24 (Danish and English texts) (Kjöbenhavn, 1935).

6. Statistical and other information are given in official reports published annually. The more important of these series are: *Landøkonomisk Aarbog* (Agricultural Yearbook), published by the Ministry of Agriculture; *Arealets Benyttelse* (Land Utilization), published by the Department of Statistics; *Høstudbyttet* (Crop production), published by the Department of Statistics; *Kreaturtælling* (Census of Livestock), published by the Department of Statistics; *Danmarks Mejeri-Statistik* (Dairy Statistics), published by the Committee on Dairy Statistics, Aarhus; *Undersøgelser over Landbrugets Driftsforhold* (Farm Accounts), published by the Bureau of Agricultural Economy; *The Agricultural Export of Denmark*, published quarterly by the Agricultural Council.

The reports of the Statistical Department are printed as fascicules of *Statistisk Meddelelser*, 4. Række. A full list of these publications is given in *Statistisk Aarbog*, 1939, pp. xxi-xxxi (Köbenhavn, 1939).

7. A survey of economic conditions in Denmark during the war of 1914-18 is given by E. Cohn in *Sweden, Norway, Denmark and Iceland in the World War* (New Haven, 1930).

8. An important general source which gives data for agriculture, land tenure, farm incomes, and agricultural population is *Documentation for the European Conference on Rural Life*, 1939, published by the International Institute of Agriculture (Rome, 1939).

Chapter XII. Fisheries

1. The two chief descriptive works on Danish fisheries are: F. V. Mortensen and A. C. Strubberg, 'Die dänischen Seefischerei' (Stuttgart, 1931), which is the second part of the eighth volume of the *Handbuch der Seefischerei Nordeuropas* edited by H. Lübbert and E. Ehrenbaum, and *Ibid.*, *Dansk Saltvandsfiskeri* (Köbenhavn, 1935).

These works contain bibliographies of the detailed literature.

2. Reports and statistics on fisheries are published in: *Fiskeriberetning* (Köbenhavn, annually); *Bulletin statistique des Pêches maritimes des Pays du nord et de l'ouest de l'Europe*, publié par le Conseil permanent international pour l'Exploration de la Mer (Copenhagen, annually); *Aarbog for den danske Fiskerflaade* (Köbenhavn, annually).

3. Reports on oceanographical and fisheries research are printed in: *Beretning fra Den danske biologiske Station* (Köbenhavn, annually); *Meddelelser fra Kommissionen for Danmarks Fiskeri og Havundersøgelser* (Köbenhavn, periodically).

Chapter XIII. Industries

1. There is no adequate up-to-date account of the industries of Denmark. Background material may be found in the following works: M. K. Hansen, *Die Entwicklung der Industrie in Dänemark* (Leipzig, 1925); A. Nielsen, *Dänische Wirtschaftsgeschichte* (Jena, 1933); J. Samsoe, *Die Industrialisierung Dänemarks* (Jena, 1928); F. V. Vedsö, *Danmarks Industri* (Köbenhavn, 1933); H. Westergaard, *Economic Development in Denmark before and during the World War* (Oxford, 1922).

2. The following trade directories provide the usual data about individual firms: *Krak's Vejviser* (Köbenhavn, annually); *Green's Danske Fonds og Aktier* (Köbenhavn, annually). Popular accounts of some leading firms are given in M. Edelberg, *Denmark in Word and Picture* (Copenhagen, 1934).

3. Statistical information is contained in 'Produktionsstatistik', which is a fascicule of *Statistiske Meddelelser*, 4. Række (Köbenhavn, annually) and also in abridged form in *Statistisk Aarbog* (Köbenhavn, annually). The latest industrial census was taken in 1935 and is reported in 'Erhvervstællingen', *Statistisk Tabelværk*, 5. Række, Litra A, Nr. 21 (Köbenhavn, 1936).

4. Articles on individual industries and enterprises are scattered through several trade journals, especially *Ingeniören* (Köbenhavn) and *Chemische Industrie* (Berlin).

Chapter XIV. *Commerce*

1. The best accounts of the commerce of Denmark in English are printed in the periodic reports of the Department of Overseas Trade on *Economic Conditions in Denmark*. The most recent report was published in 1937. The corresponding Danish report, *Handelsberetning*, is published by the Committee of the Merchants' Guild (København, annually). An annual summary of this report in English is J. Vestberg, *General Review of the World Markets and Denmark* (København).

2. Detailed statistical information is given in 'Danmarks Vare-Ind-og Udførsel', which is a fascicule of *Statistisk Tabelværk*, 4-5. Række, Litra D (København, annually), and summary tables are printed in *Statistisk Aarbog* (København, annually). Comparative data are collected conveniently in the *Statistical Year-book of the League of Nations* (Geneva, annually).

3. A good general account of the trade of Europe is given in *Europe's Trade*, issued by the Economic Intelligence Service of the League of Nations (Geneva, 1941).

Chapter XV. *Public Finance*

1. A useful account of the administration of public finance and the organization of banking in Denmark is given in *Denmark*, 1937, published by the Royal Danish Ministry for Foreign Affairs and the Danish Statistical Department (Copenhagen, 1937).

2. A summary in German is C. Olsen, 'Der Staatshaushalt und das Finanzsystem der Skandinavischen Länder, A. Dänemark' (Tübingen, 1928), which is included in vol. III of the *Handbuch der Finanzwissenschaft*, by W. Gerloff and F. Meisel.

3. Surveys of the financial situation in Denmark are given in the Reports of the Department of Overseas Trade on *Economic Conditions in Denmark* (London, periodically).

4. Summary tables of budgets and of state and bank accounts are included in the *Statistisk Aarbog* (København, annually). Detailed figures are published in *Indkomst- og Formueskat til Staten*, and in *Kommunale Beskatning*, both of which are included in *Statistiske Meddelelser*, 4. Række (København, annually). A full list of the publications of the Statistical Department on financial matters is given on pp. xxvii-xxviii of *Statistisk Aarbog*, 1939 (København, 1939).

Chapter XVI. *Mercantile Marine*

1. Tables giving details of the composition and age of the Danish merchant fleet are published in *Lloyd's Register*, 1939-49, vol. III (London, 1939). The Danish official list of ships is *Danmarks Skibsliste*, published by the Ministry of Commerce (København, annually).

2. Reports and statistics dealing with the commercial activities of the merchant fleet are published in *Danmarks Handelsflaade og Skibsfart*, which is a fascicule of *Statistiske Meddelelser*, 4. Række (København, annually). An annual report, *Skibsfartberetning*, is also published by the Danish Steamship Owners' Association (København).

3. Useful information is scattered through the files of the *Scandinavian Shipping Gazette* (Copenhagen, weekly).

Chapter XVII. *Ports*

1. The most complete and authoritative source of information about the ports of Denmark is *Den danske Havnelods*, published by the Danish Hydrographic Office (*Det Kongelige Søkort-Arkiv*), 12th ed. (Köbenhavn, 1936, with Supplement dated December 1937). The fullest accounts of all ports, published in English, are given in the *North Sea Pilot*, part 4 (London, 1934 with supplements to 1943) and the *Baltic Pilot*, vol. 1 (London, 1926 with supplements to 1939).

2. A good account of Köbenhavn is *Port of Copenhagen* published for the Port Authority by the 'Scandinavian Shipping Gazette' (Copenhagen, 1938). The history and commerce of this port have been carefully studied in J. Reumert, *The Commercial-Geographic Importance of the Situation of Copenhagen*, which was published as a Supplement to *Geografisk Tidsskrift* (Copenhagen, 1929).

3. Accounts of all the significant ports are also given in D. Bruun, *Danmark: Land og Folk*, 5 vols. (Kjöbenhavn and Kristiania, 1919-22), and J. P. Trap, *Beskrivelse af Kongeriget Danmark*, 10 vols. (Köbenhavn, 1920-32). These accounts cover the lay-out of the port and town, trade, industries, administration and history.

4. Statistics of port activities are published in *Danmarks Handelsflaade og Skibsfart*, which is a fascicule of *Statistiske Meddelelser*, 4. Række (Köbenhavn, annually).

5. Accounts of developments at different ports occur periodically in many trade journals, especially *The Dock and Harbour Authority* (London, monthly), *Bauingenieur* (Berlin, monthly), *The Scandinavian Shipping Gazette* (Copenhagen, weekly), and *Ingeniören* (Köbenhavn, weekly). The more substantial of these accounts are: Köbenhavn, *Dock and Harbour Authority*, vol. XIV, pp. 140-50, 171-4, 186-8 and vol. XVII, pp. 221-3 (London, 1934 and 1938); Aarhus, *Bauingenieur*, Bd. XX, pp. 495-502 (Berlin, 1939); Fredericia, *Bauingenieur*, Bd. XX, pp. 370-5 (Berlin, 1939).

Chapter XVIII. *Roads*

1. Information on Danish roads is contained mainly in *Dansk Tidsskrift* (Köbenhavn). Outstanding events and achievements are usually described in the engineering journals cited above. Summary statistics are printed in *Statistisk Aarbog* (Köbenhavn annually).

2. The plan for building bridges across the Great Belt and the Sound was outlined, by private initiative, in *Motorveje med Broer over Storebælt og Öresund* (Köbenhavn, 1936).

Chapter XIX. *Railways*

1. The history of railway development up to about 1910 is dealt with in the article 'Dänische Eisenbahnen' in H. von Roll's *Enzyklopädie des Eisenbahnwesens*, Bd. III, pp. 213-20 (Berlin, 1912); see also 'Les chemins de fer danois', *Revue Générale des Chemins de Fer*, 1911, pp. 472-7 (Paris, 1911).

2. Much miscellaneous information is summarized in an article on 'Train speeds and services', by L. Wiener, in *Bulletin of the International Railway Congress Association* (English ed.), vol. XVIII, pp. 609-40 (Brussels, 1936).
3. The peculiar features of Danish railway operation—railcars, train ferries and the great bridges—are described in various technical journals, notably the *Railway Gazette* (London, weekly).
4. Statistical information, in considerable detail for the State Railways and in summary form for the private lines, is given in the annual statistical reports of the Danish State Railways (*De danske Statsbaner: Beretning om Virksomheden*), published in København.

Appendix I

BORNHOLM

Geology: Relief: Coasts and Ports: Rønne: Ertholme

The position of Bornholm is between $14^{\circ} 46'$ and $15^{\circ} 10' E$, and between $54^{\circ} 59'$ and $55^{\circ} 18' N$. Eighteen kilometres north-east is a small group of islands known as Ertholme, two of which are inhabited. Bornholm is only 35 km. south-east of the coast of Sweden, but Rønne, its largest and westernmost town, is 185 km. from København. The island is rhomboid in shape with a greatest length of 39 km. from north-west to south-east and a greatest breadth of some 27 km. from Arnager Odde in the south to Hammer Odde in the north. Its 158 km. of coastline enclose an area of 587.5 sq. km., which is almost exactly the same size as the Isle of Man. The population, which is also comparable in size with that of the Isle of Man, numbered 45,930 in 1935. Of these, 10,898 lived in Rønne, but the next largest town is Nexsö with 2,817 inhabitants.

The strategic importance of Bornholm, lying towards the middle of the sea between south Sweden and Germany and where the Baltic begins to widen into its north-south part, is diminished by its inhospitable rocky coasts, which offer no large harbours, and by the upland which forms the greater part of its surface. In the twelfth century it became a fief of the archbishop of Lund, and although captured by the Hanseatic League in 1512 it came under Danish rule in 1522. It passed into the possession of Sweden in 1645 but remained Danish in sympathy. The Swedes were expelled, and in 1660 the island reverted to Denmark which has held it ever since. It is administered as a county (*amt*) of Denmark.

The following account deals only with those features in which Bornholm differs markedly from the remainder of Denmark, namely, geology, relief and coasts. The other aspects of the geography and economy of the island are well within range of variation found in Jylland and the archipelago. For example, the climate and agriculture of the island differ less from those of east Sjælland than do those of north or west Jylland. The general accounts of administration, education, health, population, social conditions, commerce and finance refer to the country as a whole without regional differentiation.

GEOLOGY

Geologically, the island is part of southern Sweden and differs very markedly from the remainder of Denmark. While Jylland and the Danish archipelago have no rock outcrops which are older than the Cretaceous period, Bornholm has nothing that is younger except for the superficial deposits left after the Ice Age. The ancient granites of Bornholm give craggy outcrops and rocky cliffs which contrast with the soft rocks and rolling landscape of the remainder of Denmark. Bornholm lies, with the Swedish province of Skåne, in a zone interspersed with faults which borders the ancient land mass of the Scandinavian peninsula. In this zone the rocks have been much fractured and dislocated by the crustal movements which led to the sinking of the surrounding areas.

Pre-Cambrian rocks

The greater part of the island consists of a 'horst', or block, of granite of pre-Cambrian age, which was left standing after the areas around it had foundered. It occupies about two-thirds of the area of the island as shown in Fig. 125, and lies north of a line approximately from Rønne to Neksö. For the greater part, it is about 100 m. above sea level to which it falls in fairly steep slopes and cliffs, except in the north-east between Ypnasted and Neksö. The granite is of different kinds and is widely quarried for a variety of uses. Most of it is grey in colour, with striation of dark and light components in alternate thin layers, and varies from medium to fine grain. Near the surface it usually becomes reddish. All these varieties are used as building stone, paving stones, setts, etc. In the Paradisbakker the stone is dark grey with white streaks, and of fine grain; it is used especially as façade stone in buildings. In the south-west of the granite mass, inland from Rønne, the stone is medium-grained and dark grey in colour; it polishes handsomely and is used, not only as building stone, but also for monumental stones and it commands higher prices than the other varieties. East of Rønne the granite has decomposed into an incoherent mass of grey-white kaolin which occurs in a bed, about 4 km. long and between 200 and 300 m. wide, lying along the margin of the granite mass. It is overlain by beds of Mesozoic age and has been quarried since its discovery about 1775. At high temperatures this kaolin turns grey or yellowish and is therefore not suitable for the finer grades of porcelain, but it is much

used for coarse earthenware and as a filling in the paper industry after the quartz in it has been washed out. The coarser particles removed by washing out are used, together with fireclay and raw kaolin, in the manufacture of various fireproof goods such as kaolin bricks.

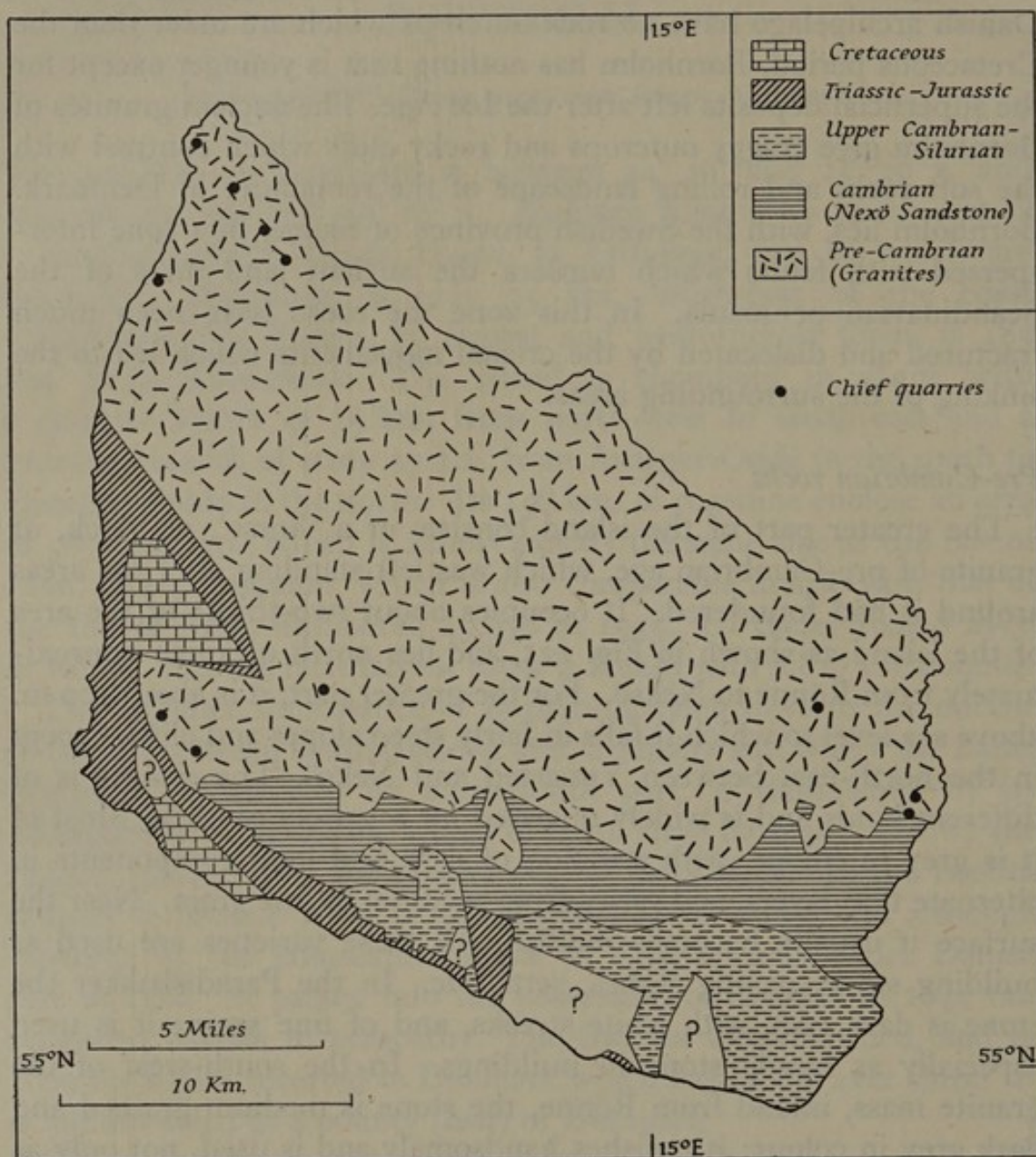


Fig. 125. The solid geology of Bornholm

Based on a map in V. Milthers, 'Bornholms Geologie', *Danmarks geologiske Undersøgelse*, 5. Række, Nr. 1 (København, 1930).

Palaeozoic rocks

South-west and south of the granites are sedimentary rocks which were deposited under water in front of a granite coast. This old coastline still appears here and there as former cliffs fronted by

slightly inclined sandstone strata which, on the whole, dip towards the south. Only in a few places do the sedimentary rocks lie on the granite; they usually meet it along the lines where the granites were broken off. The area of their formation was alternately exposed and submerged, so that deposition was not continuous and the succession of strata has many gaps.

The oldest sedimentary rocks, which are sandstones of Cambrian age (Nexö sandstone), lie along the southern edge of the granite in beds about 60 m. thick. Southwards they are overlain by dark greenish sandy shales which are interspersed here and there with sandstone beds and are considered to be about 60 m. (200 ft.) thick; they, in turn, are overlain by a thin bed (3 m.) of incoherent speckled sandstone.

These rocks are, for the most part, undisturbed by earth movements. They were originally covered, in part, by later deposits at least 47 m. thick. These have since been eroded away from most areas, but on account of dislocation and sinking of some beds they are preserved in some areas in the south where they are exposed in river valleys. They occur as black bituminous shales covered by dark grey limestones overlain by more shales, all of either late Cambrian, Ordovician or Silurian age. The uppermost shales contain, in some localities, lime concretions that include small clear crystals which, although only quartz, are commonly known as 'Bornholm diamonds'.

Triassic and Jurassic rocks

After Silurian times, the whole of the present area of Bornholm lay above sea level. Consequently, rocks of Devonian, Carboniferous and Permian age are absent and no further deposition occurred until it became submerged again towards the end of the Triassic period. Then were deposited, sometimes under sea, sometimes in lakes and lagoons and sometimes in estuaries, beds of sandstones, conglomerates, sands, a variety of clays and some coal seams. These rocks occur as a fringe along the south-east and south coasts from Hasle around to just beyond the Öle Aa and also in a small area in the bay west of Gudhjem; they have been much fractured and dislocated. Some of the coal seams were deposited early in this series (lower Lias), but the most extensive seams were laid down in Jurassic times. In the area between Hasle and Sorthat there are twenty-five coal seams varying from 7 to 70 cm. in thickness. This coal has been mined sporadically since the beginning of the seventeenth century, but on account of its poor and sulphurous quality, the narrowness

of the seams, and the difficulty of keeping the shafts shored up and free of water, it is only occasionally that its exploitation is profitable. During the war of 1914-18 some mining was done, but it ceased as soon as coal imports were restored after the armistice.

The clays of this geological period (Rhaetic and Lias) are fireproof and are used for bricks, terra-cotta, earthenware, and stone-ware.

Cretaceous Rocks

Bornholm then remained above water until towards the end of the Cretaceous period. The rocks which were then laid down are preserved in a triangular area lying about half a kilometre behind the coast south of Hasle and also along the coast from the Stampe Aa to Arnager. These are all older than the Cretaceous deposits of Jylland and the archipelago, and occur as sands, ironstones, clays, conglomerate, greensand and limestone. The limestone, which is the youngest deposit, and is of Middle Chalk (Turonian) age, is exposed in a cliff between Horsemeyre Odde and Arnager.

After this, Bornholm remained above sea level and no further deposition of rocks occurred. During the Quaternary glaciation the ice sheets spread a mantle of boulder clay over most of the island, but this is much thinner than that which was laid over the Danish archipelago and east Jylland. The ice-sheets at one time overrode the whole island but later they divided around it reaching up to a height of almost 100 m., but leaving most of the granite mass, north of a line approximately from Neksö to Knudskirke, standing out as an island above a sea of ice. Ice erosion and morainic deposition were therefore much heavier on the southern part of the island, over the sedimentary rocks and the fringes of the granite mass. On the granite upland large areas were overlain with morainic sand from the first ice-sheets. These sands carried heath in their natural state but have now been systematically planted with coniferous trees.

RELIEF

The granites of Bornholm form hilly terrain which rises from the north-west and north coastlines along steep glaciated slopes to a height of about 90 m. In the north-east the ascent is gentler, rising to about 70 m. in front of the higher Paradisbakker. In the south the granites slope most steeply, not towards their junction with the sedimentary rocks along the Rönne-Neksö line, but farther north

along a line approximately from Hasle to Neksö. South of this latter line the granites together with the sedimentary rocks form a rather featureless foreland which slopes gently southwards (cf. Figs. 125-6).

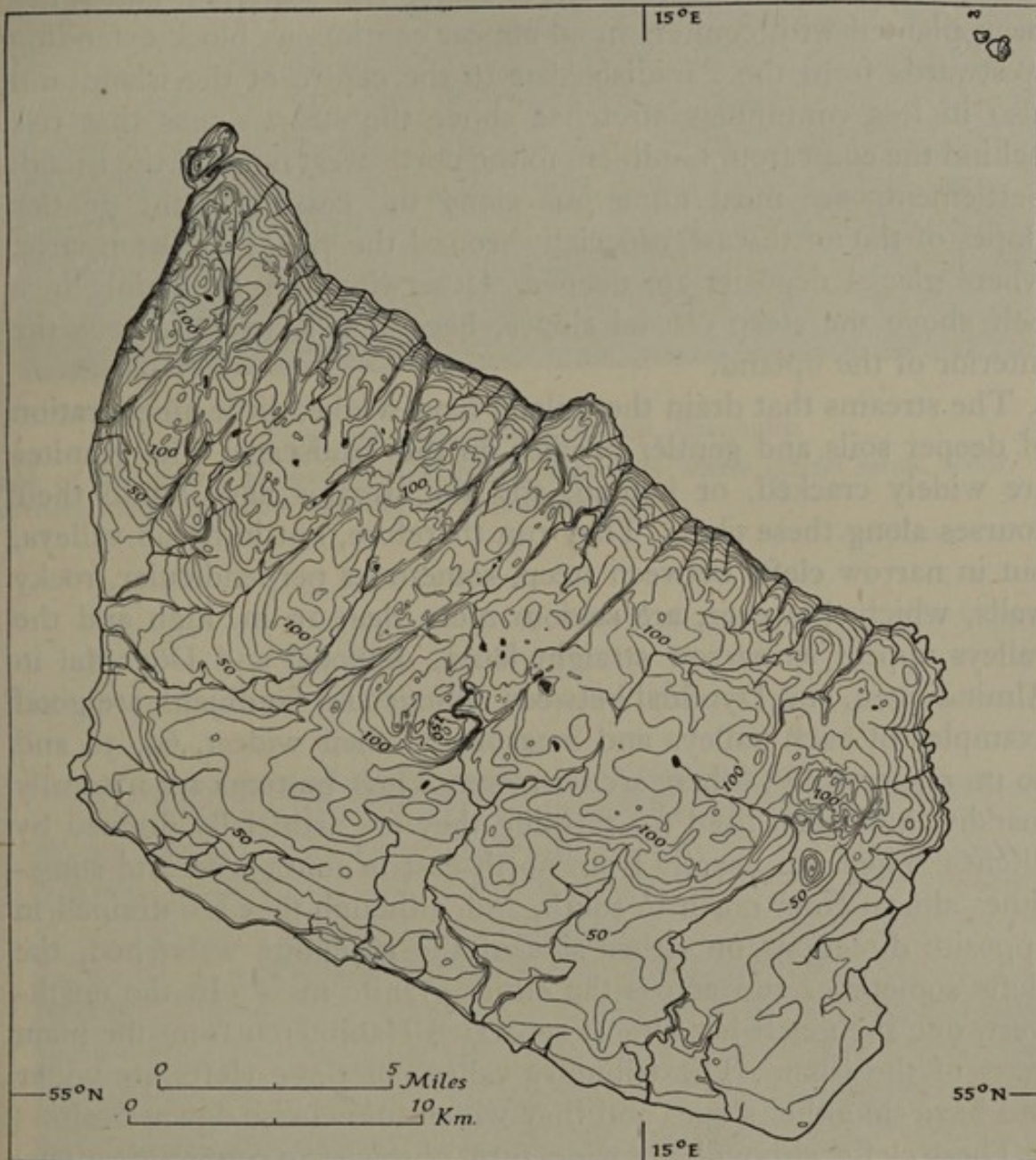


Fig. 126. The relief of Bornholm

Based on the *Geodætisk Institut's* 1 : 100,000 map, sheet 66.

The contours are at intervals of 10 m.

The Granite Upland

Within the area bounded by the steepest slopes the granites form rounded hills smoothed by glaciation. They rise gently to summits of about 120 and 130 m. and culminate in Rytterknægten (162 m.) near the centre of the island and within the large plantation of

Almindingen. The greater part of this hilly mass is covered, if sometimes only thinly, with glacial clays and sands, but here and there the rocky core juts out in rough, sharp-edged outcrops. This is meagre land where settlement is sparse and scattered, and it has been planted with conifers in an almost continuous block extending westwards from the Paradisbakker to the centre of the island and also in less continuous stretches above the steep slopes that rise behind the coast from Gudhjem to the north-west point of the island. Settlements are most numerous along the coast and the gentler slopes of the north-east, especially around the village of Östermarie, where glacial deposits are deeper. Otherwise they lie mainly in a belt above the steep coastal slopes, becoming sparser towards the interior of the upland.

The streams that drain the upland have worked little amelioration of deeper soils and gentler profiles on this landscape. The granites are widely cracked, or jointed, and the streams have found their courses along these clefts. They run therefore, not in broad valleys, but in narrow clefts between steep, sometimes perpendicular, rocky walls, which, however, are seldom more than 10 m. high and the valleys appear as narrow straight lanes. Ekkodal and Dövredal in Almindingen, and Dynddal between Allinge and Gudhjem, are good examples of such valleys and measure, at their widest, 60, 50 and 80 m. respectively; others are narrower. Their bottoms are naturally marshy, but when used for farming they are artificially drained by ditches. They run usually from north-east to south-west and sometimes almost from north to south, and, although they are drained in opposite directions on either side of the indefinite watershed, the clefts sometimes run across the entire granite mass. In the north-west, one such cleft has almost separated Hammeren from the main mass of the island. The tributary valleys of these clefts are wider and have smoother slopes and they widen funnelwise downstream.

