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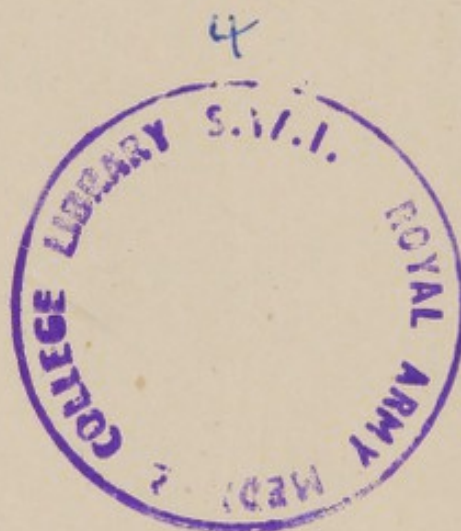
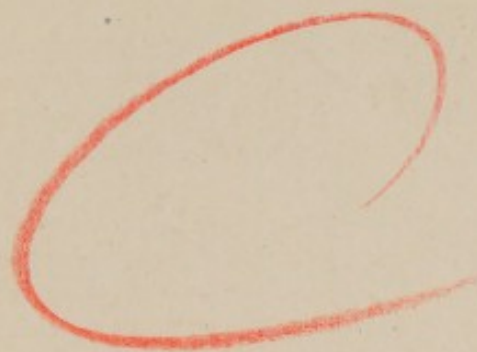
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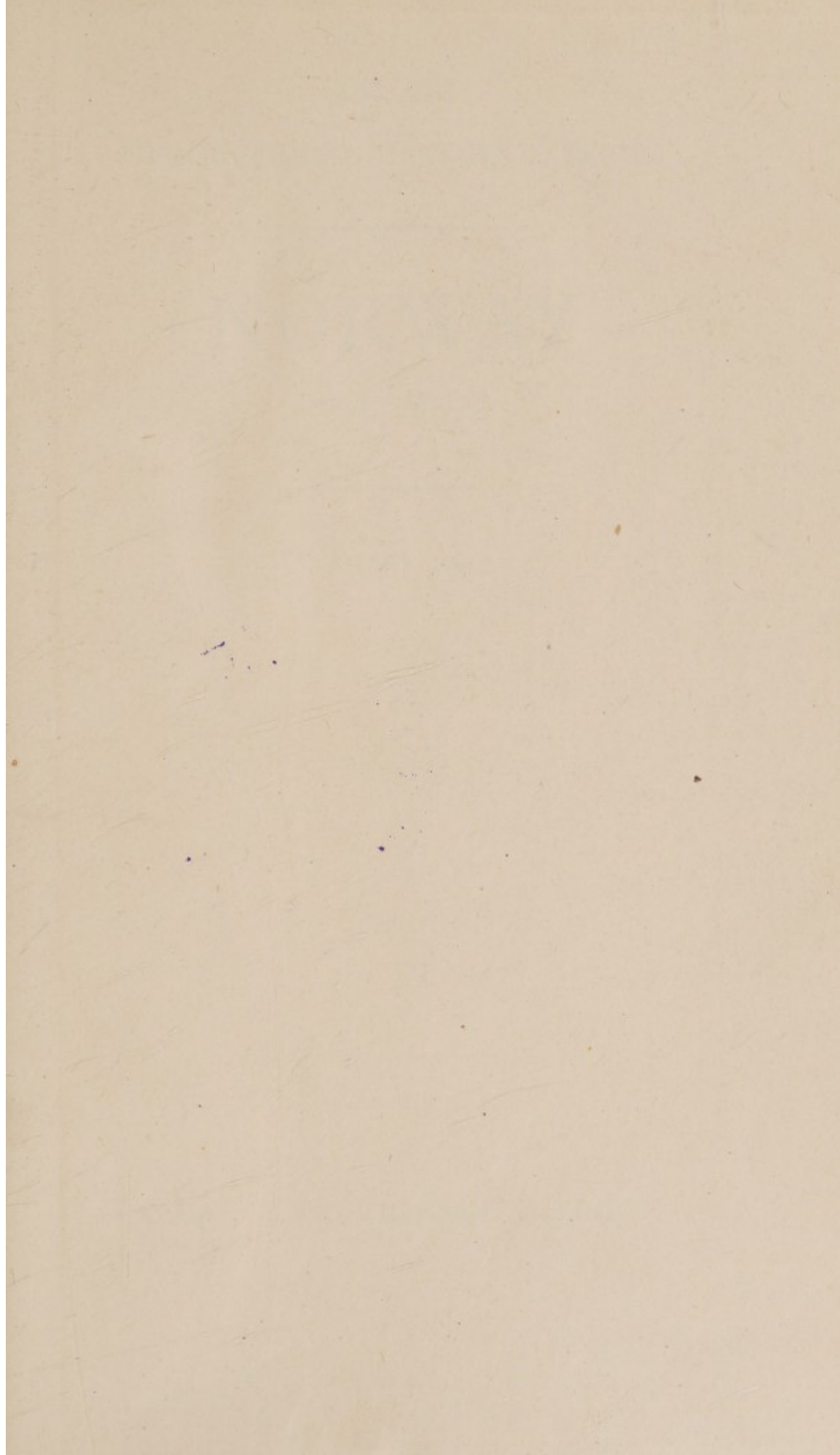
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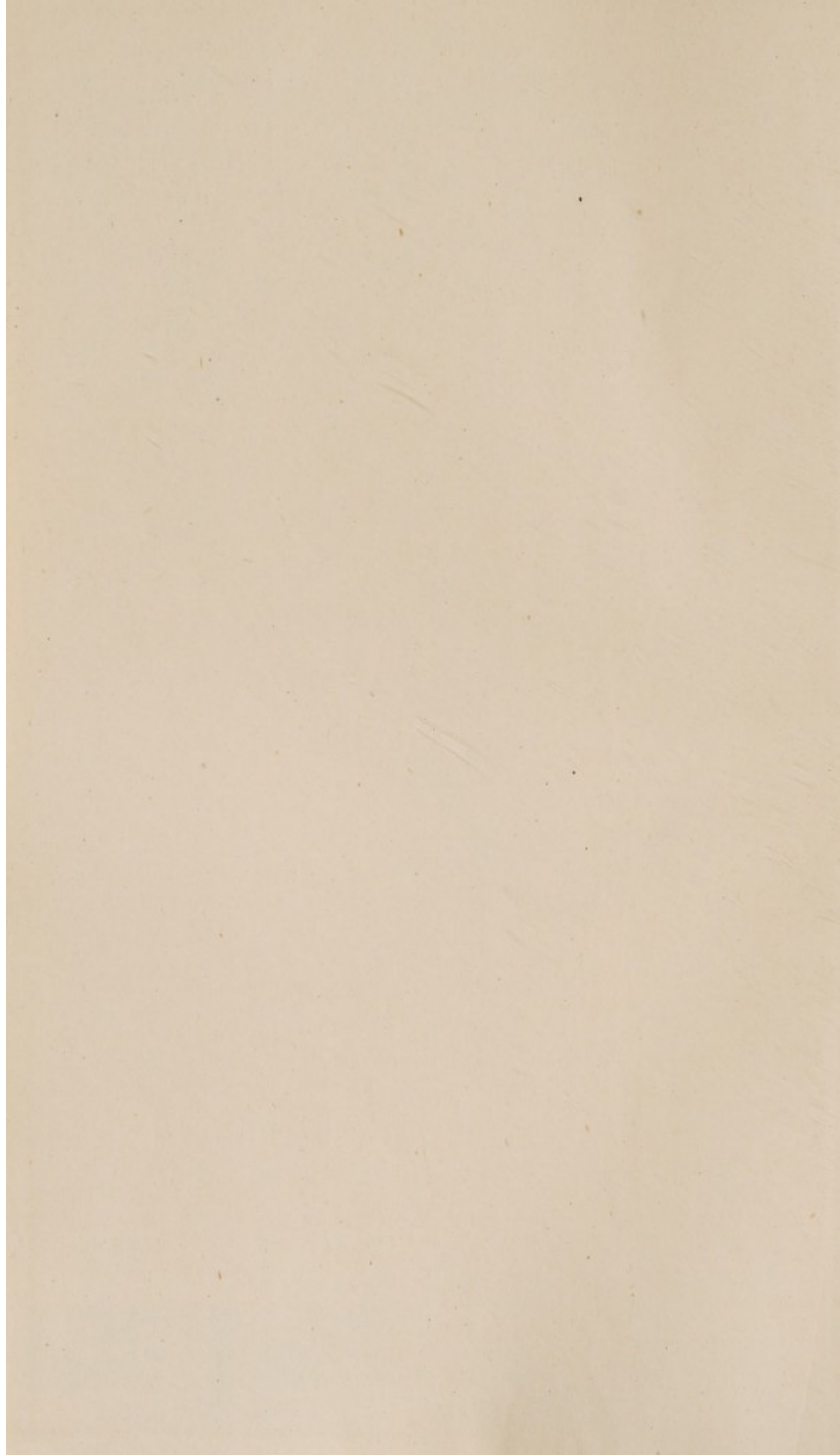
VOLUME I

NAVAL INTELLIGENCE DIVISION



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GEOGRAPHICAL HANDBOOK SERIES

NORWAY

VOLUME I

JANUARY 1942

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 required 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. At the present time (October 1941) books covering twenty-five countries

are in course of preparation, and this list will be substantially extended by the end of 1942.

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, &c.) 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.

This volume has been compiled by the Oxford sub-centre of the Naval Intelligence Division, under the direction of Professor K. Mason, M.C., M.A. (late R.E.), of the School of Geography, University of Oxford, and has been mainly written by Mr. C. F. W. R. Gullick, B.Litt., M.A., of the School of Geography, University of Oxford, and by Miss E. A. Aste, B.A., whose services are gratefully acknowledged.

J. H. GODFREY
Director of Naval Intelligence
OCTOBER 1941

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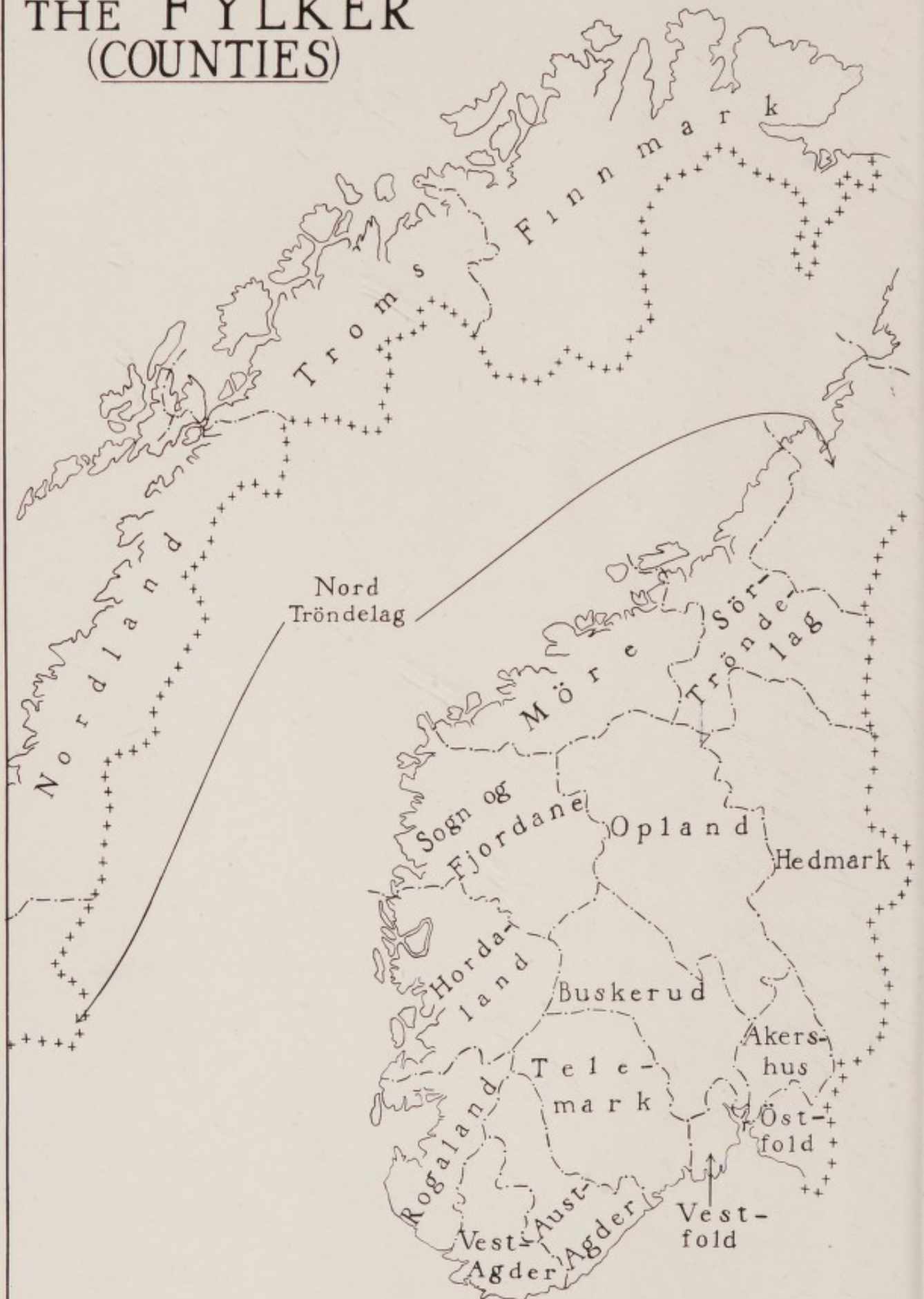
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Scandinavia and the Baltic	In pocket at end	





THE FYLKER (COUNTIES)



CHAPTER I

INTRODUCTION

Position and Extent

NORWAY occupies the western and northern part of the Scandinavian peninsula. The country is surrounded on three sides by the sea, on the south by the Skagerrak from Lindesnes to the Swedish frontier, on the west by the North Sea and the Atlantic (or Norwegian Sea) from Lindesnes to the North Cape, and on the north by the Barents Sea from the North Cape to the Finnish frontier. The Scandinavian peninsula is, therefore, cut off from the rest of Europe, except for the land connexion through Finland.

Norway extends from the island of Kråge near Mandal in the south-west (lat. $57^{\circ} 57'$ N.) to Knivskjelodden on Mageröy, west of the North Cape (lat. $71^{\circ} 11'$ N.), in the north-east. The most southerly point is in the same latitude as northern Scotland, Labrador, Alaska, and central Siberia; the most northerly in that of central Greenland, Jan Mayen, and parts of the Siberian coast. From Lindesnes to the North Cape is 1,100 miles, as far as from Lindesnes to the Pyrenees. The most westerly point of Norway is Steinsöy, at the entrance to the Sognefjord, longitude $4^{\circ} 30'$ E. (the same as Rotterdam). The most easterly point is Hornöy, near Vardö, longitude $31^{\circ} 10'$ E. (the same as Kiev). There is thus a difference in longitude of $26^{\circ} 40'$, representing a difference in time of 1 hour 46 minutes 40 seconds. The greatest breadth is only about 276 miles (north of the Sognefjord) and the least about $3\frac{1}{2}$ miles (from Hellemobotn in Tysfjord to the frontier with Sweden). The country is broadest in the south, narrows northward, and broadens again in the fylke (county—Map 1) of Finnmark to about 160 miles between the North Cape and the source of the river Tana.

The length of the coast, disregarding indentations, is about 2,100 miles. Including the coastline of long inlets and large islands, it is at least 16,400 miles, or more than half the circumference of the earth.

The area is approximately 124,500 square miles, which is larger than that of the British Isles. Of this area about 8,900 square miles are distributed over some 150,000 islands or skerries. By the treaty of 9 February 1920 Norway was awarded sovereignty over Spitsbergen (Svalbard) and Bear island (Björnöya), and if these are included the State territory amounts to 155,000 square miles. During

the Middle Ages the kingdom of Norway was approximately twice as large as it is to-day since the Swedish districts of Jämtland, Harjedalen (ceded in 1645), and Bohuslän (ceded in 1658) were included. Norway had also, at different periods, a number of tributary lands such as parts of Ireland, Scotland, the Isle of Man, the Hebrides (ceded in 1266), the Orkneys, the Shetlands (ceded in 1468-9), the greater part of the present Swedish, Finnish, and Russian Lapp districts (frontier regulations of 1751 and 1826), the Faeröe Islands, Iceland, and Greenland (lost in 1814).

Frontiers

The Norwegian-Swedish boundary is 1,025 miles long and the Norwegian-Finnish boundary 572 miles; the total land frontier is, therefore, nearly 1,600 miles long.

The boundaries in the Scandinavian peninsula are marked by posts. The Norwegian-Swedish section was finally delimited in 1751. From the southernmost point to latitude 60° N. the boundary is entirely artificial, the result of many adjustments dependent on the changing fortunes of the two countries. Between latitudes 60° N. and 63° N. it is less artificial, depending mainly on topographical features and running approximately along the main watershed of the peninsula. From latitude 63° N. to the Finnish frontier, it more or less follows a line connecting the greatest heights of the region.

The boundary with Finland between Koltapahta and Mutkåvåra, 465 miles long, was also mostly delimited in 1751, when Finland formed part of Sweden. It starts from the cairn at Koltapahta (Kuokimmutka) where Norway, Sweden, and Finland meet, and winds along the watershed between the Arctic and Baltic drainage to the sources of the Skjettsamjokka river. It then follows the latter river and the Anarjokka and Tana rivers to near Polmak in latitude 70° N. From there onwards the line was for a long time under dispute until settled in 1826. It follows a devious course south-east to the Neidenelv, which it crosses, and continues southwards to the Pasvikelv at Mutkåvåra.

The remaining section of the Norwegian-Finnish boundary, 107 miles long, was delimited in 1826 when the ancient joint Norwegian-Russian zone was partitioned. This only became part of the boundary with Finland in 1920 under the peace of Dorpat when Russia ceded to Finland the 'corridor' leading to the Arctic. In 1924 Norway and Finland confirmed the former frontier treaties. This boundary-line runs for a short distance south-eastwards to Gelsomiojarvi, and thence

follows the Pasvik (or Påtsjoki) river almost to its mouth; it then turns south, rounds Hundvand, and goes eastwards to the Jakobselv, which river it finally follows to the sea.

The Neutral Zone (Map 2, p. 5)

The neutral zone between Norway and Sweden was defined in the Karlstad convention of 1905. On the Norwegian side of the boundary it is enclosed by a line (Map 2) passing through Kirkeö island, and north-west of Singleö island to Ingedal on the mainland. The neutral boundary then follows a series of straight lines continuing eastwards from Ingedal to Rokke church and thence to a point on the north bank of the mouth of the Halden river in Femsjön lake, before turning south-east to near the farm of Röd (at the mouth of a small stream entering Femsjön lake). Here it turns sharply north and passes through Klosatjären before reaching Grefslivand (north of Haerland church), where it bears north-north-east to the head of the peninsula which almost cuts Lake Ögderen in two. From Lake Ögderen it runs north-east to the strait between lakes Mjermen and Gåsfjord, where it turns north-north-west for a short distance and passes through Eidsdammen (near Björkelangen station) before reaching the south-west end of Dyrerudtjären (at the north end of Liermosen). From Dyrerudtjären it runs west-north-west for a short distance to Urskog (Aurskog) church before turning sharply north-east to the south end of Holmtjären (south of Kongsvinger), and then north-north-east to Lake Digersjön. From Digersjön the line continues northwards, almost parallel to the international boundary, passing through the north end of Lake Skasensjön and the east end of Nordre Flögensjön lake (east of Jöмна railway station) to the point where the Ulvå river (Flisa) cuts the parallel of latitude 61° N.