These clefts, although not wide, form obstacles to communications. On account of their steep and hard rocky sides, crossroads are found only where they widen into valleys. Their influence on communications is well demonstrated in the north-west of the island where the roads run from north-east to south-west along the land between the clefts and are linked by a road running diagonally near the watershed and another running near the summit of the steep slope to the north coast.

Where the cracks in the granites are numerous the land has been broken up into triangular and rhomboid areas which rise sharply



Plate 105. The granite upland, Bornholm

Much of the upland is covered with heath, especially where glacial sands occur. Here and there the granite core appears as rugged outcrops.



Plate 106. View from Österlars Church

Elsewhere the upland forms a kinder landscape which is well wooded, and settlement is in hamlets and scattered farms.



Plate 107. The west coast of Hammeren, Bornholm

The cliff-edged coast, fronted by a boulder-strewn beach, is characteristic of much of the north-west coast of Bornholm. On the hill are the ruins of Hammershus castle.



Plate 108. The north-east coast of Bornholm

On the north-east coast of Hammeren the boulder-strewn beach is lacking and the upland drops sharply to the sea. The 'plinth'-like final drop is characteristic of most of the coasts of the island.

above one another although the differences in height are usually only slight. One such triangular area forms the highest point of the island. This stepping of granite blocks is strongly developed in the Paradisbakker.

The Southern Foreland

The granites descend to the southern foreland along a sharp slope, at the foot of which the granites and sedimentary rocks alike slope gently southwards, from a height of about 80 m., to the sea. They are so well covered with glacial clays and sands that rocks rarely appear on the surface. The fissure valleys of the granite mass stop abruptly and the streams now meander in shallow beds between damp meadows almost to the coast. The foreland drops to the sea in a sharp step 10–15 m. high, and so the streams do not empty through funnel-shaped estuaries into bays but tumble down through the notches which they have incised in the coastal step. These miniature 'hanging valleys' are a feature of the coasts everywhere except along the dune-fringed south-east corner of the island.

This clay-smeared southern foreland is the most populous part of the island. Settlement is dispersed and consists mainly of farms standing among their tilled fields and along roads. Villages and hamlets are few and are usually no more than small groups of houses around churches. Aakirkeby, which had a population of 1,560 in 1935, is the only settlement of any size in Bornholm apart from the ports, and it serves as the agricultural centre for much of the south of the island.

COASTS AND PORTS

General Description

The foundering of the areas around Bornholm left the granite mass with straight, almost rectangular, edges which, from Hasle around the north of the island to Ypnasted, rise steeply from the sea. The coast is generally steep-to except off the south-west and south-east sides. Along some stretches, cliffs rise sheer from the water, and even where the land slopes more gently there is almost everywhere a steep final drop of 10 or 15 m. to the sea. Usually, however, the coast consists of sharp glaciated slopes, smeared with glacial clay, and while they are not cliffs in the sense of vertical rock faces, their height and gradient are such that they are little more hospitable. Torrents

plunge down the face of the slopes in narrow gullies. Along the whole stretch of coast it is only seldom that deposition has occurred and the foreshore is very narrow. In places the sea has eroded along the lines of crevices in the granite and has left stacks and rocky points projecting between the inlets, with outlying reefs forming skerries on a very small scale.

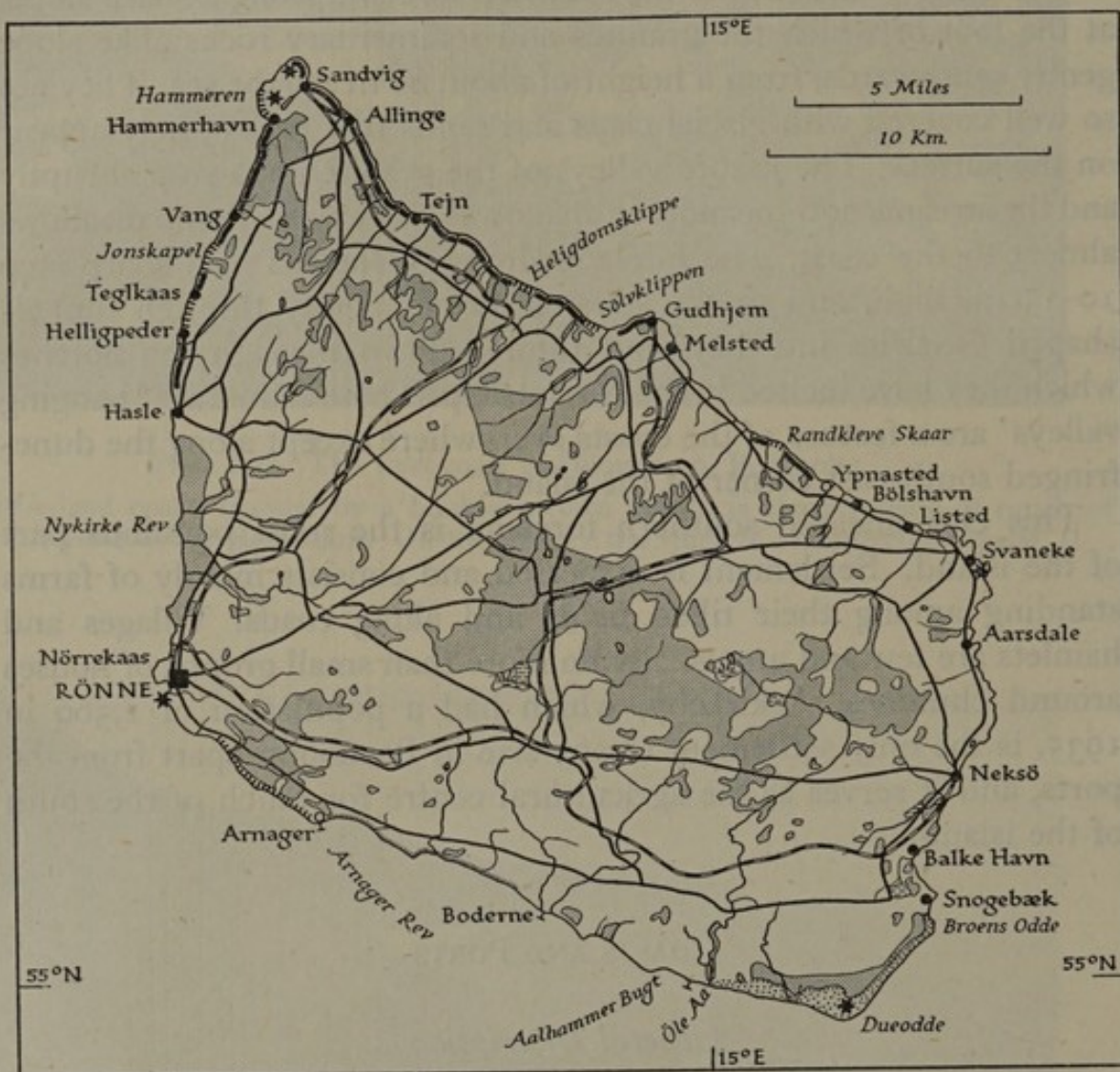


Fig. 127. The coasts of Bornholm

For key see Fig. 8, p. 26. The heavy lines indicate the main roads; the half-filled double lines show the railway system.

Where the sedimentary rocks reach the sea, from Hasle southwards and eastwards to Neksö, the hinterland slopes gently inland, but even here the low rim of cliff behind the shoreline is present almost everywhere and projects here and there to form short blunt promontories. In front of the low cliff, and around the promontories, there is usually narrow foreshore strewn with boulders. A strip of

sandy beach develops into a belt of dunes 12–15 m. (40–50 ft.) high around the south-east corner of the island; behind the dunes the low rocky step is still preserved.

Detailed Description

The West Coast: Rønne to Hammer Odde

For a distance of about 6 km. ($3\frac{3}{4}$ miles) north of Rønne the coast is fronted by several rocky reefs which extend up to 2 km. ($1\frac{1}{4}$ miles) offshore and are only 1 m. (3 ft.) below the surface in places, but from Nykirke Rev northwards the 4 m. (2 fathoms) line lies within $\frac{1}{4}$ km. (275 yd.) off the shore. From Rønne to Hasle the coast is low and slopes gently inland under a belt of forest, some 1 km. deep, that extends along almost the whole distance and behind which is the main road between the two towns. North of Hasle the granites rise steeply from the coast leaving only a very narrow foreshore, and in places they form rocky cliffs which rise sheer from the sea up to about 70 m. The north tip of the island, Hammeren, is a rocky hill 82 m. (270 ft.) high which rises steeply on its south-west side but slopes gradually on its north-east flank. Between Hasle and Hammeren there is anchorage in depths of 20–30 m. (11–16 fathoms) everywhere off the coast while the wind is offshore, but from Hasle southwards to Rønne the uneven rocky bottom renders ships liable to lose their anchors.

Hasle. Along this whole stretch of coast the only port of any size, apart from Rønne (see p. 507), is Hasle. Close north of the harbour foul ground and a reef, with least depths of 3 m. (10 ft.), extend about $\frac{1}{2}$ km. ($\frac{1}{4}$ mile) offshore. The harbour is enclosed by stone moles and is divided within, by stone quays, into an outer basin and two inner basins with depths of 3.6–4.3 m. ($11\frac{3}{4}$ –14 ft.). The dredged channel from the entrance, across the west part of the outer basin, to the inner basins is also 4.3 m. deep, but eastwards to the shore the outer basin shoals rapidly to depths of 0.6 m. (2 ft.). Westerly winds can lower the water level by 0.6 m. (2 ft.), and gales from the north-east can increase it by a similar amount. The port contains a slip for ships up to 100 tons, and a crane to lift $12\frac{1}{2}$ tons. It has no railway.

At Helligpeder, Teglkas, Vang and Hammerhavn are small boat harbours, enclosed by moles and with depths of 1.2 m. ($3\frac{3}{4}$ ft.), 2.5 m. (8 ft.), 3.1 m. (10 ft.) and 4 m. (13 ft.) respectively. A main road reaches the coast at Hasle only and crosses the upland to Allinge and thence to Sandvig; there is no railway.

The North-east Coast: Hammeren to Svaneke

Landing is possible at most places along this coast except in some localities, especially at Helligdomsklippe and Randkleve Skaar, where cliffs rise sheer from the sea. Behind the shore, however, the land rises steeply except in the north-east between Ypnasted and Svaneke. The coast is steep-to, the 4 m. (2 fathoms) line lying close

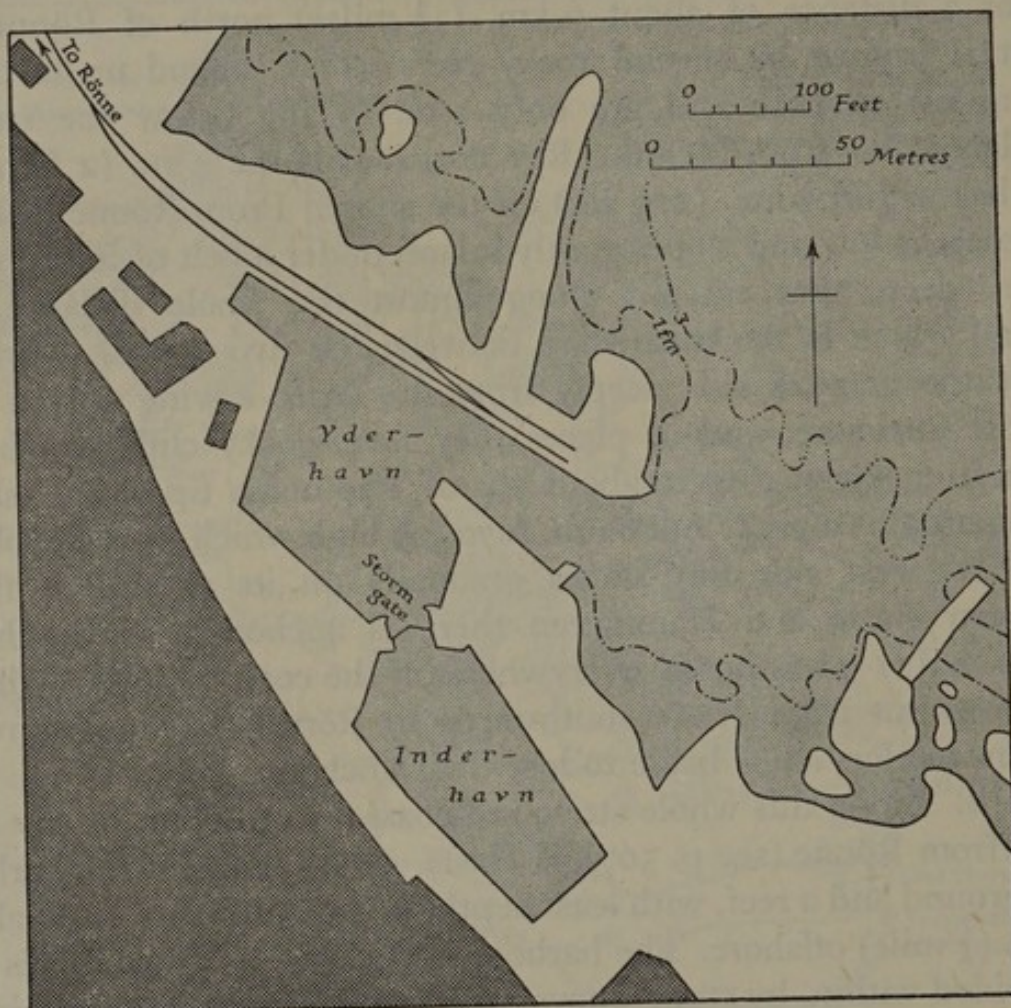


Fig. 128. The port of Allinge

inshore. With offshore winds there is anchorage everywhere, but westerly winds quickly raise a considerable swell. At Helligdommen the granites have been much fractured. The sea has worked along these lines of weakness and has left stacks and steep rocky projections between the inlets.

A few fishing villages back on the sea and have small boat harbours. Such are Sandvig, Tejn, Melsted, Bølshavn and Listed, which have depths ranging between 1·4 and 2·8 m. (4½–9 ft.). The only harbours for ships other than fishing vessels are at Allinge, Gudhjem and Svaneke.

Allinge. The harbour at Allinge is enclosed within granite moles and consists of an outer part with depths of 4.7 m. (15½ ft.) and an inner part with depths of 4.4 m. (14½ ft.). The quay on the north-east side of the outer harbour is about 100 m. (330 ft.) long and has two railway tracks along its entire length; these are connected to the island's railway system. A storm-gate separates the outer and inner harbours across an entrance some 10 m. (33 ft.) wide and gives protection against onshore gales. The port contains one crane to lift 5 tons in the outer harbour and two, to lift 20 tons and 6 tons respectively, in the inner harbour.

The relatively high place occupied by such a small port as Allinge in a classification of Danish ports by tonnage of ships entered, is due to its importance as a place of shipment for granite. Most of the ships enter in ballast, and are mainly small ships from home ports. In 1938 the imports of the port totalled only some 6,000 tons, more than a half of which consisted of coal and coke and the remainder largely of general supplies. Outgoing cargoes, on the other hand, weighed 157,000 tons, of which 156,000 tons consisted of stone, all of which was shipped to Danish ports in eleven hundred ships of 125,000 register tons.

Gudhjem. At Gudhjem are two harbours which lie on either side of Sorteodde and about 300 m. (330 yd.) apart. They are both small and are enclosed by granite moles which tie on to rocks that flank the entrances to the harbours. The northern harbour, which is known as Nørresand Havn, consists of a single basin with depths of 3.4 m. (11 ft.). The southern harbour is divided within into three basins which lie adjacent to one another from west to east. The outer basin has an entrance 11 m. (36 ft.) wide and depths of 4.0 m. (13 ft.) alongside the quays. The middle basin is entered from the east side of the outer harbour and has depths of 3.7–4 m. (12–13 ft.). It gives access to the easternmost basin which has depths of 2.0–2.5 m. (6½–8 ft.). The middle basin has a crane to lift 10 tons. Neither harbour has railway connexions.

Svaneke. The harbour of Svaneke lies within granite moles and consists of an outer and an inner basin separated by a gate across an entrance about 10 m. (33 ft.) wide. Depths in the outer basin are 4.4 m. (14½ ft.) and in the inner basin 3.7 m. (12 ft.). On the north side of the entrance to the outer basin is a boat harbour with depths of 1.5 m. (4¾ ft.). The port contains a slip for boats up to 20 tons, a boatyard and a crane to lift 5 tons. The port has no railway connexions.

Between Allinge and Gudhjem the only main road climbs steeply out of these towns and runs parallel to the coast at the top of the steep coastal slope. The coast road from Gudhjem to Svaneke runs along the foot of the slope which is here much gentler. From Gudhjem a single-track metre-gauge railway runs across the centre of the island to Aakirkeby where it joins the railway from Rønne to Neksö.

The East Coast: Svaneke to Dueodde

From Svaneke southwards to Neksö the coast is still steep-to with a rocky boulder-strewn foreshore, but the hinterland rises gradually. South of Neksö the nature of the coast changes. Here the softer sedimentary rocks reach the sea and the coast shelves more gradually from sandy beaches. The hinterland rises gently and settlements are much more numerous. From Broens Odde around the south-east angle of the island to about the mouth of the Öle Aa the coast is lined with sand dunes which reach a maximum width of about 100 m. and a height of 15 m. behind Dueodde. Behind the dunes a conifer belt with an average width of about 25 m. (80 ft.) has been planted to check the landward drift of the sand.

Along the east coast there are boat harbours at Aarsdale, Balke Havn and Snogebæk with depths of 2.5, 0.9 and 1.5 m. respectively. The only harbour for vessels other than fishing boats is at Neksö.

Neksö. The harbour at Neksö is enclosed by moles and protected on the south-east by a curved breakwater which leaves an entrance some 35 m. (115 ft.) wide and 5 m. (16½ ft.) deep. The harbour is divided into northern and southern basins by a broad quay. The northern basin has depths of 5 m., and on its north side is a dry dock which can take ships 52 m. (170 ft.) long, 9.4 m. (30 ft.) broad and of 3.7 m. (12 ft.) draught. On the east side of the dry dock is a slip which can take ships of about 50 gross tons. The basin contains a floating crane and one transportable crane, each to lift 1½ tons. The entrance to the northern basin has a storm gate which is closed during onshore gales.

The southern basin is divided into three small basins by short interior moles. The outermost part has depths of 2.8–3.7 m. (9–12 ft.), and the others have depths of 1.4–2.5 m. (4½–8 ft.).

The harbour is accessible in almost all weather, but onshore gales cause an outgoing current inside the breakwater; this current may attain a speed of 1½ knots. Winds from between east and south-west lower the water level, but, after continued strong westerly winds, easterly winds may raise the water level as also do westerly, northerly



Plate 109. The port of Gudhjem

The view was taken from the south side of the southern harbour looking towards the entrance which is in the top centre of the photograph.



Plate 110. The port of Svaneke, from the south



Plate 111. The port of Rönne, from the south-east

In the foreground is the shallow bay with its bathing place and boat harbour; beyond is *Inderhavn*. The main quay with its coaling crane is along the west side of Inderhavn. Sydhamn is off the picture on the left (cf. Fig. 129).

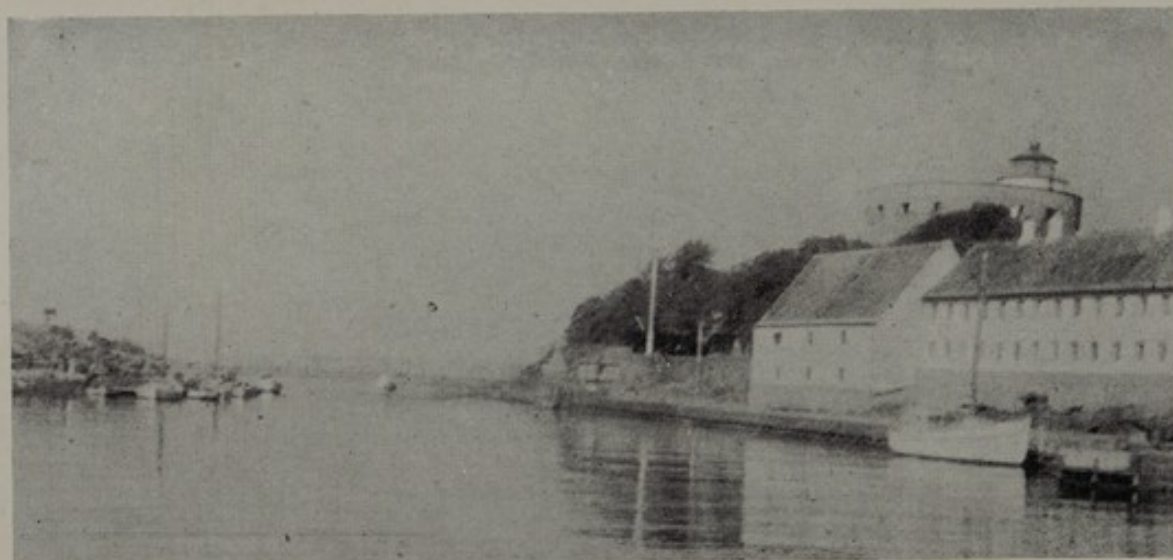


Plate 112. The harbour of Christiansö, from the south

The view shows the southern part of the harbour.

and especially north-easterly winds, but the difference in the water level is rarely more than 0.6 m. (2 ft.).

Railways run on the quays on the west and south sides of the northern basin. These are linked with the island's railway system which gives Neksö communication with Aakirkeby and Rönne. A coast road runs from Svaneke to Neksö where it turns inland, one route passing through Aakirkeby to Rönne and the other runs far behind the south coast.

The South-west Coast: Dueodde to Rönne

The south-west coast is virtually harbourless and has very few settlements. At Boderne, seven miles west of Dueodde, is a pier 45 m. (148 ft.) long with depths of about 1.5 m. ($4\frac{3}{4}$ ft.) at its head; this was reported as unfit for use in 1937. The only well-sheltered anchorage, in depths of 1– $4\frac{3}{4}$ fathoms, is in Arnager Bugt, and Arnager has a very small boat harbour 2 m. ($6\frac{1}{2}$ ft.) deep enclosed within a stone mole which lies at the head of a long mole projecting about a cable from the coast.

The coast is fronted by reefs, rocks and shoal patches up to 5 km. (3 miles) off the coast in its western part. Eastwards from Arnager Rev to Aalhammer Bugt soundings are irregular in depths of less than 9 m. (5 fathoms), and within a mile of the shore are several rocky patches with depths of $6\frac{1}{2}$ m. ($3\frac{1}{2}$ fathoms). Between Aalhammer Bugt and Dueodde the coastal bank extends about a quarter to half a mile offshore, and south of Dueodde are steep-to, shifting sandbanks.

The coast is, for the greater part, bordered by low cliffs although behind the cliffs the land slopes gently. From Korsodde to Arnager are limestone cliffs up to 18 m. (60 ft.), while eastwards the Mesozoic rocks drop in low cliffs to a narrow foreshore strewn with glacial boulders, and projecting here and there to form blunt headlands (*Odde*) which become less steep and gather sandy fringes towards the east. Road communications lie well inland except towards Arnager where it approaches the cliff edge.

RÖNNE

At the south-west angle of the island is Rönne ($55^{\circ} 06' N$, $14^{\circ} 42' E$; population 10,898 in 1935), the chief port and largest town. It ranks sixth among Danish ports in the total tonnage of ships entered,

although the weight of goods loaded and discharged is relatively small. The port is at the head of a bay which is flanked on its north and south sides by two rocky reefs extending nearly a kilometre ($\frac{1}{2}$ mile) out to sea and having depths of between 1 and 10 m. (3–33 ft.). Approximately midway between the two reefs is a rocky shoal, Trindelen, with a least depth of 3.4 m. (11 ft.).

Approach and Access.

The port is protected by three detached moles, of which the central one lies on Trindelen shoal. Entrance to the outer harbour lies on either side of the central mole. The northern entrance has a least depth of 5.9 m. ($19\frac{1}{4}$ ft.), but the main and southern entrance has a least width of 80 m. (262 ft.) and gives access to a channel dredged to a depth of 8.5 m. (28 ft.), over a width of about 150 m. (490 ft.), and which leads into the northern basins.

Depths in the basins range from 3.1 to 7.0 m. (10–23 ft.). About 580 m. (1,900 ft.) of quays have depths of 6–7 m. ($19\frac{1}{2}$ –23 ft.) alongside and about 900 m. (3,000 ft.) of quayage with smaller depths. There is adequate turning space over depths of 8.5 m. (28 ft.) in the outer harbour.

Tides are imperceptible, but east winds may raise the water level by 0.8 m. ($2\frac{1}{2}$ ft.), and, in exceptional circumstances, by 1.8 m. (6 ft.). Westerly winds may lower the water level by 0.9 m. (3 ft.).

For Ice Conditions see Appendix IV.

Detailed Description

The port consists of an outer harbour, two northern basins known as *Inderhavn*, and a new south harbour, *Sydhavn*, which is in process of construction. The outer harbour shoals gradually outside the dredged area to depths of 1.3 m. ($4\frac{1}{4}$ ft.) along its northern and eastern borders.

Inderhavn is enclosed by two stone quays between the ends of which is an entrance about 80 m. (260 ft.) wide and 7–8 m. (23–26 ft.) deep. The harbour is divided into two main basins by a quay. The western basin has depths of 6–7 m. ($19\frac{1}{2}$ –23 ft.). The greater of these depths also occurs along the north side of the south quay. The eastern basin is shallower, with depths of between 3.7 and 5.0 m. (12–16 $\frac{1}{2}$ ft.), the deeper berths lying along the east side of the basin. The north-west angle of this basin is separated from the main basin by a short quay and is used mainly by fishing boats.

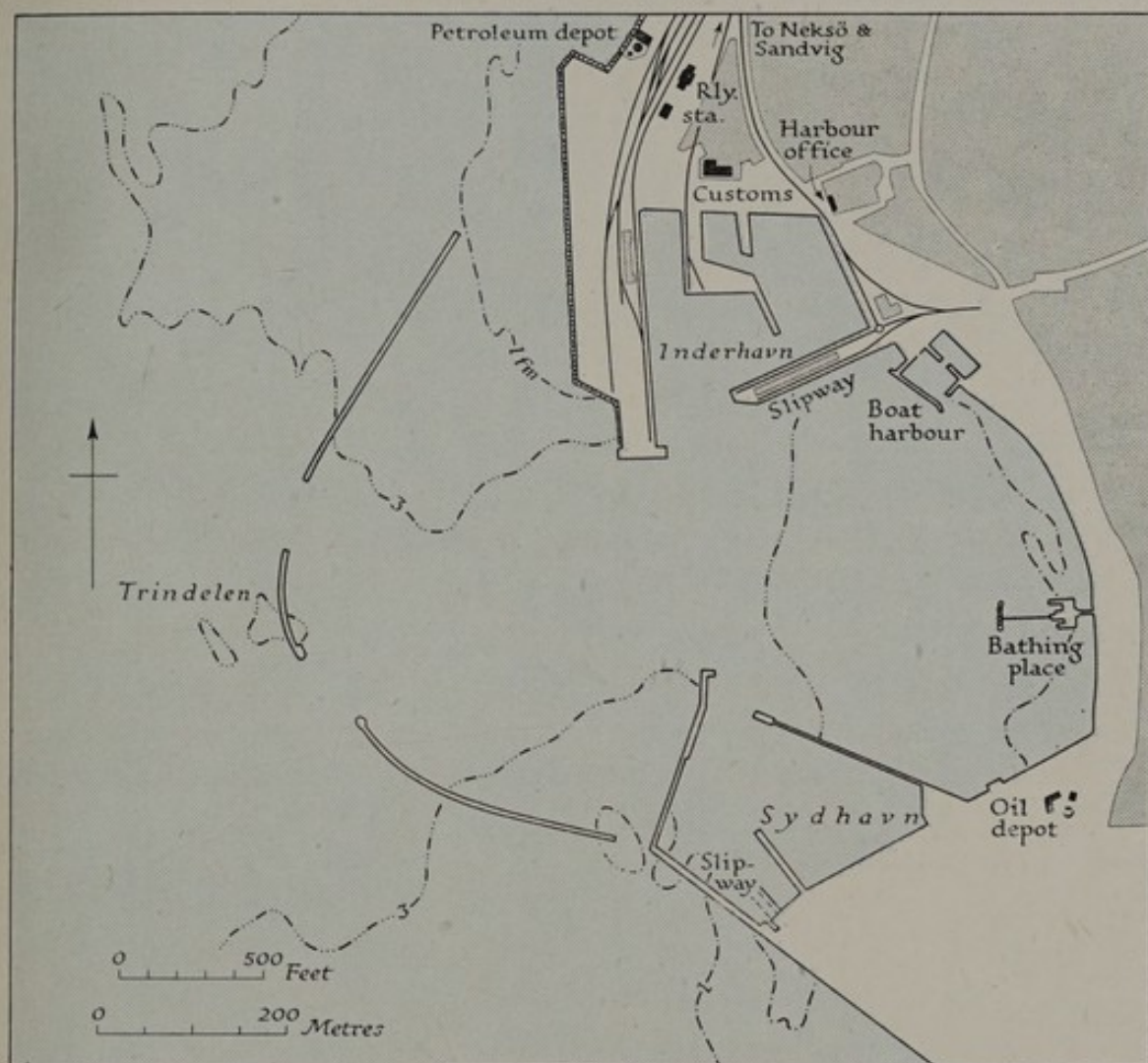


Fig. 129. The port of Rønne

Reconstruction work was still in progress in Sydhavn during the summer of 1943. It was then reported that a new slip, capable of lifting 400 tons, had been built south of the mole. This slip has probably replaced the slipway which is marked on the plan.



Sydhavn is enclosed by an L-shaped breakwater and a stone dyke which had been completed in December 1938. It then had 120 m. (390 ft.) of quayage with a depth of 4 m. (13 ft.) alongside. In the entrance and outer part of the harbour the depths are 5 m. (16½ ft.).

Between *Inderhavn* and *Sydhavn* the water shoals to the shore. The southern side of the south quay of *Inderhavn* has depths of 6 m. (19½ ft.) alongside its western half, and close south of it is a small boat harbour with depths of 1.8 m. (6 ft.). Between the boat harbour and the root of the breakwater is a slip.

At Nørrekaas, close north of Rønne harbour, is a small boat harbour with a least depth of 1.7 m. (5½ ft.) in the entrance.

Port Facilities

The port contains a slipway for ships up to 100 tons and another, in *Sydhavn*, for ships of up to 50 tons (see note to Fig. 129). In the town are two foundries, with machine shops, which can undertake minor repairs. There is one crane to lift 18 tons and one electric coaling crane. Railways run on all the main quays of *Inderhavn* and have direct communications with the island's railway system.

Trade

In 1938, a total of 1,116 ships of 408,457 gross tons discharged 100,000 tons of cargo in the port. Nine hundred of these ships and rather more than half the weight of cargo were from Danish ports, and their cargoes consisted mainly of grain, feeding stuffs, fertilizers and general goods. More than half of the weight of foreign cargoes consisted of coal and the remainder mainly of feeding-stuffs and fertilizers. Fifty more ships left with cargoes than entered laden, and their cargoes weighed about 10,000 tons more than those discharged. Over a half of the weight of cargoes consisted of granite and the remainder almost entirely of earthenware and agricultural produce consigned to Danish ports. Only 107 ships, loaded with 24,000 tons of cargo, were destined for foreign ports.

Industries

The industries of Rønne arise mainly from the kaolin pits and quarries which lie a short distance east of the town. Bricks, tiles, drainage pipes and coarse earthenware are the chief products of the district, and a great deal of the activity of the port is concerned with exporting these and also granite and sandstone for road-metal and building, and with shipping raw kaolin. The port also serves as a

collecting centre for agricultural produce which is prepared and packed for export.

Communications

A single-track metre-gauge railway, with passing loops, runs north-east across the granite upland through Nykirke and Klemenskirke to Rö and thence north-west along the coastal slope to Allinge and Sandvig. A similar railway runs east through Aakirkeby to Neksö, while another line runs from Aakirkeby through Östermarie and Österlars to Gudhjem. Four main roads lead out of the town and communicate with all parts of the island. Regular steamship services run to Köbenhavn.

ERTHOLME

Christiansö and Frederiksö are the only inhabited islands in the Ertholme group. Christiansö is 22 ha. in extent and supported a population of 74 in 1935; Frederiksö had 37 inhabitants, and is 4 ha. in extent. A harbour, with least depths of 5 m. (16½ ft.) in the channel and maximum depths of 3.7 m. (12 ft.) alongside the quays, lies in the strait between the two islands. The harbour is divided into two parts by a bridge which opens and allows ships of 5 m. (16½ ft.) draught to pass. There is a slip for ships of up to 20 tons.

Christiansö is administered by the Ministry of Marine which maintains there a steward, a doctor, and a priest.

Appendix II

SLESVIG SINCE 1914

SLESVIG DURING THE WAR OF 1914-18

During the war of 1914-18 the Danish-speaking people of Slesvig (Danish Slesvigens) were harshly treated by the German authorities. At the outbreak of war all authority was withdrawn from the civilian administrators and placed in the hands of the military. Slesvig was thus subjected to the General in Command at Altona. Liberty of speech, of the press and of holding meetings was immediately abolished. The political attitude of the Danish Slesvigens was carefully watched by the German authorities. During the first days of August 1914, over three hundred political suspects were arrested in Slesvig, and confined to prison without trial.

The men of Slesvig were called up by the army like those of other parts of Germany. The authorities took no consideration of linguistic differences or of national sympathies, and even the stateless (*Heimatlose*) were compelled to serve under the German banner. It is estimated that about 30,000 Danish Slesvigens took part in the war on Germany's side, and that nearly 6,000 of them lost their lives. These men were distributed among various units of the German forces, so that there was no possibility of mutiny, or of any concerted subversive action among them. A few hundred Danish Slesvigens were made seamen on German blockade-runners, which flew the Danish flag and supplied the German forces in East Africa. Others, on account of their knowledge of Danish, were employed as spies in Scandinavia. It is said that German espionage against Allied shipping in Trondheim was, for a long time, controlled by a Danish Slesviger. As time went on, the anti-German sentiments of the Danish Slesvig soldiers asserted themselves. A number of them deserted, and escaped across the frontier into Denmark. The immediate result of these desertions was to intensify the restrictions placed on the Danish Slesvigens. Heavy sentences were inflicted on those who helped deserters to escape.

Economically, Slesvig suffered during the war no less severely than did other parts of Germany. Large quantities of its agricultural produce were commandeered for the forces and for other parts of

Germany. Conscription resulted in a serious shortage of labour and a consequent reduction in agricultural production. Large numbers of cattle had to be slaughtered because of the shortage of feeding stuffs. Whereas, in 1913, the Slesvig dairies had produced 184 million kg. of milk, in 1919 they produced only 45 millions. The shortage of food resulted in a sharp increase in the death-rate.

PROSPECTS OF REUNION WITH DENMARK

In spite of the severity of the German government, Danish Slesvigiers continued, throughout the war, to work for the ultimate reunion of their country with Denmark, though most of them realized that this could not be achieved so long as the war lasted. The most influential political leader among the Danish Slesvigiers at that time was Hr H. P. Hanssen, who was one of the representatives of Slesvig in the German *Reichstag*. Owing to his tact, and to the moderation of his demands, Hanssen maintained friendly relations with many German politicians. Moreover, in his demand that Germany should fulfil the obligations which she had undertaken under Paragraph 5 of the Treaty of Prague (see p. 136), Hanssen gained the support of some of the more liberal politicians in Germany. He demanded only that those parts of Slesvig in which the Danish language and Danish sympathies predominated should be reunited with Denmark at a fitting time. But for a long time the German government refused to consider the demands of the Danish Slesvigiers. In 1915 it was authoritatively stated in Germany that the Dano-German frontier would not be altered in any way, whatever might be the outcome of the war.

During the war, the plight of the Danish Slesvigiers received considerable notice in foreign countries. Eminent Norwegians and Swedes published articles and pamphlets in support of the Danish Slesvigiers. In France the question of Slesvig's future was also discussed, and among those who advocated the reunion of Slesvig, or a part of it, with Denmark, were Anatole France, and Paul Verrier, Professor of Scandinavian languages in Paris. Professor Verrier afterwards came to play an important part in the settlement of the Slesvig question.

The Danish government and *Rigsdag*, on the other hand, studiously avoided open discussion of the question during the first three years of the war. Throughout the war the Danish government was led by Hr C. T. Zahle, with Hr E. Scavenius as Foreign Minister. In the summer of 1917, J. C. Christensen, then a member of the Cabinet,

proposed that the Slesvig question should be raised with Germany, and that the support of Norway and Sweden should be solicited. But the Foreign Minister and the rest of the Cabinet refused to adopt Christensen's proposal. They maintained that, if Germany were to return north Slesvig to Denmark, Denmark would be obliged to make some concession to Germany in return, and that this would be inconsistent with Denmark's neutrality. Many of the Danish Slesvigers believed that the Danish government's silence about the Slesvig problem, during the war years, arose from lack of interest. Consequently, there was a good deal of ill-feeling against the Danish government in Slesvig itself.

During the last two years of the war the Danish government, in reality, gave much consideration to the Slesvig question though most of its deliberations were secret. Changing conditions in Germany in the early autumn of 1918 stimulated hopes of reunion, both in Denmark and in Slesvig itself. When President Wilson's 'Fourteen Points' were published, in October 1918, many of the Danish Slesvigers believed that their own claims for reunion with Denmark would find support in the President's insistence on the right of self-determination of nations. Some were, nevertheless, disappointed that the President's proclamation did not expressly mention the case of Slesvig.

Early in October 1918, Hr Hanssen, as representative of the Danish Slesvigers, began some negotiations with the German government which now appeared willing to consider redrawing the Dano-German frontier, at some later date, in a way which would be more favourable to Denmark. During these negotiations, Hr Hanssen was assisted by Professor Aage Friis and other Danish experts. These Danish experts, it appears, took part in the discussions with the German government solely on their own initiative. It has been denied that they represented the Danish government in any way. In spite of German invitations the Danish government resolutely refused to open direct negotiations with Germany on the Slesvig problem, and maintained, throughout, that this question must be settled at the Peace Conference. Nevertheless, Hr Hanssen's negotiations provoked rumours that Denmark was secretly negotiating with Germany, and that she intended to settle the Slesvig question by a direct treaty with Germany, without considering the interests of the Allies. Although these rumours were several times denied by the Danish government, they were generally believed. On 14 October, the British Minister in Copenhagen questioned the Danish government about the supposed negotiations with

Germany and explained that, if the reports were true, the consequences might be detrimental to Denmark's interests. It has been maintained that the belief that Denmark had already concluded a secret agreement with Germany considerably influenced the attitude of the Allied statesmen towards Denmark during the Peace Conference in 1919.

GERMAN AND DANISH VIEWS IN 1918

Both Hr Hanssen and the Danish government maintained that the Danish Slesvigers had a legal right to demand the reunion of the territory which they inhabited with Denmark. They asserted that Paragraph 5 of the Treaty of Prague had given them this right (see p. 136). The German Foreign Minister, Dr Solf, on the other hand, disputed this assertion. He maintained that the Treaty of Prague had been the concern of Prussia and Austria only, and that it gave no rights to the Danish Slesvigers. Paragraph 5 of that Treaty had, moreover, been abrogated both by Prussia and Austria in 1878. Nevertheless, the German government recognized the rights of self-determination, and pronounced itself willing to redraw the Dano-German frontier on national principles, so that the majority of those who spoke Danish and had Danish sympathies should be reunited with Denmark. It was commonly held that the people in the areas concerned should be asked to express their views in a plebiscite.

Although it denied that it had discussed the question with the German government, the Danish government formulated its views in a circular issued on 22 October 1918. In this circular it was stated that nearly all members of the Danish *Rigsdag* hoped that the new frontier between Denmark and Germany would be drawn according to the wishes of the local inhabitants, rather than on historical principles. The government and *Rigsdag* realized the dangers and administrative difficulties that would result if large areas of Slesvig, in which the inhabitants spoke German and had German sympathies, were to be included in the Danish state. The Danish government would therefore oppose the inclusion of southern Slesvig, and the Germanized districts of central Slesvig, with Denmark.

Outside the *Rigsdag*, a number of more Chauvinistic Danes, realizing the impending collapse of Germany, were now beginning to demand that the historical frontier between Denmark and the German states should be restored, and that it should follow the River Eider or, at any rate, the *Dannevirke* (see p. 102). Those who sub-

scribed to these views were few, but they were not without influence in the negotiations which followed.

On 17 November 1918, the north Slesvig *Vælgerforening* held a meeting at Aabenraa and, by a large majority, passed a resolution endorsing Hr Hanssen's plan for the settlement of the Slesvig frontier dispute. The *Vælgerforening* was a political organization of Danish-speaking residents in north Slesvig. In 1914 it had about 10,000 members, and was considered fully representative of the views and aspirations of Danish-minded people of north Slesvig. Hr Hanssen's plan was adopted, without substantial alteration, by the Danish government on 25 November 1918. Its moderation was much criticized during the Peace Conference, and many attempts were made to alter it, both in Denmark and abroad. Nevertheless, it was on these lines that a solution was eventually found.

In accordance with Hr Hanssen's plan, the Danish government proposed that a plebiscite should be taken in the area designated as north Slesvig, and in the parishes immediately south of it. North Slesvig, according to this proposal, consisted of the territory between the Dano-German frontier of 1866, and a line which is practically identical with the Dano-German frontier of 1920. The plebiscite was to be taken in north Slesvig as a unity, so that it should be decided, simply by majority of the votes cast in that area, whether it should remain a part of Germany or whether it should be reunited with Denmark. The people living in the parishes immediately south of north Slesvig should also be asked to express their wishes in a plebiscite. But there the vote should be taken parish by parish, so that it should be decided, separately in each case, whether the parish should be Danish or German, according to the will of its inhabitants. These two districts, north Slesvig, and the parishes immediately south of it, were called zone 1 and zone 2. The southern limit of zone 2 was not to be decided until the national sympathies of the inhabitants of the more southerly districts had become better known. The important town of Flensburg was included in zone 2. Practically all men and women, over 20 years of age and resident in the area, were to have the right to vote.

This plan was communicated by the Danish government to representatives of the Allied governments in the latter days of November 1918. Its publication was followed by protests from municipal and parochial councils, and other German organizations in Slesvig. These protests continued throughout the diplomatic campaign. It was argued that economically, culturally and especially on historical

grounds, the two duchies of Slesvig and Holstein were united and indivisible. The German organizations mostly admitted the justice of deciding the future of Slesvig by plebiscite, but they maintained that the whole duchy should vote as a unity, in which case a majority of votes favouring union with Germany would be assured. These views were not supported by the German government, which conducted itself with dignity and maintained its adherence to the principle of self-determination.

Early in December 1918 the Danish government informed the Allied governments that Denmark intended to submit the Slesvig question to the Peace Conference. Hr Bernhoft, Danish Minister in Paris, was appointed Denmark's representative at the Conference, and Hr H. V. Clausen and other experts were appointed to assist him in dealing with the Slesvig question. In its instruction to Hr Bernhoft, the Danish government clarified its intentions. The government desired that as many as possible of those Slesvigers who talked Danish and 'felt' Danish should be united with Denmark. But the government did not desire the inclusion in the Danish state of any who did not themselves actively desire it. Otherwise, political and administrative difficulties would result. The instructions emphasized that the government's view was shared by the great majority of the Danish *Rigsdag*. It was admitted that there were a few politicians in Denmark who desired an historical Dano-German frontier, drawn along the River Eider or the *Dannevirke*, but there were none who wished to place it so far south that the Kiel Canal should be included in the Danish state. Hr Bernhoft was instructed, therefore, to ask the Peace Conference to arrange a plebiscite on the lines suggested in the Aabenraa Resolution. If the Allies would not agree to a decision by plebiscite, Hr Bernhoft was authorized to accept, without a plebiscite, the area designated as north Slesvig. Certain parishes farther south might also be reunited without a plebiscite, if it could be proved that they were predominantly Danish in speech and sympathy. Denmark would not, however, agree to the reunion of Flensburg or of any parish in central or southern Slesvig, where there was a German-speaking majority, unless a plebiscite were taken in those areas.

The views expressed in the Danish government's instructions were supported by the north Slesvig delegation, which arrived in Paris on 3 March 1919 and included Hr Hanssen and other prominent Danish Slesvigers. They found further support in the statements of Professor Paul Verrier, who had been appointed by the *Comité d'Etudes* to study the Slesvig question. Working independently, Professor Verrier had

reached practically the same conclusions as Hr Hanssen and the Danish government.

In February 1919, the Council of the Peace Conference decided to refer the Slesvig question to the Commission appointed to deal with the Belgian problems. The British Commonwealth, France, the U.S.A., Italy and Japan were represented on this Commission.

The chief difficulty with which the Danish representatives were faced was that of convincing the Commission and other Allied statesmen that Denmark's intentions were really as moderate as her demands, and that Denmark genuinely desired to establish her frontier on national, rather than on historical, lines. The Allied statesmen were probably influenced, to some extent, by more ambitious Danes, such as Dr Collin and Count Holstein, who visited Paris during the Peace Conference as representatives of Danish interests in the central and southerly districts of Slesvig. These men showed themselves implacable enemies of Germany and consequently they opposed the conciliatory policy of Hr Hanssen and Hr H. V. Clausen. Although they had no official status they made contact with members of the Commission in March 1919 and quickly gained a hearing in the anti-German atmosphere of Paris. They submitted general memoranda to the Peace Conference and the Commission, which noticeably influenced the Commission's policy.

The Commission quickly accepted the Danish proposal that the inhabitants of the territory designated as zone 1 should vote as a unity. After some discussion, agreement was also reached about zone 2, and its southern limit was established as a line running west to east, passing south of the islands of Amrum and För, south of Stiglund and south of Frörup (see Fig. 130). The results of the plebiscite in zone 2 were to be considered separately, parish by parish, when the new frontier was drawn.

THE QUESTION OF A THIRD ZONE

During the Peace Conference there was much agitation for the inclusion of areas in the plebiscite farther south than those covered by zones 1 and 2. Dr Collin and Count Holstein were actively pursuing a policy independent of that of the Danish government. They argued that the people of Slesvig, as far south as a line joining Kappel and Tönning, would be 'Danish-minded' if they were only given an opportunity to express their minds, although they had lost their Danish language. In accordance with these views, the Com-

mission proposed to create a third zone, in which a plebiscite should be taken after it had been taken in zone 2. In spite of the opposition of the Danish delegation this proposal was included in the draft treaty, which was published and delivered to the German representatives on 7 May 1919.

The Danish government now feared that, for the sake of economic advantage, many people of German speech and sympathy would vote for union with Denmark. Denmark would then have to absorb a large and probably troublesome German minority. The Danish government appealed to President Wilson, and persuaded him to propose to the Supreme Council of the Peace Conference that the paragraphs relating to zone 3 should be deleted from the draft treaty. President Wilson was supported by Mr Lloyd George, when he made this proposal on 14 June 1919. Mr Lloyd George remarked that the Conference had perhaps shown greater interest in excluding territory from Germany than it had in repairing the injustice to Denmark. The Supreme Council, accordingly, deleted the paragraphs relating to zone 3 from the draft of the Treaty, to the great relief of the Danish government.

THE PLEBISCITE

Under the Treaty of Versailles (28 June 1919), it was stipulated that a plebiscite should be taken in zones 1 and 2. The conditions under which this plebiscite was to be taken may be summarized as follows: zone 1 was to be treated as a unity, and a simple majority of votes should decide whether it should belong to Denmark or to Germany. In zone 2 the votes were to be counted parish by parish, and the frontier drawn in accordance with the result, consideration being taken of geographical and economic conditions. All German troops and authorities were to be withdrawn from the area, in which the plebiscite was to be held, within ten days after the Treaty had come into force. Administration was to be taken over by an international commission consisting of three Allies, one Norwegian and one Swede. Voting should take place in zone 1 three weeks after the German authorities had left. In zone 2 voting should take place within five weeks after it had taken place in zone 1. Both men and women over twenty years of age were entitled to vote, so long as they were either born in the relevant zone, had been domiciled there since 1900, or had been domiciled there before 1900 but expelled by the German authorities. Within fourteen days after the plebiscite had

been finished, a Commission of seven members should be appointed to draw a new frontier. This Commission should consist of five members appointed by the Allies, and one each by Denmark and Germany.

During the interval which elapsed between the conclusion of the Peace Treaty and the evacuation of the German authorities, there were many complaints about the behaviour of German soldiers, police and population towards those who expressed sympathy with Denmark. Although these complaints were probably well founded, it is unlikely that many of the pro-Danish voters were deterred by persecution and threats of persecution.

The Peace Treaty was finally ratified on 10 January 1920. Voting took place in zone 1 on 10 February 1920. The result was a conclusive victory for Denmark in zone 1, as the following figures show:

Area of zone 1	387,753 ha.
Population (1910)	166,744
Entitled to vote	111,191
Total votes cast	101,632 (91.5 %)
For union with Denmark	75,431 (74.2 %)
For union with Germany	25,329 (24.9 %)
Spoilt papers	872 (0.9 %)

Voting took place in zone 2 on 14 March 1920, and the result was a conclusive victory for Germany in practically all parishes. The votes were distributed as follows:

Area of zone 2	129,166 ha.
Population (1910)	106,580
Entitled to vote	70,854
Votes cast	64,941 (91.7 %)
For union with Germany	51,724 (79.7 %)
For union with Denmark	12,800 (19.7 %)
Spoilt papers	417 (0.6 %)

Shortly after the results of the plebiscite had been published, the Danish government expressed its intention of abiding by the people's decision. The government stated in a circular (20 March 1920) that if, in spite of the expressed will of the people, it were decided to include Flensburg and other parts of zone 2 with Denmark, it would mean that large numbers of people would be made Danish citizens against their will. These people would constitute a danger to the



Fig. 130. The results of the plebiscite in Slesvig, 1920
 Based on official sources.

Danish state. Hr Hanssen and many people of zone 1 supported the government's policy.

But many opponents of Hr Zahle's government, both in Denmark and in central Slesvig, showed bitter dissatisfaction at the result of the plebiscite in zone 2. Accordingly, they suggested that the terms of the Treaty of Versailles should be modified. It was widely held that Flensburg, at any rate, should be part of Denmark, even though only about 9,000 who voted there voted for Denmark and 27,000 voted for Germany. An alternative suggestion was that the whole, or part, of zone 2 should be internationalized, and that it should be subject to the League of Nations for a period of 10-15 years. After that time a second plebiscite should be held in zone 2, to decide which parts of it should belong to Germany and which to Denmark.

So great was the agitation in Denmark, and the sympathy with the Danes of central Slesvig, that the king of Denmark was persuaded to dismiss Hr Zahle's Ministry (30 March), an unusual step in so democratic a country. After a new election, a Ministry was formed by Hr N. Neergaard. Hr Neergaard's Ministry supported the plan to internationalize central Slesvig, in so far as this was considered consistent with the Treaty of Versailles. Although appeals were lodged with the International Commission for Slesvig, and with the Ambassador's Council in Paris, they had no result. The new Dano-German frontier was drawn in accordance with the results of the plebiscite. Zone 1 was finally awarded to Denmark under a Treaty between the Allied Powers and Denmark, signed in Paris, 5 July 1920. Denmark immediately took over the administration of zone 1, and renamed it *Sönderjylland* (South Jutland).

THE GERMAN MINORITY IN SOUTH JUTLAND

When South Jutland was reunited with Denmark in 1920, a population of 163,622 (census of 1921) was transferred to Denmark. 25,239, or about 25 % of those who had voted in the plebiscite, had favoured union with Germany. According to the Treaty of Versailles, inhabitants of South Jutland who wished to retain their German nationality had the right to do so by option, but in that case they must emigrate to Germany. A small number, therefore, left South Jutland.

By 1935 the total population of South Jutland had increased to 184,453, but the percentage of those who remained German-minded had probably decreased. Since 1920 the German minority has been organized as a political party, called the Slesvig Party, though it is

evident that not all who consider themselves Germans have supported this party. A considerable number of those who voted for union with Germany in the plebiscite have supported the Social Democrats and other political parties in parliamentary and municipal elections. Since 1920 the Slesvig Party has held one seat in the Danish *Rigsdag*.

The following table indicates the numbers and percentages of votes polled by the Slesvig Party in elections to the *Folketing* between 1920 and 1939 (see also p. 148).

Date	Total votes cast in South Jutland	Votes for Slesvig Party	Percentage for Slesvig Party
Sept. 1920	52,295	7,505	14.3
Apr. 1924	57,448	7,715	13.5
Apr. 1929	68,501	9,787	14.3
Nov. 1932	74,668	9,868	13.3
Oct. 1935	81,663	12,617	15.5
Apr. 1939	94,432	15,015	15.9

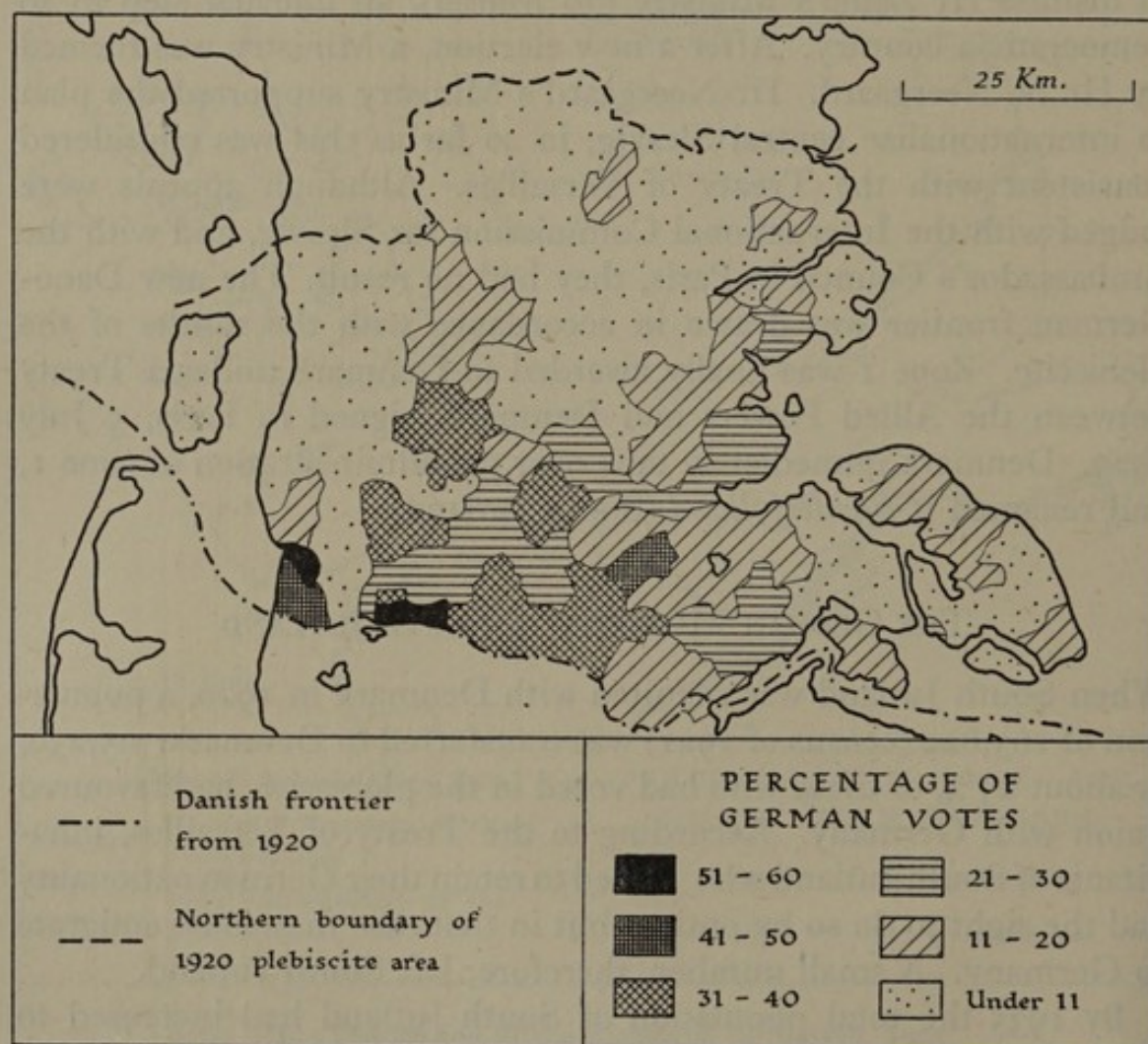


Fig. 131. The percentage of German votes in South Jutland (north Slesvig) according to the *Folketing* elections of 1935

Based on official sources.