There is a similar neutral zone on the Swedish side of the frontier. The irregularities of the neutral boundaries in the south, where the zone is very narrow, were made in order to avoid, on the Norwegian side, the inclusion of Skiebergkilen, the bay at the head of the Singlefjord, and on the Swedish side, to exclude Strömstad. Islands and reefs which lie within these boundaries are neutralized as well as the mainland, but not arms of the sea.

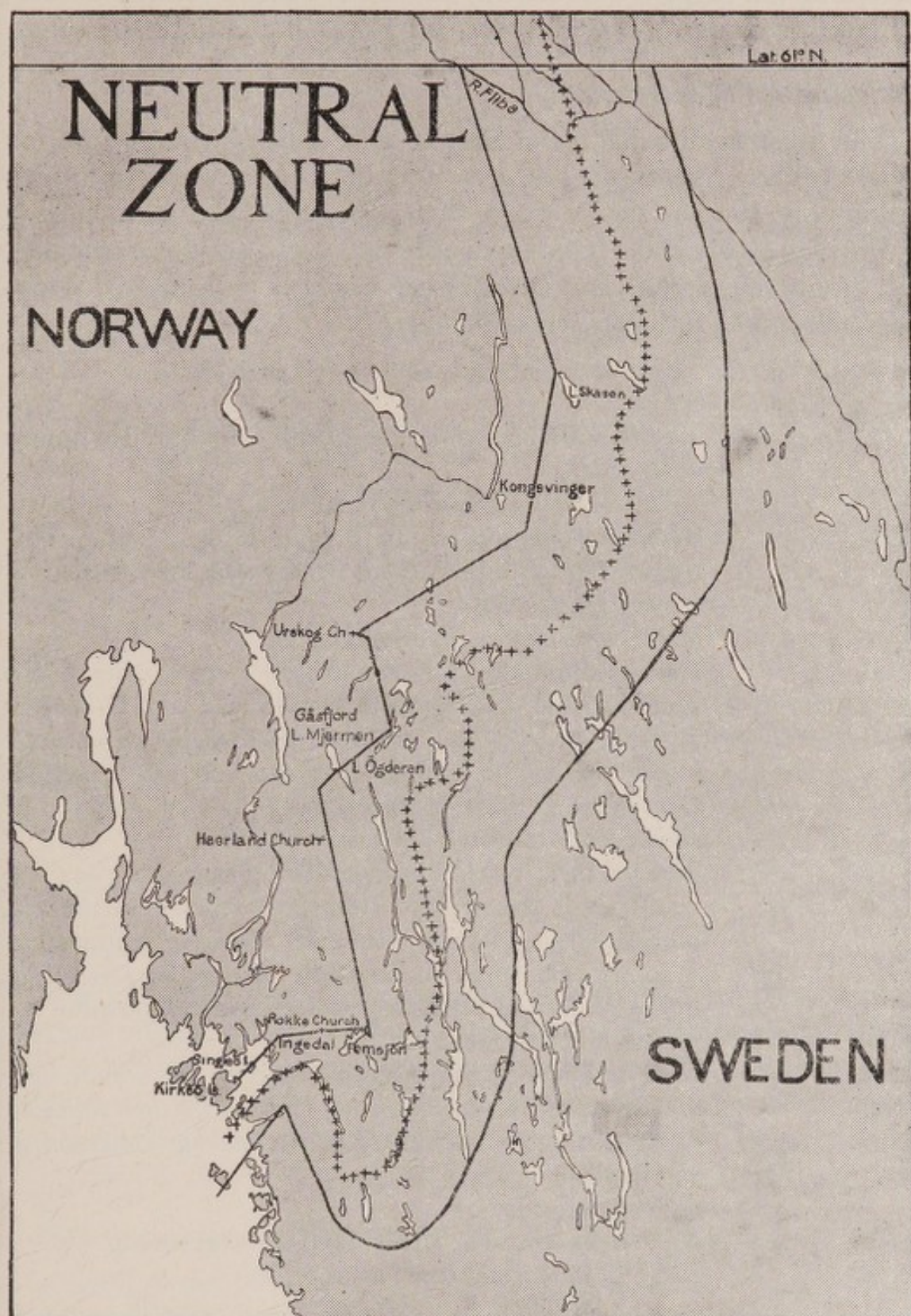
All fortifications in the neutral zone, except old and obsolete ones of historical interest, were dismantled or destroyed. It was also agreed that the fortifications of Kongsvinger, which lies outside this zone, should not be increased.

General Features

Norway consists of a high plateau, intersected in the south-east by great valleys and in the west by deep fjords and bays. More than half its surface is over 2,000 feet. Here, because of the high latitude, the land is not of great use for agriculture or habitation, despite the ameliorating influence of the North Atlantic drift. It is, accordingly, not surprising to find that the average density of population is the lowest in Europe, excepting Iceland. The interior of Norway is generally so mountainous that the population is settled almost entirely along the coast. Only in the great valleys of southern Norway and in the Trondheim depression is there a high density of population inland.

The occupations of the Norwegian people are to a very large extent determined by the natural conditions of the country. Agriculture plays an important part in their life, so much so, in fact, that Norway was an almost entirely agricultural country until the beginning of this century, when hydro-electricity was first used for large-scale industry. Now, owing to the abundance of cheap power, many manufacturing industries have grown up, notably the electro-chemical and electro-metallurgical, although most raw materials have to be imported. Norway possesses considerable quantities of pyrites (cupriferous and non-cupriferous) and iron-ore of commercial value. Timber is another natural product, though it is not so plentiful as in Finland and Sweden. Timber industries, which largely depend on water-power, and lumbering, are important in the national life; and because of the long coastline, shipping, fishing, and fish industries afford occupations for a relatively high proportion of the population.

The land-forms do not facilitate road or rail transport. The communications are, however, improving, though they are not yet good. In the east and south-east regions roads follow the main north to south valleys and the low-lying coastal stretch from Kristiansand S. to the Swedish frontier. Along the west coast, where the mountain walls rise precipitously from the fjords, the roads are poor, except for a few, which lead inland from the heads of the fjords across the barren mountain plateau to the main north to south valleys. The roads in the north, except in the Trondheim area, are less inter-connected and worse than in the south, being broken into by fjords and bays. The railways, which generally follow the same valleys and passes as the roads, are mainly confined to the eastern and south-eastern regions,



MAP 2

excepting the Bergen–Oslo railway and the Nordland railway. Communication along most of the coast is by coastal and fjord steamers.

Pronunciation of Norwegian¹

The Riksmål alphabet is the same as the English, with the addition of *æ*, *ö* (*ø*), and *å* at the end. *c*, *q*, *w*, *x*, and *z* occur in words of foreign origin only, the *x* in native words being now expressed by *ks*.

The vowels are short before a double consonant or two consonants, e.g. Drammen, Sande; and short vowels are now indicated by doubling consonants formerly written singly.

a	The long and short Italian vowels as in <i>lāvā</i> .
aa	See <i>å</i> .
ai	The two Italian vowels, frequently diphthongal almost as in <i>aisle</i> .
au	Like Cockney <i>ow</i> in <i>cow</i> ; Haugesund.
b	Sometimes equivalent to <i>p</i> (and in such cases now replaced by <i>p</i>) especially in names with <i>Håb</i> and <i>Åben</i> (now <i>Håp</i> , <i>Åpen</i>).
c	Rare; <i>s</i> before <i>e</i> , <i>i</i> , <i>y</i> ; otherwise <i>k</i> .
d	Usually mute after <i>l</i> , <i>n</i> , <i>r</i> , and long vowels, when in the same syllable, and in <i>-stad</i> , e.g. Harstad; but <i>ld</i> is often replaced by <i>ll</i> , Fjeld, or Fjell; and <i>nd</i> by <i>nn</i> in some words; Vand, or Vann; but Sand and Sund remain. Otherwise <i>d</i> . Final <i>d</i> sometimes equals <i>t</i> ; <i>-fod</i> ; but in such cases <i>d</i> is often replaced by <i>t</i> ; <i>-fot</i> .
e	The 'neutral vowel' <i>e</i> when final, and in final <i>-en</i> , <i>-er</i> , <i>-et</i> (if <i>-et</i> is the definite article, in which case the <i>t</i> is mute); Norge, Horten, Ustaoset; otherwise <i>e</i> ; Enebak.
eg	A sound between <i>ai</i> and <i>ei</i> when followed by <i>l</i> or <i>u</i> , and in the 1st person pron., <i>feg</i> ; otherwise <i>eg</i> ; Egersund.
ei	A sound between <i>ai</i> and <i>ei</i> .
f	As in English. <i>ph</i> must not be used for this sound.
g	<i>y</i> before <i>i</i> , <i>ei</i> , <i>öi</i> , and <i>y</i> ; Giske, Gyland; <i>k</i> (now replaced by <i>k</i>) before <i>t</i> ; Sandebukt; mute in final <i>-ig</i> ; otherwise <i>g</i> .
gj	<i>y</i> ; Gjøvik.
gn	<i>ng</i> ; Sognefjord.
h	Mute before <i>j</i> and <i>v</i> ; Hjelle, Hvaler; otherwise <i>h</i> .
i	Long as in <i>marine</i> ; short as in <i>piano</i> .
j	<i>y</i> ; Jelö, Mjölfjell.
k	<i>ky</i> before <i>i</i> , <i>ei</i> , and <i>y</i> ; Kirkebö; otherwise <i>k</i> .
kj	<i>khy</i> ; Kjosen.
l	As in English.

¹ For further details of the Norwegian language see Chapter VII, p. 157.

m		As in English.
n		As in English.
.	ng	A single sound, as in <i>singer</i> ; Hardanger.
o		<i>aw</i> (short) before two consonants; Opset; otherwise a sound between <i>ō</i> and <i>ū</i> ; Lofoten.
p		As in English.
q		Only in words of foreign origin.
r		As in English.
s		As English <i>ss</i> in <i>boss</i> .
	sj, skj	<i>sh</i> ; Mosjøen, Skjold.
	sk	<i>sh</i> before <i>e, i, j, y</i> ; Skedsmo, Skein, Skyvann; otherwise <i>sk</i> ; Skøyen.
t		As in English.
	th	<i>t</i> ; Thamshavn; except in adjoining syllables; Stathelle.
	tj	<i>khy</i> ; Tjern; <i>ty</i> only in the word <i>tjener</i> .
u		Long as in <i>rude</i> ; or as <i>oo</i> in <i>boot</i> ; short as in <i>pull</i> .
v		As in English.
w		<i>v</i> ; only in words of foreign origin.
x		Only in words of foreign origin.
y		<i>ü</i> , as in French <i>tu</i> ; Bygland, Vestby.
z		As in <i>gaze</i> .
æ		Generally broader than <i>a</i> in <i>fat</i> ; Laerdal, Svolvær. The short <i>æ</i> is now replaced by <i>e</i> in many words; Gress.
ö (ø)		Nearly the English sound in <i>fur</i> .
öi, öy		The diphthong as in French <i>œil</i> ; Krakerøy.
å		This Swedish letter is now used for <i>aa</i> and is pronounced approximately as <i>aw</i> in <i>law</i> , though not so broad; Ålesund.

Place-names

There is no uniformity in the spelling of Norwegian place-names. Several systems are in use on different maps. In this volume inland names are spelt as far as possible as on the latest Norwegian maps, and coastal names as in the *Norway Pilot*. Places with railway stations are generally given as in the Norwegian time-tables. No uniformity is claimed as there is none in common usage.

The following words frequently occur in place-names and on maps:

<i>å</i> , small river.	<i>bu</i> , farm-house.
<i>ås</i> , ridge, hill.	<i>by</i> , town, village.
<i>aust</i> (<i>öst</i>), east.	<i>bygð</i> , parish, village.
<i>bakke</i> , hill.	<i>dal</i> , valley.
<i>breen</i> (<i>brae</i>), glacier.	<i>cide</i> , isthmus.
<i>bru</i> (<i>bro</i>), bridge.	<i>elv</i> , river.

en (as suffix), masc. indef. art.
ei (as suffix), fem. indef. art.
et (as suffix), neut. indef. art.
fjeld (*fjell*), mountain.
fjord, arm of the sea.
foss, waterfall.
gård, farm.
hav, sea.
havn (*hamn*), harbour.
holm, island.
hus, house.
indre, inner.
jernbane (*bane*), railway.
jökul, glacier.
kai, quay.
låg, river.
mark (*mork*), forest
myr, marsh.
nedre, lower.
nes, cape.

nord (*nordre*), north.
Norge, Norway.
ö, öy, island.
os, mouth of river.
ovre, upper.
sjö, lake.
skog, forest.
skole, school.
sör (*syd*), south.
stor, great.
sund, strait.
tind, peak
våg, bay.
varre (Lap.), hill.
vatn (*vann, vand*), lake.
vei, road.
vest, west.
vik (*vig*), creek.
ytre, outer.

CHAPTER II

GEOLOGY AND TOPOGRAPHY

GEOLOGY

THE land-forms of Norway date from the very earliest geological times, but it is not profitable to attempt their reconstruction before the formation of the pre-Cambrian 'peneplain'.¹ This peneplain was fully developed on the Archaean rocks of Fennoscandia, which comprises the greater part of Scandinavia, Finland, and the Kola peninsula. In Norway the remnants of this land-mass are found principally in the south in two areas. Firstly, there is the Great South-East Block, the northern margin of which extends from Trysil, near the Swedish frontier, south-westwards to the southern shores of the Boknfjord. South of this irregular margin the greater part of southern Norway, excepting the region of the Oslo eruptives, consists of this Archaean mass, which, both geologically and geographically, is a direct continuation of the great Archaean region of central and southern Sweden. Secondly, there is the Great North-West Block, the southern margin of which extends along a highly irregular line from the Samnangerfjord (east of Bergen) north-eastwards to the Trondheimsfjord; this mass continues still farther north to the coast beyond Namsos. The continuity of this Archaean province is broken by a series of enclaves of later rocks, the most notable of which are around Bergen and between the mouths of the Sognefjord and Nordfjord. In northern Norway the Archaean areas are not so extensive nor so continuous as in the south, by far the largest area occurring in the inland parts of Finnmark.

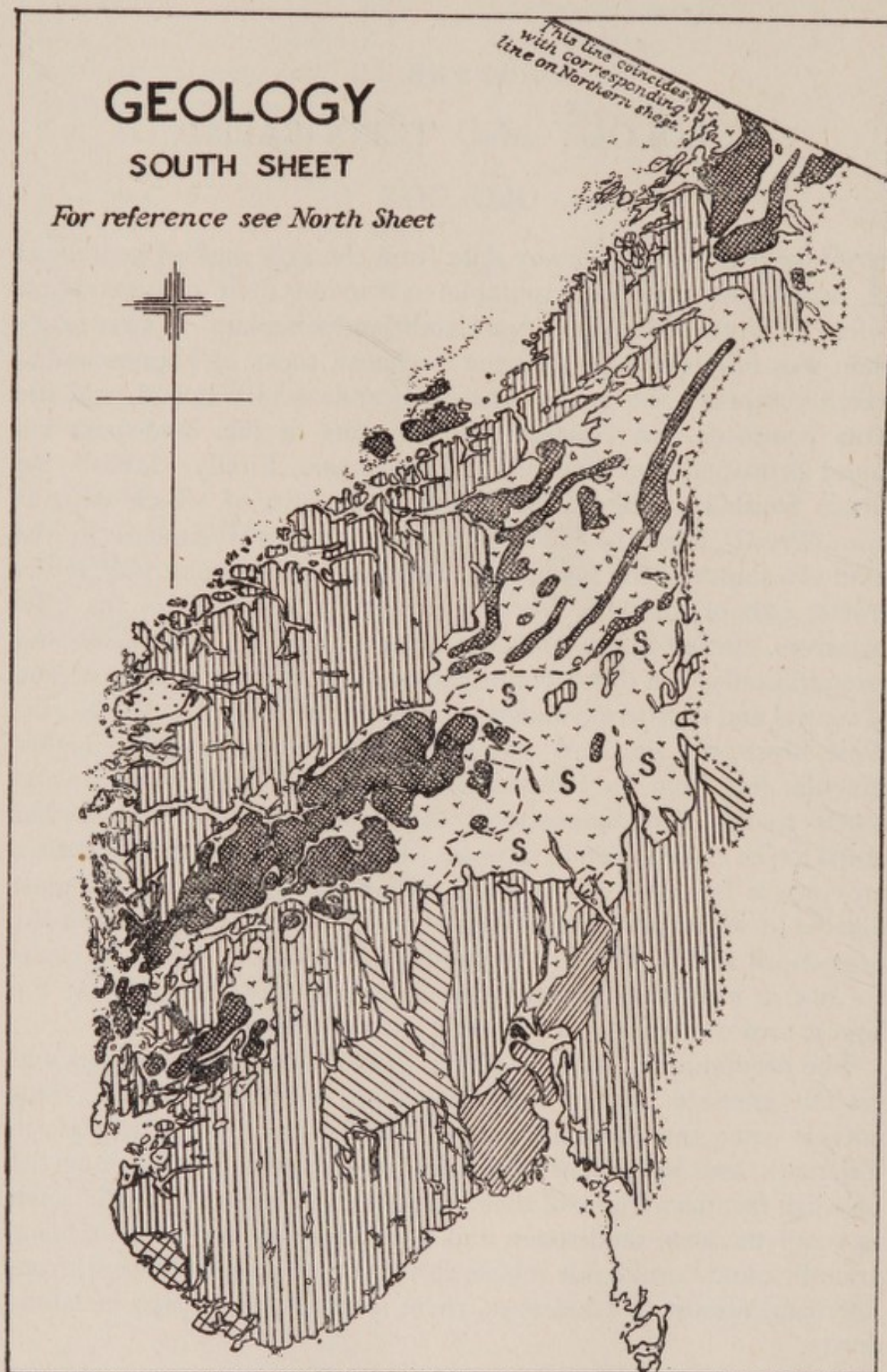
The predominant rocks in the Archaean masses are gneisses and granitic gneisses. Other rocks only occur subordinately, the most notable being the Telemark series. These occur over wide areas in Telemark, and in somewhat similar form around Trysil, along the Swedish frontier. Many of these less extensive rocks are clastic, such as conglomerates, sandstones, and clay-slates, but crystalline schists, granulite, and hornblende schists also occur. In the south-west, from Egersund almost to Lindesnes, there is an extensive area of labradorite.

¹ A peneplain is an almost level land-surface which may appear at greatly varying altitudes. It is formed by long-continued denudation.