According to recent estimates 30,000–35,000 inhabitants of south Jutland might be described as 'German-minded', or about 17% of the total population of the area. It is believed, however, that not more than 10,000 of these, or 5.5% of the total population of south Jutland, actually talk German in daily life. The larger towns, Tönder, Aabenraa, Sønderborg and Haderslev all have considerable German minorities and 29 of the 119 rural parishes also have considerable German elements. The small parishes of Ubjærg and Höjer Flække, near to the present frontier, actually showed a majority of votes for the Slesvig Party in 1935, while in Uge, Tinglev and Burkal about 40% of the voters supported that party.

ADMINISTRATION AND SOCIAL CONDITIONS

Danish administration in South Jutland, since 1920, has been characterized by liberality and scrupulous justice towards the German minority. Full provision has been made for elementary education in German for those children whose parents desire it. In the towns (Aabenraa, Haderslev, Sønderborg and Tönder) the elementary schools are divided into Danish and German sections. Parents may send their children to whichever section they prefer. In the country parishes, elementary education is provided in German if the parents of twenty-four children desire it. German education is also provided in the country parishes if it is demanded by 20% of the electors of the school district, so long as they represent not less than ten children. In 1934, 2,459 children were receiving German education in thirty-one elementary schools of South Jutland, while 21,386 children were being educated in Danish. During the present war the number of children receiving German education in South Jutland has increased considerably, though reliable figures are not yet available. It was reported that 3,626 children were being instructed in German in 1940, and about 4,000 in 1941. There are German secondary schools, supported by the Danish Ministry of Education, in Haderslev, Sønderborg and Tönder. Similar provision has been made for Church services to be held in German in parishes where the congregations desire it. These services are often conducted by pastors from Germany. German may also be used in the law courts by any party unable to speak Danish.

The German minority, as a whole, have complained little of their treatment by the Danes. Nevertheless, there has been a good deal of agitation, accompanied by anti-Danish threats, in the German press

of the neighbourhood, and, not least, by German pastors in the pulpit. It has not been made clear how far this agitation has been directed from Germany, but it is generally believed that the local agitators have exceeded their instructions from Germany. Since 1939 there have been Nazi propaganda offices in all the towns of South Jutland. There are active branches of the German Nazi Party in the border districts. This party does not co-operate with the Danish Nazi Party.

There has been some concern about the so-called 'land struggle' opened by the German minority in 1926. In that year a bank, known as *Kreditanstalt Vogelsang*, was founded in Haderslev with German capital. This bank has been supported financially by the German state. Its apparent purpose is to assist members of the German minority to purchase land in the border districts. It has also bought mortgages on Danish-owned land, and has often managed to acquire the mortgaged land, later selling it to German-minded people. In 1927 the Danes of South Jutland formed a similar financial organization, called *Landeværnet*, in order to counter the influence of the *Kreditanstalt*. It has been widely felt that the Danish government has not taken sufficiently energetic measures to prevent Danish-owned lands passing into German hands.

On the whole, social relations between the Danes of South Jutland and the German minority have been cold and reserved, and have become more so in recent years. There has, however, been comparatively little open hostility between the two national groups.

In most respects the position of the German minority has altered little since Denmark was occupied by German forces in April 1940. No particular privileges have been granted to German-minded people, though some recruiting has been done for the German army. There has been some discussion on German-Danish relations in the Danish and German newspapers of South Jutland during the war, and considerable goodwill has been shown on both sides.

THE DANISH MINORITY IN GERMANY

The fate of the Danish minority which remains south of the Dano-German frontier of 1920 should be noted briefly. In the plebiscite held in 1920, 12,800 voters in zone 2 chose union with Denmark, compared with nearly 52,000 who favoured union with Germany. After the plebiscite a few hundred Danes exercised their right of option, and emigrated to Denmark. In a general election held in

1920, after the new frontier had been established, the Danish Party (*Den slesvigske Forening*) polled about 4,700 votes, of which 3,700 were cast in Flensburg. In an election held in 1924, the number of Danish votes was increased to 6,800. In subsequent elections the number of Danish votes tended to decrease, especially in Flensburg. It is believed that a large number of Danish-minded people voted for the Social-Democratic and Communist Parties. In April 1932, the Danes polled 2,000 votes, and in March 1933, after Hitler's attainment of power, 4,650 votes.

These figures give but a poor idea of the number of Danish-speaking people in German Slesvig. According to official German statistics, their total number, in 1935, was only 5,000, including about 1,300 bilinguals. But according to more scientific and reliable statistics (1936, 1937), the total number of Danish speakers in German Slesvig can hardly be less than 7,000, of whom about half live in Flensburg. A number of small parishes immediately south of the frontier still have Danish-speaking majorities.

The Danes of German Slesvig have sometimes had reason to complain of their treatment by the German authorities and people. A conscious policy of Germanization of the frontier regions has been pursued by the German government both before and since Hitler's advent to power. Nevertheless, instances of friction have, on the whole, been few, and certain privileges have been allowed to the Danish-minded. A number of Danish-speaking schools were founded in the years following the plebiscite. Some of these were private, and others were supported by the German and Danish states. In 1933, Danish schools south of the border were teaching nearly 900 pupils. This number appears to have decreased under Hitler's régime, though some of the schools were still active in 1937. The Danish press has suffered considerable restriction under the Nazi régime, though the most important Danish newspaper of German Slesvig, *Flensborg-Avis*, continues to appear daily, even since the outbreak of war. Children of Danish-minded parents are not, in most cases, compelled to join the Hitler Youth organization, but Danes are subject to conscription for labour and military service.

Appendix III

CLIMATIC TABLES

The locations of most of the following stations are shown in Figs. 24-29. Hofmansgave is on the west side of Odense Fjord, 15 km. north of Odense, and Frihedslund is 20 km. south-south-east of Kalundborg.

I. Mean Monthly and Mean Annual Maximum and Minimum Temperatures °C., 1886-1925

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year	
													° C.	° F.
Varde	Max. Min.	— -10.3	— -9.8	— -3.2	— 0.2	— 4.1	— 7.1	— 6.8	— 2.8	— -1.7	— -5.6	— -9.2	— -13.8	— 7.0
Vestervig	Max. Min.	6.9 -7.8	6.1 -8.1	15.3 -1.8	22.5 1.8	24.7 5.9	25.4 9.0	23.4 8.8	20.6 4.6	15.5 0.2	10.9 -3.4	8.4 -6.1	27.1 -10.9	80.8 12.4
Viborg	Max. Min.	7.2 -11.0	7.1 -11.2	11.5 -7.9	25.5 -0.2	27.7 3.8	28.3 6.4	25.9 6.2	22.6 1.9	17.2 -2.2	11.1 -6.0	8.3 -9.6	30.0 -14.9	86.0 5.8
Askov	Max. Min.	6.6 -10.3	6.8 -9.9	10.9 -7.3	24.2 0.0	26.3 4.1	27.0 6.8	24.9 6.4	22.0 2.9	16.9 -1.5	11.1 -5.6	8.0 -9.1	28.6 -13.2	83.6 8.4
Randers	Max. Min.	7.5 -11.6	7.5 -12.1	12.0 -8.7	25.3 -1.8	27.9 2.3	28.9 4.9	26.5 4.3	22.9 -0.4	17.5 -3.9	11.5 -7.3	8.7 -10.2	30.1 -15.2	86.2 4.5
Tvingstrup	Max. Min.	7.1 -10.3	6.9 -10.3	11.0 -7.7	24.0 0.1	26.4 4.0	27.7 6.4	25.4 6.2	21.9 2.1	16.5 -1.8	10.8 -5.6	8.1 -8.9	28.8 -13.7	84.0 7.2
Assens	Max. Min.	— -7.7	— -7.3	— -5.2	— 2.5	— 7.3	10.1 10.1	— 10.0	— 6.1	— 1.0	— -3.0	— -5.6	— -10.0	— 14.0
Hofmansgave	Max. Min.	7.2 -7.5	7.5 -7.4	11.8 -5.1	22.6 2.2	24.6 6.4	25.8 8.8	24.4 8.9	21.3 5.7	16.3 0.8	11.3 -3.0	8.6 -5.8	27.3 -10.2	81.2 13.4
Frihedslund	Max. Min.	6.1 -9.8	6.1 -10.1	10.9 -7.4	25.2 0.9	27.5 5.1	28.3 8.1	26.7 7.6	22.5 3.7	16.6 -1.5	10.5 -4.9	7.5 -7.9	29.7 -13.0	85.5 8.6
Köbenhavn (Landbohøjsk.)	Max. Min.	6.7 -9.4	6.8 -9.9	11.2 -7.1	24.2 1.2	26.8 5.3	27.7 8.2	26.1 7.4	22.3 2.8	16.9 -1.6	10.8 -4.6	7.9 -7.7	28.9 -12.6	84.1 9.2
Hammershus	Max. Min.	5.7 -6.7	5.8 -6.6	9.9 -5.3	21.6 2.2	23.0 6.7	24.8 10.5	24.4 10.6	20.8 6.8	16.1 2.1	10.9 -1.8	7.6 -4.3	26.6 -8.4	80.0 16.8

Source: *Danmarks Klima* (Köbenhavn, 1933).

II. Mean Monthly and Mean Annual Rainfall (1886-1925) and Rain Days (35 or 40 year averages)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year		Total
													mm.	in.	
Varde	56 14	43 11	47 12	43 11	41 10	53 11	68 12	94 16	81 14	87 15	68 15	74 16	755	29.7	157
Vestervig	54 19	41 16	47 18	43 14	41 13	41 10	57 13	84 17	62 16	83 19	70 18	77 21	701	27.6	192
Viborg	43 13	36 10	39 12	40 11	41 11	47 10	64 13	82 15	58 13	68 14	56 13	59 15	632	24.9	150
Askov	54 13	38 11	47 12	43 12	45 11	55 11	72 13	96 16	73 13	79 15	63 14	69 15	733	28.9	155
Randers	41 15	33 13	38 14	38 12	40 11	46 10	59 13	77 16	50 13	58 15	50 14	53 16	583	22.9	162
Tvingstrup	40 15	32 12	39 14	42 13	45 12	44 11	62 13	80 16	57 14	67 16	56 14	57 16	621	24.4	166
Assens	49 13	38 10	47 12	44 11	43 10	48 10	61 12	80 15	56 12	64 13	53 13	62 14	645	25.4	147
Hofmangave	40 13	32 10	39 13	40 12	42 11	45 11	57 13	75 16	50 13	57 15	48 13	51 14	576	22.7	153
Frihedslund	37 12	30 10	37 12	38 12	36 11	47 10	63 13	75 14	56 12	57 13	46 13	52 14	575	22.6	146
Søndersted	37 13	30 10	37 13	38 12	35 11	44 11	65 12	74 16	53 14	60 16	45 14	51 16	570	22.4	158
København (Landbohøjsk)	38 15	31 13	37 15	41 14	41 12	47 12	61 14	76 17	50 14	56 16	47 16	54 18	579	22.8	175
Hammershus	42 18	33 14	37 16	37 13	35 10	36 10	51 13	64 14	53 13	57 16	51 16	54 19	549	21.6	170

Source: *Danmarks Klima* (København, 1933).

Note. The Danish meteorological service defines a rain day as one on which more than 0.1 mm. of rain falls.

III. *Average Number of Days with Frost and Average Dates of Earliest and Latest Frosts, 1886-1925*

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year	Average date of	
														Earliest frost	Latest frost
Varde	19	19	17	8	1	0	0	0	0	3	10	15	92	Oct. 19	Apr. 30
Vestervig	17	17	15	4	0	0	0	0	0	1	7	13	74	Nov. 3	Apr. 12
Viborg	21	21	19	8	1	0	0	0	1	4	11	17	103	Oct. 15	Apr. 30
Askov	21	21	18	8	1	0	0	0	1	3	11	17	101	Oct. 20	May 1
Randers	21	21	21	11	3	0	0	0	1	7	14	19	118	Sept. 28	May 12
Tvingstrup	22	22	19	8	1	0	0	0	0	4	11	17	104	Oct. 17	Apr. 27
Assens	19	19	15	4	0	0	0	0	0	1	6	13	77	Nov. 10	Apr. 9
Hofmangave	23	23	18	4	0	0	0	0	0	1	8	17	94	Nov. 7	Apr. 8
Frihedslund	22	22	19	7	1	0	0	0	0	3	10	17	101	Oct. 23	Apr. 22
Söndersted	22	22	20	10	2	0	0	0	1	5	12	18	112	Oct. 1	May 10
Köbenhavn	21	20	17	6	1	0	0	0	0	3	8	15	91	Oct. 16	Apr. 20
Hammershus	19	20	16	4	0	0	0	0	0	0	4	11	74	Nov. 19	Apr. 14

Figures adjusted from *Danmarks Klima* (Köbenhavn, 1933).

Appendix IV

ICE CONDITIONS IN DANISH WATERS

Ice forms in the principal waters around Denmark on an average of one winter in three. In severe winters ice, whether fast to the coast or in movement, may persist for as long as two months or even more. The ice along the eastern coasts of Denmark may become so thick as to prevent, or seriously hinder, all traffic for up to two months between the middle of January and the middle of April except in the deep-water channel in the Kattegat off the Swedish coast. A cold spell may last long enough to cause the Baltic to be cut off from the North Sea; this occurs usually about twice in ten years.

The surface salinity in the Great Belt is about $15^{\circ}/_{\infty}$, and in the Kattegat it rises to $20^{\circ}/_{\infty}$ at Anholt and $30^{\circ}/_{\infty}$ off Skagen; at 20 m. (11 fm.) depth the corresponding figures are 25–30, 30 and $32^{\circ}/_{\infty}$ respectively. For salinities below $24.7^{\circ}/_{\infty}$ the maximum density of sea water is reached above freezing-point, and therefore the surface layers in the Great Belt and Kattegat may freeze without the lower layers being also cooled to freezing-point. Considerable cooling must, however, take place, and on this account frosts in December or January are less likely to bring about ice formation than milder frosts in February and March. After the middle of January, 10–14 days of easterly winds with continuous frost are sufficient for ice to form in the fairways and to hinder navigation.

The main waters which are most liable to freeze over are the Sound, the Great Belt off Smaalandsfarvandet, and the southern and western parts of the Kattegat. Ice usually forms first in the southern parts and tends to spread northwards irrespective of wind direction. The earliest ice often forms on the shoal water around Sjælland, in the Sound around København, Salholm and Amager and in Drogden. Ice also forms early in the entrances to the fjords of east Jylland.

The Sound. Ice in the fairways becomes bad enough to prevent navigation during about two winters in ten years, and lasts on the average from late January until late March. Conditions from year to year may vary greatly. For example, there was ice in the Sound on only one day in 1902 and 1920, but on 124 days in 1888 and 103 days in 1924. When there is ice in the Sound, south-east winds, together

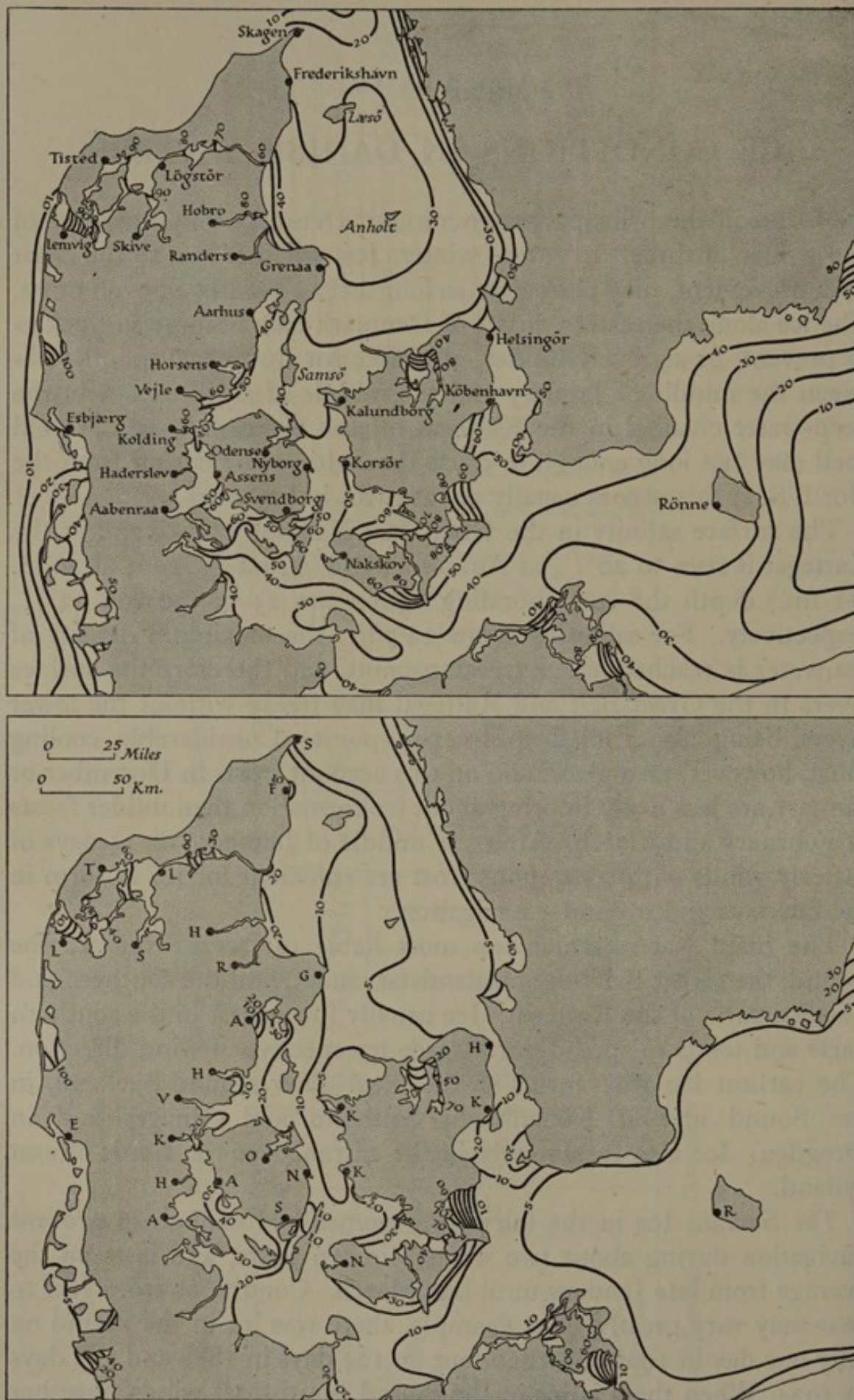


Fig. 132. For legend, see p. 531.

with the current from the south, cause the ice to become screwed ahead to the south of Kronborg point. In the wider channel to the north the ice will normally spread, but in north-westerly gales it may become tightly packed in the funnel north of Kronborg. Formerly, the ice over the Sound remained unbroken, apparently for long periods, and sometimes provided a passage, dry-shod, between Denmark and Sweden, but now steamships and ice-breakers keep lanes open almost constantly, and it is very seldom that the ice remains unbroken for a long period.

The Great Belt. Between four and six weeks after mid-December with temperatures below -2.2°C . (28°F .) are usually necessary before there is sufficient ice to suspend navigation in the Great Belt, but lower temperatures will shorten the period of frost required to close the channels. Three weeks of severe weather are adequate to make navigation largely dependent on ice-breakers, and a fortnight of such weather is sufficient to hamper navigation seriously. Navigation will be resumed, with difficulty, after not less than a week of very mild weather.

The Little Belt. The Little Belt, being narrower and shallower, becomes frozen sooner than the Great Belt; a fortnight of severe weather is adequate to make navigation dependent on ice-breakers. At least a fortnight of very mild weather is necessary before navigation can be resumed, even with difficulty. These narrower waters are more liable to become entirely frozen over. This is most likely to occur between Assens and Aarö sund, but when the channel is filled with ice, this may become frozen together between Lynsodde and Stenderup.

The Kattegat. In calm weather, preceded by a long period of frost, the Kattegat may freeze over within 24 hr., and in a north-easterly gale, with frost, the ice may become 10 cm. thick in this time. If frost continues the ice may form a continuous expanse, but the island of

Legend to Fig. 132

Fig. 132. Ice conditions in the waters around Denmark

Based on maps 23 and 25 in G. Prufer, 'Die Eisverhältnisse in den deutschen und den ihnen benachbarten Ost- und Nordseegebieten', *Annalen der Hydrographie und maritimen Meteorologie*, Bd. LXX, Heft 2 (Berlin, 1942).

The upper map shows the average number of days during which ice caused hindrance to navigation by steam ships in hard winters.

The lower map shows the average number of days during which navigation was stopped on account of ice during hard winters. The maps show almost the worst conditions, which occur only once, or perhaps twice, every ten years. In most years navigation is not stopped and in many years there is even little hindrance.

Læsö has never been known to be frozen in on any side, and it is seldom that ice extends unbroken from shore to shore in the Kattegat. Usually the ice will be drifted to and fro by wind and current, and there will be open water on the side from which the wind is blowing. The ice is seldom firm outside a line from Fornæs to Havknuden, and it rarely appears off Fornæs until the Kattegat is more or less filled with ice. When there is much ice in the Kattegat it is liable to pack between Anholt and Morups Tange and near the Paternosters, because the currents here set towards the Swedish shore. The ice hummocks to a considerable height when the current changes direction. It piles up forcibly on all shoals, especially on Dvalegrund, Kalkgrund and Naveren, and on the shoals in Aarhus Bugt. During hard winters the chief period of ice formation in the Kattegat, as also in the Belts, is between the beginning of February and the beginning of March. During this period these waters may become closed by ice, but they become largely free of ice again during March. The ice moving from the Kattegat finds its way out along the Swedish shore in a more or less wide belt which is carried towards the Norwegian coast by the Baltic current. When there is a great quantity of ice in the Kattegat it may drift out past the Skaw and along the west coast of Jylland. For example, in January 1893, brash ice was observed from the Skaw westwards to Hanstholm, and in February 1929 brash ice extended to about 25 miles offshore along the whole of the west coast of Jylland. Westerly winds usually bring the thaw, which, together with the action of the wind, breaks up the ice and causes it to drift to the eastern side of the Kattegat and then outwards. In this way the western channel of the Kattegat may become clear of ice in three or four days, or even less.

Western Baltic Sea. In the western part of the Baltic Sea, between Gedser, Mön and Bornholm, ice seldom forms. When it does occur it is in January at the earliest and usually only in February and March. Since ice formed in this area has to pass out through the Great Belt and the Sound, its occurrence tends to lengthen the duration of ice in these channels, especially the Sound.

West Coast of Jylland (Jutland). Ice does not form along the west coast of Jylland except on very exceptional occasions with constant easterly winds and strong frost. Under such conditions young ice may appear, and is most extensive south of 56° N. Ships which can withstand slight ice bumping and pressure can always use the ports, but there is sufficient ice to cause considerable hindrance to navigation in the approaches to, and in, the ports of Esbjerg and Hirtshals.

on perhaps 20 days or more during February and March in particularly severe winters. South of Esbjerg, and in Ringkøbing Fjord and Limfjord, ice-breakers will be necessary during severe winters, and the inner parts of these fjords will be closed for upwards of three months. At Esbjerg ice is formed on shoals. At high water this ice is carried into the fairway and drifts to and fro with tide and current. It may cause difficulty for navigation, but fixed ice over the whole fairway is practically unknown. A south-westerly wind and a falling tide prevent the ice from passing out to sea, and at the close of the ebb it may pack in the narrows of the fairway; but strong easterly winds may carry the ice out to sea and then it will not reappear.

Danish Ports. In ports along the open coast ice seldom forms to such an extent as to become an absolute hindrance to navigation. It may be sufficient to cause difficulties, but serious hindrance rarely lasts long. The ports are most liable to be affected by ice between mid-January and mid-March. Esbjerg is never closed, and Hirtshals, Helsingör (Elsinore) and København (Copenhagen) are kept open by ice-breakers. Ports on the Baltic coasts of Denmark may be closed for between 10 and 30 days, according to position, during hard winters, while in very severe winters the period will be longer. Ice-breakers were necessary at all these ports for most of February and March in the exceptionally hard winters of 1940-2. Many of the Danish ports lie within fjords where the stiller and shallower waters are more liable to freezing than the open sea. The extent to which they freeze depends partly on their communication with the open sea and partly on the depth of water in the fjord. Thus while Tyborön channel is never closed (although drifting ice may lie in the channel), the eastern parts of Limfjord and Horsens Fjord become sufficiently frozen to stop navigation by coasting craft within 14 days of severe weather. Isefjord becomes frozen equally quickly near its shores, and in its branch fjords, but the whole fjord does not become ice-covered for about three weeks. Mild conditions do not affect the ice in the fjords so soon as in the open sea, where winds have more effect, and the inner ends of fjords are likely to remain unnavigable by small craft for about a fortnight after the Great Belt has become open to traffic. Ice-breakers keep the chief ports open longer than natural conditions would otherwise permit. The following table gives details of ice conditions at particular ports.

Occurrence of ice during the 25 years 1906/7-1930/1

	Earliest occurrence	Latest occurrence	Greatest observed thickness	
			cm.	in.
West Coast of Jylland (Jutland)				
Esbjærg	18 Nov.	24 Mar.	25	9 $\frac{1}{2}$
Limfjord				
Tyborøn Channel	10 Nov.	20 Mar.	12	4 $\frac{1}{2}$
Lemvig	13 Nov.	9 Apr.	35	13 $\frac{1}{2}$
Struer	15 Nov.	10 Apr.	50	19 $\frac{1}{2}$
Limfjord off Aalborg	23 Nov.	28 Mar.	40	15 $\frac{1}{2}$
Limfjord between Aalborg and Hals	28 Nov.	9 Apr.	40	15 $\frac{1}{2}$
Kattegat				
Skagen	19 Dec.	23 Mar.	50	19 $\frac{1}{2}$
Frederikshavn	17 Dec.	18 Mar.	30	11 $\frac{1}{2}$
Læsø-Rende	19 Dec.	23 Mar.	60	23 $\frac{1}{2}$
Kattegat east of Læsø	20 Dec.	8 Apr.	42	16 $\frac{1}{2}$
Kattegat east of Anholt	28 Dec.	24 Mar.	75	29 $\frac{1}{2}$
Kattegat west of Anholt	27 Dec.	23 Mar.	16	6 $\frac{1}{2}$
Mariager Fjord	9 Nov.	13 Apr.	40	15 $\frac{1}{2}$
Randers Fjord	9 Nov.	5 Apr.	40	15 $\frac{1}{2}$
Grenaa	27 Dec.	24 Mar.	25	9 $\frac{1}{2}$
Aarhus	20 Dec.	22 Mar.	35	13 $\frac{1}{2}$
Horsens	15 Nov.	29 Mar.	32	12 $\frac{1}{2}$
Fairway west of Samsø	29 Dec.	27 Mar.	32	12 $\frac{1}{2}$
Fairway south of Samsø	5 Jan.	27 Mar.	50	19 $\frac{1}{2}$
Odense (harbour and canal)	16 Nov.	25 Mar.	50	19 $\frac{1}{2}$
Samsø Belt	9 Jan.	23 Mar.	70	27 $\frac{1}{2}$
Little Belt				
Vejle	2 Nov.	29 Mar.	30	11 $\frac{1}{2}$
Fredericia	28 Nov.	10 Apr.	21	8 $\frac{1}{2}$
Middelfart	28 Dec.	13 Mar.	16	6 $\frac{1}{2}$
Little Belt near Middelfart	23 Dec.	27 Mar.	26	10 $\frac{1}{2}$
Kolding	13 Nov.	30 Mar.	45	17 $\frac{1}{2}$
Assens	29 Dec.	21 Feb.	32	12 $\frac{1}{2}$
Haderslev Fjord	8 Nov.	31 Mar.	40	15 $\frac{1}{2}$
Aabenraa	22 Dec.	24 Mar.	38	15
Als-Sund	27 Nov.	26 Mar.	35	13 $\frac{1}{2}$
Great Belt				
Kalundborg	4 Dec.	31 Mar.	35	13 $\frac{1}{2}$
Nyborg	20 Dec.	30 Mar.	9	3 $\frac{1}{2}$
Korsør	20 Dec.	27 Mar.	25	9 $\frac{1}{2}$
Nakskov	27 Nov.	27 Mar.	32	12 $\frac{1}{2}$
The Sound				
Fairway off Helsingør (Elsinore)	19 Dec.	31 Mar.	32	12 $\frac{1}{2}$
Helsingør	19 Dec.	7 Apr.	30	11 $\frac{1}{2}$
København (Copenhagen)	18 Dec.	3 Apr.	—	—
Drogden	21 Dec.	26 Mar.	30	11 $\frac{1}{2}$
Flintrännan	21 Dec.	20 Mar.	10	4
Køge	16 Dec.	5 Apr.	80	31 $\frac{1}{2}$
Isefjord				
Entrance between Rörvig and Hundested	25 Dec.	24 Mar.	35	13 $\frac{1}{2}$
Nykøbing	3 Dec.	7 Apr.	40	15 $\frac{1}{2}$
Holbæk	14 Nov.	10 Apr.	40	15 $\frac{1}{2}$
Fairway south of Fyn (Fünen)				
Svendborg	2 Dec.	26 Mar.	40	15 $\frac{1}{2}$
Faaborg	22 Dec.	9 Apr.	49	19 $\frac{1}{2}$
Rudkøbing	5 Dec.	27 Mar.	45	17 $\frac{1}{2}$
Fairway near Marstal	2 Dec.	2 Apr.	45	17 $\frac{1}{2}$
Smaalandsfarvandet				
Storstrøm	16 Dec.	10 Apr.	40	15 $\frac{1}{2}$
Guldborg Sund (northern part)	17 Nov.	2 Apr.	75	29 $\frac{1}{2}$
Fairway off Stubbekøbing	27 Jan.	31 Mar.	10	4
Kalvehave-Stege	13 Nov.	7 Apr.	40	15 $\frac{1}{2}$
Baltic Sea				
Femer Belt off Rødby	29 Dec.	29 Mar.	56	22
Gedser-Warnemünde	21 Dec.	30 Mar.	—	—
Bornholm				
Rønne	29 Dec.	3 Apr.	36	14

Source: *Nautisk-meteorologisk Aarbog*, 1931, pp. xi-xiv (København, 1931). Some of these dates were exceeded during the winters of 1940 and 1941.