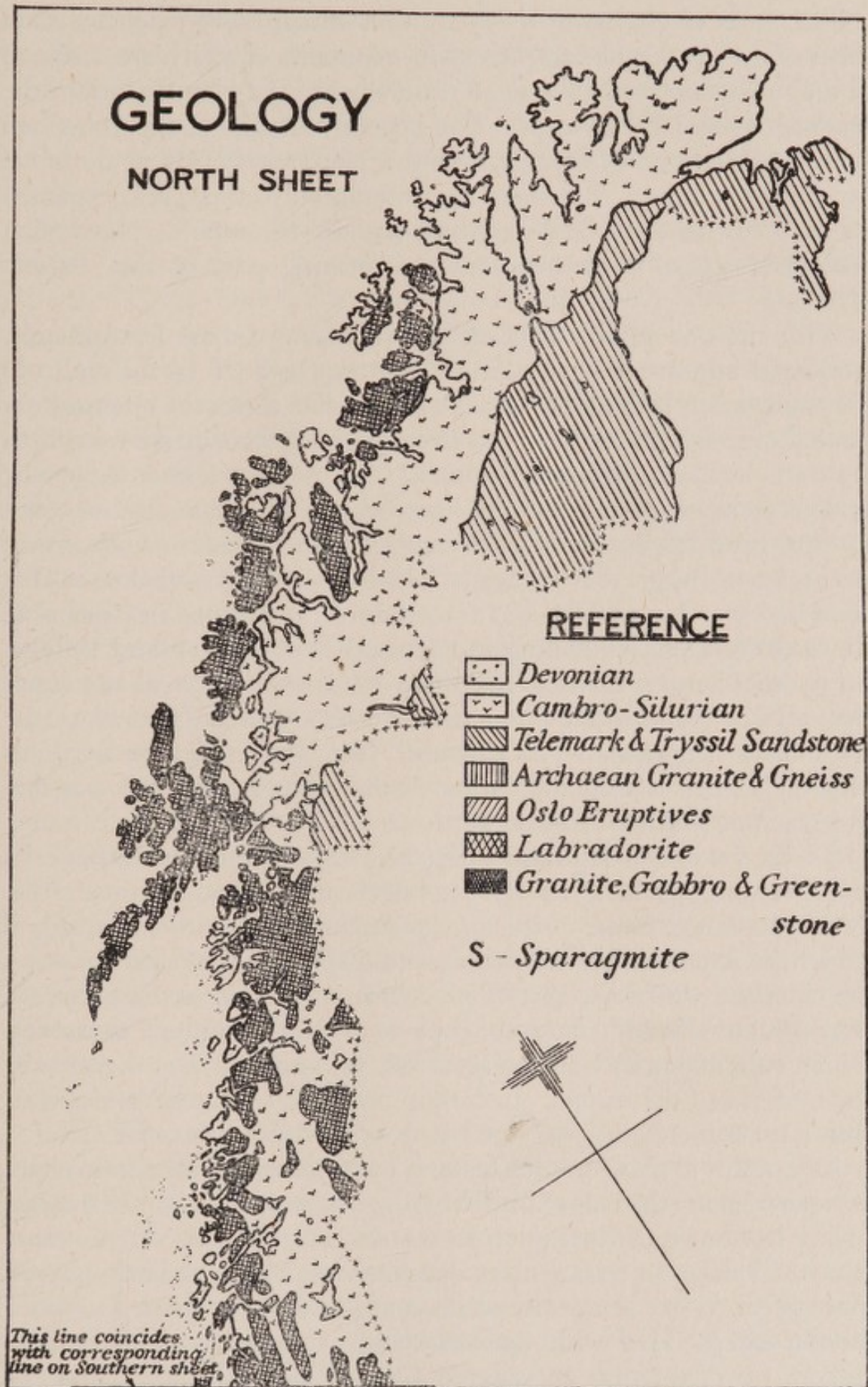
GEOLOGY

SOUTH SHEET

For reference see North Sheet



MAP 3a



MAP 3b

The areas of Archaean rocks are now much more extensive than those of the pre-Cambrian peneplain, remnants of which are confined to the uplands close to the main watershed of the country and to the regions covered by ice-caps. The largest remnant of the peneplain is in south-central Norway where the Hardangervidda is the most prominent example. But there are undoubtedly other great expanses of it to the east of Gudbrandsdal and in Finnmark. Norwegian geologists regard these remnants as forming part of the 'Palaeic plateau'.

With the oncoming of Palaeozoic (Primary) times the Archaean land-mass appears to have subsided and was invaded by the sea from the south-east. During Cambrian and Silurian times the open sea extended over the greater part of Norway, and it remained over different parts until early Devonian times. The deposits laid down by the various transgressions appear to have been of no great thickness, and to have been largely removed by subsequent denudation, except in the region of the great Norwegian 'fold-trough' or 'geosyncline'. This consisted of a zone which was forced down and folded in Palaeozoic times along a belt extending in the south from Jaeren and Ryfylke across the Bergen district, and then north-eastwards to the inner Sognefjord. From there it continues across central Norway to the Trondheim depression. Northwards the greater part of northern Norway comes within the limits of this trough with the possible exception of southern Finnmark.

Whilst the fold-trough was being formed, molten igneous material was forced up, probably as the result of the deep down-warping of the Archaean mass. Some of this igneous material was probably pushed under the Archaean blocks, raising and displacing them in relation to one another, whilst the rest of it spread out within the limits of the fold-trough. Finally, under the influence of the continued pressures, which culminated in Caledonian times, vast masses were thrust over the margins of the trough. In certain places Archaean masses shared this displacement, the pressure being exerted from the west.

As a result of this complex history, the Caledonian mountain chain was raised along the belt of the fold-trough as well as farther to the east owing to the overthrusting on to the Archaean shield. At the same time the Palaeozoic sedimentary deposits were highly metamorphosed and appear to-day as massive sandstones, slates, dolomites, and limestones, interbedded with igneous rocks. Frequently, indeed, it is difficult to distinguish the altered Cambro-Silurian rocks from the pre-Cambrian. The most extensive sedimentary deposit is the sparag-

mite, a felspar-bearing sandstone, which occurs in beds of enormous thickness and has, in the area of its greatest occurrence to the north of Lake Mjösa, been little disturbed. The highest land in Norway to-day is within the fold-trough belt and coincides with masses of gabbro, which existed before the folding process developed and were affected by it.

Northern Norway lies almost entirely within the zone of the Caledonian fold-trough. In contrast, southern Norway was divided into the Great South-East and the Great North-West Archaean Blocks, separated from one another by the fold-trough. Within the South-East Block, however, the Caledonian mountain-building movement was felt in the Oslo area. Here is a tectonic depression, studded with hills of igneous rocks, and distinguished as a separate geological and topographical region. The post-Silurian eruptive rocks of the depression are fringed by Cambro-Silurian sedimentary rocks, mainly clay-slates and limestones, with occasional sandstones. All these sedimentary rocks weather easily and provide some of the best soils in the country.

The continuity of the Great North-West Block is interrupted by a remarkable area known as the 'Bergen Arc'. This, from a geological point of view, belongs to the Caledonian mountain chain and consists of a narrow belt of folded Silurian strata strongly compressed between the Archaean on the east and west. The arcuate shape of this tectonic region is very distinct. Another break in the continuity of the Archaean is to be found along the coast between the Sognefjord and the Nordfjord. Here folded Silurian rocks, similar in certain respects to those of the Bergen area, outcrop. But what are more remarkable are the deposits of Devonian rock. It is uncertain how these Devonian areas were formed, yet the presence of huge beds of conglomerate suggests denudation and transportation of such strength that they were formed during the early stages of the denudation of the Caledonian mountain chain.

Since Devonian times the Norwegian land-mass has remained above sea-level excepting small areas around and close to the present coast. The most noteworthy of these marginal marine transgressions took place in Jurassic times and particularly during Quaternary times. During the Jurassic period sandstones containing a few seams of coal were laid down over a small area in the island of Andøy. The more extensive transgressions of Quaternary times will be considered below.

Throughout the period following the formation of the Caledonian

mountain chain the physical history of Norway has been mainly governed by sub-aerial denudation. It is not possible to distinguish the different phases of this period. There seems, however, little doubt that by the end of the Cretaceous period the land-mass had been reduced to an almost perfect plain (or peneplain) with mountains rising from it particularly in the Jotunheim and Dovre districts. The river system, which, no doubt, was the most important element in the completion of this phase, developed after the uplift of the Caledonian mountain chain. The original (or consequent) drainage was naturally at right angles to the main chain so that the rivers flowing to the west coast had predominantly a north-west direction, and those to the east and south had either a south-easterly or, where the chain in its south-western limits curved round towards the west, a more southerly direction. A subsequent direction of flow, parallel to the main chain, also developed along almost south-westerly lines, particularly within the south-western limits of the mountain chain where cut across transversely by the coast between the Sognefjord and Jaeren. As the result of long-continued denudation these main drainage lines became more and more under the influence of local geological and tectonic features, and particularly of faulting. Faulting, indeed, was important in Caledonian times, and was accentuated still further in Tertiary times. The present Norwegian river pattern may, therefore, be regarded as due to influences initiated in Caledonian times.

The great phase of sub-aerial denudation, which had continued throughout Mesozoic (Secondary) times, ended in Tertiary times as a result of large-scale uplift and warping. The fact that the highland areas of Norway no longer entirely coincide with those of Caledonian folding is due to this later uplift, of which the more complex effects are considered in Appendix I (*v.i.* p. 323). The immediate result was, of course, the initiation of a fresh cycle of erosion accomplished, in large measure, by the rejuvenation of the river system along lines mainly dictated, as already described, in post-Caledonian times.

The more recent phase of peneplanation initiated in mid-Tertiary times is highly complicated, largely owing to the great Ice Age and to marked oscillations of sea-level. The Quaternary Ice Age in Norway was marked by two major phases of ice-radiation separated by an important inter-glacial period. The ice-sheet of the first phase no doubt covered the entire Norwegian land-mass; that of the second was much more restricted, being neither so continuous nor so thick. The

higher ridges and mountains (e.g. the higher peaks of the Trollheim, Jotunheim, Dovre, and Rondane) rose as 'islands' or *nunataks* above the glaciers. Much of the marginal areas of the west coast, particularly between the Sognefjord and the Lofoten islands, was probably never overlain by a continuous ice-covering during this period, which was, generally speaking, much the less effective of the two. The principal work of the second phase was the clearance of vast piles of superficial deposits, which had accumulated during the first phase and the inter-glacial period, and the continued sculpture of corries, fjords, and valleys. The overwhelming influence of the second ice-phase on the land-forms is more apparent than real. It is due not so much to its own inherent strength as to the short period available since its time for important modifications in a region of tough and resistant rocks.

The Ice Age in Norway is most marked to-day by the features of denudation, by corries or *botner*, by arêtes or *tinder*, by confluent basins, by U-shaped and hanging-valleys, by rounded, polished, and striated rocks. The features of glacial deposition, such as moraines, outwash-plains of sand and gravel, drumlins, and eskers, are all present but somewhat scarce. The reason for this is twofold. In the first place the Scandinavian peninsula was an area of glacial erosion; the central European plain, the Skagerrak, and the seas on the west were all areas of deposition. Immense masses of Norwegian rocks lie in the north European plain as clay, sand, and erratic boulders. Similar material, carried westward by the fjord-glaciers, was piled up in the sea in front of their snouts and now forms great shore-banks along the west coast. The bulk of the loose material which was left lying on the land after the first glacial phase and the inter-glacial period must have been picked up and removed by the glaciers of the second phase. Only the morainic deposits of Lister and Jaeren are at all extensive, and there they give rise to scenery more reminiscent of the north European plain than of the rest of Norway.

In the second place Norway has in Quaternary times been subjected to considerable oscillations of sea-level, which permitted marine transgressions of varying extent. The superficial materials deposited by the glaciers of the last ice-phase were largely deposited, as already shown, in banks along the coast. But as the land has since risen, these marine deposits have been elevated in terraces of re-sorted gravel, sand, and clay. The extent of elevation does not seem to have amounted to as much as 1,000 feet, whilst the most extensive areas of transgression were less than 600 feet. It is accordingly only on the low-

lying parts of Norway that superficial deposits are at all widespread; they are found particularly in the south-east, in the Oslo region, in the south coast lowlands and valleys, and in the Trondheim depression. Along the higher west coast, superficial deposits are essentially scattered and of small extent. Immediately above the old coastline they are found only in the valleys whose flanks may be covered by scattered patches of ground moraine and whose floors may be covered by coarse gravel or fine sand, according to the gradient. The steepness of the slope has, indeed, an important bearing on the extent of the preservation of the superficial deposits. The steep dip of the plateau and valley west of the watershed strictly limits the area of deposition; whereas the more gently sloping plateaux of the south and east, and particularly the comparatively well graded and mature river valleys, have helped to preserve the ground moraine, and especially the boulder-clay. But, on the whole, the superficial covering plays a relatively unimportant part in the landscape of the country.

TOPOGRAPHY (GENERAL)

CERTAIN fundamental physical features characterize the topography of Norway, whilst variations in their form and type accentuate the variety of the landscape. The principal features are (1) the skjaergård and the strandflat, (2) the fjords, (3) the gorges, and (4) the plateaux with summits rising above their surfaces, ice-sheets and other glacial forms, and valleys often deeply incised.

(1) *The Skjaergård and the Strandflat* (Fig. 1). The coast, with a few exceptions of which the coast of Jaeren is the most noteworthy, is bordered by an island zone, the great skerry-fence or skjaergård. Most of the islands are composed of hard crystalline rocks, but a few are covered by superficial sediments, sometimes protected by boulders. All have been glaciated and most have been stripped of any mantle of soil or loose rocks. There is very little vegetation so that smooth striated rock is nearly everywhere exposed. Island summits are generally rounded and of uniform height in a given area, but altitudes vary considerably in adjacent areas.

The outer islands are low-lying, with heights between 25 and 100 feet, and occupy not more than one-fifth of the total area, the water surrounding them being comparatively shallow. Towards the mainland, however, they are higher and some are over 1,000 feet; they are

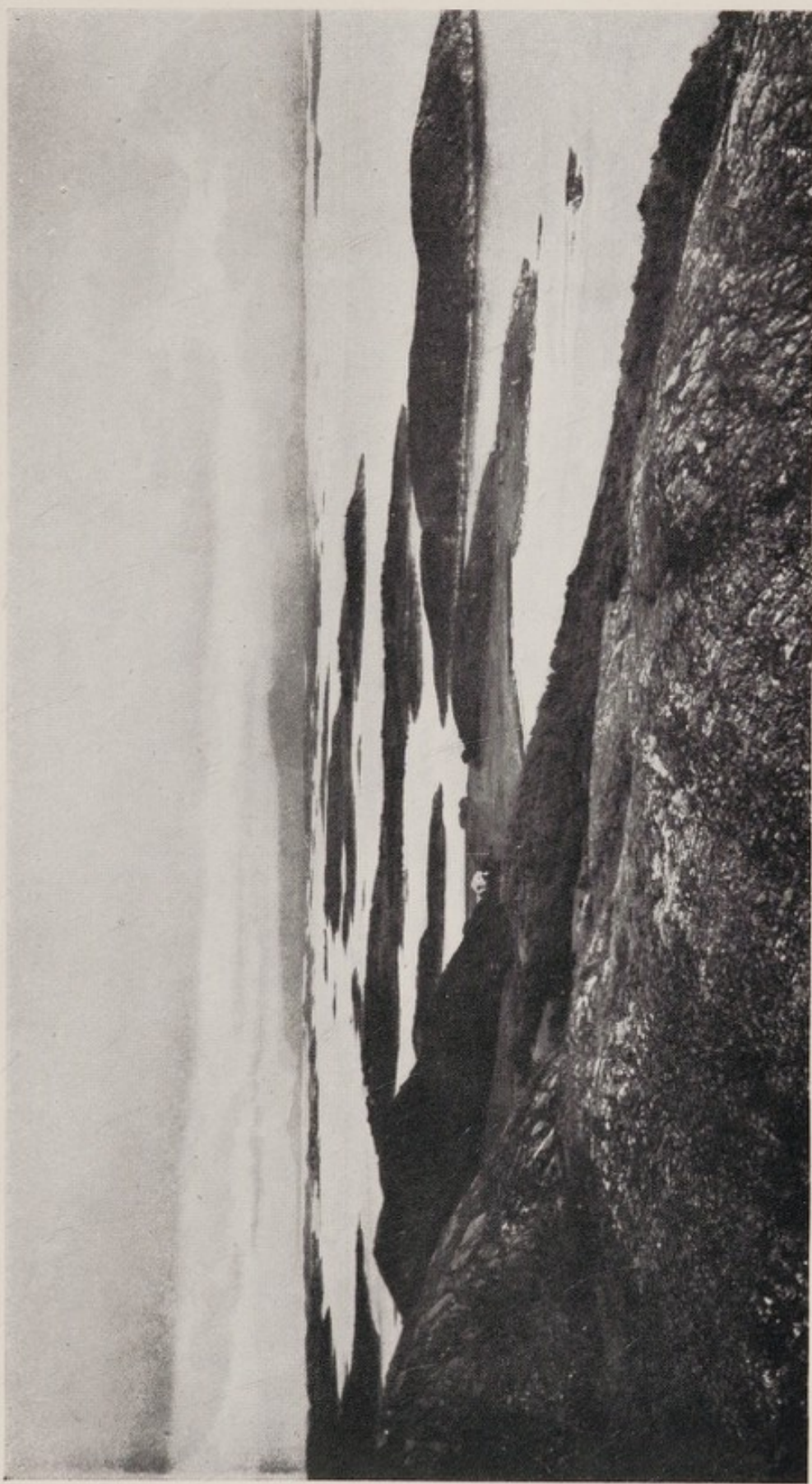


FIG. 1. *Torghatten. Skjaergård and strandflat*



FIG. 2. *View across the Hjørundfjord towards the Norangsfjord, a typical glaciated fjord incised in a highly dissected plateau. The village of Saebo stands on a terrace of a deltaic flat*



FIG. 3. *The head of the glaciated Eidfjord, Hardanger, with L. Eidfjord (in the middle distance) separated from the fjord by a terminal moraine, fronted by deltaic terraces*

larger and closer together, so that about half the total surface is land. Channels parallel to the coast become rarer as mainland peninsulas increase in number and deep transverse valleys, almost at sea-level, take their place. Glacial deposits cover more and more of the rock surface, whilst moraine and boulders are increasingly found along the floor of the channels, which become deeper and safer for navigation. Finally, farther inland, a landscape gradually appears which is similar to that of the fjords.

A series of rock terraces, known as the strandflat, occurs along the borders of many of the islands and in the mouths of some of the fjords. These terraces form a highly significant feature of the island zone. There is very little reason to suggest that any marked difference exists between the forms of the areas either below or above sea-level. In fact if the sea were to disappear from a belt 10 to 20 miles wide encircling the Norwegian coast, the land surface revealed would resemble a peneplain. The landscape would, indeed, very much resemble those parts of the upland plateau devoid of a permanent covering of ice, and even possess the same appearance of thorough glaciation.

(2) *The Fjords* (Figs. 2 and 3). The fjords have all the characteristics of glaciated valleys, being long, narrow, and straight, with uneven floors whose basins are separated by sills, frequently of rock, but occasionally of drift. The average height of the land gradually increases from the islands of the outer zone, throughout the fjord zone to the uplands where glaciated rock surfaces of fairly level aspect cover most of the area. The valleys joining either the heads or sides of fjords are often similar to the seaward ends of the main fjords. A short distance up the valleys their fresh waters are divided from the salt waters of the main fjord by moraines or by rock bars, and higher still, a chain of lakes, rising step by step, is strung along the valley. Abandoned deltas, now appearing as terraces, frequently occur between 25 and 30 feet above sea-level, and a number of them may line the sides of a single fjord valley.

(3) *The Gorges* (Figs. 4, 5, and 6). The gorges extend inland above the level of the fjords. Torrents flow down from the high uplands in great falls and cascades, roaring through the gorges. Some of these gorges are several miles long, others are only a few hundred feet or less. Their depth also varies from a few feet to as much as 2,000 feet. Just as the islands and fjords show clear evidence of glaciation, so do the gorges reveal their origin and history. They are carved in an upland glaciated surface, though they are themselves not glaciated

but post-glacial in age. Some cut down to the heads of fjords, some join along their sides; others lead to large and deep valleys which contain no sea-water and yet are glaciated, smoothed, and over-deepened just like the fjords. The Norwegians, indeed, are fundamentally correct in calling many of their inland lakes 'fjords'. The gorges are continuously being extended by the recession of the falls towards the ice-caps which mask portions of the uplands. Some have already reached the margins of the ice-caps, whilst others still have some distance to go.