Appendix V

POSTS, TELEGRAPHS AND TELEPHONES

The postal, telegraph and long-distance telephone services are operated by the state and are administered by the General Directorate of Posts and Telegraphs which is under the jurisdiction of the Ministry of Public Works. The local telephone services, except those of Sønderjylland, are operated by private companies holding government concessions.

POSTAL SERVICES

Mail is delivered daily to every house in the country, and there were, in 1939, daily air-mail dispatches to most large European cities. In 1938-9 there were 10,666 post boxes feeding 1,495 post offices and sub-post offices. In 1938 they handled 342 million letters and postcards, of which some 41 million were to and from foreign countries, over 11 million parcels, 281 million newspapers and 236,000 registered letters. The post offices also handled nearly 3 million postal orders with a total value of 190 million kroner, and 1.6 million C.O.D. collections totalling 38 million kroner.

TELEGRAPHS

The postal and telegraph services were long operated together, then separately for thirty years, and were combined again in 1927. In 1938-9 there were 1,042 telegraph stations including 426 State Railway telegraph stations. The total length of lines was 12,000 km., of which nearly 10,000 km. were underground lines or submarine cables. Over 3 million telegrams were dispatched during 1938, and of these over one-half were to or from foreign countries and 685,000 were transit messages. The personnel of the postal and telegraph services numbered 13,453 in 1938-9. Most of the telegraph supplies are provided by the Great Northern Telegraph Company of København, but other supplies are Siemens (German), Standard Electric Co. (British) and L. M. Ericsson (Swedish).

TELEPHONES

The *Statstelefon* deals with all foreign and inter-provincial communication and holds the right of way on all local lines. The chief private companies, which operate the local services, are *Københavns Telefon A/S* (Copenhagen Telephone Co.) and the *Jydsk Telefon A/S* (Jutland Telephone Co.), but there are also four other private companies operating in the islands. The tariffs which the private companies may charge are fixed by the state. The state was due to take over the majority stock control of all the private companies on 1 July 1939. The details of the several companies for the year 1938-9 were:

	Stats- telefon	Køben- havns Telefon A/S	Other private com- panies in the islands	Jydsk Telefon A/S	Totals for private companies
No. of subscribers	14,246	212,952	42,744	94,705	350,401
Length of lines (km.)	189,319	1,300,136	338,516	585,364	2,224,016
No. of exchanges	155	370	202	1,099	1,671
Personnel	*	5,209	956	2,785	8,950
Trunk and toll calls (millions)	9.8	38.8	18.1	36.7	93.6
Local calls (millions)	17.8	404.6	50.7	125.8	581
Receipts (million kroner)	*	35.4	6.7	15.5	57.7
Expenses (million kroner)	*	30.8	6.1	13.2	50.2
Capital (million kroner)	—	246.8	54.6	99.3	400.7

* Included with postal and telegraph services, see below.

Source: *Statistisk Aarbog* 1939, p. 110 (København, 1939).

In addition there were, in Jylland, ten very small telephone companies with a total of 1,912 subscribers. The numbers of telephones and of telephone conversations per head of population are higher in Denmark than in any other European country and are exceeded in the United States and Canada only; the number of telephone conversations per head in 1937 was over four times as great as in the United Kingdom.

SUBMARINE CABLES

Submarine cables connect Denmark with England, France, Norway, Sweden, Germany and Latvia. The cable to Latvia gives connexion

with Finland and the U.S.S.R. via Helsinki and Leningrad. The details of these cables and of those between different parts of Denmark are given in the following tables. The Great Northern Telegraph Co., which has its headquarters in Köbenhavn, was formed in 1869



Fig. 133. Submarine cables, telegraph services and radio stations in Denmark

Based on official sources.

The radio stations at lightships are not shown.

through the amalgamation of several companies. In addition to its network in the Baltic and North Seas it owns several cables in Asiatic waters between the U.S.S.R., Japan and China and has a line across European Russia and Siberia.

Submarine Cables between Denmark and other Countries

	Date of laying	No. of lines	Length in nautical miles	Owner
To England				
Söndervig to Newbiggin	1868	1	341.4	G.N.T. Co.
	1913	1	350.9	
Hirtshals to Newbiggin	1873	1	427.2	
To France				
Fanö to Oye	1873	1	382.9	G.N.T. Co.
	1891	1	370.5	
To Norway				
Höjer to Arendal	1879	3	246.2	Germany and Norway Denmark and Norway
	1906	1	297.9	
Hirtshals to Arendal	1867	1	67.5	
To Sweden				
Skagen to Marstrand	1873	2	34.1	G.N.T. Co.
Helsingör to Hålsingborg	1904	4	2.7	
	1918	4	2.6	Denmark and Sweden
	1919	4	2.6	
	1922	18	2.9	
Vedbæk to Landskrona	1899	4	9.1	
Charlottenlund to Barsebäck	1931	172	12.0	
Rønne to Ystad	1931	20	35.4	
To Germany				
Gedser to Warnemünde	1926	48	25.0	Denmark and Germany
	1931	90	25.2	
Syltholm to Puttgarden	1903	4	10.6	
	1907	4	10.9	
To Latvia				
Rödvig to Libau	1907	1	824.8	G.N.T. Co.
Snogebæk to Libau	1869	1	226.4	

Source: *Nomenclature des Cables formant le Réseau sous-marin du Globe* (Berne, 1939).

Submarine Cables between different Parts of Denmark

	Date of laying	No. of lines	Length in nautical miles
Skærbæk to Römö	1883	1	5.1
	1935	4	5.2
Bangbostrand to Vesterö (Læsö)	1934	4	15.2
Selvig (Samsö) to Hov (Jutland)	1899	7	11.6
	1904	4	11.0
	1909	10	11.0
	1915	4	10.7
	1920	8	10.7
Ballen (Samsö) to Rösnaes (Zealand)	1899	7	9.5
	1904	4	8.9
	1910	10	8.9
	1915	4	9.1
	1920	8	8.9
Hjarnö to Endelave	1917	1	6.4
Spodsbjærg to Taars	1937	18	7.4
Nyborg to Lejeodde (Korsör)	1933	98	11.1
	1934	98	10.6
Stjerneskanen (Nyborg) to Halskov	1896	7	10.4
	1906	8	10.4
	1920	8	10.5
	1920	8	10.2
	1920	8	10.4
Kalundborg to Sejerö	1890	1	8.0
Halskov to Sprogö	1869-1927	7	5.1
	1880-1928	7	4.9
Knudshoved to Sprogö	1869-1912	7	5.1
Rörvig to Hesselö and Anholt	1887	1	48.7
Birkholm to Ærösköbing	1924	16	4.4
Mön to Bornholm	1868	1	79.6
Cables of 4 nautical miles or less	—	—	112.2

Source: *Nomenclature des Cables formant le Réseau sous-marin du Globe* (Berne, 1939).

Appendix VI

RADIO COMMUNICATIONS

Radio Telegraph and Telephone Stations

There are radio telegraph and telephone stations at Anholt Havn, Christiansö, Grenaa, Köbenhavn, Kronborg lighthouse, Lappegrund lightship, Odense, Ringsted, Rönne and Skamlebæk. Those at Anholt Havn, Christiansö, Grenaa, Rönne and Skamlebæk are operated by the General Directorate of Posts and Telegraphs and are open to public correspondence. The others are official stations, except Odense which is open to restricted use by the Press. Skamlebæk ($50^{\circ} 20' N$, $11^{\circ} 25' 26'' E$) operates on several wave-lengths and frequencies and was the only station which maintained direct services to European countries and America, except that the station at Ringsted, which was operated by the Danish State Railways, had a service to Germany.

Aeronautical Stations

In 1939 there were aeronautical stations at Aalborg, Esbjerg and Köbenhavn, all owned by the General Directorate of Posts and Telegraphs. The stations are used for official correspondence; public correspondence is admitted only so far as the regular transmission of correspondence respecting the safety and regularity of aerial navigation will permit. The Danish air force and the Danish navy also have aeronautical stations for their own use.

Coast Stations

Twelve coast stations maintain communication with ships. The chief stations are at Blaavand, Lyngby and Köbenhavn, and these also give medical advice by radio in case of sickness or accident on board. The others are all light-vessels with the exception of Rödsand Syd lighthouse, and for all these correspondence is restricted to urgent ships' service messages.

Radio Beacons

There are, along the Danish coasts and in Danish waters, twenty-five radio beacons for ships and all of which, except for some low-powered stations, are operated when visibility is four miles or less. Thirteen of the stations are lighthouses and six are light-vessels. The stations, apart from two on the west coast of Jylland, are

along or off the coasts of the Kattegat and the Sound. Only six are independent stations; the others work in groups of two or three. The stations at Skagens Rev, Sletterhage and Nakkehoved are linked with Swedish stations, and Hanstholm is linked with Lister lighthouse in Norway. Details of the stations are given on chartlet 5067 and in the text of *The Admiralty List of Radio Signals*, vol. II.

Broadcasting

A broadcasting station, established and financed by private initiative at Köbenhavn, started a regular service in the autumn of 1924. In the spring of 1925 the number of listeners was 21,000, and by 1926 it had grown to 100,000. In that year the control of broadcasting was assumed by the state, and a Radio Council (*Radioraadet*) was set up under the supervision of the Ministry of Public Works but otherwise as an independent institution. In 1927 the main broadcasting station at Kalundborg was opened.

Before 1940, the Radio Council, consisting of fifteen members, was appointed by the Minister of Public Works for periods of four years. The Council included representatives of the *Rigsdag*, the Ministry of Education, the Press and listeners' associations. It was responsible for advising the Ministry on the fixing and collecting of licence fees, establishing the general principles to be applied in broadcast programmes, and co-operating with the General Directorate of Posts and Telegraphs in defining the conditions under which the programme service and the technical department should work together. In August 1940 the supervision of the Radio Council was transferred to the Ministry of Education. Technical work is still undertaken by the General Directorate of Posts and Telegraphs, which is under the Ministry of Public Works.

The programmes and general management are controlled by a director who is responsible for general efficiency of transmission and the finances of the organization. A programme committee, consisting of members of the Radio Council and specialists in music, literature, science and economics, considers and decides on suggestions for programmes made by the director.

Transmitters. There is a long-wave transmitter at Kalundborg (60 kW., 240 kcyc./sec., 1,250 m.), and a medium-wave transmitter (10 kW., 1176 kcyc./sec., 255.1 m.) at Herstedvester, 10 km. west of Köbenhavn. One of the 6 kW. transmitters of the General Directorate of Posts, Telegraphs and Telephones at Skamlebæk is also used for broadcasting. A station, believed to be at Esbjerg and to have a power of 5-10 kW., has been heard on 394 kcyc./sec. (761.4 m.)

transmitting dictation-speed material for the Danish Press daily. A new short-wave transmitter of 50 kW. is under construction at Herstedvester and is due to be completed in 1943, but has not been heard yet (July 1943). At the beginning of November 1942 an ultra-short-wave frequency modulation station at København with a power of 800 W. and with a frequency of 50.2 Mcyc./sec. (5.976 m.) started regular transmissions, which are, however, still in the experimental stage and are intended for reception in the København area.

Kalundborg Radio gave the number of registered receiving sets in Denmark in the spring of 1943 as 959,000; in 1938-9 the number was 713,000. The licences, of 10 kroner a year, are collected by the postal administration; the poor, the old and the sick are exempt from payment of licence and to these a private society distributes free sets.

Listeners' Associations. Listeners' associations have always played an important part in Danish broadcasting and were represented on the Radio Council by six members before the war. In May 1942 the four chief associations were: (a) *Arbejdernes Radioforbund* (Workers' Radio Union), which had a membership of 122,000 in 1940, and was closely connected with the Labour movement; (b) *Landsforeningen Kristelig Lytterforening* (National Christian Listeners' Society), with 78,000 members in 1940, which aimed at the maintenance of religious services on Sundays, the representation of the Church in the direction of state broadcasting and the increase in the number of broadcasts of a Christian nature; (c) *De upolitiske danske Radioklubber* (Non-political Danish Radio Club), which had 35,000 members in 1940, and aimed at preventing the exploitation of the radio for political purposes; (d) *Den jydske Lytterforening* (The Jylland Listeners' Society), which had 40,000 members in 1940. These four associations merged to form a single society at the end of 1941. Other associations are the *Odense Radioklub*, *Danmarks Radio Union*, and *Landbelytterforeningen* (Rural Listeners' Union).

NOTE ON TIME

Before the outbreak of war and until the German Occupation, Denmark kept Central European time (1 hr. in advance of G.M.T.) throughout the year. After the Occupation 1 hr. of summer time (i.e. 2 hr. ahead of G.M.T.) was introduced on or about 15 May 1940, and remained in force until 2 November 1942, when Central European time was restored. Summer time was reintroduced on 29 March 1943; on 4 October 1943, Denmark reverted to Central European time.

Appendix VII

CIVIL AVIATION BEFORE 1940

Civil aviation has never been of great importance in the communications of Denmark, where distances are so small, but a good deal of progress had been made during the two years immediately before the outbreak of war. In 1937 *Det danske Luftfartselskab A/S* (Danish Airways Co. Ltd.) was reorganized and given a ten years' concession to operate all Danish air-lines to foreign countries. In the same year this company opened a service from Köbenhavn to Esbjerg, and in 1938 services from Köbenhavn to Aalborg and from Aalborg, via Silkeborg and Esbjerg, to Hamburg were started. In 1940 a service to Bornholm was opened.

Civil aviation was under the supervision of the Ministry of Public Works and was administered by a director of civil aviation and the *Statens Luftfartstilsyn* (Aviation Inspection Department).

Air Traffic of Danish Companies, 1937-38

	Distance flown (1,000 km.)		No. of passengers		Passenger- kilometres	
	1938	1937	1938	1937	1938	1937
International routes	687	521	14,624	12,956	3,602	2,288
Provincial routes	275	32	3,712	337	962	93
Other services	105	268	24,507	8,367	1,009	879
Total	1,067	821	42,843	21,660	5,573	3,260

	Luggage (kilometre-tons)		Posts (kilometre-tons)		Freight (kilometre-tons)	
	1938	1937	1938	1937	1938	1937
International routes	56,481	33,638	97,705	50,144	71,423	50,886
Provincial routes	5,542	494	2,480	517	533	133
Other services	886	3,074	2	2,717	5	1,180
Total	62,909	37,206	100,187	53,378	71,961	52,199

Source: *Statistisk Aarbog* 1939, p. 109 (Köbenhavn, 1939).

Transport Companies and Services

All routes in Denmark were operated by *Det danske Luftfartselskab A/S* and its subsidiary, *Provins Luftfartselskab A/S* (Provincial Air-

ways Co. Ltd.), both with headquarters at Kastrup airport, København. *Det danske Luftfartselskab* operated the following lines in 1939:

Köbenhavn-Malmö (6 lines) daily, in co-operation with *A.B. Aerotransport* of Stockholm.

Köbenhavn-Hamburg-London, daily, in co-operation with *Deutsche Lufthansa A/G*.

Malmö-Köbenhavn-Berlin, daily, in co-operation with *A.B. Aerotransport* and *Deutsche Lufthansa A/G*.

Köbenhavn-Berlin, daily, in co-operation with *A.B. Aerotransport* and *Deutsche Lufthansa A/G*.

Malmö-Köbenhavn-Amsterdam, daily, in co-operation with *A.B. Aerotransport* and *K.L.M.* (Royal Dutch Air Lines).

Stockholm-Norrköping-Köbenhavn-Amsterdam, on weekdays, in co-operation with *A.B. Aerotransport* and *K.L.M.*

Köbenhavn-Aalborg-Silkeborg-Esbjærg-Hamburg, daily.

Malmö-Köbenhavn-Hannover, night mail service, 6 nights weekly, in co-operation with *A.B. Aerotransport*.

Provins Luftfartselskab operated the following services in 1939:

Köbenhavn-Aalborg, daily.

Aalborg-Köbenhavn, daily.

Köbenhavn-Esbjærg.

Airports

There were customs airports at Kastrup, Aalborg and Esbjerg. Kastrup airport is owned by the state, and the others by the municipal authorities of the two towns. There were, in addition, landing fields at Aabenraa, Aarupgaard, Marslev (near Odense), Frederikshavn, Hillerød, Rønne, Silkeborg, Skagen, Slagelse, Stampan (Bornholm) and Torup, and emergency landing fields at Rødby Havn and Præstø. Kastrup, Esbjerg, Aalborg and Frederikshavn had accommodation for seaplanes.

Private Flying

Interest in private flying quickened after 1937, and the number of private planes grew from 15 in that year to 46 in 1938, and to 58 in 1939. There were about ten private flying schools, in København, Aalborg, Esbjerg and Horsens, and several flying clubs. *Det kongelige danske aeronautiske Selskab* (The Royal Danish Aeronautical Society), to which the other clubs were affiliated, was a branch of the *Fédération Aéronautique Internationale*.

Appendix VIII

CONDITIONS SINCE THE OCCUPATION

During the night of 8/9 April 1940, German troops crossed the unfortified Danish frontier into Jylland, and landings were made at Danish ports, especially Köbenhavn. At 4.30 a.m. the German ambassador in Köbenhavn informed the Danish government that important points in Denmark had been occupied. The Danish armed forces comprised a lightly equipped army of about 25,000 men, a navy consisting of two old light cruisers, a dozen submarines, seventeen torpedo boats and a few fishery patrol vessels, and a total of about a hundred aircraft; the countryside presented no natural barriers other than sea channels, and had no strongly fortified lines. Denmark was thus in no position to offer any effective resistance, although fighting occurred along the frontier and in Köbenhavn. The king and his ministers considered the position between 5 and 5.30 a.m., and decided to accept the German occupation under protest. The Germans on their part declared that they did not intend to interfere with the territorial integrity and political independence of Denmark.

A small country like Denmark, which possessed few industrial resources and which could be used best as a source of food supplies by maintaining her economic and political organization, was a favourable field for demonstrating the advantages of co-operation with the New Order. Until August 1943 German rule in Denmark was characterized by moderation; the occupation brought no constitutional changes and few modifications. The king countered, with the threat of abdication, all attempts at instituting a government which did not command the support of the *Rigsdag*. The machinery of government was maintained and allowed to function fairly freely in matters of internal administration, in spite of frequent outspoken speeches on public matters at home and abroad. German control was, in the main, indirect and through representations to the Danish Foreign Office, but pressure was used to replace the leaders of opposition to Germany in the cabinet by more sympathetic ministers. Care was taken not to arouse opposition by placing power in the hands of the Danish National-Socialist party, and its leader, Frits Clausen, won no preferment. Foreign relations and economic

matters, on the other hand, were largely German-controlled. In August 1940 a special committee with power to decide, without reference to the *Rigsdag*, almost all questions of foreign trade, rationing and the utilization of raw materials, was set up.

During the summer of 1943 the success of Allied arms in North Africa and Sicily, the failure of the German summer offensive in Russia and the gathering weight of the air offensive against Germany, found their echo in the stiffening of resistance in occupied and neutral countries in Europe. In July, Sweden's refusal to permit transit across her territory led to the diversion of the leave traffic of German troops in Norway through Denmark. This provided richer opportunities for sabotage, which increased to such an extent that on 4 August Germany demanded jurisdiction in all cases of sabotage, with trials in German courts according to German law, and prison sentences served in Hamburg. The refusal of the Danish government to agree to these measures led to a deadlock. Strikes and riots broke out at centres of German activity such as Esbjerg, Aalborg, Aarhus, Kolding, Frederikshavn, Odense, Svendborg, Helsingør, and many other places, apart from København where disturbances and sabotage were widespread. On 29 August martial law was declared throughout Denmark. The following account gives a brief description of conditions before the German military authorities assumed control.

POLITICAL CONDITIONS

Government and Administration

The government in office at the time of the occupation was a coalition of Social Democrats and Radicals, with Thorvald Stauning as Prime Minister. The opposition consisted mainly of members of the Conservative and Liberal Left parties and a small minority of National Socialists, Communists and members of the Free People's Party (see p. 148). Between April 1940 and the general election in April 1943, there were three changes in the government, mainly by reshuffling of the cabinet. The first change occurred immediately after the occupation by the inclusion in the cabinet of members of the opposition other than National Socialists and Communists. The change was due to a natural development to sink party differences and present a united front, rather than to German influence.

This cabinet proved to be short-lived. The members were soon criticized for lack of co-operation, and in the country generally public

confidence in the government was weakened by its failure to take positive action in the economic problems, such as control of wages and prices, which the occupation had precipitated.

The second coalition cabinet was approved on 8 July. The chief political appointment was that of Erik Scavenius as Foreign Minister. The German sympathies of Scavenius were well known, since he conducted Danish-German relations during the war of 1914-18, although he had shown no National-Socialist leanings. The programme of the new government was announced as one of maintaining Denmark's independence and integrity, reform of economic conditions, and co-operation with Germany as the only way to preserve self-government and future independence. The government was well received by the Press and received support from all sides, but this support was conditional and depended on the loyalty of the government to Danish interests.

On 3 May 1942, Thorvald Stauning, the Prime Minister, died after a short illness and was succeeded by V. Buhl who had been Finance Minister in the government. The appointment of Buhl was probably a gesture of independence, since he held strong democratic views and had often made outspoken speeches on independence and freedom of thought.

Sabotage and offences against the German military had been increasing since the summer of 1941 and tension grew. At the beginning of November 1942 Scavenius was summoned to Berlin and charged with the formation of a new government, and a new German envoy, Werner Best, was sent to Denmark. The cabinet resigned on 7 November. In the new government the chief changes were the omission of the leaders of resistance against Germany, and the appointment of Scavenius as Prime Minister. None of the new ministers had openly expressed pro-German sympathies but their appointment was regarded as being due to German influence.

The new government soon passed measures which encroached considerably on the independence of the *Rigsdag*, of industry and of private citizens. The government was authorized to issue decrees in the interests of national security without reference to the *Rigsdag*. Cases arising from infringement of such decrees might be tried by Power of Attorney law, under conditions which varied according to the nature of the cases. A law was passed providing for the protection of industries and public utilities against saboteurs by means of patrols recruited from factory personnel and trained and maintained at the expense of the industries concerned.

New elections to the *Rigsdag* became due in April 1943. Although open-air meetings were banned and party campaigns were rigorously restricted, the statements of the Press and democratic speakers that the issue was not one for, or against, the government but for or against democracy and the upholding of the constitution, won a strong response in that 89% of the electorate voted, compared with 77% in 1939. The elections provided overwhelming support for the democratic parties which gained 93% of the votes cast. The allocation of seats in the *Folketing* was:

	1943		1939	
	Votes	Seats	Votes	Seats
Social Democrat	894,777	66	729,619	64
Conservative	421,069	31	301,625	26
Liberal Left	376,413	28	309,355	30
Radical Left	175,025	13	161,834	14
Free People's Party	24,701	2	50,829	4
Justice Union	31,085	2	33,783	3
National Socialists	43,267	3	31,032	3
Slesvig Party	—	—	15,016	1
Dansk Samling	43,257	3	8,553	0
Communist	Banned	—	40,893	3

Note. After 1939 the Free People's Party (*Det Frie Folkesparti*) was known as the Peasants' Party (*Bondeparti*). The German minority, represented by the Slesvig Party, decided to give up parliamentary representation, since many of its members were on service with the German Army and it would probably have had difficulty in retaining its single seat. As compensation, a bureau was established in the Ministry of Home Affairs to maintain contact between the minority and the Danish authorities. *Dansk Samling* gained parliamentary representation for the first time. This party does not hold orthodox democratic views but has gained support from some who feel that the democratic parties have conceded too often to German demands.

The elections to the *Landsting* showed the same tendencies as those to the *Folketing*. The election results were openly commented on as an expression of Denmark's devotion to democracy and the right of a nation to order its own affairs, and there was some outspoken comment on Scavenius and Frits Clausen, the Danish Nazi leader.

Justice. The administration of justice remained with the Danish law courts, which heard all civil cases including those involving sabotage and offences against German military personnel. The only reservation was that since May 1941 certain cases might be heard *in camera*, without a jury, and records might be withheld, but even here decision regarding procedure appeared to lie with the Supreme Court. The numbers of police were increased from 3,205 in 1938 to

about 6,000 in the autumn of 1942, but they remained Danish and were controlled in the ordinary way by the Danish government. Denmark was spared Gestapo control, summary convictions, concentration camps, hostages and mass executions. The Germans tried Danish subjects by court-martial on isolated occasions only; internment was possible only under anti-Communist legislation. Official contact between the German military authorities was made through the public prosecutor in Köbenhavn. The German police carried on counter-espionage and made arrests, but the prisoners were usually handed over to the Danish authorities sooner or later, since their detention in German hands led to vigorous protests from chiefs of police and from the public, who pressed the Danish authorities to a strict attitude towards prompt trial of Danes in Danish courts and their retention in Danish prisons.

National-Socialist Parties

The only party of any importance is *Danmarks National Socialistiske Arbejder-Parti* (D.N.S.A.P.) (Denmark's National Socialist Workers' Party), which was founded in 1929 by Dr Frits Clausen, its present leader. The party gained no seats in the 1935 elections but returned three members to the *Folketing* in 1939 and in 1943. The party formerly derived its support mainly from the frontier districts in South Jylland, but its supporters are now found largely among discontented workers in the larger towns, especially Köbenhavn. The German minority in South Jylland has its own brand of the German National-Socialist Party—*National-Sozialistische Deutsche Arbeiter Partei Nordschleswigs* (N.S.D.A.P.N.), led by Jens Möller.