(4) *The Plateaux* (Figs. 7, 8, and 9). The upland surface above the gorges and the falls consists of a series of plateaux, formed almost exclusively by the various forces of sub-aerial denudation at different periods. These plateaux rise, as already described, steeply from the west coast towards the main watershed of the country, which in the south runs both parallel and close to the west coast, and in the north follows, roughly speaking, the frontier with Sweden. The eastern flanks of the watershed are, within Norway, restricted mainly to the south of the country where they gradually dip down in a series of plateaux, incised by the deep south-easterly flowing rivers, either to the coastline or across the frontier into Sweden. The southern flank of the watershed is similar, but here a southerly dip and direction of flow of the rivers is dominant.

The upland plateaux are more extensive in southern than in northern Norway, where differential denudation¹ has been more active. Normally the plateaux are most perfectly preserved in the watershed areas of the high *fjeld*. But even so they are of two contrasting types, for a broad distinction can be drawn between the areas covered by ice-caps and those free from permanent snow. Altogether some 2,000 square miles are covered by ice-fields, which extend between heights of from 3,000 to 6,500 feet. Glacier-lobes, however, extend downwards from the ice-sheets to within about 200 feet of sea-level. The lower limit of the ice-surface or 'snow-line' in northern Norway is lower than in the south, but even so only one glacier-lobe (of the Svartisen glacier) reaches the sea. The ice-cover is now receding and is primarily limited to the plateaux, but its margins are fringed with lobes, the remnants of valley glaciers. A few lobes are half a mile long, but the valleys are remarkably free of ice. In southern Norway the ice-free areas of the plateau extend principally between 3,000 and 5,000 feet in altitude. In northern Norway both

¹ Differential denudation denotes the varying effects of erosion acting on rocks of differing degrees of resistance.



FIG. 4. *Gudvangen, at the head of the Naeröfjord, a fjord formed by the submergence of the lower end of the Naerödal gorge*



FIG. 5. *Stalheim. View down the Naerödal gorge*



FIG. 6. *Vöringfoss, at the head of the Måbodal gorge*

the upper and lower limits may be less than in the south. For further details of Norwegian glaciers see Appendix II (*v.i.* p. 329).

The most outstanding characteristic of the ice-free plateaux is their barrenness. Great stretches of smooth, rounded, old land-forms extend on all sides, the surface being bare, scored, and often polished by glacial action. Boulders are scattered here and there, and patches of gravel and drift alternate with considerable areas under water. Vegetation is sparse; trees are almost unknown; grass is rare; mosses, lichens, and a few shrubs have gained a foothold, whilst a few peat-bogs are scattered here and there. Such is the fjeld.

Old rounded summits are occasionally found as *monadnocks*, or peaks, rising above the plateau to about 7,000 feet, and rarely to over 8,000 feet. Sometimes they project through the surface of the ice-sheets as *nunataks*. Frequently their rounded, mature appearance has been modified by frost which has split the rocks, and their flanks have become scarred with precipitous corries. Such are the highest mountains of Norway as exemplified by the higher summits of the Dovrefjeld or the peaks of the Jotunheim.

DIFFERENCES BETWEEN NORTHERN AND SOUTHERN NORWAY

The features of (1) the skjaergård and strandflat, (2) the fjords, (3) the gorges, and (4) the plateaux are all found in both northern and southern Norway; but the extent and development vary greatly from place to place. The most marked differences are to be found in the extent of the plateaux, which vary particularly in northern and southern Norway.

In southern Norway the upland plateau extends westwards of the watershed past the gorge and fjord belts to the island zone. The surface of the plateau decreases in height throughout, and finally beyond the western margin of the islands continues as a broad submerged platform. The descent of the plateau on the east and south of the watershed is not so steep as on the west. But the same features, although in modified forms, are revealed. The plateau is incised by gorges leading to the fjords, but now the fjords are large inland lakes, such as Mjösa, Randsfjord, Tinnsjö, and Bandak. The river courses are longer, the catchment areas are more extensive, so that the valleys themselves, and not the separating ridges, become the predominant features of the landscape. Not only is the descent to the east and south more gradual, but, largely on account of it, the whole landscape is softer. The barren wastes of the fjeld give way sooner than on the west to the forests—birch on the higher slopes and coniferous in the

lowlands—with their scattered clearings for agriculture and settlement.

The continuity of the landscape, so marked in southern Norway, is not so evident in the north, where the plateau is not so continuous or extensive. Northern Norway largely coincides with the region of the fold-trough, and the extent of Archaean rocks is far less. As a result, differential denudation is more marked, in spite of the almost invariable toughness of Norwegian rocks. Northwards of the Dovrefjeld, remnants of the plateau are mainly confined to the coastal and upland areas, and the major topographical features, except in Finnmark, are alined along north to south belts, which are due both to tectonic causes and to denudation.

The major belts of northern Norway consist of : (1) A highland region along the frontier with Sweden. This is generally known as the *Kjölen* and is composed of resistant sandstones and various intrusive rocks, e.g. greenstones, gabbros, and granites, which tend to form the higher elevations. Heights of over 5,000 feet are frequent. The *Kjölen* is bordered on the west by (2) a lowland belt, which has been carved out of relatively unresistant rocks such as crystalline schists, calcareous schists, and metamorphosed limestones. Deposits due to the post-glacial oscillations of sea-level are also found. These occur mostly in terraces and are of marine alluviums and clays. They are particularly well preserved in the neighbourhood of Trondheim up to heights of about 600 feet.

The lowland belt is only extensive in the Trondheim depression. Northwards it narrows to a series of large valleys connected with one another by lesser valleys, gaps, and cols. North of the Ofotfjord it entirely disappears and is replaced by channels and fjords, parallel to the coast. Here the *Kjölen*, which forms the inner mountain belt south of the Ofotfjord, becomes the coastal range as far as the Altafjord.

The lowland belt is succeeded on the west by (3) the coastal highlands. In the south these are built up of gneiss interbedded with Algonkian schists, and, farther north, of sandstones and various intrusive rocks, notably granites and gabbros. This zone is quite high with extensive areas over 3,000 feet and rising to over 5,000 feet in the Svartisen glacier. The coastal ridge is broken into by numerous valleys and fjords, and particularly by those fjords which have cut back along narrow channels before expanding headwards in the lowland zone to the east. The continuity of the coastal uplands is entirely destroyed by the Vestfjord and Ofotfjord, and northwards is represented by a series of islands extending almost parallel to and along the

coast of the mainland as far north as Mageröy. These islands consist almost invariably of igneous rocks and are joined at an oblique angle by a further chain of similar rocks, which form the Lofoten and Vesterålen islands.

Seaward of the coastal highlands is a final belt of (4) the skjaergård and strandflat. Both these features are particularly well developed along the middle stretches of the coast of northern Norway. The skjaergård continues as far north as the island of Mageröy but ceases there. Little evidence of the strandflat exists in Mageröy and still less farther east. The most northerly extensive remnants of the strandflat are around the island of Kvalöy.

This division into belts breaks down in (5) the plateau of Finnmark. North and east of the Lyngenfjord the country no longer comprises merely a coastal strip of from 30 to 60 miles, but widens, particularly in the basins of the Alta and Tana rivers, to 100 miles and more. This region is predominantly a plateau at from 1,500 to 2,000 feet dipping gently eastwards to the valley of the Tana. Scattered summits rise above the general level of the plateau which consists of quartzites, gneisses, and various types of sandstones, many of which are only very slightly folded.

Both this exception and the linear disposition of the highlands and lowlands of northern Norway contrast strongly with the descent, whether gradual or steep, of the plateau on all sides from the watershed in southern Norway. This contrast is, however, largely due to a different stage of evolution. No doubt there extended in northern Norway at one time a continuous peneplain from the Kjölen to the skjaergård. But now this peneplain has been largely destroyed, and particularly in the lowland belt. Its disappearance is due to the fact that ice not only has powers of denudation, as already stressed, but has also, by its very presence, protective powers from other forces of denudation. In northern Norway this protection was largely lacking during the second stage of ice-radiation because the ice-cap was then either almost or completely absent, as in the Lofoten islands or in low-lying coastal regions. This is not to suggest that northern Norway is lacking in glacial forms. It does, indeed, possess in different stages of development all the topographical forms of southern Norway except, of course, the gentle easterly descent of the plateau from the watershed, which in the north occurs in Sweden.

The principal topographical features and the sequence of their evolution have been described in the foregoing sections. In many instances, however, the method of formation has only been considered

very briefly, whilst the essential unity and the close connexion between all the topographical features have been stressed but not explained. An attempt is made in Appendix I (*v.i.* p. 323) to clarify these complex aspects, which are mainly of theoretical interest.

TOPOGRAPHY (REGIONAL)

See Appendixes II, III, and IV

I. SOUTHERN NORWAY

There are four major topographical divisions of southern Norway:

- I. The Fjeld, which includes parts of the Great South-East Archaean Block, the fold-trough, and the Great North-West Archaean Block.
- II. The South-Eastern Lowlands, which comprise parts of the fold-trough and the Great South-East Archaean Block. This region includes within its limits the important sub-region of
- III. The Oslofjord, which largely coincides with the area of the Oslo eruptives and Cambro-Silurian sedimentaries.
- IV. The West Coast or Fjord region, which includes parts of the Great North-West Archaean Block and of the fold-trough.

I. *The Fjeld* (Map 4)

The great barren plateau, known as the fjeld, occupies the western part of much of southern Norway. This plateau slopes from the main watershed of the country steeply towards the west coast and more gently towards the east. It is cut up by fjords, gorges, and valleys and has been highly glaciated. Communications are restricted; there are few minor roads, and the main roads and railways follow the large valleys which mainly cross the fjeld from the north-west to the south-east.¹ Six main subdivisions may be distinguished:

- | | | |
|------------------------|---|---|
| (a) The Viddas | } | Often collectively termed the Langfjeld. |
| (b) The Jostedalsbreen | | |
| (c) The Jotunheim | | |
| (d) The Dovrefjeld | } | Often collectively termed the Dovrefjeld. |
| (e) The Trollheim | | |
| (f) The Rørosvidda | | |

(a) *The Viddas*. The Viddas, of which the Hardangervidda is the

¹ The references after roads refer to the route numbers as they appear in Volume II, where the railways are also described.



FIG. 7. *The high fjeld near Haugastöl*



FIG. 8. *An ice-eroded monadnock in the Jötunheim*

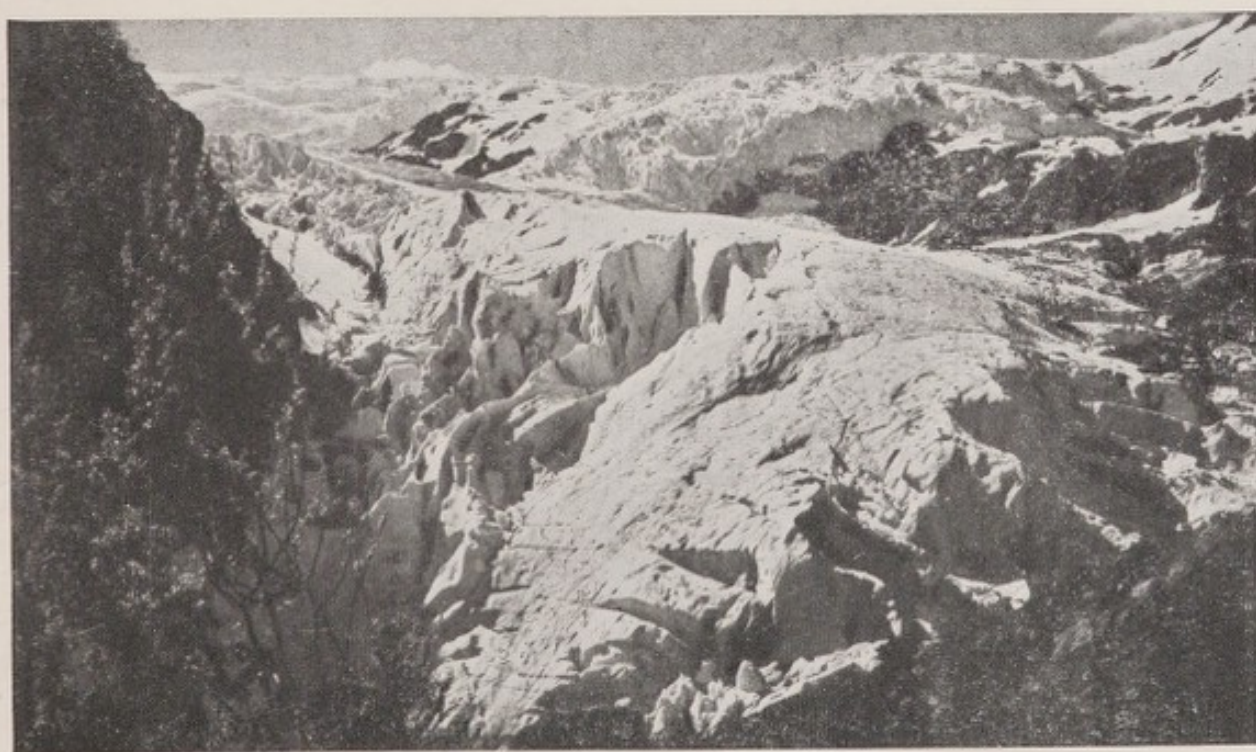


FIG. 9. *The Folgefonn ice-sheet, with the Buarbreen glacier in the foreground*



most extensive, comprise the immense stretch of fjeld lying in the south-west. They are terminated on the north by the Sognefjord and on the east by the middle valleys of the Hallingdal, Numedal, and the large valleys of Telemark. The Hardangerfjord and the Boknfjord penetrate deeply into the fjeld from the west. The plateau lies between 4,500 feet and 2,500 feet, dipping slightly towards the south-west. Several peaks and glaciers rise above this level. The most prominent are the Folgefonn (5,423 ft.), an ice-cap extending for about 100 square miles in the angle between the Hardangerfjord and the Sörfjord; Hartigen (5,541 ft.) to the east of the Sörfjord; the Hardangerjökkel (6,109 ft.), an ice-cap about 50 square miles in area, to the east of the inner Hardangerfjord; and the Hallingskarvet ridge (6,342 ft.) and Storskavlen (5,672 ft.), both bordering the Hardangervidda on the north-east. In the south-east the Gausta peak (6,174 ft.) is the most prominent.

The Viddas stretch for mile after mile of barren, windswept rock with occasional patches of wild moorland and bog. There are numerous lakes and rivers (well stocked with fish) which add to the desolation of the scene, especially when the winter snows lie on the ground (Fig. 7).

Several deep valleys cut across the Viddas, whilst at their margins gorges, with their accompanying hanging-valleys, are notable features (Fig. 6). The deep valleys with their connecting gaps and passes provide the main lines of communication between the south-eastern lowlands, of which they form an upland extension, and the west coast. The Setesdal is a narrow, wooded valley followed by a road from Kristiansand S. (2 C); at the head of the valley a road joins from Arendal, Kragerö, and Skien (2 D, 2 J, 1 C, 5 D) before the Vidda is crossed by a pass to Breifonn and thence to the Hardangerfjord and Boknfjord (5 D, 4 C).

The upper Numedal, above the Norefjord, is a wooded and well-cultivated valley with the road from Kongsberg leading from it across the Hardangervidda to the Hardangerfjord (5 C).

The upper Hallingdal is followed by a road (5 B) and the Bergen-Oslo railway. Between Flå and Gulsvik the river flows in a narrow gorge with scattered forest, but above the gorge the valley broadens and becomes more forested and more extensively farmed. At Gol the valley divides, the main valley climbing west-south-west and the Hemsedal north-west. The Hemsedal is a shallow, forested valley with barren fjeld on either side. It is followed by a road which finally leaves the valley and crosses the fjeld before descending the

narrow gorge to Laerdal on the Sognefjord (6 c, 6 A). The Bergen-Oslo railway and the road to the Hardangerfjord climb the main valley west-south-west past scattered farms and forest into the barren fjeld. At Geilo the road joins from the Numedal (5 c), whilst at Haugastøl the road and railway diverge. The railway passes between the Hardangerjøkel glacier and the snowy peaks of the Hallingskarvet before descending the narrow, forested Raundal valley to Voss and Bergen, whilst the road turns south-west to the head of the Hardangerfjord (5 B).

(b) *The Jostedalsbreen.* This region, lying north of the Sognefjord, is largely covered by the immense ice-cap of the Jostedalsbreen, extending over an area of 580 square miles. The main ice-cap lies at about 6,500 feet and is believed to be over 1,000 feet thick. Smaller ice-caps lying east of the main one include Spørtegbreen (5,708 ft.), Hartbarsbreen (6,637 ft.), Sikkilbreen (5,747 ft.), Skridulaupbreen (6,995 ft.), and Hestbrepiggene (6,869 ft.). Glacier tongues extend from the ice-caps down the many lake-filled valleys which dissect the surrounding fjeld and penetrate to the Sognefjord, Sunnfjord, Nordfjord, and Storfjord.

The smaller ice-cap of the Ålfotbreen (5,347 ft.) lies west of the Jostedalsbreen and to the south of the Nordfjord.

(c) *The Jotunheim.* This is the wild, mountain region lying between the Jostedalsbreen and the Böverdalen on the west, and the Gudbrandsdal in the east. The Ottadal separates it on the north from the Dovrefjeld, and the Valdres valley separates it on the south from the Viddas. It is a region of towering snow-covered peaks (Fig. 8) rising above the plateau, which is dissected by deep gorges and lake-filled valleys. The highest peaks are Galdhøpiggen (8,097 ft.), the highest mountain in Norway, Glitretind (8,041 ft.), and Skagastølstind (7,887 ft.) which stand about 1,500 feet above the general level of the fjeld. The plateau is cut up by narrow gorges and valleys, mainly running north-east to south-west, such as the Utladal and Böverdalen, and broader lake-filled valleys, such as Bygdin and Gjende, running from east to west.

Communications are restricted to the valleys, the through-roads from the south-east lowlands following only the boundary valleys of Gudbrandsdal (10 B), Ottadal (7 A), Böverdalen (7 c), and Valdres (6 A).

(d) *The Dovrefjeld.* The Dovrefjeld extends from the Ottadal northwards to the Drivdal and north-eastwards between the Orkdal and Gauldal to the Trondheim depression; it is bounded on the east

by the Österdal. The Rondane is a south-eastward extension of the Dovrefjeld lying between Gudbrandsdal and Österdal.

The fjeld is a sea of barren, rocky summits with occasional patches of moorland and peaks towering above the general plateau level. In Rondane, Rondeslottet (7,162 ft.), Högronden (6,936 ft.), and Storonden (7,027 ft.) rise with bare, serrated peaks above the highland pastures. In the central Dovrefjeld the main peaks are Skarvdalseggia (6,420 ft.), Snöhetta (7,500 ft.), and Skrimkolla (6,509 ft.). Westwards, where the Romsdalsfjord cuts into the fjeld, the plateau is lower and the Romsdalshorn (5,100 ft.), Vengetinderne (6,040 ft.), and Trolltind (5,774 ft.) form outstanding peaks.