The organization and programmes of the D.N.S.A.P. and the N.S.D.A.P.N. are imitations of those of Germany, the uniforms are indistinguishable, they use the swastika as their symbol and have S.A. and S.S. divisions. The D.N.S.A.P. claimed to be a distinctly national party and was, before the occupation, reluctant to enter into any open collaboration with Germany. The D.N.S.A.P. and the N.S.D.A.P.N. formally broke with one another early in 1941, and there have been no later attempts at collaboration.

There is no evidence that the Danish parties had any part in, or knowledge of, the German plans for occupation, and they have received no preferential treatment. They were not exempt from the ban on political meetings and the wearing of uniforms which was imposed immediately after the occupation, and members of the party have frequently been prosecuted and imprisoned for political disturbances.

They received, on the whole, little support in the German Press, and a good deal of abuse in the Press and in speeches in Denmark.

Since the occupation several other parties with National-Socialist or Fascist leanings have appeared and indicate the degree of dissension among people of these persuasions in Denmark. Their numbers are small, their loyalties are somewhat indefinite, and several of them have been formed under the leadership of former members of the D.N.S.A.P. The chief rival of the D.N.S.A.P. is the *Dansk Folkeparti* which was formed in March 1941 by a process of amalgamation of small sects around the nucleus of *Dansk Socialistisk Parti*, which was the only group of some years' standing. The only other significant party is *Den National Aktion* which was formed in July 1942 by the fusion of four recently formed parties which were themselves the results of fusion of other groups formed from discontented elements of the older party.

The D.N.S.A.P. formed a coalition with the *Landbrugernes Sammenslutning* (Farmers' Union) and the *Bondeparti* (see p. 548) in June and July 1940 respectively. The former is an organization, formed in 1931, for furthering agrarian interests. It had a membership of about 130,000, and several of its leaders were wealthy landowners with Fascist or National-Socialist sympathies. It has declined steadily since its alliance with the D.N.S.A.P.

These alliances and the activity of the D.N.S.A.P. towards the end of 1940, when there were negotiations in Berlin about a possible change in the government, were vigorously condemned by all other parties in public speeches and in their respective presses. Indifference, which had always been the Danish attitude to the D.N.S.A.P., turned into active dislike. After this the German Press paid little attention to the National-Socialist elements in Denmark, probably because it was realized that they were too weak and too ill-regarded to be useful.

Anti-Communism and Anti-Semitism

The Russo-Finnish war called forth frequent expressions of sympathy with Finland, and misgivings regarding Russia's intentions towards Scandinavian integrity. At the same time Denmark's non-belligerency was emphasized, but medical supplies, food, clothes and other philanthropic help was sent and a few unorganized volunteers went to fight in Finland.

The German attack on Russia met with a mixed reception. The Danish ambassador in Moscow was withdrawn and there were some

vague references to the leadership of Germany in the cause of preserving European civilization. Volunteers for the *Nordland* regiment of the German army were few, but at the beginning of July 1941 a Free Corps, named *Danmark*, was organized by the D.N.S.A.P. to fight against Russia. The Free Corps has received little support except from National-Socialists, and public recruiting meetings have been attended by disorders. Medical and other humanitarian services have been organized by the Danish Red Cross, but these have been on a noticeably smaller scale than during the Russo-Finnish war. Danish members of the *Nordland* regiment and members of the Free Corps have been ill-received when home on leave from the Russian Front.

On 20 August 1941 Communist organizations and activity in Denmark were forbidden by law, and the Minister of Justice was given power to take into custody, for an indefinite period, those who were suspected of possible Communist activities. On 25 November 1941 Scavenius signed the anti-Comintern Pact in Berlin on behalf of Denmark. According to the Swedish Press, the pact was signed only under German pressure and in face of a threat to cancel the agreement of 9 April 1940 and to regard Denmark as an enemy power if she did not adhere to the pact. Rumours that the pact had been signed without the sanction of the king and government led to serious disturbances in Köbenhavn. A week later Count Reventlow, the Danish Minister in London, telegraphed to Köbenhavn his inability to accept further orders from the government, since he felt that Denmark's adherence to the anti-Comintern pact endangered good relations between Denmark and Britain, but he would continue to represent Danish interests in Britain as the representative of a free Denmark.

Anti-Semitism has not been prominent. The D.N.S.A.P. has occasionally railed against the Jews but no campaigns developed, there have been no ghettos or yellow stars, and anti-Jewish writers have often been prosecuted successfully for libel. On 27 May 1943, *Kamptegnet*, an anti-Jewish journal, ceased publication owing partly to the imprisonment of its editors for libel.

The Danish Press and Public Opinion

The Press in Denmark has remained relatively free and has occasionally been outspoken on matters of internal politics and administration. Comment on matters affecting the relations between Denmark and Germany is usually careful, but speeches containing criticism of Germany are freely reported, and accounts of the pro-

gress of the war have usually been well balanced. There is no direct censorship, but there has been a considerable amount of indirect control. Articles containing delicate matter are submitted to the official Danish Press Bureau which acts under German instruction in general terms. To avoid direct censorship the Press has formed its own council which imposes fines on newspapers which are considered to have overstepped the limits; some editors have 'resigned', but few newspapers have been closed down. The most pro-German papers have been the organs of the National-Socialist parties, *Faedrelandet* and *Nationalsocialisten*. There has been no ban against listening to foreign broadcasts.

Public opinion has remained independent. While there have been some outcries against Denmark's passive role in the war, the German occupation is mostly regarded as the inevitable fate of a small unarmed nation. Danish national feeling and Scandinavian solidarity are continually being stressed, and the attitude of the population towards the German military is on the whole correct, but cool and reserved, although the clergy have been warned to refrain from anti-German agitation. There has been a regular flow of arrests for sabotage, defacement of notices and attacks on German soldiers, food supplies and armaments, but these were never on a large scale until the summer of 1943.

The German Minority in South Jylland (Jutland)

Although the German minority had hoped for annexation to the Reich, the occupation brought no change in their relations other than that which affected the remainder of Denmark. Minority activities, which had increased since the advent of National Socialism in Germany, became more vigorous after the occupation, and youth organizations, trade clubs, etc. became party organizations.

German activities in South Jylland have been mainly concerned with education. The number of minority schools has increased greatly, and the number of children attending them rose from 3,626 in May 1940 to 4,053 in May 1941, but has shown no marked increase since; this increase was due, in considerable measure, to fear of discrimination and to preferential economic treatment of children of pro-German parents. With the changes in the course of the war, children are now being transferred back to Danish schools and some German schools have been forced to close down.

The *Kreditanstalt Vogelsang*, which held about 10,000 acres of land in 1939, has continued its policy of plantation by buying land for

German settlers in preparation for a possible new plebiscite, while *Deutsche Selbsthilfe* (German Self Help) has been granting loans to Germans for capital and taxes.

The minority has been active in organizing labour and production in the form of trade groups and workers' groups which train and place apprentices, direct labour, and regulate prices. Tension between the Danes and the minority has increased since the occupation, and there have been some minor clashes, but on the whole the political role of the minority has been small.

The Faroes and Greenland

British troops occupied the Faroes on 13 April 1940. Danish sovereignty has been maintained in principle, and the islands took part in the *Folketing* elections of 1943. The local self-governing institutions have continued to function. On 9 April 1941 the Danish ministry in Washington signed an agreement with the government of the United States whereby the latter took over the defence of Greenland, but recognized Danish sovereignty in Greenland. The Danish government repudiated this agreement.

ECONOMIC CONDITIONS

General Survey

The outbreak of war exposed Denmark to the same difficulties as those she experienced during the war of 1914-18. Her overseas commerce was restricted and had to run the risk of submarine attack and mines, her ships were subject to examination by blockade control, and markets for her purchases, as well as for her sales, became disorganized, while some of the raw materials on which she had long depended, such as British coal, were diverted to national uses. During the first seven months of the war she carried on her commerce as well as conditions allowed, but the German occupation brought her trade on the high seas to a standstill. Britain, her best customer and important provider of raw materials, was now outside the field of her economic activities, and she was cut off by the British blockade from her usual sources of agricultural raw materials such as grain, oil-seeds, feeding stuffs and fertilizers, and also from petroleum products and textile raw materials.

The disposal of her food exports and the occupation of her industrial population could be diverted and adapted to German needs.

But these industries depended heavily on imported raw materials, only some of which Germany could provide. Coal and iron were available in Germany and the lands which she had overrun, but adequate supplies could not be provided owing to German needs and the shortage of labour and transport. Imports of oil-cake were very difficult, especially after Russia had entered the war, and while Germany could easily provide potash and nitrogen fertilizers, which have been maintained at or above pre-war levels, phosphates were almost unobtainable and the supply has been less than one-tenth of the pre-war consumption.

Thus the numbers of livestock had to be cut down, industrial activity was curtailed to eliminate non-essential products and to conserve fuel, and the efficiency of the economic machine was impaired by restrictions on the use of gasoline and fuel oil, with a consequent increase on the burden which the railways had to bear, especially since about a half of the Danish mercantile marine was in foreign ports or on the high seas at the time of the occupation and most of it came into allied hands; Danish ships in American ports were taken over in March 1941. Only about one-third of the Danish merchant fleet, totalling 417 ships of 410,000 gross tons, fell into German hands. But depleted and restricted trade has made fuel shortage a more serious factor than shortage of ships, and it is estimated that about one-quarter of the tonnage has been laid up for this reason.

The net result has been a marked reduction in the output of both agriculture and industry. Some measure of this may be gleaned from the following table which is based on a Danish source; German sources usually give higher figures.

	Animal products				Index of industrial production (1935 = 100)
	Butter	Bacon	Beef	Index of production (1935 = 100)	
	(thousand tons)				
1939	152	244	137	106	115
1940	136	244	175	100	94
1941	104	133	135	66	90
1942	91	72	124	51	90

Source: *Økonomi og Politik*, October–December, 1942 (Köbenhavn, 1942).

The cost of living index, taking the index for 1935 as 100, rose from an average of 107 in 1938 to an average of 162 for 1942 and stood at 165 in July 1943.

Agriculture

Livestock. The stoppage of imports of feeding stuffs has caused a marked decline in the numbers of livestock and, consequently, in the production of animal foodstuffs. The numbers of livestock became fairly stable after the spring of 1942.

Numbers of Livestock, 1938-43

	Cattle	Pigs	Poultry
	(thousand head)		
July 1938	3,238	2,885	22,075
March 1940	3,226	3,066	21,884
March 1941	2,976	1,873	8,055
March 1942	2,831	1,267	5,908
March 1943	2,824	1,866	6,418

The reduced output of dairy produce is not due entirely to smaller herds but also to reduced milk yield per cow and deterioration in the quality of the stock owing to poorer feeding as a result of the cutting off of feeding stuffs, especially oil-cake. The yield of milk per cow has fallen by nearly 30 %, and the total milk production fell from 5.3 million tons before the war to 3.3 million tons in 1942.

The reduction in butter production is more serious for Germany on account of increased home consumption, which has resulted from the virtual stopping of the manufacture of margarine; exports of butter have fallen to 15 % of the pre-war level.

Crops. Some attempt has been made to increase the acreage under grain and root crops but this has not been successful. The main change has been a reduction of the area under wheat to a third of the pre-war amount (1938 = 134,000 ha., 1943 = 45,900 ha.) and an increase of over 50 % in the area under rye (1938 = 147,000 ha., 1943 = 225,600 ha.). There has been a total decrease of about 90,000 ha. in the area under barley, oats and mixed cereals, and a decrease of some 10,000 ha. in the area under root crops. The production of wheat fell from 470,000 tons before the war to 20,000 tons in 1942. The most considerable contribution to the problem of fodder has been the use of green silage to replace imported grain and fodder. The total yield of the harvests, despite these measures, has declined as shown in the following table. These reductions are due partly to shortage of phosphates and partly to the shortage of liquid fuel which is particularly serious, since Danish farming is so highly mechanized.

Yield of Harvests (in millions of crop units (see p. 234))

	1934-8 (average)	1941	1942
Bread grain	6.4	5.0	4.3
Fodder grain	26.8	20.5	30.9
Potatoes	3.2	3.0	3.8
Root crops	27.8	32.1	27.3
Hay	7.9	3.1	2.7
Total	72.1	63.7	69.0

Various measures have been introduced as a result of reduced food output. The use of fodder has been restricted and imported grain may not be fed to livestock. Bread, cereals, sugar, fats, tea and coffee are rationed, but rationing in Denmark is much less comprehensive than in other occupied countries. The average annual consumption of different foods per head (see p. 98) has changed little, except that the consumption of milk has fallen by 30 kg. and that of sugar by 10 kg.; the failure of margarine supplies has more than doubled the consumption of butter. Danish diet has remained well above the average for occupied countries, and the average calorie intake is only 10% below the pre-war figure. Germany has, so far, been content with taking such agricultural produce as was left after Danish needs were satisfied.

Industry

Coal and Coke. Denmark normally imported 80% of her coal and coke from Britain and the remainder from Germany and Poland. The difficulties of supply from Germany arise from the heavy demands made on German coal by war industries and by the needs of occupied countries, and from restricted labour and transport. Details of imports since the war are:

	Million tons		Million tons
1938	5.4	1941	3.5
1940	3.7	1942	2.7

The output of coal mined from the seams in Bornholm has remained small.

Peat. The difficulty of obtaining fuel has resulted in the exploitation of Denmark's resources of peat, lignite and natural gas. The production of peat has increased from about $\frac{1}{2}$ million tons annually, which was the average output for the period 1921-39, to $2\frac{1}{2}$ million tons in 1940, and to 3.5 million tons in 1942.

Lignite. Danish lignite has a low calorific value but is improved by making it into briquettes. The deposits were scarcely used before the war, but production reached $\frac{1}{2}$ million tons in 1940, 1 million tons in 1941, and 1.7 million tons in 1942. The calorific value of peat and lignite production in 1942 corresponded to about 2 million tons of coal which is roughly one-third of Denmark's normal consumption.

Natural Gas. Natural gas has been used in north Jylland, especially around Frederikshavn, for domestic heating, lorries and industrial uses, but its contribution to the fuel supplies is small and recent reports indicate that supplies are failing.

Liquid Fuels. Supplies of liquid fuels are a much more serious problem. The only source of supply is Germany and German-occupied territories. Motor cars may be run only by special permits, heavy lorries may be run on producer gas only, and the small amount of fuel oil available is used for industrial purposes, especially power stations and water-pumping installations. Marine transport and fishing vessels have suffered particularly. A large proportion of the local ferry services have had to be suspended, but regular shipping services between Köbenhavn and provincial ports have been maintained.

Power. Owing to the opening of the Isefjord and Masnedö power stations (see p. 297) in 1940 the total output of electricity in 1942 was 12% above the pre-war level. Since 1940 work on power stations on the Storaas, near Esbjerg, and on the Skernaa has been in progress, but no station has been completed.

Many measures of fuel rationing have been introduced. Imported solid fuels are largely reserved for industrial use, and even industrial concerns have been limited to fractions of their normal consumption. Imported coal may be used only in urban areas and is allocated by a rationing system in which the value of the coupons differs according to classes of dwellings. Running hot water is prohibited, and regulations govern the number of rooms which may be heated in private dwellings and the maximum temperatures which are permissible in public buildings. Gas and electricity are also rationed. Train services have been reduced by at least a half and bus services have been severely cut. Since the rail-car and the high-speed Diesel electric services were the first to be abolished, the deterioration in railway services has been even more severe than the 50% cut would indicate. About 25,000 motor vehicles and tractors are being run on producer gas, some using imported coke, but increasing numbers are being run on wood and some on prepared peat. Producer gas is also used in ships, especially ferries and fishing boats.

Metals. Denmark has always imported the bulk of her requirements of iron from Germany, but the demands of German war production place a limit on her export surplus. Danish imports of iron and steel fell from 528,000 tons in 1939 to 198,500 tons in 1940 and to 150,000 tons in 1941. Supplies are allocated according to the purposes to which this metal, like all other metals, is put, and while those firms which are engaged on war materials are probably kept adequately supplied, the needs of other industries are strictly limited. Scrap iron, which Denmark formerly exported mostly, is being collected, and although much has been made, in the Press, of Danish deposits of bog iron-ore, fuel difficulties, the low ore content of the deposits, and the high cost of production, make it unlikely that production of metal from this source is significant. Bog iron ore, together with pyrites from Sweden and scrap from Denmark, is being used to produce iron in converted rotary kilns in the Norden cement works at Aalborg, where the annual output is estimated at 25,000 tons. A steel works, with an annual capacity of 40,000 tons, was opened at Frederiksværk in 1942 to use scrap. The use of metals in industry is closely restricted, and no considerable amounts of iron and steel may be used without permits.

Owing to short supplies of raw materials the Danish engineering industry has not been working to capacity, and while it has continued to produce Diesel engines, locomotives, machine tools, etc., it has been much used for repair work and for manufacturing producer-gas units. A/S Burmester and Wain, with characteristic adaptability, have built the first ocean-going ship to run on producer gas. The completed output of the Danish shipyards was about 60,000 gross tons between August 1941 and August 1942 and 35,000–40,000 tons during the next six months. Since February 1943 the yards have been working to nearly half their capacity on German standard merchant ships. The total tonnage of ships under construction in February 1943 amounted to 162,000 gross tons.

Other Raw Materials. Imports of wool, cotton, flax, hemp, oil-seeds and rubber have been negligible since the occupation. In some cases there has been some importation of substitute products from Germany, and *Det dansk Sojakagefabrik* has been producing some synthetic rubber. Cotton is not available, but *De danske Bomulds-spinderier* has planned an annual output of 250–300 tons of 'Cotonin', a substitute prepared from flax and hemp tow. Leather production is only about 60% of the pre-war amount, owing to lack, not of hides, but of accessory materials. Margarine factories closed down for some

time after the occupation owing to lack of raw materials, but since then the vegetable oil and oil-cake industry has been able to continue very limited production by using home-grown linseed. Similarly, home-produced animal fats have allowed the manufacture of a small amount of soap which is meagrely rationed. The cotton and rayon textile industry has been depending largely on imported cellwool (rayon staple fibre) eked out by a small amount of home-grown flax and hemp. The home production of flax increased from 600 tons in 1940 to over 2,500 tons in 1942, and the acreage under the crop has increased five-fold, while that under hemp has increased four-fold. Pure wool textiles may not be manufactured; rabbit fur, cow hair and horse hair have been used as admixtures. Clothes rationing was introduced in April 1943. The manufacture of cement has been restricted owing to fuel shortage, and its use is allowed under special licence only.

Labour

Unemployment has continued owing to reduced means of production and to the disinclination of Danes to go to work in Germany. Owing to a change in the method of classification, figures for the period before and after the occupation are not comparable. To relieve unemployment, legislation provided, until May 1942, for reduced hours with compensation paid from a fund supplied by a tax on industrial workers earning over 2,400 kroner a year. Since the summer of 1942 unemployment has decreased markedly. Much work on land reclamation and improvement, forestry, building and road construction, have been financed by the state to relieve unemployment, especially in winter.

Wages have been supplemented by payment of bonuses, but such increases have been only about a half of the increase in the cost of living. The pre-war machinery for settlement of industrial disputes (see p. 96) has been supplemented by a committee consisting of members from the Employers' Association and the trade unions, to avoid strikes and lock outs, and to regulate wages and working conditions. This machinery has continued to be successful in avoiding strikes.

There has been no compulsory recruitment of workers to Germany, as in other occupied countries, although economic pressure, such as threats to withhold domestic supplies of coal, has been brought to bear. The maximum number of Danish workers in Germany was about 50,000 in 1942, but the number had fallen to 35,000 in March

1943. Bombing of north German cities during the summer of 1943 has reduced this number further. Some seven or eight thousand Danes are working in Norway.

Commerce

Trade with Germany accounted for nearly 100% of the total Danish trade in 1940, 80% in 1941 and 67% in 1942. In spite of rising prices the value of imports has fallen steadily from 1,740 million kroner in 1939 to 1,200 million kroner in 1942, while the value of exports fell from 1,578 million kroner to 1,000 million kroner between the same dates. Trade agreements with countries in the German sphere have been made regularly for periods of 6 or 12 months, but apart from those with Sweden the amounts involved have been small.

Financial control has remained in Danish hands, and no elaborate administrative machinery has been set up as in other occupied countries. The government refused to negotiate a customs and currency union with Germany in 1940, and the matter has not been raised since. The Danes have suffered the usual exploitation in the form of occupation costs and the clearing system of trade. In July 1943 Denmark's credit balance had risen to 1,556 million kroner on the clearing account and to 1,855 million kroner on the Sundry Debtors account.

Appendix IX

MAPS AND CHARTS OF DENMARK

HISTORICAL INTRODUCTION

The first modern systematic survey of Denmark was carried out by the *Videnskabernes Selskab* (Academy of Science) between 1762 and 1825 on a scale of 1 : 20,000. As a basis for the maps a triangulation of the country was carried out between 1762 and 1792 under the direction of Thomas Bugge. The maps were published between 1768 and 1841 in 18 sheets on a scale of 1 : 120,000 covering the whole country. They carried no indication of relief, were rather meagre in details, and were considered inadequate, especially for military purposes; the triangulation was also not sufficiently accurate.

In 1808 the General Staff was formed and it started a survey of the country, but only maps of special areas were produced. In 1816 the Danish geodetic survey was established under the direction of H. C. Schumacher, and a new primary triangulation was started. The triangulation was carried out between 1817 and 1870 and consisted of a polygon comprising the islands, and a single chain along the east side of Jylland from the Skaw to the Elbe. From this primary triangulation a network of the second order, consisting of triangles with sides of 15–20 km., was laid down. The triangulation was linked, across the Sound, with the Swedish net and later with the Prussian network across Falster and the western Baltic. Two base-lines were measured, one on the island of Amager and the other near Lammefjord in north-east Sjælland. In 1842 the state took over the survey department, established a topographical section of the General Staff, and charged it with the survey of the country.

Work was started immediately on a plane-table survey on a scale of 1 : 20,000 and with contours at intervals of 5 Danish feet. As a basis for this work the surveyors used a large-scale (1 : 4,000) property survey which was carried out by the *Videnskabernes Selskab* between 1760 and 1860 as a basis for a new registration of the country which the agrarian reforms of the late eighteenth century had made necessary. The plans produced by this property survey were independent plans, each covering a village and its fields, and were concerned mainly with the boundaries of properties: no map projection was used, and there was no indication of the geographical position of the plans or their connexion with one another. These plans were reduced by pantograph to a scale of 1 : 20,000 and issued to the surveyors, who were to revise them, fill in details and establish their geographical position.

The new survey was based on the triangulation of Schumacher which was then in progress. The contouring was based on a primary levelling carried out along the main roads, with their origin at a port, the mean water level of which was taken as the datum which therefore differed slightly from place to place. Secondary lines were levelled from these primary lines. Along these guiding lines the survey of the country was carried out, starting with Sjælland and finishing with Jylland in 1887. The original plan was to print the maps on a scale of 1 : 80,000, but in 1871, after 29 sheets of the islands had been published (see no. 4, below), it was decided to continue with the mapping of Jylland on a scale of 1 : 40,000. In 1865 it had already been decided to publish a map on a scale of 1 : 20,000, and from this series smaller scale series were produced later.

The maps produced from the first survey were of different standards of accuracy, and errors were sometimes of the order of over 50 m. on the ground. The maps of the areas first surveyed were obsolete before the survey was completed in Jylland. In 1884, three years before the first survey was completed, a new survey was begun, with a new triangulation and a new levelling based on a single datum, and carried

out in the same sequence of areas as before. In the archipelago a triangulation of the second order was based on the old triangulation of the first order, which was considered sufficiently accurate, but in Jylland a new triangulation was carried out and linked with the net over the archipelago. The new net had sides of about 50 km. or less, and from it a triangulation of the second order was laid down with triangles of the same size, on the whole, as in the primary network. The levelling was carried out between 1885 and 1904 as a precision levelling centred on Aarhus cathedral. The permanent levelling points are 2 km. apart, and, with the levelling of second and third orders, no point in the country is more than $1\frac{1}{2}$ km. from a levelling point. This survey was completed in 1923. The survey scale was at first 1:20,000 but was later increased to 1:15,000 and to 1:10,000 for the most densely built-up areas.

The 1:20,000 maps of Denmark, which is the basic series, are based on these two surveys. The maps of Sjælland and the neighbouring islands, and of the southern part of Fyn, are based on the newer survey (1884-1923); the maps of the remainder of the country are based on the first survey (1842-87) of the General Staff, but the sheets have been revised periodically. The maps are drawn on a conical projection with standard parallel 56° N and central meridian $2^{\circ} 12'$ W of the *Rundetaarn* (the old observatory) at København.

Later work has shown that the triangulations of 1817-1906 were not sufficiently accurate. The error of closure is considerable in some cases, and a remeasurement of the base on Amager in 1911 showed a discrepancy of 51 mm. Consequently a new triangulation of the first, second and third orders was started in 1922 and completed in 1934. The triangulation consists of two limbs, along the east and west sides of Jylland, linked with a polygon over the islands. New base-lines were measured near Saksköbing, Brønderslev, Tarm and Döstrup. The Danish network was linked with that of Germany in 1931-2 and with that of Sweden in 1933. A revision of the primary levelling of 1885 and 1904 has also been in progress.

In 1928 the Geodætisk Institut was formed by amalgamation of the geodetic survey and the topographical section of the General Staff.

The Danish Hydrographic Office (*Det kongelige Søkort-Arkiv*) was founded in 1784 and carried out maritime surveys between 1790 and 1807, but these surveys were not trigonometrically determined. The greater part of the Danish waters was surveyed systematically for the first time between 1829 and 1840, but the Kattegat was not surveyed until 1847-58. The charts were produced on a scale of 1:120,000 which was later reduced to 1:130,000, which scale has been maintained ever since. On these surveys and charts, with revisions, the later charts have been based. An account of surveying methods and of old surveys of Denmark is given in H. O. Ravn, 'The Maritime Survey of Denmark', *Hydrographical Review*, vol. VII, no. 1, pp. 129-41 (Monaco, 1930).

DESCRIPTION OF MAPS

The maps of Denmark are described in the following order:

- A. Danish government topographical maps:
 - (a) Main series covering the whole country;
 - (b) Special series.
- B. Maps issued by the Geographical Section of the British General Staff.
- C. British Admiralty Charts.
- D. Danish Admiralty Charts.
- E. Geological maps.
- F. Miscellaneous maps.

In each group the maps are listed in order of scale, those on a large scale coming first. The following particulars are given where possible for each series:

- (1) Authority responsible for its production.

(2) Date of publication. These dates cover the period during which the latest complete set was produced. They include revisions and are not necessarily an indication of the period during which the first complete series was produced.

(3) Number of published sheets in the series—to the latest available date (usually 1938) for Danish government maps and to June 1943 for G.S.G.S. maps.

(4) Size of sheets, measured to the margin of the area mapped.

(5) Projection. (Danish official maps are on a conical projection with one standard parallel.)

(6) Meridian of origin.

(7) Scale.

(8) Marginal information.

(9) Whether coloured or in black.

(10) Method of representation of relief.

(11) Details of roads, railways, and other information.

When a map has been issued in several editions, the details are given for the latest edition.

A. DANISH GOVERNMENT TOPOGRAPHICAL MAPS AND PLANS

These maps are produced and published by the Geodætisk Institut, København, and unless specified otherwise the longitudes are numbered from the meridian of København ($12^{\circ} 34' 40''$ E of Greenwich).

(a) *Main Series covering the Whole Country*

(1) 1 : 20,000. *Maalebordsblade* (plane-table sheets)

Latest complete set published between 1902 and 1938 in 833 sheets, each measuring 37.7×47.1 cm. and covering about 71 sq. km.: two sheets, of water areas only, not published. Drawn on a conic projection. No graticule but margins marked at 1 min. intervals. Scales in metres and Alen ($=0.63$ m. $=2.0$ ft.). This series replaced an older series produced between 1875 and the end of the century, which covered part of the country and in which the general content was similar (see above). In the old series some sheets were printed in colour and others were hand-coloured.

The maps are printed in three colours: water in blue, contours and parish boundaries in brown, other details in black.