There are several deep, forested valleys cutting across the fjeld and providing through routes from Oslo. The Gudbrandsdal is connected with the Romsdal, leading to Åndalsnes, by a lake-filled col which gives rise both to the river Lågen and the river Rauma. This through valley (known as a *skar*) is followed by both road (9 A, 10 B) and railway from Oslo to Åndalsnes. The Drivdal, leading to the Tingvollfjord, is connected southwards with the Gudbrandsdal and northwards with the Orkdal by marshy depressions, and thus provides a through-route, followed by a road (10 B) and the main railway, from Oslo to Trondheim. The Orkdal and Gauldal, both forested valleys with scattered cultivation, lead northwards from Österdal to the Trondheim depression and are followed by roads (10 M, 10 A, 10 C) and railways from Oslo to Trondheim.

(e) *The Trollheim.* The Trollheim extends northwards from the Drivdal to the Trondheim depression. It is bounded by the Orkdal on the east and slopes to the coast on the west. The higher part of the Trollheim is barren and rocky with the peaks of Trolhetta (5,387 ft.), Svarthetta (5,157 ft.), Snota (5,541 ft.), and Blåhö (5,512 ft.) rising steeply above the plateau. Towards the coast the plateau decreases rapidly in height and there are vast forested areas. The plateau is broken by the forested Surna valley, which provides a route from the Halsafjord to Trondheim (9 D).

(f) *The Rörosvidda.* The Rörosvidda lies between the upper Österdal on the west and the frontier with Sweden on the east; northwards it extends to the Trondheim depression. The fjeld here lies at about 3,000 feet and is extensively forested where it is broken by small valleys and lake basins. A road from Oslo leaves the Österdal at Röros and crosses the Rörosvidda by way of the forested depression of Lake Aursund, to the frontier with Sweden (10 M).

II. *The South-Eastern Lowlands* (Map 5)

The south-eastern lowlands consist of the parallel middle and lower valleys of the great rivers flowing south to the Skagerrak and south-east to the Oslofjord, together with the plains extending round their mouths and along the coast. Many of the valleys show the characteristic features of fjord, gorge, and broad valley, which are so well formed in the west coast region. The fjords in the south-eastern lowlands do not, however, appear as a coastal feature but as long, narrow, inland lakes in the middle and lower courses of the rivers. The pleasant, undulating country-side and the rivers with their great waterfalls combine to encourage both agricultural and industrial development.

Communications in this region are comparatively good; the main towns along the coast and its hinterland are connected by a series of good roads and railways. The valleys provide through-routes to other parts of the country, but communication between the upper parts of the valleys themselves is restricted.

Since the valleys form the dominant features of south-eastern Norway, it will be convenient to describe the individual valleys of this region in sequence from the south-west to the north-east.

East of Flekkefjord the barren Viddas gradually decrease in height and give place to a broken and sparsely wooded country, with the main valleys, the Kvina, Lyngdalselv, and Mandalselv, cutting back towards the Viddas and running in a north to south direction.

The largest of the valleys of this south-western region, the Setesdal, is followed by the river Otra for 150 miles to its mouth in the Kristiansandsfjord. This valley is generally narrow and sparsely forested above the Byglandsfjord (Fig. 10), below which it opens out into more undulating, cultivated country. A series of falls below Lake Otteraen have been harnessed for power to serve the industrial centre of Kristiansand S., from which a road follows the valley to the Hardangerfjord (2 c). There are also railways south of Byglandsfjord.

The Topdalselv has its headwaters in the Strömsfjord and flows in a narrow valley as far as Herefossfjord, below which its valley gradually opens out into low-lying country around its outlet in the Topdalsfjord. A road follows the lower part of the valley (2 D, 2 A).

The Nidelv flows eastward across the fjeld as far as the Vråvand, where it turns south. It next flows through the Nisservand, below which it is joined by a stream from the Fyresdalsvand, and descends through a narrow and sparsely forested valley to Böilefoss. At



MAP.5.



Böilefoss the country becomes more open and cultivated. The river next flows through several lakes before it makes a sharp bend eastwards and crosses low-lying, forested land to its mouth near Arendal. A road follows the valley and crosses the fjeld to the Hardangerfjord (5 D, 2 D). There is also a railway which runs from the south end of the Nisservand towards the coast and links up with the Sörland railway.

East of the Nidelv there are several forested plateaux and small valleys, of which the Toke is followed by a road from Kragerö to the Hardangerfjord (2 J, 5 D), connecting with the road from the Nidelv (2 D). The lower part of the Toke valley is also followed by the Sörland railway and the Kragerö branch.

Telemark is a transition region between the Viddas, where they extend close to the coast on the west, and the more extensive lowland to the east. It is a region of many lakes and river valleys, with bare rock outcrops and patches of pine, spruce, and deciduous forest as well as cultivation along the valleys. The fjeld is broken by three main river systems whose waters flow east to be collected and carried south-east by the Norsjö. (1) In the south the Totakvand, on the edge of the high fjeld, leads down into a deep, forested valley where the river runs through a series of lakes, Bandak, Kviteseid, and Flå (Roir), to Ulefoss on the Norsjö. The river between these lakes is interrupted by many falls, but it has been made navigable by a remarkable series of locks between Ulefoss and Dalen. (2) In the centre the Seljord is a narrow, forested valley followed by a main road (*see below*). (3) In the north the Tinnsjö collects its waters from the Mår, flowing from the Mårvand, and the Månelv, which rises in the west of the Hardangervidda and flows through the Mös-vand in a deep, forested valley to the mighty Rjukan falls. Below Lake Tinnsjö the river, known as the Tinne, descends by a series of great falls, Årlifoss, Grönvollfoss, Svaelfoss, Lienfoss, and Tinnfoss, to the Hitterdalsvand, where the valley is more open and cultivated. These three river systems all flow into the Norsjö and thence drain to the Langesundfjord by the Skiens river. This river is navigable from the sea as far as Skien and thence by a series of locks to the Norsjö. South of the head of Norsjö the country is open, with considerable cultivation and many scattered hamlets. Roads follow the main valleys connecting with each other and with the Numedal to the east. There is a railway from Rjukan to Tinnsjö and another along the Tinne valley below Tinnoset. The principal through-route by road to the west is along the Seljord valley (5 D), connecting with the roads from the Nidelv (2 D) and Setesdal (2 C) to the Hardangerfjord.

East of Telemark the many rivers, which cut far back into the fjeld, flow south-east towards the Oslofjord.

The river Lågen, flowing through the Numedal (Fig. 11), rises in the Hardangervidda and after a course of 190 miles reaches the sea in the Larviksfjord. There are several lakes in the upper valley but none in the last 90 miles, which are in consequence subject to considerable irregularity of flow. The Tunhovdfjord, a lake in the upper valley, is important as the falls at its outlet provide power for the hydro-electric station at Rødberg, situated above the Norefjord. Below the Norefjord the river flows through a deep, forested valley to Kongsberg before descending by several large falls, Labrofoss, Gravenfoss, and Vittingfoss, to more open, undulating, and cultivated country near its mouth (*v.i.* p. 47). The valley is followed by a road leading to the Hardangerfjord (5 C, 1 D) and a railway between Kongsberg and the power station at Rødberg.

The upper waters of the Hallingdal consist of a series of east-flowing streams rising in the Hardangervidda, Hallingskarvet, and Hemsedalsfjeld. Below Gol the Hallingdal flows south-eastwards in a broad cultivated valley to Flå, where it enters a narrower gorge-like reach, emerging at Gulsvik to flow into Lake Kröderen. Below the lake the valley is again broad and well cultivated until it flows over a series of waterfalls into the Dramselv (*v.i.* p. 30) below the Tyrifjord. The Hallingdal is followed by a road from the Oslo region to the Sognefjord (5 B, 6 C) and the Hardangerfjord (5 B) and by the Bergen-Oslo railway, which enters the valley below Gulsvik. There is also railway communication with Oslo from Kröderen.

The headwaters of the river Begna rise in the south of the Jotunheim and flow through the Valdres valley in a series of lakes, of which Vangsmjøsen, Slidre, and Strondefjord are the most important. Near Aurdal, below the Strondefjord, the Begna flows in a gorge which leads to a deep, forested valley; this valley becomes less restricted above the long, fjord-like Lake Sperillen. Between Lake Sperillen and its confluence with the Randselv the river descends a broad forested valley by a series of rapids and waterfalls, of which the largest are Svinefoss, Hofsfoss, and Hønefoss. The valley is followed by a road leading from Hønefoss to Laerdal on the Sognefjord (6 A) and is also connected at Aurdal with the Etna valley to the east by a road (6 B) and a railway, the latter continuing as far as Fagernes.

The two short rivers Dokka and Etna flow through narrow forested valleys into the Randsfjord (Fig. 12). This long, narrow, fjord-like lake lying in an open, cultivated valley, drains southward into the

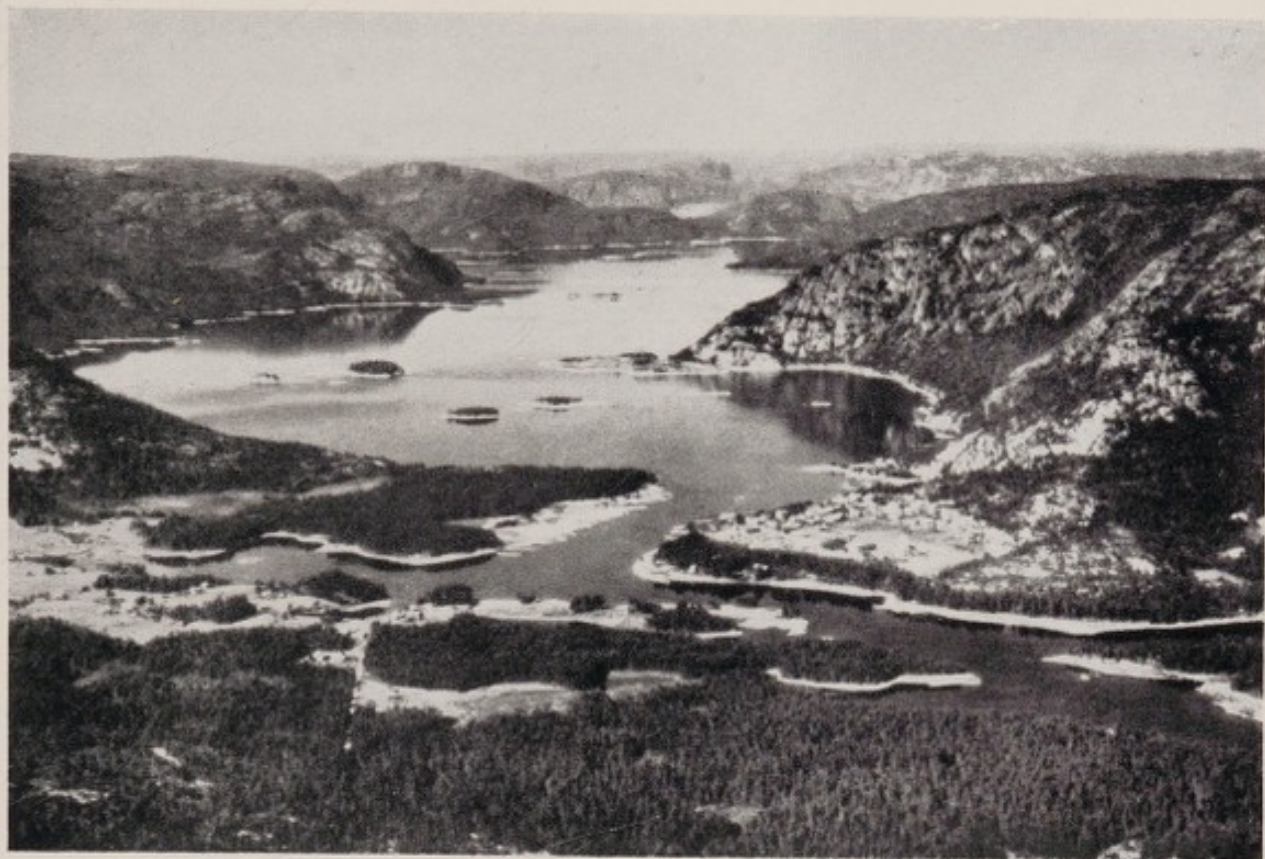


FIG. 10. *The Setesdal, at the south end of L. Byglandsfjord*



FIG. 11. *The Numedal, at Nore*

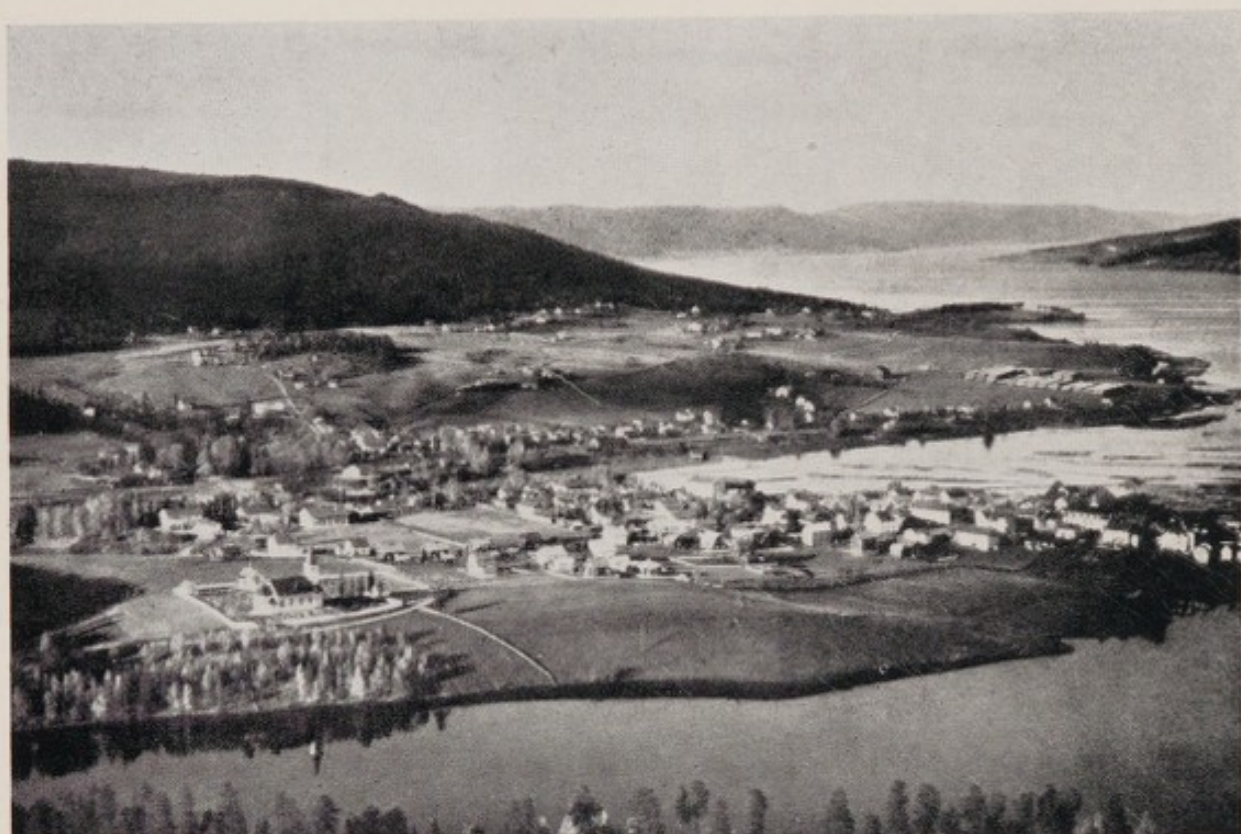


FIG. 12. *The Randsfjord, with the town of Randsfjord at its outlet*

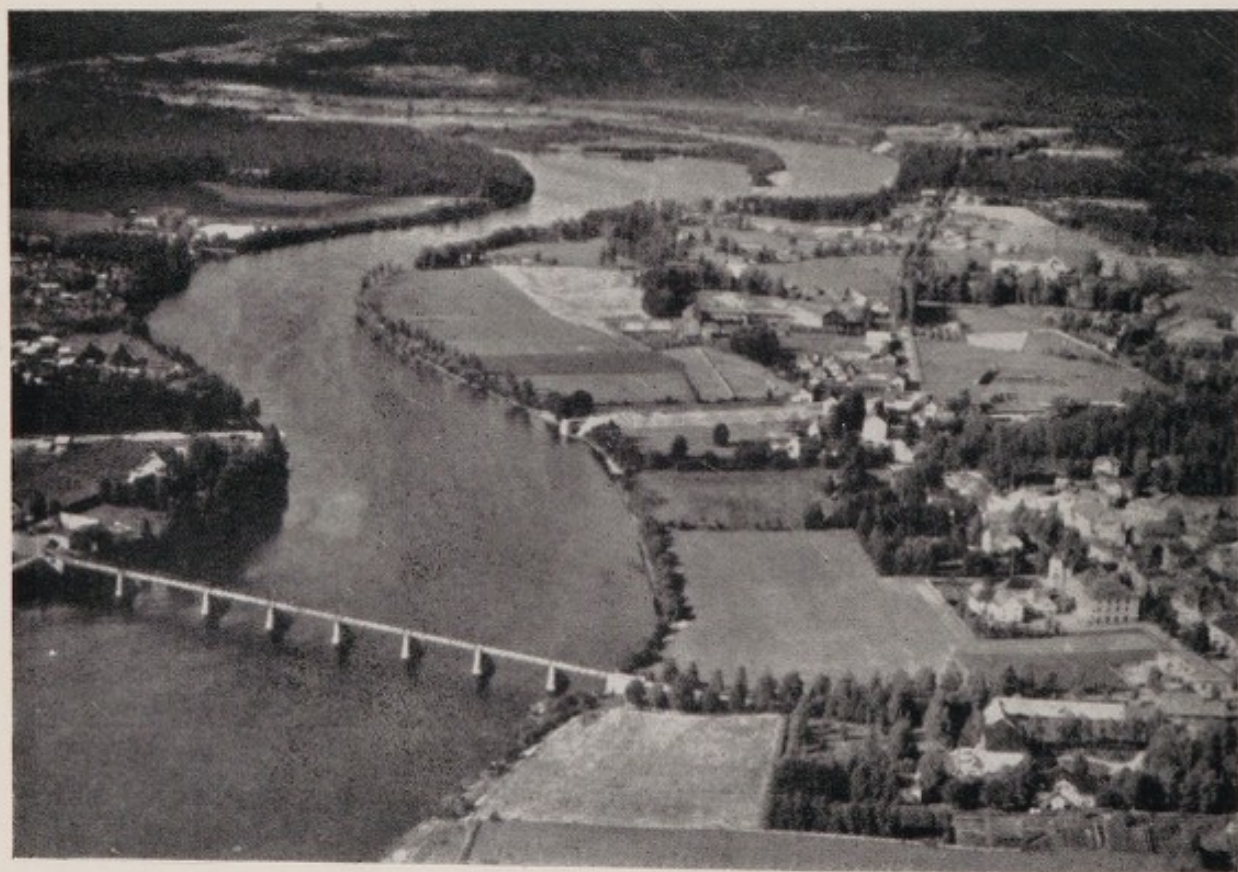


FIG. 13. *The Österdal, at Elverum*

Tyrfjord by the Randselv. The Randselv is a short stretch of river with large falls at Kistefoss and Askerudsfoss before Hønefoss, where the river Begna joins on the west. Below Hønefoss the river flows in broad meanders, through open cultivated country to the Tyrfjord.