Contours at intervals of 5 Danish ft. (1 Danish ft. $=0.31$ m. $=1.03$ English ft.) on sheets of Jylland and Bornholm and of 2.5 m. on sheets of the islands except the Fyn group, on which the interval is 2 m. Spot-heights in metres or in Danish feet. Submarine contours at 1, 2, 3 and 4 fm. on most sheets, but at 2, 4, 6 and 10 m. on later sheets. Spot-depths in Danish feet.

Railways as double lines, half-filled, and tramways by double lines. Three categories of roads by double lines. Three categories of towns and villages by plan; four categories of farmsteads by productivity. Black symbols for deciduous woodland, coniferous woodland, copses, thickets, heath, dunes, salt-marsh, water-meadow, bog, churches, mills, lighthouses, sand-, clay-, gravel- and marl-pits, dykes, hedges and fences; industrial establishments by description. Later sheets show high-tension cables.

(2) 1 : 40,000. *Atlasblade*

The sheets of Jylland are based on the survey carried out there between 1866 and 1887; the other sheets are based on surveys or revisions carried out after 1901. The latest complete set, including sheets published between 1870 and 1928 is in 232 sheets, each measuring about 37.5×46.5 cm. and covering about 284 sq. km.;

4 sheets, of water areas only, not published. Drawn on a conic projection with standard parallel 56° N and standard meridian $2^{\circ} 12'$ W of København. Graticule at 6 min. intervals of longitude and 4 min. intervals of latitude. Scales in metres and Alen.

All black, printed from the engraved plates. The sheets were also obtainable hand-coloured, with water in blue, main roads in brown and either with administrative boundaries in green or with water-meadow, bogland and marsh in green and heath in red.

Contours at intervals of 10 Danish ft., except for Fyn and the islands around it, where the interval is 2 m. Spot-heights in Danish feet. Four submarine contours at intervals of 6 Danish ft. from the coast: spot-depths in fathoms.

Railways with stations marked. Three categories of roads by double lines. Distinctive symbols for coniferous woods, deciduous woods, copses, thickets, heaths, salt-marsh, water-meadow, bog, sand and cliffs. Four categories of towns and villages by plan. Five categories of farms by productivity. Symbols for dykes, fences, mills, churches, trigonometric stations, mile (Danish) and kilometre stones. Key on index sheet only.

(3) 1 : 40,000. *Atlasblade* (coloured edition)

Latest complete set published between 1910 and 1939 in 236 sheets. No graticule, but margin is divided into 4 min. intervals of latitude and 6 min. intervals of longitude. One line of longitude on each sheet is given its value from the meridian of Greenwich. The content of the maps is the same as in no. 2, but woods and main roads (two or three categories) are overprinted brown and water-meadows, bogs and water are overprinted blue.

Contours at intervals of 10 Danish ft. except for Fyn and south Jylland, where the interval is 2 m., every fifth contour pecked on most sheets. Spot-heights in metres. Submarine contours at 2, 4, 6 and 8 m., layer-shaded; some sheets have contours at intervals of 10 Danish ft. and submarine contours at 6, 12, 18 and 24 Danish ft.

Some sheets, published after 1936, have woods in green and contours in brown at 2.5 m. intervals with alternate contours pecked. In these the submarine contours are at 2, 4, 6 and 10 m., and the sea is not layered.

(4) 1 : 80,000

Published between 1845 and 1872 in 29 sheets, each measuring about 37.5×47 cm. and covering the islands only. Projection is a modified Flamsteed with central meridian $2^{\circ} 12'$ W of København and standard parallel 56° N. Graticule at 4 min. intervals of latitude and 6 min. intervals of longitude. Scales in metres and Alen.

All black, printed from the engraved plates.

Contours at intervals of 10 Danish ft. for Sjælland, Møn and Fyn, and 5 Danish ft. for Lolland and Falster. Spot-heights in Danish feet. Submarine contours at 6, 12, 18 and 24 Danish ft.; spot-depths in fathoms. Railways and stations, three categories of roads, parish boundaries. Symbols for coniferous woods, deciduous woods, heath, water-meadow, bogland, sand, trigonometric stations and mills. Towns and villages in plan. Four categories of settlements by symbols. Some sheets have a faint blue wash around the coast, fading outwards; others have the wash over all water areas and others have no colour.

(5) 1 : 100,000

New edition published between 1919 and 1934 in 63 sheets, each measuring 33.3×40.8 cm. and covering about 1,350 sq. km., except for the double sheets (1-2, 4-5 and 7-8), all of north Jylland, which are of larger size (33.6×60 cm.). There are also four special sheets, of large and irregular size, covering north-east Sjælland, south-east Sjælland, north-west Sjælland (Odsherred), and the island of Als and the adjacent shores of Jylland. Drawn on a conical projection with graticule at 6 min. intervals of longitude and 4 min. intervals of latitude. Scale in km.

The maps are printed in five colours, land coloured cream, woodland in green with distinctive black symbols for coniferous and deciduous woods, heath in red, marsh and bogland in blue with distinctive black symbols, dunes in black stipple. Watercourses, lakes and sea in blue, with 4 m. and 10 submarine contours in black. Spot-heights in metres; cliffs and steep slopes by hachures. Main roads in red; other roads (two categories) in black. Railways, standard and narrow gauge, in black. Five categories of towns and villages by plan in black. Seven categories of settlements (castles, manors, large farms, houses, etc.) by black symbols; inns, dairies, schools, etc., named. Special black symbols for mills, forts, trigonometrical stations, life-saving stations, lighthouses, lightships, springs, waterworks, quarries, churches. Boundaries of counties, districts and parishes.

This series is also published in atlas form in three volumes (North Jylland; South Jylland and Fyn; Islands east of the Great Belt). Each volume measures 22.8 × 23.8 cm. The atlas contains a gazetteer and tables of distances between towns.

(6) 1 : 100,000

Published between 1921 and 1938. Details as for no. 5 with the addition of contours in brown at 5 m. intervals and with every fifth contour pecked.

This is the best map of Denmark for general purposes.

(7) 1 : 100,000

This series is an earlier edition of no. 5 and was published between 1891 and 1897 in 68 sheets, each measuring 33.8 × 40.2 cm. and covering the whole area of the country as far south as the pre-1920 boundary (see Fig. 38). No graticule, but the margins are divided at 10 min. intervals. Scale in metres and Alen.

The maps are printed in five colours: land cream, woodland in brown with coniferous and deciduous woods distinguished by symbols, heath in red, water-meadow and bogland in green with distinguishing symbols in black, dunes in fine black stipple. Roads, railways and other details in black.

No contours on land or sea. Spot-heights in metres. General content and technique is similar to no. 5.

(8) 1 : 150,000. *Populært Færdselskort*

Published in 1938 in 9 sheets, each measuring about 60 × 80 cm. and covering an area of about 10,800 sq. km. No graticule. Scales in km.

The maps are printed in five colours: water in blue, woodland in brown, water-meadow and bogland overprinted in blue, arterial roads in red and accentuated, other main roads in brown, other roads in black. Railways in black. Towns and villages by plan in black. No relief.

A rather crude motoring map.

(9) 1 : 160,000

Current series published between 1911 and 1927 in 26 sheets (including one double sheet), each measuring 37.7 × 39.2 cm. and covering about 3,783 sq. km. The series was completed in 1916, except that the sheets of South Jylland were added after the plebiscite of 1920.

Graticule at 4 min. intervals of latitude and 6 min. intervals of longitude. Scales in km. and Alen.

The maps are printed in four colours, land cream, woodland in brown, marsh and bogland in green, heath in red, water in blue, dunes in fine black stipple. Other details in black.

No contours; spot-heights in metres. Submarine contours at 4 and 10 m.; spot-depths in metres.

Railways in black, main roads in brown. Two categories of other roads in black. Boundaries of counties, districts, judicial districts and parishes; administrative divisions numbered and keyed by sheets. Towns and villages by generalized plan.

Symbols for six categories of settlements, for churches, mills, lighthouses and trigonometric stations.

This series is also issued in pocket-atlas form of two volumes, one for Jylland and the other for the islands. Each book measures 13×21 cm., and has a gazetteer.

(10) 1 : 160,000

Identical with no. 9 but with contours in at 5 m. intervals.

(11) 1 : 160,000

This is a heliogravure edition of no. 9 and was published between 1909 and 1929 in 27 sheets, each measuring 37.2×38.9 cm. All black, with or without contours at 5 m. intervals. Otherwise the maps are as described above, and the areas coloured in no. 9 are left with their distinctive black symbols, but the sheets were also obtainable with water areas and administrative boundaries hand-coloured.

(12) 1 : 200,000. *Danmark*

Published in 1932 in 16 sheets of varying size.

Land areas are covered by 10 sheets, and the series is completed by 6 sheets of water areas to cover a rectangular area measuring about 215×165 cm.

Graticule at 15 min. intervals of longitude and 10 min. intervals of latitude. The value of one meridian on each sheet is given from the meridian of Greenwich. Scale in km. on key sheet (no. 16) only.

The map is printed in six colours. Land coloured cream, woodland in brown (with black symbols to distinguish coniferous and deciduous woods), heath in red, water-meadows and marsh in green with distinctive black symbols. Water in blue with submarine contours at 4 and 10 m. Dunes in black stipple.

No contours; spot-heights in metres and steep slopes hachured. Main roads in red with every 10 km. stone marked; other roads (two categories) in black. Railways in black. Ferry services in red. Six categories of towns, villages and hamlets shown in generalized plan. Distinctive black symbols for churches, castles, manors, large farms, peasant farms, houses, mills, forts, springs, trigonometrical stations, lighthouses, lightships, air beacons, air-fields, boat-landing places, harbours (with maximum depths in metres) and industrial establishments. Key to symbols on sheet 16 only.

This series is also published in atlas form (one volume), measuring 12.5×21.75 cm. and containing a gazetteer and a table of distances between towns.

(13) 1 : 200,000. *Danmark*

Published in 1939. Details as for no. 12 except that woodland is in green, heath is in buff and marsh and water-meadows are in blue; the arterial roads are numbered and they alone are in red, while other main roads and ferry routes are in brown. Administrative boundaries are in yellow and the areas enclosed are given index numbers.

(14) 1 : 320,000

Published in 1929 in 4 sheets of different size. Graticule at 15 min. intervals of latitude and 20 min. intervals of longitude with margin divided into 1 min. intervals of latitude and 2 min. intervals of longitude. Scale in km.

The maps are printed in five colours. Land in buff, woodland in green, with coniferous and deciduous woods distinguished by black symbols. Water-meadow and bog in blue with distinguishing black symbols; salt-marsh in distinctive blue. Water in blue, heath by symbol, dunes stippled. Main roads in red; other detail in black.

No contours, spot-heights in metres, steep slopes and cliffs hachured. Submarine contours at 4 and 10 m., spot-depths in metres. Railways in black. Main roads in red and numbered; by-roads in black. Boundaries of counties, districts

and judicial districts. Chief towns by plan in black; two categories of other towns by black symbols. Five categories of villages by symbols. Black symbols for four categories of settlements. Lighthouses, lightships, trigonometrical stations and mills by black symbols.

This series is also published as an atlas of one volume, measuring 13 × 21 cm. (several editions).

(15) 1 : 320,000

Edition of 1935 in 3 sheets of different size. Details as for no. 14, except that motorable roads, other than main roads, are in brown, and kilometre distances between towns are printed in red alongside the roads.

(16) 1 : 320,000. *Automobil Kort*

Latest edition published in 1938 in 3 sheets of irregular size. Graticule at 15 min. intervals of latitude and 20 min. intervals of longitude; margin divided into 2 min. intervals of longitude and 1 min. intervals of latitude.

The maps are printed in five colours: sea in blue, water-meadow, bogland and rivers in purple, woodland in green, arterial roads in red and numbered; all other motorable roads in brown, with distances between chief towns in kilometres. Railways and other detail in black.

No contours; spot-heights in metres; cliffs and prominent land-forms hachured. Submarine contours at 4 and 10 m.; spot-depths in metres. Main towns by plan; two categories of other towns, five categories of villages and four categories of settlements, by symbols. Symbols for lighthouses, lightships, air beacons, air-fields, trigonometrical stations and mills.

(17) 1 : 500,000. *Kongeriget Danmark*

Published in 1937 in one sheet measuring 63 × 74.5 cm.; various earlier printings of similar character but with slight variation. Graticule at intervals of 20 min. of latitude and 30 min. of longitude. Insets of Bornholm and the Faroes. Scale in kilometres.

The map is printed in five colours; water in blue, water-meadow and bogland overprinted blue, woodland in green with deciduous and coniferous woods distinguished by black symbols, main roads in red, administrative boundaries in brown, with administrative areas (counties and judicial districts) numbered to a key printed on the back of the map. Railways and other detail in black.

No contours; spot-heights in metres with steep slopes and prominent land-forms hachured. Submarine contours at 4 and 10 m. Eight categories of towns and villages, differentiated according to size by symbols and lettering. Symbols for three categories of settlements, churches, trigonometrical stations, lighthouses, lightships, ports, life-saving stations, air-fields, air beacons, radio stations, car ferries and historical ruins.

(18) 1 : 500,000. *Kongeriget Danmark*

As no. 17 but without administrative boundaries.

(19) 1 : 500,000. *Kommune-og Sogne-Kort over Danmark*

Published in 1938 in one sheet. No graticule. Scale in kilometres.

Outline map with boundaries of communes and parishes in brown and their names in black. Counties indicated by Roman numerals and referred to a key in the margin. Insets of Bornholm and the Faroes with similar boundaries.

(20) 1 : 520,000. *Kongeriget Danmark*

Published in 1937 in one sheet measuring 63.5 × 74.5 cm. Graticule at intervals of 30 min. of longitude and 20 min. of latitude. Insets of Bornholm and the Faroes. Scale in kilometres.

The technique and content are almost identical with no. 17 above, but with arterial roads numbered in red.

(21) 1 : 750,000. *Danmark*

Published in one sheet, measuring 43 × 50 cm. Graticule at intervals of 30 min. of longitude and 20 min. of latitude. Scale in kilometres.

The map is printed in six colours: land in cream, water in blue, woodland in green, roads in red, administrative boundaries in brown, railways and other detail in black.

No contours; spot-heights in metres. Submarine contours at 4 and 10 m.; spot-depths in metres. Towns by symbols according to size.

A rather crude and generalized map of the motoring type.

(22) 1 : 1,000,000. *Danmark*

Published in 1924 in one sheet measuring 47 × 60 cm.; various later printings. Graticule at 1° interval; longitudes numbered from the meridian of Greenwich. Scales in kilometres and Danish miles (=7.532 km.). The map has been drawn according to the conventions used in the International 1 : 1,000,000 series (*Carte internationale au millionième*). Contours at 0, 20, 50, 100 and 150 m., layer-shaded in green up to 50 m. and in brown at higher altitudes; spot-heights in metres. Submarine contours at 10, 20, 50, 100, 200 and 500 m.; spot-depths in metres. Sea layered in five shades of blue; lakes and rivers in blue.

Four categories of railways in black (double-track, single-track, narrow-gauge, projected). Two categories of roads in red. Seven categories of towns and villages by size. Black symbols for lighthouses, lightships, harbours with depths over 6 m., life-saving stations, trigonometrical stations, air-fields, landing grounds, air beacons, radio stations, woodland and dunes.

(b) *Special Series*

(23) 1 : 5,000. *Kort over Indsøer* (maps of lakes)

Published in 1931. Two sheets, viz. Hampen Sø og Geddesø (40 × 68 cm.) and Almind Sø og Slaaensø (34.5 × 68 cm.).

No graticule, but the position of each lake, its area, and height above sea level, are given. Scale in metres. The maps are printed in two colours: water in blue and all other detail in black.

Contours at intervals of 5 Danish feet and spot-heights in Danish feet. Lake contours at 1 m. intervals and layered in four shades of blue. Spot-depths in metres. Black symbols for deciduous woodland, coniferous woodland, water-meadow, bogland and heath. Buildings by plan in black.

The maps are primarily bathymetric maps of lakes, but they also show the adjacent land areas to distances of about 2 or 3 km. from the lake shores.

(24) 1 : 5,000. *Købstæder*

This is an older series of town plans which is complementary to the later 1 : 7,500 series (no. 25, below). The series covers the following towns and the sheets were published in the years given in brackets after each town:

Aalborg and Nørre-Sundby, four sheets (1909).	Odense, four sheets (1908).
Esbjærg, one sheet (1911).	Randers, one sheet (1909).
Horsens, one sheet (1910).	Svendborg, one sheet (1905).

No graticule, but reference grid numbered and lettered. Scales in metres and Alen.

The maps are printed in four colours: water in blue, woodland in green with deciduous and coniferous woods distinguished by symbols, contours in red, buildings, built-up areas, roads and railways in brown, other detail in black.

Contours at intervals of 0.5 m. with every tenth contour pecked; spot-heights in metres. Submarine contours at 6, 12, 18 and 24 Danish feet; spot-depths in Danish feet. Roads by surveyed widths; street names. Buildings by plan in brown with chief sites named. Railways in brown.

Margin has gazetteer of chief buildings and locations, list of levelling points with heights and locations, list of rectangular coordinates of fixed points.

(25) 1 : 7,500. *Kort over Købstæder*

These are plans of the following towns and were published in the years given in brackets after each town. The sizes of the sheets differ.

Aabenraa (1937)	Haderslev (1928)	Roskilde (1932)
Aarhus (1931)	Helsingør (1933)	Sæby (1930)
Frederikshavn (1930)	Hillerød (1937)	Skagen (1930)
Frederikssund (1937)	Hjørring (1930)	Sønderborg (1937)
Frederiksværk (1934)		

No graticule, but reference grid numbered and lettered. Scale in metres.

The maps are printed in six colours: woods in brown, water in blue, water-meadow and bogland in green, built-up areas in two shades of grey, chief buildings in solid black.

The sheets of Aabenraa and Haderslev are contoured at 2 m. intervals, but the other maps show no relief. No submarine contours, but the maximum depths of the chief basins in the larger ports are given. Railways in black and roads by surveyed widths; street names. Margin has gazetteer of chief buildings and locations.

(26) 1 : 10,000. *Maalebords-Kvartblade*

Published in 1931. Based on the survey of 1875 and revised in 1927-31. Series of 12 sheets, each measuring 37.7 × 47 cm., covering Aarhus and district. No graticule. Scale in metres.

The maps are printed in three colours: water in blue, contours and administrative boundaries in brown, other details in black.

Contours at intervals of 5 Danish feet, alternate contours pecked. Spot-heights in Danish feet. Four submarine contours at 2 m. intervals. Spot-depths in metres.

Railways in black. Roads by surveyed width. Towns, villages and settlements in plan. Aarhus in black and brown. Industrial concerns, public utilities, etc., are described by name. Woods, water-meadows and bogland shown by black symbols.

(27) 1 : 10,000. *Kort over Indsøer* (maps of lakes)

Published between 1931 and 1934. Series of 17 sheets of widely different sizes covering the following lakes and adjacent land areas:

Blegsø, Nors Sø og Vanned Sø	Julsø
Storre Okssø og Madsum Sø	Knudsø og Ravnsø
Glenstrup Sø	Salten Langsø
Tjele Langsø	Mossø
Rødsø, Haerup Sø og Klejtrup Sø	Skanderborg Søerne
Haldsø og Hinge Sø	Rorbæksøerne
Viborg Nørre- og Søndersø	Tissø
Silkeborg Langsø og Sminge Sø	Pederborg Sø, Tuel Sø og Sötorup Sø
Ornsø, Brassø og Borres Sø	

Details as for no. 23 above.

(28) 1 : 10,000. *Randers og Omegn*

One sheet of Randers and district. Substantially the same as the maps in the 1 : 20,000 series (no. 1 above) but with contours at intervals of 1 m.

(29) 1:10,000. *Turistkort*

Two sheets of the following areas:

Dybbøl (with general map of Sundevad—also plan of Sønderborg). Roskilde og Omegn.

(30) 1:10,000. *Mølleaen*

One sheet of the land around this river from Lyngby to the Sound. Content is similar to the 1:20,000 series (no. 1 above), but with contours at intervals of 1.25 m.

(31) 1:10,000. *Fægtningsskydningsterrænet ved Borris*

One sheet of the shooting range at Borris, based on a special survey of 1906, with contours at 1 m. intervals and triangulation and levelling points shown in addition to the usual topographical detail.

(32) 1:15,000. *Turistkort*

Produced in 1937. Three sheets of the following areas:

{København og nordlige Omegn
{Central København

Aarhus og Omegn
Bornholm

No graticule, but reference grid with letters and numbers. Scale in metres. No relief shown.

The maps are printed in six colours: water in blue, woods in green, built-up areas in grey and brown with chief buildings in solid black and named. Main-line railways, tramways and bus routes in red, dock railways in black, main roads in pink, others white; street names. Commune boundaries in green and boundaries of postal districts in yellow. Symbols for churches, post offices, police stations, pharmacies. Many buildings and locations named. The København sheet is issued with a booklet containing a gazetteer of streets, buildings and locations, and sketches of outer suburbs with street names.

(33) 1:20,000. *Skydeterrænet ved Oksbøl*

Published in 1933. One sheet measuring 71 × 113 cm. showing the shooting range at Oksbøl. Water in blue, property of War Ministry outlined in yellow and that of the Ministry of Agriculture in green. Contours at intervals of 5 Danish feet. Spot-heights in Danish feet. Submarine contours at 2, 4, 6 and 10 m. All other details in black. General content is that of no. 1 above, but symbols are not keyed.

(34) 1:20,000. *Borris Sønderland med Statens Hede*

One sheet of the state property at Borris Sønderland. The content and technique is generally as in the 1:20,000 sheets (no. 1 above). This map is also available on a scale of 1:40,000.

(35) 1:20,000. *Turistkort*

Published in 1934. Five sheets measuring 45.5 × 83 cm. and covering the following districts. The maps are printed on two sides of a sheet:

Helsingør og Omegn
Dyrehaven-Hareskovene til Nivaa
Gribskov og Omegn

Frederiksværk-Liseleje-Tisvildeleje
Lillebæltsbroen og Omegn

No graticule. Scale in metres.

The maps are printed in three colours: contours in brown, woods in green, other details in black.

Contours at intervals of 2.5 m., with alternate contours pecked; spot-heights in metres. Submarine contours at 2, 4, 6 and 10 m.; spot-depths in metres. Railways in black. Three categories of roads by double lines, not filled. Symbols for coniferous woods, deciduous woods, water-meadows and bogland.

(36) 1 : 30,000. *Turistkort*

Hammeren with ground plan of Hammershus.
Almindingen with ground plan of Lilleborg.

(37) 1 : 40,000. *Turistkort*

Silkeborg og Omegn.

(38) 1 : 100,000. *Turistkort*

Folded maps covering the following areas:

1. (a) Nord-Øst Sjælland with town plans of Frederikssund, Frederiksværk, Helsingør, Hillerød and Roskilde.

(b) Nord-Øst Sjælland. Archaeological map.

2. (a) Sud-Øst Sjælland og Mön with a special map of Möns Klint and town plans of Køge, Præstø, Stege, Store Hedinge and Vordingborg.

(b) Sud-Øst Sjælland og Mön. Archaeological map.

3. (a) Sundeved-Als.

(b) Sundeved-Als. Archaeological map.

4. Odsherred.

The content of the maps is similar to that described under no. 5. The town plans are printed on the inner sides of the covers and show the built-up area in brown.

B. MAPS ISSUED BY THE GEOGRAPHICAL SECTION OF
THE BRITISH GENERAL STAFF

(39) 1 : 100,000. G.S.G.S., series nos. 2375 and 2375A. *Denmark*

Published between 1909 and 1915 in 22 sheets of irregular size and enlarged photographically from Danish 1 : 160,000 (no. 9 above). Four sheets covering Sjælland, Mön and eastern Fyn were specially drawn with the following details:

Graticule at 5 min. intervals; longitudes numbered from the meridian of Köbenhavn. Scales in miles and kilometres. The maps are printed in four colours: water in blue, woodland in green, main roads and defence works in red, other detail in black.

Contours in red at intervals of 30 ft.; spot-heights in feet above sea level. Submarine contours at 5 and 10 fathoms with layer shading in blue.

Main roads in red; two categories of other roads and paths in black. Distinctive symbols for single- and double-track railways and stations. Rivers and lakes in blue. Bogland and water-meadows by blue symbol. Distinctive symbols for churches, mills, lighthouses, powder magazines, defence works, wells and springs. Towns and villages by plan. Settlements by classified symbols, not keyed. English key to Danish words printed on the map (e.g. inns, dykes, bridges), and to descriptive geographical terms.

(40) 1 : 100,000. G.S.G.S., series no. 4210. *Denmark*

Reproduced in 1941-2, sheet by sheet, from Danish 1 : 100,000 of 1921-38 (no. 6 above) with English translation printed alongside Danish key and abbreviations. Scales in miles and kilometres. 10 km. grid in blue.

(41) 1 : 250,000. G.S.G.S., series no. 3982. *Europe Air* (second edition)

Compiled and drawn at the War Office and printed by the Ordnance Survey. Second edition in progress 1943. Parts of Denmark covered by the Flensburg

and Kiel sheets, each measuring 60×45 cm. Drawn on a conical orthomorphic projection with graticule at 10 min. intervals and margin divided into 1 min. intervals. Longitudes numbered from the meridian of Greenwich. Isogonal lines at 30 min. intervals. Skeleton grid, at 10 km. intervals, marked in brown in margins and as crosses on the map.

The maps are printed in six colours: sea in red and blue, coastline, rivers and lakes in blue, woodland in green, main roads in brown (two categories), other details in black. Grid data printed in margin.

No contours; spot-heights in metres. Submarine contours at 6, 10 and 13 fathoms, layer-shaded in red and blue. Beaches and drying banks in black stipple. Towns by plan in brown; villages by plan in black. Railways in black.

- (42) 1 : 250,000. G.S.G.S., series no. 5010. *Europe (Air)* (marine contoured edition)

Series in progress since 1942. Denmark covered by sheets 21-25 and 33, each sheet measuring about 40×50 cm. Drawn on a conical orthomorphic projection with graticule at 10 min. intervals and margin divided into minutes. Longitudes numbered from the meridian of Greenwich. Isogonals at 30 min. intervals. Scales in statute miles and nautical miles.

The maps are printed in four colours: sea in red and blue, woodland in green, roads in red, other details in black.

No contours; spot-heights in metres. Submarine contours at 6, 10 and 13 fathoms, layered in red and blue. Beaches and drying banks in black stipples.

Three categories of railways (double-track, single-track and light or narrow-gauge) in black. Main roads and secondary roads in red. Villages and towns by plan in black. Red symbols for lighthouses and light-buoys, lightships and air-lights.

- (43) 1 : 500,000. G.S.G.S., series no. 4072. *Europe (Air)*

First edition compiled and drawn by the War Office in 1940-1 and printed by the Ordnance Survey. Second edition 1942. Denmark covered by three sheets (NE 54/6, NE 54/10, NE 56/8) of different size. Drawn on a conical orthomorphic projection with graticule at 10 min. intervals and margins divided into minutes. Longitudes numbered from the meridian of Greenwich. Map border marked in divisions of 10 statute miles. Isogonal lines at 30 min. intervals. Scales in kilometres, statute miles and nautical miles. Local mean times, as compared with G.M.T., given for meridians.

The maps are printed in five colours: land over 100 m. in purple, water in blue, woodland in green, roads and towns in brown, other details in black. Conversion table for feet and metres in margin.

Contours at 100 m.; spot-heights in metres. Submarine contours at 5 and 20 m., layer-shaded. Drying banks in black stipple. Double-track, single-track and light railways in black. Arterial roads, main roads and minor roads shown distinctively in brown. Train-ferry services in black. Towns by plan in brown; villages by plan in black. Marsh by blue symbol. International boundary in black. Black symbols, sometimes composite, for air-fields, landing-grounds, seaplane stations, seaplane mooring areas, airship hangars and mooring masts, landmarks (described), radio-electric stations, obstructions over 60 m., lighthouses and light-buoys, light vessels, air-lights, overhead high-tension cables, danger areas and explosive areas.

The *second edition* differs from the first edition in that towns and roads are in red and the map has a 10 km. skeleton grid printed on margins and as crosses on the map. Grid data printed on map.