The river Lågen, flowing through the Gudbrandsdal, rises in Lake Lesjaskog, in the heart of the Dovrefjeld, where the valley is shallow and covered with sparse forest and scattered cultivation. South of Dombås the valley deepens and becomes more forested, the river flowing through several small gorges. Below Otta, where the tributary river Otta joins the main river on the west, the Lågen flows through a series of small lakes connected by many rapids and waterfalls, of which Harpefoss is the largest. Finally the Lågen flows into Lake Mjøsa, below which it is known as the river Vorma as far as its confluence with the Glomma. Lake Mjøsa, the largest lake in Norway, lies in an open wooded valley, with gently sloping hills on either side and considerable cultivation along its shores. The Gudbrandsdal is very important as it affords a route for both road and railway across southern Norway from Oslo to Trondheim (10 B), with a branch at Dombås leading to Åndalsnes (9 A).

The Österdal is followed by the river Glomma, which has a course of 400 miles from its source in the Rørosvidda, at 2,290 feet, to its mouth on the east of the Oslofjord. Below Lake Aursund, near its source, the river flows through forests, mainly spruce, in a deep valley about a mile wide. Below Koppang the width of the valley varies considerably, but it is generally wider and more cultivated. At Rena the tributary Renaelv joins on the east, flowing from Lake Storsjö through a deep, forested valley. Below Elverum the character of the valley changes (Fig. 13); there is extensive cultivation along the river and broad level stretches of forest and marsh on either side merge with the gently sloping forest-clad hills. At Kongsvinger the Glomma makes a sharp bend where, after the Ice Age, it changed its course from south-east to west. The south-east depression which formed the old valley of the river, affords a route, followed by road and railway, to Charlottenberg (1 V) in Sweden. Below Kongsvinger there is a series of rapids before the Vorma, flowing from Lake Mjøsa, joins the Glomma above Lake Öyeren, the only large lake on the river. Below the lake the country gradually opens out to the coastal plain, the river descending by seven large falls, Mörkfoss, Fossumfoss, Kykkelsrud, Vrangfoss, Vamma, Sarpfoss, and Hafslund, to the industrial region near its mouth on the Oslofjord. The falls are all harnessed for power to

supply Sarpsborg and Fredrikstad and the many farms of the undulating forested lowland. The current of the Glomma is swift, especially during the spring floods when the river is used for floating timber. The river is navigable for sea-going craft as far as the port of Sarpsborg. The Österdal is followed by both road (1 T, 10 A, 10 C) and railway from Oslo to Trondheim; routes into Sweden branch off eastwards, along the tributary valleys at Kongsvinger (1 V, 1 W), Flisa (1 X), Elverum (1 Y), Rena (10 J), Koppang (10 JJ), and Røros (10 M).

The Trysilelv is the most easterly of the great south-east-flowing rivers, and flows from Lake Femund through a deep, forested valley followed by a road (10 J, 1 Z) to the Swedish frontier.

III. *The Oslofjord* (Map 6)

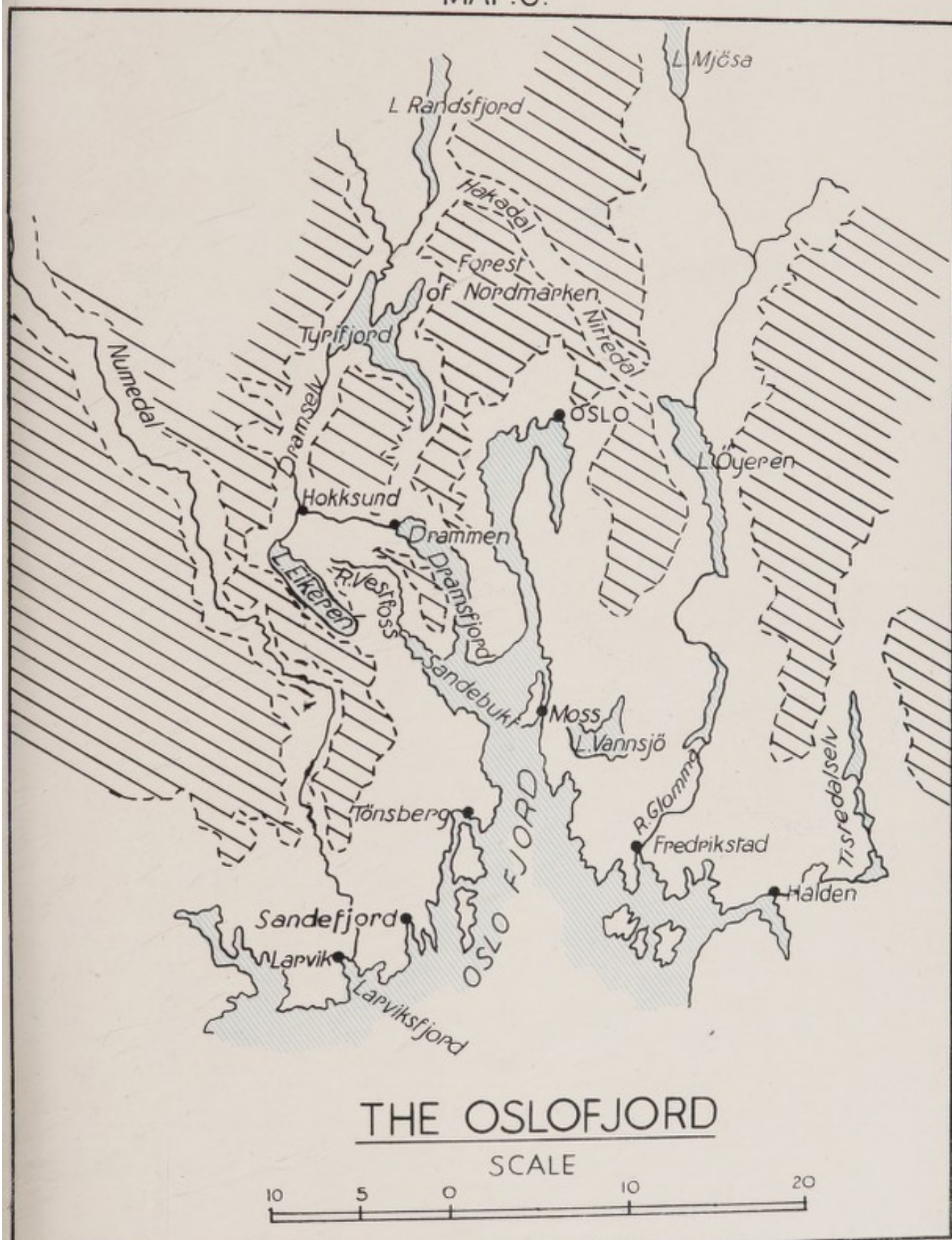
The Oslofjord region coincides roughly in the west and north with the area of volcanic rocks and sedimentary deposits, and in the east with the area of extensive superficial glacial deposits. Although this is the most important industrial region in Norway, there are large stretches of forested upland and undulating well-farmed country round the towns.

Between Larviksfjord and Sandebukt there is a broad stretch of open, cultivated country extending inland from Larvik, Sandefjord, and Tönsberg. This lowland is separated from the Numedal valley on the west by low, forested, volcanic hills, which continue north of Sandebukt between the valleys of Lake Eikeren and the river Vestfoss.

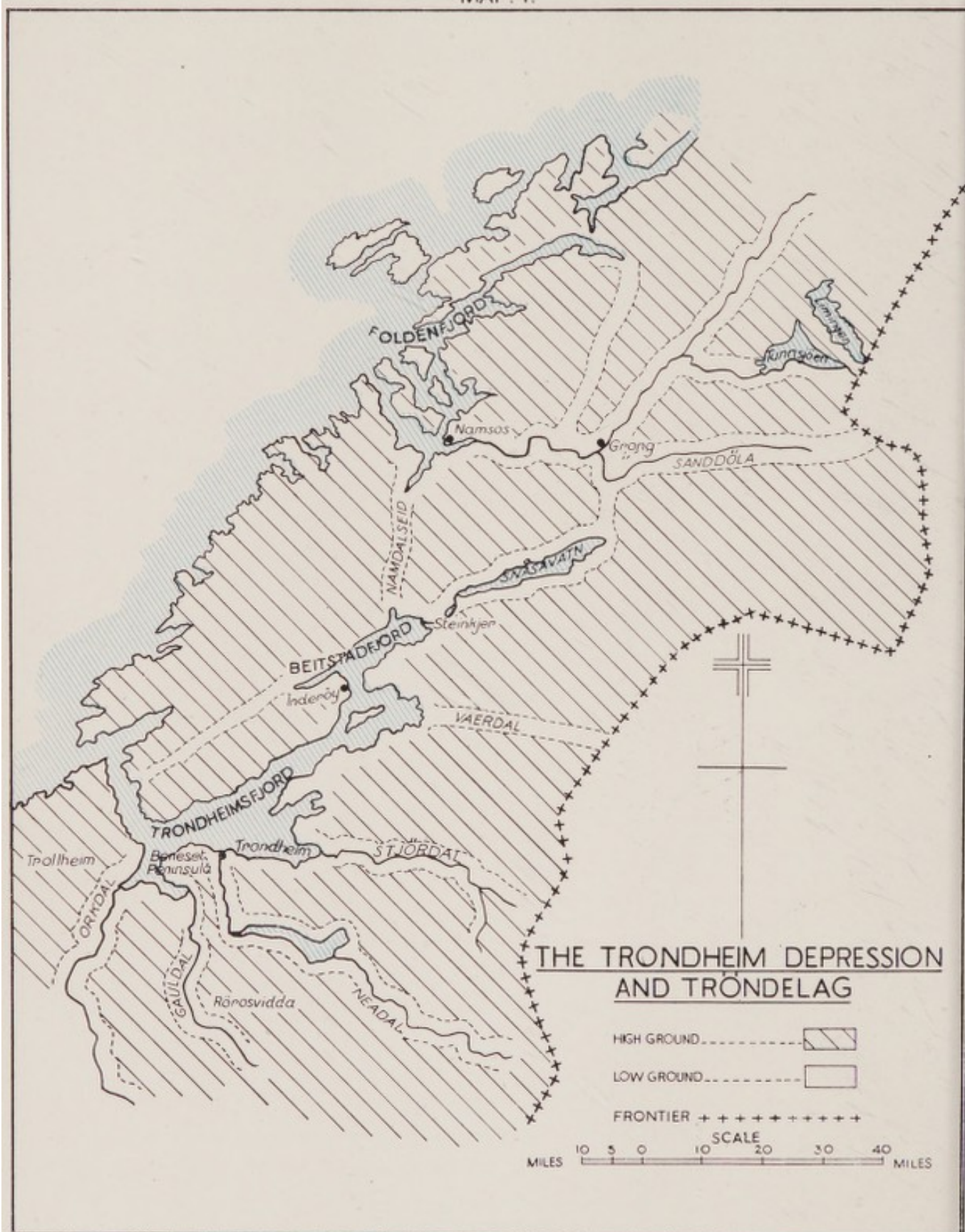
The Dramselv, draining the Tyrifjord, descends in a broad valley over the Gravfoss and Embretsfoss falls to Hokksund, where it turns sharply eastward and flows through a broad, cultivated valley to Drammen, at the head of the Dramsfjord. There is a wide and very well-farmed valley, formerly followed by a narrow-gauge railway, leading northwards from Drammen to the south-east end of the Tyrifjord. This broad lake lies between low, forested hills to west and east, while north of the fjord there is open, rolling country with large farms and patches of pleasant woodland.

Oslo itself lies in a small depression at the head of the fjord. Low, rounded, volcanic hills, covered with spruce and pine forest and with occasional marshy patches, extend westwards of the city. Immediately northwards of Oslo the hills rise higher in the forest of Nordmarken, but agricultural lands become more extensive again in Hakadal and Nittedal, which lead south-east to Lake Öyeren, and also near Lakes

MAP.6.



MAP. 7.



Randsfjord and Mjøsa. Oslo is the focal point for the communications of its own immediate district as well as for the whole of south-eastern Norway.

East of the Oslofjord there is a region of low relief with considerable cultivation and scattered patches of forest. Most of the network of small watercourses west of the Glomma flow to the Vannsjö, near the town of Moss. The plain is continued round the mouths of the Glomma and the Tistedalselv, which consists of a string of narrow lakes connected by short stretches of rapids. The important industrial towns of Fredrikstad and Halden stand in open forested country where these rivers flow into the Oslofjord.

The coastal regions of south-eastern Norway are described in Chapter III.

IV. *The West Coast Region*

This region is described in Chapter III.

2. NORTHERN NORWAY

There are five major topographical divisions of northern Norway:

- I. The Trondheim depression and its northerly extension of Namdalen, together with their enclosing highlands. This region includes the low-lying area of Sör Tröndelag and all of Nord Tröndelag.
- II. Nordland, including all of Helgeland and Salten as far north as Ofotfjord.
- III. The region between the Ofotfjord on the south and the Altafjord on the north. This region includes a small northern portion of Salten, most of Troms, and a small portion of western Finnmark.
- IV. The coastal islands between the Altafjord and Magerøy. The Lofoten and Vesterålen islands are also to be included in this fourth region.
- V. The plateau region of Finnmark, which reaches the coast east of the Altafjord and extends south-west towards the Lyngenfjord and into the inner parts of Troms.

In the course of the general topographical description of Norway the division of northern Norway into longitudinal belts was stressed (*v.s.* p. 20). Accordingly, in the detailed topographical description of northern Norway which follows next, these longitudinal divisions will, as far as possible, be stressed, the belts being described in sequence from the Swedish frontier towards the coast.

The coastal features will only be discussed here briefly in view of their description in Chapter III.

I. *The Trondheim Depression and Trøndelag* (Map 7)

(A) *The Eastern Highlands.* Towards the south of this region the eastern highlands form a northern extension of the Rørosvidda, the eastern end of the southern barrier. Here the highest altitudes are found. Storsola (5,610 ft.) and Sylane (5,092 ft.), both together on the Swedish frontier, and Oifjell (4,081 ft.), Forgen (4,786 ft.), and Storkskavern (3,871 ft.) form a ridge of highland extending between the Neadal on the south-west and the Stjördal on the north. The wide and deep Stjördal is followed by the railway from Trondheim to Stockholm. North of Stjördal a broken and well-rounded topography of fjeld country, mostly above 2,000 feet high but occasionally rising to over 3,000 feet, extends to the forested Vaerdal, along which runs the main road from Trondheim to Sweden (II A, II C). North of Vaerdal the barren fjeld is less extensive, being interrupted by forested areas of lower land, but isolated summits rise above 3,000 feet, Skjaerhattern (3,730 ft.) being the highest. The next break northwards is caused by the Sanddöla valley, along which a road runs from Namsos to Sweden (II D). Near the head of this valley and close to the frontier there rise the summits of Hartkjollen (4,560 ft.) and Penningkeisen (3,346 ft.). North of the Sanddöla valley the average height decreases somewhat, although heights over 3,000 feet are not uncommon, and Sipmeken rises to 4,695 feet. The most prominent features of this area of the highland are the large lakes of Limingen and Tunnsjö, both situated near the frontier and at heights of 1,385 and 1,165 feet respectively above sea-level.

(B) *The Lowlands* (Fig. 14). The dominant features of this belt are (i) the Trondheimsfjord, the Snåsavatn (lake), and their tributary valleys, and (ii) Namdal.

(i) The Trondheimsfjord extends for about 75 miles north-east of Thamshavn to Steinkjer. It is highly irregular in shape and varies greatly in width. Excluding the channel which cuts through the coastal range and connects the fjord with the open sea, the Trondheimsfjord consists of three main parts: (a) in the south, the narrow Orkedalsfjord and Gulosenfjord; (b) the main portion of the fjord extending from the Beneset peninsula in the south, north-eastwards to Inderøy, a distance of just over 50 miles. This section is about 30 miles wide in the south near Trondheim, but narrows to less than

4 miles in the north; (c) the most northerly section, the Beitstadvfjord, about 15 miles long (excluding narrow and irregular extensions) and about 5 miles wide, is connected with the main section of the fjord by the short and narrow Skarnsund channel.

Lake Snåsavatn is only about 12 miles to the north-east of the Beitstadvfjord, with which it is connected by a broad river and a series of small lakes. Snåsavatn is about 30 miles long, with an average width of about $2\frac{1}{2}$ miles, and lies at an elevation of 79 feet.

The country surrounding the Trondheimsfjord and the Snåsavatn is undulating and, particularly around the eastern shores of the Trondheimsfjord and near Trondheim itself, comprises a rich region of prosperous farms and extensive coniferous forests, very reminiscent of the region around Lake Mjösa in south-eastern Norway. The lower ends of the valleys tributary to the main basin are, as a rule, wide, flat, and well cultivated. Higher up their courses the valleys usually become much narrower, their slopes forest-clad, and their population more scattered. The more important of the valleys which afford routes leading to the adjacent regions are as follows:

- (1) In the south, through the southern barrier of the Dovrefjeld, Trollheim, and Rørosvidda, there are (a) the forested and cultivated Gauldal and Orkdal valleys, which provide through-routes to the great valleys of south-eastern Norway; and (b) the somewhat similar Surnadal and Drivdal valleys, which lead to the heads of fjords on the west coast.
- (2) In the east the forested Stjørdal, Vaerdal, and Sanddöla valleys all breach the barren fjeld of the Kjölen and provide routes leading into Sweden.
- (3) In the west, through the coastal mountains, there is the breach made by the Trondheimsfjord towards the open sea, and the Namdalseid. This latter valley leads to the head of the Lyingenfjord, a southerly branch of the Namsenfjord, and is followed by the Northern Trunk Road.

(ii) The lowland belt is continued northward of Snåsavatn by two valleys leading to the Sanddöla valley shortly before its confluence with the Namdal valley at Grong. The more easterly of these connecting valleys is the longer (20 miles long) and rises to about 700 feet; it is followed by the Nordland railway. The western valley is the more direct (10 miles long), but is much narrower and rises to about the same height; it is followed by the Northern Trunk Road (II A). Both valleys are forested, with marshy patches. West of Grong the Namdal cuts through the coastal mountains to Namsos,

at the head of the Namsenfjord. The lower Namdal is broad and well forested, but north of Grong it becomes narrower, less densely populated, and more forested. Finally, between Smalvatn (912 ft.) and Storemajavatn (1,132 ft.), both main road and railway from the south cross by a marshy gap into the Svenningdal and the lowland of Nordland.

The river Namsen, flowing along the Namdal into the head of the Namsenfjord, is the principal river of the Trøndelag region. It is about 118 miles long and has several notable falls, including Fiskemfoss, 105 feet high. Amongst the other rivers of this region the river Nid, flowing into the Trondheimsfjord at Trondheim, is important as a source of power owing to the Lurfoss falls. This river has a well-regulated flow as it drains Lake Selbu, but the Orkla and Gaula, the remaining principal rivers, are subject to great fluctuations of flow as they drain no important lakes.

(C) *The Coastal Highlands.* The coastal highlands are forested except for their highest parts and most of the coastal strip, which consists of fjeld and bare windswept outcrops. Agriculture is mainly confined to the heads of the more sheltered bays and fjords cutting into the highland, and to the eastern flanks where they merge into the lowland.

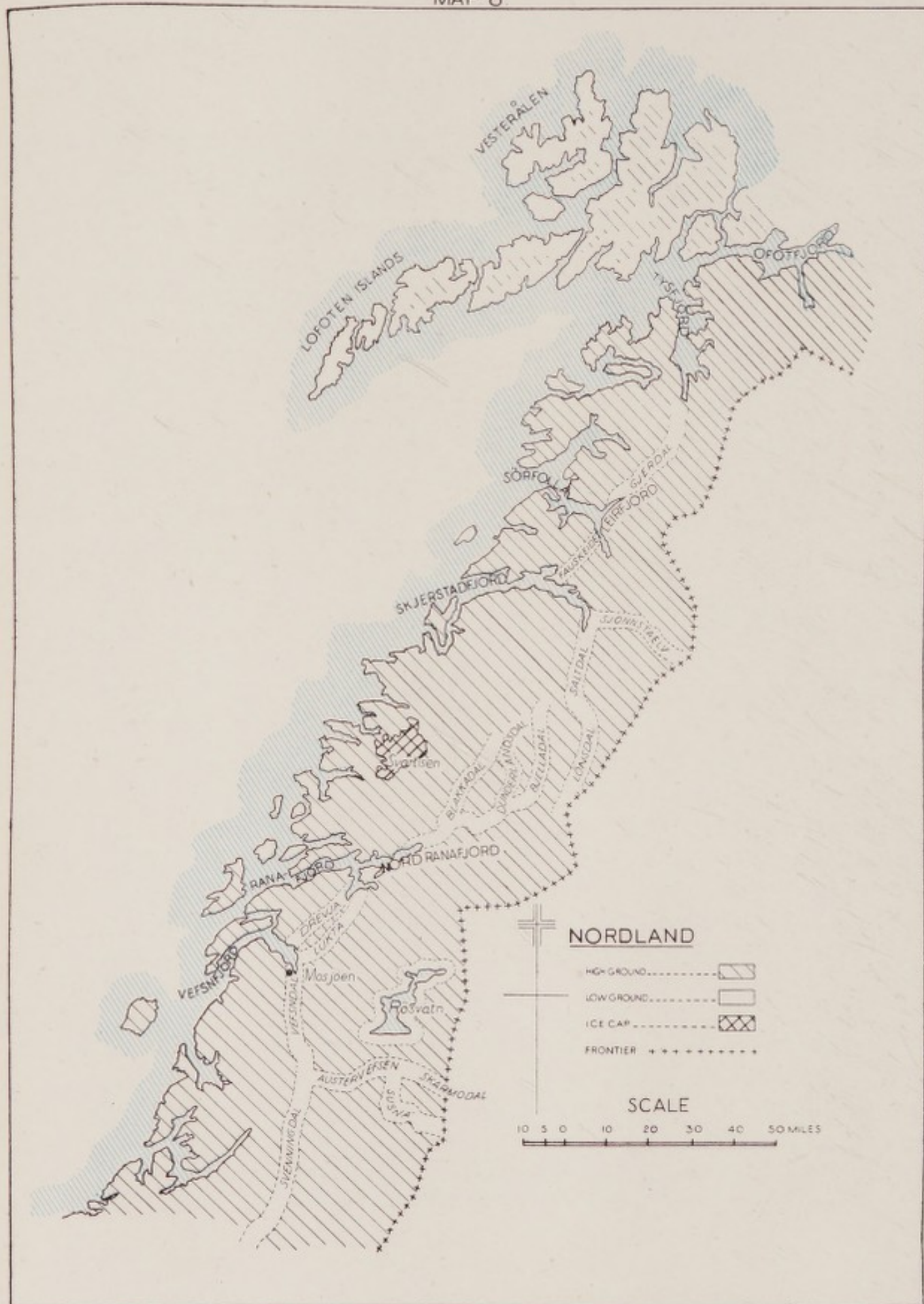
The continuity of the coastal highlands is interrupted principally by the Trondheimsfjord in the south, by the Namsenfjord in the centre, and by the Indre Foldenfjord near their northern margin. South of the Trondheimsfjord the highland consists of barren fjeld, interspersed with coniferous forests, and forms the northward prolongation of the Trollheim (*v.s.* p. 25). Its height varies between 1,500 and 2,000 feet inland and falls to about 750 feet near the coast. Between the Trondheimsfjord and the Namsenfjord similar heights prevail, the highest elevations occurring near the western shores of the Trondheimsfjord. This middle section is a difficult one to traverse as there are no motorable roads except along the coast. The deep, forested Namdalseid does, however, afford a transverse route from the head of the Trondheimsfjord to the Namsenfjord (11 A).

The coastal range between the Namsenfjord and the Indre Foldenfjord is more broken than farther south, but rises to higher elevations. Heights of over 1,500 feet are not infrequent near the coast; much of the central area is over 2,000 feet high, whilst the mountains flanking the Namdal rise to over 3,000 feet. Barren fjeld is more extensive here than in the other sections of the coastal range. The forests are confined to the valleys, and much of the coast is very bare and wind-



FIG. 14. *A scene typical of the lowlands of the Trondheim depression*

MAP 8



swept. Communications are poor. There is a road running parallel with the coast from the head of the Indre Foldenfjord to the lower Namdal and following for the greater part of the way a deep valley, with several large lakes, past scattered farms and forests (11 F). Otherwise there are no transverse routes except along the lower Namdal.

The skjaergård and strandflat are only moderately developed in the south of the region, but are prominent—particularly the skjaergård—towards the north, where the island of Vikna stands well out to sea.

All of the features which occur to the north of the Trondheim depression continue without interruption in the south of Nordland.

II. Nordland (Map 8)

(A) *The Eastern Highlands.* From the southern boundary to the Rösuvatn depression the Kjölen is bounded on the west by the Svenningdal and Vefsndal. The fjeld is here cut up by shallow valleys, many of which contain small lakes or patches of marshland. The general level of the fjeld is about 3,000 feet, but several snow-covered peaks rise above this level, notably Kvigtind (5,587 ft.), Löipskartind (5,446 ft.), and Skindfjeld (4,386 ft.). The only transverse valleys are those of the Austervefsen and the tributary Susna and Skarmodal, the two former being followed by a road almost to the Swedish frontier (11 G).

The Rösuvatn lake (1,227 ft.) lies in a depression surrounded by fjeld rising over 3,000 feet on all sides; Gjeittind (5,115 ft.) and Krutfjeld (4,603 ft.) are isolated snow-covered peaks rising immediately from the lake. The lower ends of the valleys leading into the Rösuvatn depression are broad and covered with spruce and birch forest.

North of Rösuvatn as far as Mo, on Nord Ranafjord, the fjeld is very broken. The Oskind range rises with glaciers and snow-covered peaks to Oksskolten (6,273 ft.). The general level of the fjeld is about 3,000 feet, but peaks such as Grasfjeld (4,649 ft.) and Junkeren (4,799 ft.) rise above it. There are many lakes and short, forested valleys generally running from east to west.

The fjeld extends north of the Nord Ranafjord in long north to south ranges about 3,500 feet high, divided from each other by the deep, narrow, pine-covered valleys of the Lönsdal and Saltdal, Bjelladal, Dunderlandsdal, and Blakkadal.

North of the Skjerstadfjord as far as Tysfjord, which cuts far into the country, the fjeld is again very broken; the mountains form ranges running in all directions and separated by narrow, lake-filled valleys.

The only transverse valley of importance is that of the Sjonnstaelv, leading from the head of the Skjerstadfjord itself to the copper-mines of Sulitjelma, which are served by a railway from the coast. Several snow-fields rise in isolated peaks above the level fjeld, the largest being Sulitjelma (6,283 ft.), Blåmannsisen (4,793 ft.), Hurrejiekna (4,183 ft.), and Björntopp (4,987 ft.).

North of the Tysfjord the country broadens. The highlands here extend from the coast to the Swedish frontier, and are cut into by several fjords and valleys, the longest being the Efjord and the Skjomen. The latter is continued inland by the forested Skjomadal and the Nordelvdal which leads east to the Swedish frontier. Several large snow-fields and glaciers rise above the fjeld, notably Giccecokka (4,488 ft.), Frostisen (4,282 ft.), Coarvvevarre (5,095 ft.), Storsteinsfjeld (5,896 ft.), and Blåisen (4,708 ft.).

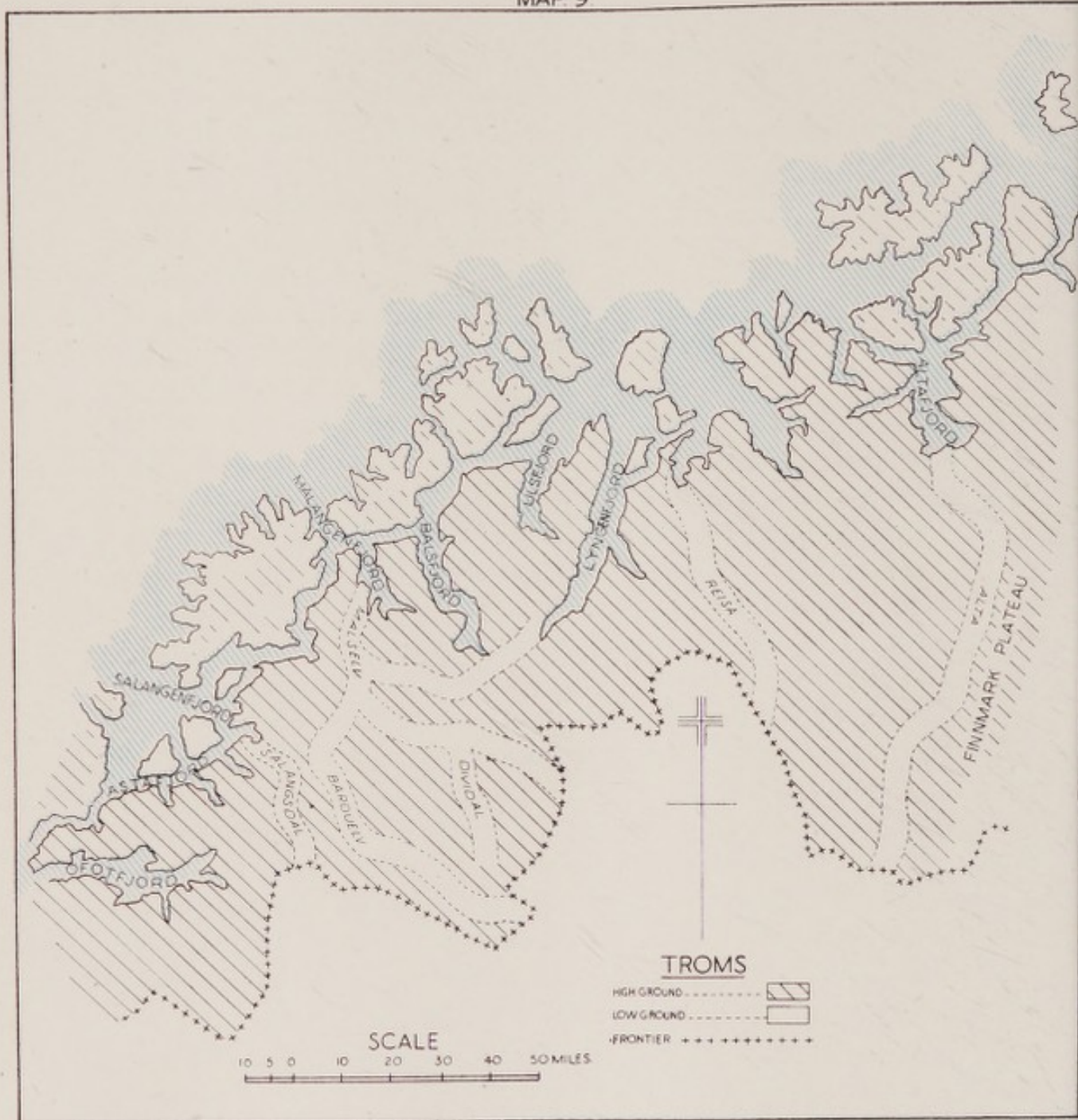
The Ofotfjord cuts inland almost to the Swedish frontier. The land south of the fjord and around its main branches is about 2,000 feet high, wooded and much broken by small, forested valleys, one of which, the Rombak, is followed by the iron-ore railway into Sweden from Narvik, near the head of the Ofotfjord.

(B) *The Lowlands.* The lowland in Nordland is very discontinuous, being represented by a series of valleys running from north to south and connected by cols, which give a through-route (11 A, 11 I) from Trondheim to Bodö on the Saltfjord. The Svenningdal, which is connected at its head with the Namdal valley across a marshy gap (*v.s. p.* 34) is a narrow, forested (spruce and birch) valley with many lakes lying in it, the largest of these being the Majavatn (1,132 ft.). The Svenningdal is tributary to the Vefsndal, which it joins where the latter turns north on leaving the eastern highlands. The Vefsna, after its confluence with the Svenningdalselv, flows in a broad valley, opening out as it approaches the head of the Vefsnfjord, where Mosjöen lies in a broad, birch-forested depression, with scattered patches of cultivation.

From Mosjöen the lowland is continued northward by the parallel Drevja and Lukta valleys, the Northern Trunk Road (11 A) following the latter. North of these valleys the lowland is submerged by the Sörfjord and the Nord Ranafjord. At the head of the Nord Ranafjord the town of Mo lies in a forested depression leading to several deep, forested, parallel valleys (*v.s. p.* 35) to the north. The largest of these is the Dunderlandsdal which is followed by the Northern Trunk Road (11 A) for a considerable distance before it crosses a col into the Lönsdal valley. The latter leads northwards into



MAP 9



the Saltdal, a deep, narrow valley with fir forests along its sides and scattered cultivation along its floor. The lowland is now interrupted by the Skjerstadvfjord, but reappears farther north in the Fauskeidet, a broad and marshy depression leading to the head of the Sörfolla and the Leirfjord, from which the narrow Gjerdal valley leads north to the Hellemofjord and the Tysfjord. North of the Sörfolla the Northern Trunk Road is interrupted by ferries, since the lowland is represented only by channels separating the coastal islands from the mainland.

(C) *The Coastal Highlands.* Between the Indre Foldenfjord and the Vefsnfjord the coastal mountains run in roughly three parallel ranges decreasing in height towards the coast; the inner range is about 3,200 feet high, the middle range about 2,700 feet, and the range nearest the coast normally less than 2,250 feet, but rising in Höiholmstind to 3,310 feet. The ranges are broken into by shallow valleys and small fjords such as Ursfjord, Velfjord, and Vistenfjord.

Between the Vefsnfjord and the Ranafjord these three ranges are less well defined and converge towards the inner Ranafjord. North of the Ranafjord lies the great Svartisen ice-field with about 230 square miles of snow surface and glacier tongues extending down the valleys leading to the heads of the many small fjords which dissect the coast.

North of the Svartisen glacier one range, interrupted by fjords such as the Skjerstad and Sörfolla, runs parallel with the coast, through such peaks as Palrakken (3,005 ft.), Snefjeld (2,690 ft.), Kistrandfjeld (3,491 ft.), Kobbvassfjeld (3,353 ft.), and Skonkefjeld (3,691 ft.) to the Tysfjord. The mountains west of this main range extend seawards in all directions and are cut up by many valleys, small fjords, and channels, which separate them into lofty islands and peninsulas.

III. Troms (Map 9)

The eastern highlands occupy the coastal part of the mainland in this region. The lowland belt is represented by the channel separating the islands, which form what was farther south the coastal highlands, from the mainland. The country is so narrow in the south of the region that the highlands, or Kjölen, occupy the whole width from the Swedish frontier to the coast. North of the Lyngenfjord the country broadens to about 100 miles; part of the plateau of Finnmark lies in the east, and the Kjölen still extends along the coast as far as the Altafjord.

The Mainland. Along the north of the Ofotfjord the land rises steeply to a narrow, forested plateau about 1,500 feet high, beyond

which massive and rounded mountains rise over 3,000 feet to barren fjeld. Their northern flanks form the southern shores of the Astafjord and are deeply incised by its southerly branches, the Grovfjord, Gratangenfjord, Lavangenfjord, and Salangenfjord. The valleys leading to the heads of these fjords are broad and pine-forested and are short, except for the Salangsdal which starts near the Swedish frontier. All of these valleys are connected with each other, with the Ofotfjord to the south, and with the Barduelv to the east, by a series of gaps which are followed by roads (11 A, 13 B, 13 C).

East of the Salangsdal the fjeld is higher, with summits rising above the plateau level to over 5,000 feet; of these the highest are Kistefjeld (5,653 ft.) and Njunnesvarre (5,472 ft.) near the Swedish frontier. The fjeld here is broken by the Målselv and its tributaries, the Barduelv and the Dividalselv. The Barduelv has its source in a series of lakes near the Swedish frontier, of which Lake Leinajavarre and Lake Alte (1,615 ft.) are the largest; below Innset it flows in a broad, deep, cultivated valley until the confluence with the Målselv. The Målselv has its source on the Swedish frontier in a lake, which also gives rise to a river flowing into Sweden. The upper Målselv and its tributary, the Dividalselv, both flow north-westwards in deep, narrow, forested valleys. After their confluence the valley of the Målselv widens and runs westwards until it meets the tributary Barduelv and finally turns northwards. Immediately above their confluence the Målselv and the Barduelv descend by mighty waterfalls into a broad depression, at the southern end of which Stind and Alapfjeld rise to over 4,800 feet. Northwards the fjeld on either side of the broad Målselv valley is lower and less wild. Both the Barduelv and Målselv are followed by roads in their middle and lower courses (11 A, 13 G, 13 F).

The coast north and east of the Malangenfjord is cut up into long, narrow peninsulas by the Malangenfjord, Balsfjord, Ullsfjord, and Lyngenfjord. These fjords converge southwards so that their heads are adjacent and are connected by a series of forested valleys (Fig. 15), which separate the fjeld to the south from the fjeld of the peninsulas and are followed by the Northern Trunk Road (11 A). These peninsulas have a wild and grand topography with mountains towering above the steep slopes of the rugged coast. The fjeld is about 3,000 feet high, but snow-covered peaks and glaciers, notably the Jaggevarre (6,283 ft.) and the Jagervandstind (5,544 ft.), rise above this level along the western shores of the Lyngenfjord (Fig. 21).