- (44) 1 : 520,000. G.S.G.S., series no. 4364. *Denmark*

Published in 1942 and reproduced from Danish 1 : 520,000 map of 1937 (no. 20 above), which it resembles except for abolition of the yellow plate. Thus land is

in white and administrative boundaries are in thin black line. Key is in English. Inset of the Faroes replaced by small outline map giving conventional English names of the peninsula and the larger islands. Scales in miles and kilometres. The north and south borders of the map are marked at 30 min. intervals numbered from the meridian of Greenwich. Grid in blue at 10 km. intervals with heavier lines every 100 km. Grid data printed in blue on the map.

(45) 1 : 1,000,000. G.S.G.S., series no. 2758. *Europe* (layered edition)

Compiled at the Royal Geographical Society and second edition printed at the War Office in 1939 (first edition 1915). Parts of Denmark on four sheets (N. 32, N. 33, O. 32, O. 33) of different size. Graticule at 1° intervals with margin divided at 5 min. intervals. Reference numbers and letters on graticule. Longitudes numbered from the meridian of Greenwich. Scales in kilometres and miles.

The maps are printed in six colours: land in green and brown, water in blue, frontier in purple, roads in red, other details in black.

Contour at 100 m. layered in green; spot-heights in metres. Marshes by blue symbol. Double-track, single-track and narrow or light-gauge railways distinguished. Two categories of roads. County boundaries. Five categories of towns by symbols showing relative importance. Map sources and pronunciation glossary printed in margin.

(46) 1 : 1,000,000. G.S.G.S., series no. 2758. *Europe* (unlayered edition)

Compiled at the Royal Geographical Society and second edition printed at the War Office in 1937 (first edition 1917). Details as for no. 45 above, except that relief is not layered; contours are in brown.

(47) 1 : 1,000,000. G.S.G.S., series no. 2758. *Europe* (ground-air edition)

Published by the War Office in 1942. Details as for no. 44, from which it was compiled. It differs from this map in that land below 100 m. is white and land above this height is shaded purple; county boundaries are not shown. Additional data on this map include isogon lines at 1° intervals, scale of nautical miles, conversion table of feet into metres and indication of local mean time in terms of G.M.T. Deep blue band around coasts.

(48) 1 : 1,000,000. G.S.G.S., series no. 2429. *Denmark* (outline)

Published in 1909 with additions to 1927, in 1 sheet measuring 32.5 × 43.5 cm. Black outline map with railways unclassified. No graticule. Chief towns by uniform symbol.

(49) 1 : 1,000,000. G.S.G.S., series no. 2429A. *Denmark: Distribution of Danish Army in Peace*

Published in 1909 with additions to 1927. No graticule. Scale in metres. Railways and chief towns (unclassified) in black. Army details overprinted in red on map no. 48.

C. BRITISH ADMIRALTY CHARTS

A list of the charts of the Danish coasts, giving scale, size of sheets, dates of publication and of new editions and large corrections, together with an index map of the sheets, is given in the *Catalogue of Admiralty Charts and other Hydrographic Publications*—Hydrographic Publication, H.D. 374, London, annually. Index maps to the charts are also given in *North Sea Pilot*, part IV (London, 1934) and *Baltic Pilot*, vol. I (London, 1926).

D. DANISH ADMIRALTY CHARTS

Danish charts are published by the Royal Danish Hydrographic Office (*Det kongelige Søkort-Arkiv*). A list of these charts is given in *Fortegnelse over Det kongelige Søkort-Arkivs Forhandlingsartikler* (København, 1939).

E. GEOLOGICAL MAPS

(50) 1 : 100,000

Series of 70 sheets planned to cover the whole country. Twenty-nine sheets, of the following areas, were published together with regional memoirs in *Danmarks geologiske Undersøgelse*, 1. Række, Nr. 1-17, between 1893 and 1935. The maps show the geology of the country in colour:

- | | |
|---|---|
| 1. Helsingør and Hillerød (2 sheets) | 9. Nyborg |
| 2. Hindsholm | 10. Aalborg (N part) and Nibe (N part) (2 sheets) |
| 3. Skagen, Hirtshals, Frederikshavn, Hjörning and Lökken (5 sheets) | 11. Faxe and Stevns Klint (2 sheets) |
| 4. Læso and Anholt (2 sheets) | 12. Skamlingsbanke |
| 5. Samsø | 13. Bornholm |
| 6. København and Roskilde (2 sheets) | 14. Varde |
| 7. Bogense | 15. Bække |
| 8. Sejerø, Nyköbing (Sjælland), Kalundborg and Holbæk (4 sheets) | 16. Blaavandshuk |
| | 17. Haderslev. |

Thirteen other sheets and memoirs were in active preparation in 1935.

(51) 1 : 500,000. *Geologisk Kort over Danmark*

Published by the Danish Geological Survey in 1922 (*Danmarks geologiske Undersøgelse*, 3. Række, Nr. 22). Compiled by J. P. J. Ravn and based on the records of the Danish Geological Survey and of the Geological Museum of the University of København. The map shows the solid geology of the country in colour.

(52) 1 : 500,000. *Jordbundskort over Danmark* (soil map of Denmark)

Produced by C. H. Bornebusch and K. Milthers, published by *Danmarks geologiske Undersøgelse* in one sheet measuring 76 × 66 cm. and printed by the Geodætisk Institut in 1935. The map shows the distribution of soils (based on a geological classification) in colour with indications of the degree of podsolization overprinted in black.

F. MISCELLANEOUS MAPS

Topographical Maps(53) 1 : 300,000. *Übersichtskarte von Europa*

Denmark is covered by 8 sheets of different size, published by the *Preussische Landesaufnahme* in 1905-12, with minor corrections, 1931-4.

No graticule, but margin divided at 5 min. intervals with longitudes numbered from the meridian of Greenwich; 10 km. grid on later sheets (1933-4). Scale in kilometres.

The maps are printed in five colours: water in blue, woodland in green, main roads in red, frontier in orange, other details in black.

No contours, but relief hachured with spot-heights in metres. Railways in black with double-track and single-track main lines, local lines and narrow-gauge lines distinguished. Four categories of roads in red or black, which are classed according to width and quality in the later sheets (1933-4). Towns by symbols. Symbols for heath, bogland, marsh, water-meadows, dunes, orchards, plantations, factories, churches, mills, inns, etc.

(54) 1 : 505,000. *Landevejskort over Danmark* (Shell Tourist Map)

Published in 1938 for *Dansk-Engelsk Benzin og Petroleums A/S* in two sheets measuring 41 × 62.5 cm. with a map of north-east Sjælland on a scale of 1 : 247,000 inset on one sheet. The map is a reproduction of no. 17 above, with the brown plate omitted.

(55) 1:505,000. *Danmarkskort*

Published in 1937 for *Det danske Petroleum A/S* in one sheet measuring 59 × 74.5 cm. The base map used is identical with no. 54 but in this edition the arterial roads are shaded in blue, over red, and the location of the company's petrol pumps is shown by blue dots. The map was issued folded in a booklet which contains plans of the chief Danish towns, all in blue and on different scales, showing the main road patterns, with through-routes accentuated and location of the company's pumps shown.

(56) 1:800,000. *Übersichtskarte von Europa*

Denmark is covered by the Kiel sheet, measuring 30 × 55.5 cm. Produced by the *Preussische Landesaufnahme* in 1919; new edition published by the *Reichsamt für Landesaufnahme* in 1923.

No graticule but margin divided at 1° intervals; longitudes numbered from the meridian of Greenwich. Scale in kilometres.

The map is printed in five colours: water, marsh and bogland in blue, woodland in green, hachures in brown, main roads and railways in red, other detail in black.

No contours, but the higher land is hachured; spot-heights in metres. Submarine contours at 10 and 20 m.

Double-track, single-track and narrow-gauge railways distinguished. Main roads in double red lines, half filled: other roads in black. Eight categories of towns by symbols according to size.

Town Plans(a) *Gennemkørselskort for 177 danske Byer*

One volume of 90 pp., measuring 12.5 × 21.5 cm., and containing 177 plans of Danish towns, published by the *Geodætisk Institut*, København, in 1933. The plans differ widely in size and scale. No graticule. Scales in metres.

The plans are printed in three colours: woodland in green, built-up area in brown, other detail in black.

Relief not shown. Main streets and through routes in heavy black lines; other streets and roads by double lines. Chief streets named. Chief buildings and locations numbered and keyed. Symbols for car ferries, stations, post offices, telegraph stations, town halls, hospitals, gasworks, hotels, churches, mills and pharmacies. Destinations of main roads, with distances, printed in margins.

The volume also contains maps, drawn with the same technique as the plans, of the chief tourist areas (e.g. Skalling, Dybbøl, Mols Bjerge, Möns Klint, etc.) and a table of distances between chief towns.

(b) Plans of the chief Danish towns have been printed as plates in:

(i) Daniel Bruun, *Danmark, Land og Volk*, 5 vols. (København, 1919-22.)

(ii) J. P. Trap, *Beskrivelse af Kongeriget Danmark*, 4th ed., 10 vols. (København, 1920-32.)

The plans differ in scale (1:15,000 to 1:20,000) and are usually within page size (15 × 23.5 cm.), although some of the larger towns are printed on folder plates. They were all prepared by the *Geodætisk Institut*, København, and are dated usually as the date of the volume. The plans in Bruun's work are all in black but in Trap's volumes the plans of the largest towns are printed in colour. The content of the plans is similar. They show the street plan and built-up area, with street names; the chief buildings and locations are numbered and referred to a key printed on the plan.

Plans of København are found in almost all guide books to the country.

Climate Maps

(a) The best and fullest series of climate maps of Denmark are printed in *Danmarks Klima*, published by *Det danske meteorologiske Institut*, København,

1933. The maps are of uniform size (12.1 × 16.2 cm.), and the climate data are overprinted in blue or black on base maps drawn on a scale of c. 1 : 2,500,000, with relief shown by contours at 20, 50, 100 and 150 m., layer-shaded in brown. The series comprises the following distribution maps:

Mean pressure by seasons, mean temperature by months, mean maximum and minimum temperatures for January, July and the year, mean number of days with frost, dates of earliest and latest frosts, mean rainfall by months.

(b) A series of 25 maps showing ice conditions in the Baltic Sea is printed in *Annalen der Hydrographie und maritimen Meteorologie*, Bd. LXX, Heft 2 (Berlin, 1942). The maps are drawn on a scale of 1 : 3,500,000 and are printed in four colours on loose folder sheets, two maps on a sheet. The maps show the mean distribution of ice around the coasts of Denmark, Germany and southern Sweden at 10-day intervals from 1 December to 1 May in mild, moderate, hard, and very hard winters; the mean number of days with ice during the same four grades of winter; and the average number of days during which navigation is stopped or hindered during moderate, hard and very hard winters. The maps have been reproduced from an atlas produced by *Deutsche Seewarte* in 1941, the details of which are not available.

Maps of Slesvig

1 : 200,000. Map 4, *Schleswig*

Produced by the *Service Géographique de l'Armée* in 1920. The southern boundaries of the first and second plebiscite zones (see p. 517) in Slesvig are superimposed in red and yellow respectively on a photographed copy of the German 1 : 200,000 sheet (c. 54 × 69 cm.) of this area. The base map shows field boundaries, roads, railways and settlements in grey, much of which is illegible. The names of towns and villages on and near the boundaries have been rewritten in black.

1 : 200,000. *Carte générale de la frontière entre l'Allemagne (Prusse) et le Danemark*

Produced by the *Commission de Délimitation* in 1920-1 in two sheets of different size. The frontier determined after the 1920 plebiscite is superimposed in green on the German 1 : 100,000 sheet for the western part and in yellow on the German chart of Flensburger Fiord for the eastern part.

1 : 200,000. *Die Abstimmungsergebnisse in Nordschleswig*

One sheet measuring 61 × 61 cm., produced by Paul Langhans and published by Justus Perthes in *Pettermans Mitteilungen* in 1920. The map shows, by parishes, the percentage of the population speaking German and Danish shaded in ten grades of red and green. Five categories of towns, by size, and railways are shown in black. Political and linguistic frontiers in red. Inset maps show the proportions of Danish speakers according to the Danish and German censuses of 1920 and 1867 respectively. On the map are also circular diagrams showing the composition of the population of the chief towns.

Maps of the frontier region have also been published on scales of 1 : 5,000, 1 : 50,000 and 1 : 100,000, but details are not available. Maps of Slesvig also occur in the texts of F. de Jessen, *Manuel historique de la Question du Slesvig* (Copenhagen et Paris, 1906), and *Manuel historique de la Question du Slesvig*, 1906-38 (Copenhagen et Paris, 1939).

Appendix X

NOTE ON PLACE-NAMES

The place-names in this handbook are spelt in accordance with the forms printed on the latest available maps published by the *Geodætisk Institut* of Köbenhavn, except that the names of the main channels into the Baltic Sea are given their conventional English forms (Little Belt, Great Belt, The Sound), and that the northernmost point of Jylland (Skagen) has been called The Skaw to avoid confusion with the port of Skagen. In the historical chapter the conventional English names of towns and regions have been used. The latest series of Danish maps available consists of the 1 : 200,000 maps published in 1939 (No. 13 in Appendix IX). The place-names in this series are identical with those printed on the 1 : 520,000 map published in 1937, which is the general reference map that accompanies this volume.

Place-names and geographical terms on British Admiralty charts follow, in general, those of the Danish charts with the exceptions mentioned above and are similar to those printed on Danish topographical maps. The Admiralty 'Sailing Directions' for Danish waters (*North Sea Pilot*, part IV (1934) and *Baltic Pilot*, vol. 1 (1926)) follow the same principle except that Köbenhavn, Jylland and Fyn are given their conventional English forms of Copenhagen, Jutland and Fünen. Slight differences of orthography occur between different series of Danish official maps, and also between the British charts and Sailing Directions and the Danish maps, but these differences are of such a minor character (e.g. 'æ' for 'e', 'ks' for 'x') as not to make any form unrecognizable. Maps of Denmark produced by the Geographical Section of the British General Staff, other than those photo-lithographed from Danish official maps, follow the forms of place-names on the latter.

The following geographical terms occur frequently as components of place-names:

Danish	English	Danish	English
Aa	= river, stream	Hoved	= headland
Aas	= ridge (of a hill)	Kalv	= calf, small rock or island lying off a larger one
Bæk	= brook	Klint	= cliff
Bakke, pl. Bakker	= hill	Klippe	= rock
Bjærg	= hill	Knude	= promontory
Borg	= castle	Løb	= channel, fairway
Bredning	= broad-water	Lund	= grove
Bugt	= bay	Mose	= bog, moor
By	= town	Næs	= headland, point
Dal	= dale, valley	Nor	= firth with narrow inlet
Dyb	= deep (sea-channel)	Ö	= island
Farvand	= fairway, sea-way	Odde	= point, tongue of land
Gab	= mouth, opening	Pynt	= point
Hage	= hook, spit	Rende	= cut channel
Halvö	= peninsula	Rev	= reef
Hav(et)	= sea, ocean	Skov	= forest
Havn	= harbour, port	Sö	= lake, sea
Hede	= heath	Sund	= strait
Høj	= hill	Ström	= current
Holm	= islet		

CONVERSION TABLES

METRIC AND BRITISH UNITS

It is customary to think of the 'metre' and the 'yard' as representing unalterable units of length. This is not so. The metre was originally intended to be the 10,000,000th part of the earth's meridional quadrant. But the accurate determination of this length proved to be extremely difficult—partly for technical reasons, and partly because of different conceptions of the 'figure of the earth'. In view of these difficulties it became necessary to define the length of the metre in terms of suitable metal bars measured under specified conditions of temperature, pressure, humidity, etc. Similar standard bars were also used to define the length of other units such as the yard. As all these metallic standards are subject to change, conversion tables differ according to the date of comparison between different bars. The tables that follow are based on the comparison between the yard and the metre made in 1895. This made 1 metre equivalent to 39·370113 in.

Metric System. List of Prefixes

Deca means ten times.	Deci means a tenth part of.
Hecto means a hundred times.	Centi means a hundredth part of.
Kilo means a thousand times.	Milli means a thousandth part of.
In abbreviations the Decametre, etc., is Dm., and the decimetre, etc., dm.	

Note on 'Nautical', 'Geographical' and 'Statute' miles

A British 'nautical mile' is the length of the minute of the meridian at any given latitude, and is therefore a variable unit. It is given in feet for Clarke's 1880 spheroid by the formula

$$60771\cdot1 - 30\cdot7 \cos 2 \text{ Lat.}$$

This is the sea mile of the scale of latitude and distance of the Admiralty Charts. From the above formula it will be found to vary from 6,046·4 ft. at the equator to 6,107·8 ft. at the poles, being 6,077·1 ft. at latitude 45°.

The so-called 'international nautical mile' of 1,852 m. or 6,076 ft. is the length of the minute of the meridian at latitude 45° on the international spheroid. This corresponds to the 6,077 ft. for Clarke's spheroid.

A 'geographical mile' is a fixed unit, being defined by some as the length of a minute of the equator and by others as that of the minute of the meridian at latitude 45°. According to the former definition its value on Clarke's spheroid is 6,087 ft. and according to the latter 6,077 ft. The round figure 6,080 is usually adopted for the purposes of ordinary navigation.

The British 'statute mile' measures 5,280 ft.

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Table 1. *Length.*

Nautical mile	Statute mile	Kilometre	Metre	Yard	Foot	Inch	Centimetre
1	1.152	1.853	1853	2027	6080*	72,960	185,300
0.8684	1	1.60934	1609.34	1760	5280	63,360	160,934
0.5396	0.621372	1	1000	1093.61	3280.84	39,370.1	100,000
0.0005396	0.0006214	0.001	1	1.09361	3.28084	39.3701	100
0.0004934	0.0005682	0.0009144	0.914399	1	3	36	91.4399
0.0001645	0.0001894	0.0003048	0.3048	0.33333	1	12	30.48
0.0000137	0.0000158	0.0000254	0.0254	0.02778	0.083333	1	2.54
0.0000054	0.0000062	0.00001	0.01	0.0109361	0.032808	0.393701	1

* This is the customary British practice, and not the 'international nautical mile', which Great Britain has not adopted.

Table 2. *Area*

Square mile	Square kilometre	Hectare	Acre	Square metre	Square yard
1	2.58998	258.998	640	2,589,980	3,097,600
0.386103	1	100	247.106	1,000,000	1,195,990
0.003861	0.01	1	2.47106	10,000	11,959.9
0.0015625	0.0040469	0.404685	1	4046.85	4840
0.00000039	0.000001	0.0001	0.000247	1	1.19599
0.00000032	0.00000084	0.0000836	0.000207	0.836126	1

Table 3. *Yield per Unit Area*

Tons per acre	Metric tons per hectare	Quintals per hectare
1	2.51071	25.1071
0.398294	1	10
0.0398294	0.1	1

Table 4. *Volume and Capacity*

Kilolitre	Cubic metre	Cubic yard	Bushel	Cubic feet	Imp. gall.	Litre	Pint
1	1.000027	1.30799	27.4969	35.3157	219.976	1000	1759.80
0.999973	1	1.30795	27.4962	35.3148	219.970	999.973	1759.75
0.764532	0.764553	1	21.0223	27	168.178	764.532	1345.43
0.0363677	0.0363687	0.0475685	1	1.28435	8	36.3677	64
0.028316	0.028317	0.037037	0.778602	1	6.22882	28.3160	49.8306
0.0045460	0.0045608	0.0059461	0.125	0.160544	1	4.54596	8
0.001	0.001000	0.001308	0.027497	0.035316	0.219976	1	1.75980
0.0005682	0.0005683	0.0007433	0.015625	0.020068	0.125	0.56824	1

Table 5. *Weight*

Ton	Metric ton or millier	Quintal	Kilogram	Pound
1	1.01605	10.1605	1016.05	2240
0.984207	1	10	1000	2204.62
0.0984207	0.1	1	100	220.462
0.0009842	0.001	0.01	1	2.20462
0.0004464	0.0004536	0.004536	0.453592	1

Table 6. *Temperature: Equivalents of Fahrenheit and Centigrade Scales*

° F.	° C.	° F.	° C.	° F.	° C.	° F.	° C.	° F.	° C.	° F.	° C.	° F.	° C.	° F.	° C.
100	37.7	79.25	26.25	58	14.4	37.4	3	17	8.3	—	—	—	—	—	—20
99.5	37.5	79	26.1	57.2	14	37	2.7	16.25	8.75	—	—	—	—	—	—20.5
99	37.2	78.8	26	57	13.8	36.5	2.5	16	8.8	—	—	—	—	—	—21
98.6	37	78	25.5	56.75	13.75	36	2.2	15.8	9	—	—	—	—	—	—21.1
98	36.6	77	25	56	13.3	35.6	2	15	9.4	—	—	—	—	—	—21.25
97.25	36.25	76	24.4	55.4	13	35	1.6	14	10	—	—	—	—	—	—21.6
97	36.1	75.2	24	55	12.7	34.25	1.25	13	10.5	—	—	—	—	—	—22
96.8	36	75	23.8	54.5	12.5	34	1.1	12.2	11	—	—	—	—	—	—22.2
96	35.5	74.75	23.75	54	12.2	33.8	1	12	11.1	—	—	—	—	—	—22.5
95	35	74	23.3	53.6	12	33	0.5	11.75	11.25	—	—	—	—	—	—22.7
94	34.4	73.4	23	53	11.6	32	0	11	11.6	—	—	—	—	—	—23
93.2	34	73	22.7	52.25	11.25	31	—0.5	10.4	12	—	—	—	—	—	—23.3
93	33.8	72.5	22.5	52	11.1	30.2	—1	10	12.2	—	—	—	—	—	—23.75
92.75	33.75	72	22.2	51.8	11	30	—1.1	9.5	12.5	—	—	—	—	—	—23.8
92	33.3	71.6	22	51	10.5	29.75	—1.25	9	12.7	—	—	—	—	—	—24
91.4	33	71	21.6	50	10	29	—1.6	8.6	13	—	—	—	—	—	—24.4
91	32.7	70.25	21.25	49	9.4	28.4	—2	8	13.3	—	—	—	—	—	—25
90.5	32.5	70	21.1	48.2	9	28	—2.2	7.25	13.75	—	—	—	—	—	—25.5
90	32.2	69.8	21	48	8.8	27.5	—2.5	7	13.8	—	—	—	—	—	—26
89.6	32	69	20.5	47.75	8.75	27	—2.7	6.8	14	—	—	—	—	—	—26.1
89	31.6	68	20	47	8.3	26.6	—3	6	14.4	—	—	—	—	—	—26.25
88.25	31.25	67	19.4	46.4	8	26	—3.3	5	15	—	—	—	—	—	—26.2
88	31.1	66.2	19	46	7.7	25.25	—3.75	4	15.5	—	—	—	—	—	—27
87.8	31	66	18.8	45.5	7.5	25	—3.8	3.2	16	—	—	—	—	—	—27.2
87	30.5	65.75	18.75	45	7.2	24.8	—4	3	16.1	—	—	—	—	—	—27.5
86	30	65	18.3	44.6	7	24	—4.4	2.75	16.25	—	—	—	—	—	—27.7
85	29.4	64.4	18	44	6.6	23	—5	2	16.6	—	—	—	—	—	—28
84.2	29	64	17.7	43.25	6.25	22	—5.5	1.4	17	—	—	—	—	—	—28.3
84	28.8	63.5	17.5	43	6.1	21.2	—6	1	17.2	—	—	—	—	—	—28.75
83.75	28.75	63	17.2	42.8	6	21	—6.1	0.5	17.5	—	—	—	—	—	—28.8
83	28.3	62.6	17	42	5.5	20.75	—6.25	0	17.7	—	—	—	—	—	—29
82.4	28	62	16.6	41	5	20	—6.6	—0.4	18	—	—	—	—	—	—29.4
82	27.7	61.25	16.25	40	4.4	19.4	—7	—1	18.3	—	—	—	—	—	—30
81.5	27.5	61	16.1	39.2	4	19	—7.2	—1.75	18.75	—	—	—	—	—	—30.5
81	27.2	60.8	16	39	3.8	18.5	—7.5	—2	18.8	—	—	—	—	—	—31
80.6	27	60	15.5	38.75	3.75	18	—7.7	—2.2	19	—	—	—	—	—	—31.1
80	26.6	59	15	38	3.3	17.6	—8	—3	19.4	—	—	—	—	—	—31.25

Table 7. Pressure: Equivalents of Millibars, Millimetres of Mercury, and Inches of Mercury at 32° F. in Latitude 45°

Mercury in.	Milli- bars	Mercury mm.	Mercury in.	Milli- bars	Mercury mm.	Mercury in.	Milli- bars	Mercury mm.	Mercury in.	Milli- bars	Mercury mm.	Mercury in.	Milli- bars	Mercury mm.
27.02	915	686.3	27.82	942	706.6	28.62	969	726.8	29.41	996	747.1	30.21	1,023	767.3
27.05	916	687.1	27.85	943	707.3	28.65	970	727.6	29.44	997	747.8	30.24	1,024	768.1
27.08	917	687.8	27.88	944	708.1	28.67	971	728.3	29.47	998	748.6	30.27	1,025	768.8
27.11	918	688.6	27.91	945	708.8	28.70	972	729.1	29.50	999	749.3	30.30	1,026	769.6
27.14	919	689.3	27.94	946	709.6	28.73	973	729.8	29.53	1,000	750.1	30.33	1,027	770.3
27.17	920	690.1	27.97	947	710.3	28.76	974	730.6	29.56	1,001	750.8	30.36	1,028	771.1
27.20	921	690.8	28.00	948	711.1	28.79	975	731.3	29.59	1,002	751.6	30.39	1,029	771.8
27.23	922	691.6	28.03	949	711.8	28.82	976	732.1	29.62	1,003	752.3	30.42	1,030	772.6
27.26	923	692.3	28.05	950	712.6	28.85	977	732.8	29.65	1,004	753.1	30.45	1,031	773.3
27.29	924	693.1	28.08	951	713.3	28.88	978	733.6	29.68	1,005	753.8	30.48	1,032	774.1
27.32	925	693.8	28.11	952	714.1	28.91	979	734.3	29.71	1,006	754.6	30.51	1,033	774.8
27.35	926	694.6	28.14	953	714.8	28.94	980	735.1	29.74	1,007	755.3	30.53	1,034	775.6
27.38	927	695.3	28.17	954	715.6	28.97	981	735.8	29.77	1,008	756.1	30.56	1,035	776.3
27.41	928	696.1	28.20	955	716.3	29.00	982	736.6	29.80	1,009	756.8	30.59	1,036	777.1
27.44	929	696.8	28.23	956	717.1	29.03	983	737.3	29.83	1,010	757.6	30.62	1,037	777.8
27.46	930	697.6	28.26	957	717.8	29.06	984	738.1	29.86	1,011	758.3	30.65	1,038	778.6
27.49	931	698.3	28.29	958	718.6	29.09	985	738.8	29.89	1,012	759.1	30.68	1,039	779.3
27.52	932	699.1	28.32	959	719.3	29.12	986	739.6	29.92	1,013	759.8	30.71	1,040	780.1
27.55	933	699.8	28.35	960	720.1	29.15	987	740.3	29.94	1,014	760.6	30.74	1,041	780.8
27.58	934	700.6	28.38	961	720.8	29.18	988	741.1	29.97	1,015	761.3	30.77	1,042	781.6
27.61	935	701.3	28.41	962	721.6	29.21	989	741.8	30.00	1,016	762.1	30.80	1,043	782.3
27.64	936	702.1	28.44	963	722.3	29.24	990	742.6	30.03	1,017	762.8	30.83	1,044	783.1
27.67	937	702.8	28.47	964	723.1	29.26	991	743.3	30.06	1,018	763.6	30.86	1,045	783.8
27.70	938	703.6	28.50	965	723.8	29.29	992	744.1	30.09	1,019	764.3	30.89	1,046	784.6
27.73	939	704.3	28.53	966	724.6	29.32	993	744.8	30.12	1,020	765.1	30.92	1,047	785.3
27.76	940	705.1	28.56	967	725.3	29.35	994	745.6	30.15	1,021	765.8	30.95	1,048	786.1
27.79	941	705.8	28.59	968	726.1	29.38	995	746.3	30.18	1,022	766.6	30.98	1,049	786.8

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