North-east of the Lyngenfjord as far as the mouth of the river Alta, the country is composed of remarkably flat, barren fjeld, about 3,000

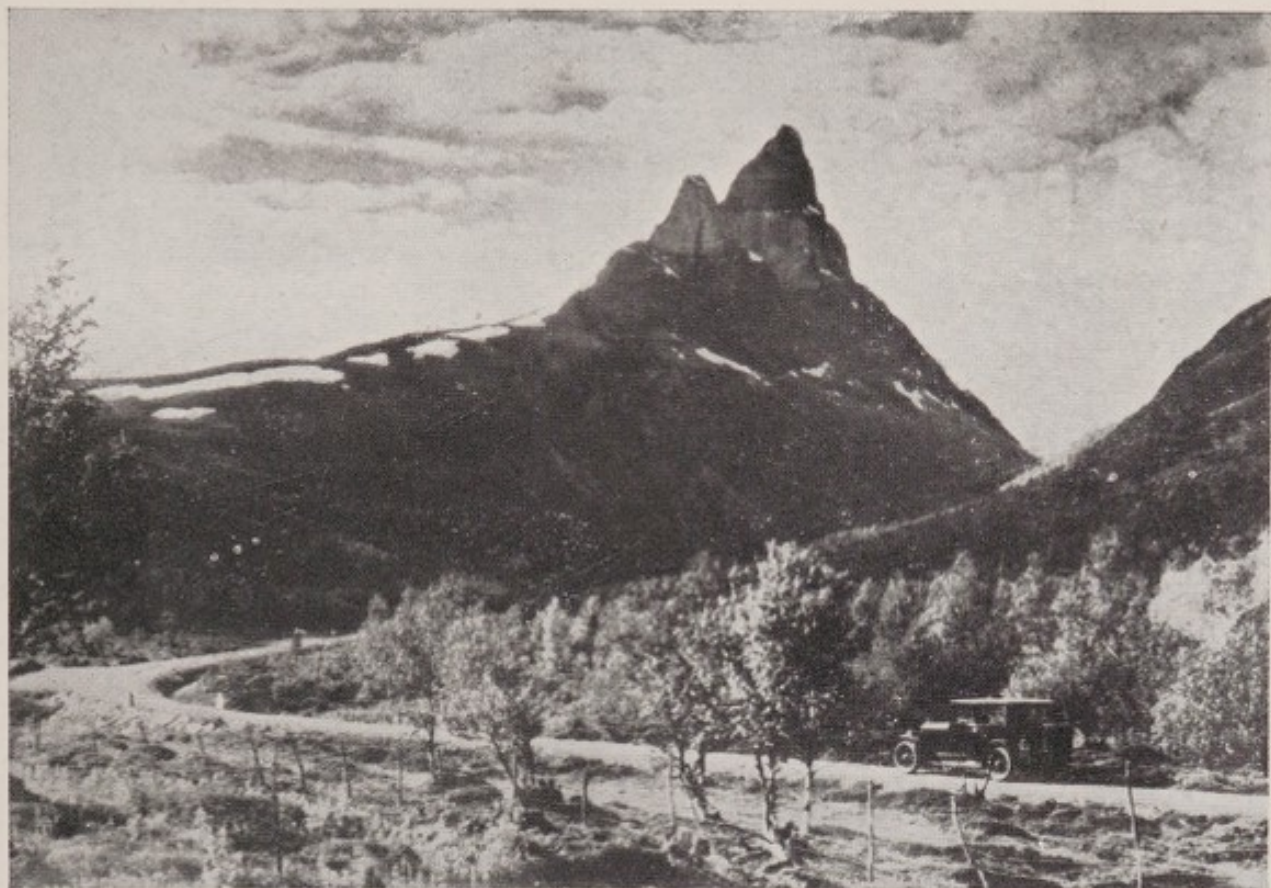
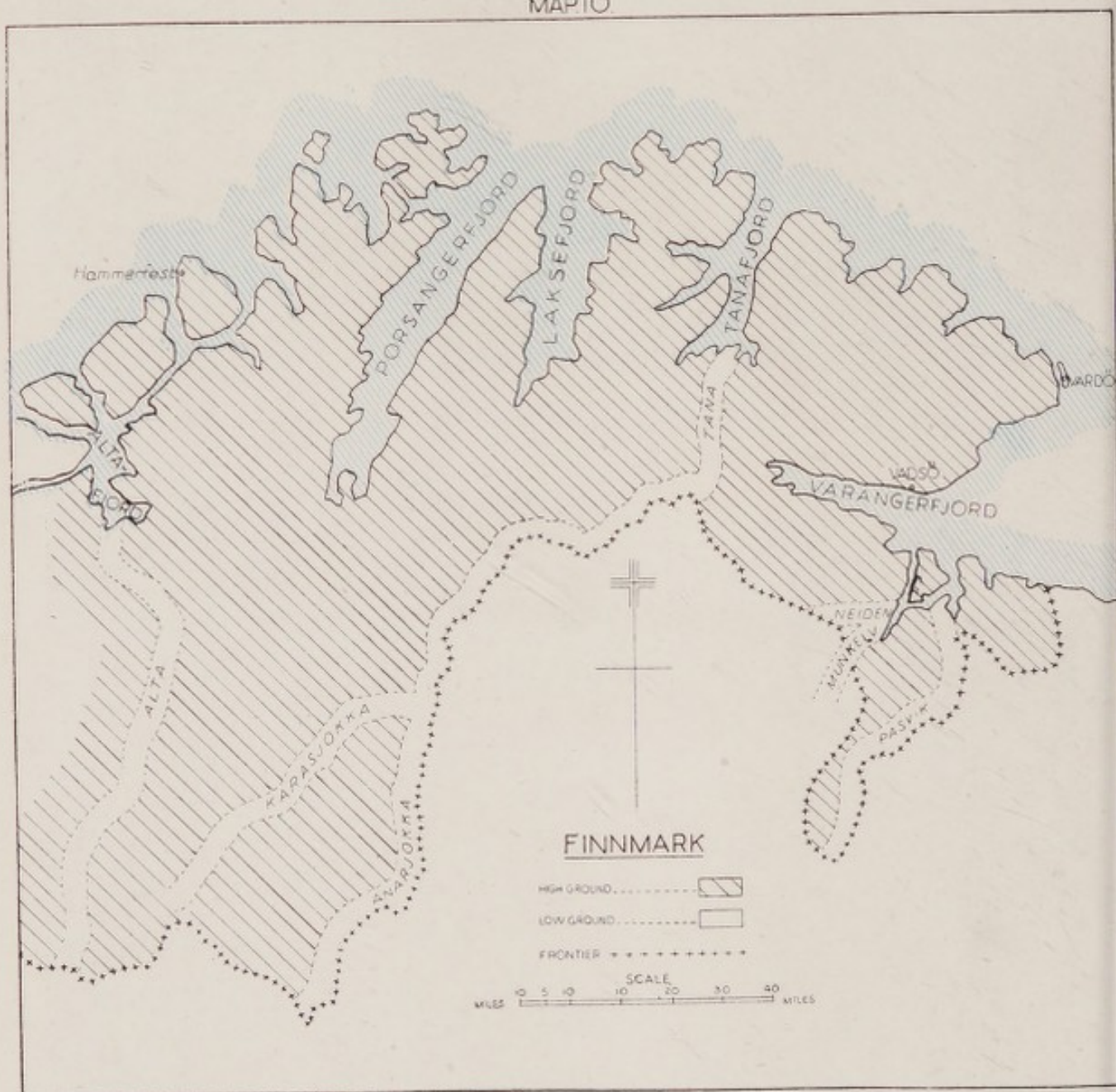


FIG. 15. *Troms (Balsfjord). A typical valley at the edge of the fjeld*



FIG. 16. *The North Cape and the plateau of Finnmark*

MAP IO



feet high; this is broken only by a few small valleys near the coast and the deep, narrow, forested Reisa valley extending north-west from near the Swedish frontier.

IV. *The Coastal Islands between the Altafjord and Mageröy*

For a description of these islands see Chapter III.

V. *Finnmark* (Map 10)

The plateau of Finnmark is a vast stretch of barren country extending from the western watershed of the Altafjord right across the northern part of Norway to the frontier with Finland. The highest parts, about 2,100 feet high, are in the north-west, whence the plateau dips to about 1,300 feet in the east and south-east.

The coast is generally formed by low, but steep, cliffs, unscreened by islands and exposed to the Arctic Ocean (Fig. 16). There are many open, exposed bays and several wide fjords, with few ramifications and smooth and uniform sides. The principal fjords are the Altafjord, Porsangerfjord, Laksefjord, Tanafjord, and Varangerfjord. All of them cut deeply southwards into the plateau, except the Varangerfjord, which penetrates westward, so that it is separated from the head of the Tanafjord only by a low gap.

At the head of the Porsangerfjord the Gaisene peaks rise to about 3,000 feet and the plateau extends inland beyond them. This bare windswept expanse of rock, snow-covered in winter and dotted with lakes, rolls mile after mile southwards and eastwards to the frontier with Finland. The plateau is dissected by numerous rivers with forested valleys, of which the Alta, Tana, Neiden, Munkelv, and Pasvik are the largest.

The Alta rises near the frontier with Finland at a height of about 1,600 feet, and flows northwards for 112 miles to the Altafjord. Its upper course, called the Kautokeino, consists of a series of long narrow lakes linked by short stretches of river, most of which are interrupted by rapids. Half-way along the course is the Nieiddagordsje waterfall. In most places the river flows in a deep, birch-forested valley, which broadens out towards the mouth of the river where the birch gives place to pine. Below the Svatso Falls (about 40 miles from the mouth) the river can be navigated by small boats, though rapids are frequent. Floods occur at the end of May, when the river rises 10 feet above its lowest summer level.

The Tana is formed by the confluence of the Karasjokka and the Anarjokka, the latter rising in Finland. The Anarjokka and the Tana

form the frontier with Finland for about 150 miles. The river has a low gradient; shoals and sandbanks are common and are continually changing, for, in the absence of lakes to regulate the flow, floods are frequent, the river rising 20 or 30 feet in early summer, when dams of ice also add to the dangers of flooding. The banks are low, with birch and pine forests extending for miles on either side of the river. The tide reaches 6 or 7 miles up the river mouth and enables small vessels to enter, while river boats can ascend as far as the confluence with the Karasjokka.

The Neiden rises in Finland and has only 12 miles of its course in Norway. It flows through a forested valley into the Kjölfjord, a branch of the Varangerfjord. There are several waterfalls along its course, notably Skoltefoss (52 ft. high), but boats can reach the frontier with portage round the falls.

The Munkelv rises in Finland and has only about 10 miles of its course in Norway; it is navigable and flows in a shallow forested valley into the head of the Kjölfjord.

The Pasvik forms the frontier with Finland for about 60 miles. It consists of a series of lakes linked by short, turbulent stretches of river with many waterfalls, of which Skiltefoss, Havefoss, and Holmfoss are the largest. The river can be navigated throughout by the shallow Lapp boats, and is followed by a road (14 G), which crosses the Finnish frontier.

Communications in this region are very restricted. The Northern Trunk Road (11 A) has been completed across the plateau from the Altafjord to Kirkenes, connecting the heads of the principal fjords. Otherwise, movement is mainly by reindeer track.



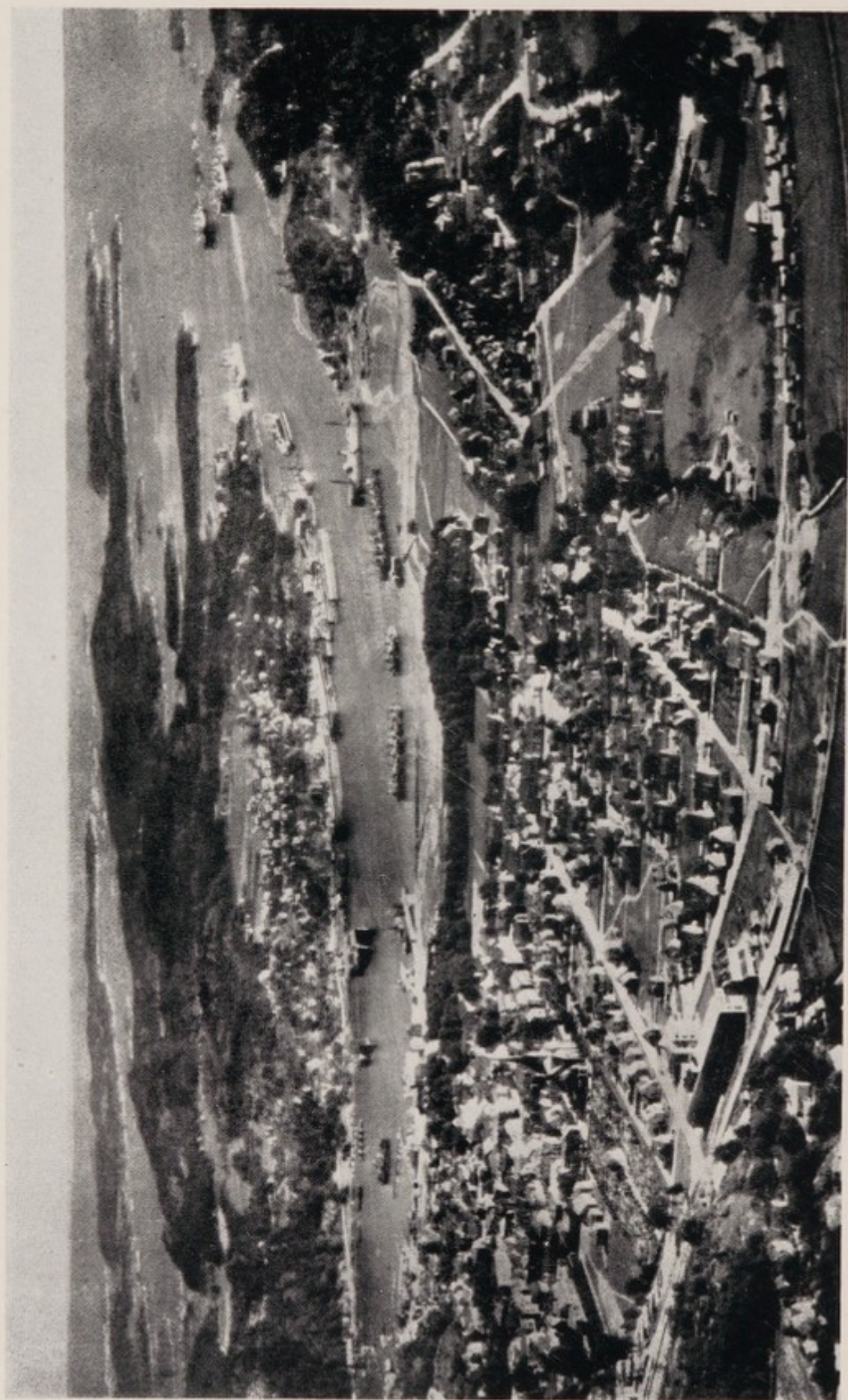


FIG. 17. Sandefjord, and lowlands typical of the south coast

CHAPTER III

THE COASTS

NORWAY is surrounded by a continental shelf, consisting of the submerged portions of the peneplain which appears above sea-level in the islands and the mainland. Its depth varies considerably, but is always less than 100 fathoms. The outer edge of the platform is comparatively close to the shore except in the Sunnmøre bank, the Halten bank, and the Lofoten bank, where it extends up to 100 miles offshore. These banks form the chief Norwegian fishing-grounds. The platform is least wide between the entrance to the Oslofjord and the Boknfjord where the Norwegian Deep, a remarkable channel about 400 fathoms in depth, follows the outline of the land.

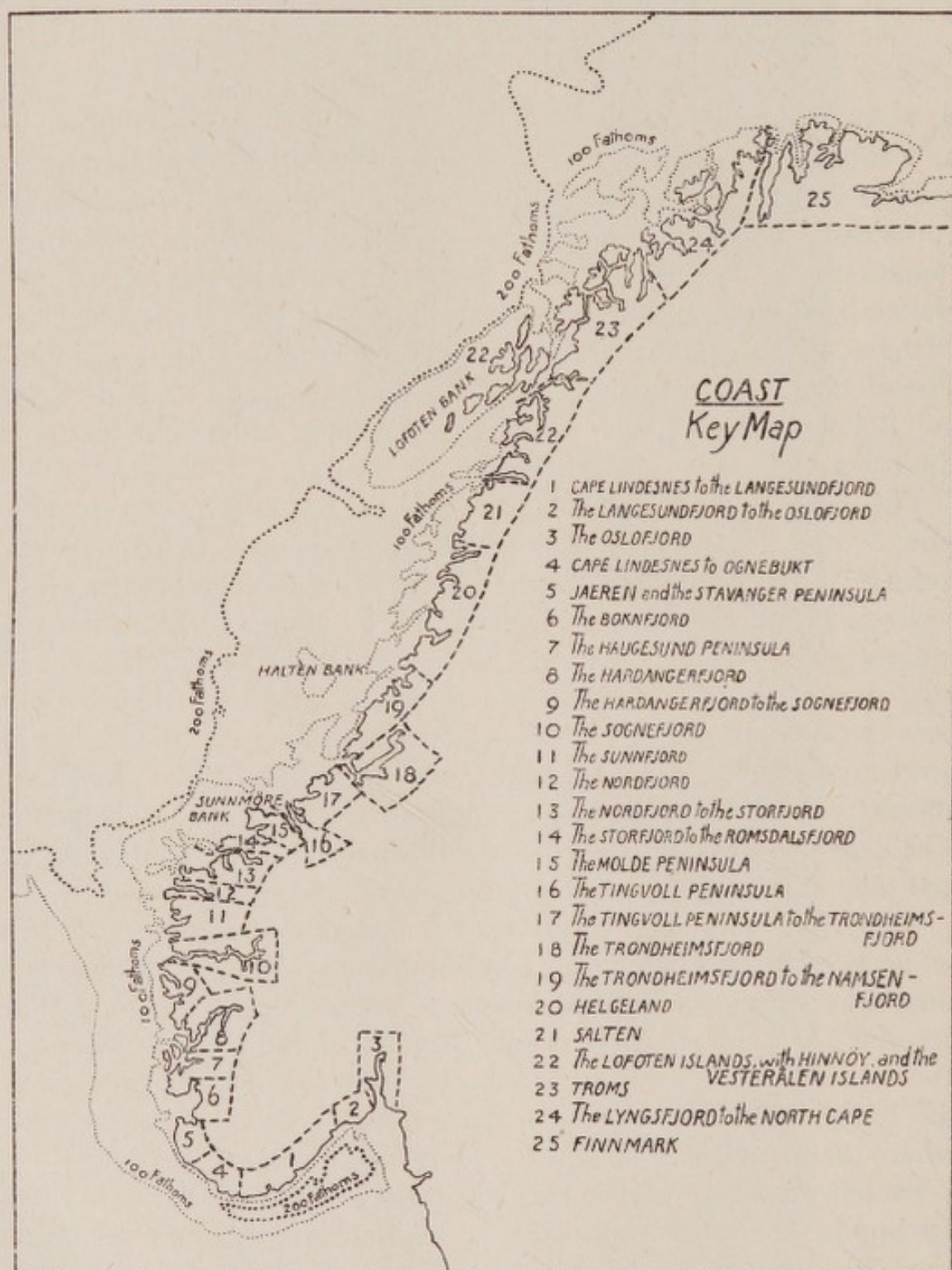
The great development of fjords gives rise to a coastline of extreme complexity. This is advantageous in that ships can penetrate many miles inland, but the rugged nature of the shores, often rising in sheer rock walls from the water's edge, restricts landing and confines penetration inland to a few definite routes. Jaeren, with its beaches and sand-dunes, is the one outstanding exception to this rugged coast; but here the seaward approaches are dangerous owing to the absence of protective islands. These islands, or *skjaergård*, fringe the shore almost without interruption as far north as the island of Mageröy. The deep channels between the islands are generally easy to navigate and they protect the coast from the prevailing westerly winds.

The coast, with the exception of the islands, has been described in detail eastwards from Cape Lindesnes to the Swedish frontier, and then northwards from Cape Lindesnes to the Finnish frontier. The account has been subdivided into sections as indicated on Map 11, and where possible each section begins with a general description of the topography, followed by a more detailed account of the parts where there are important routes, factories, or mines.¹

Sketch-maps are included for all sections of the coast where there are important routes or industries. The following symbols have been used throughout:

—————	Main road.
-----	Other motorable roads.
++++++	Railway.
++++++	Frontier.

¹ Fish-oil factories, which are shown on Map 48, have not been mentioned.



MAP 11

●	Town or hamlet.
△	Quayage or ports of call.
Ⓟ	Electric power station.
Ⓒ	Electro-chemical works.
Ⓜ	Electro-metallurgical works.
Ⓐ	Aluminium works.
Ⓡ	Iron works.
Ⓩ	Zinc works.
Ⓜ	Mines.

The list of ports of call has been compiled from references to steamer stopping-places in Bryde's *Norges Handels-Kalendar*, in time-tables, and in the *Norway Pilot*. Most ports of call, unless otherwise stated, are equipped with small wooden erections, but sometimes there are no special facilities.

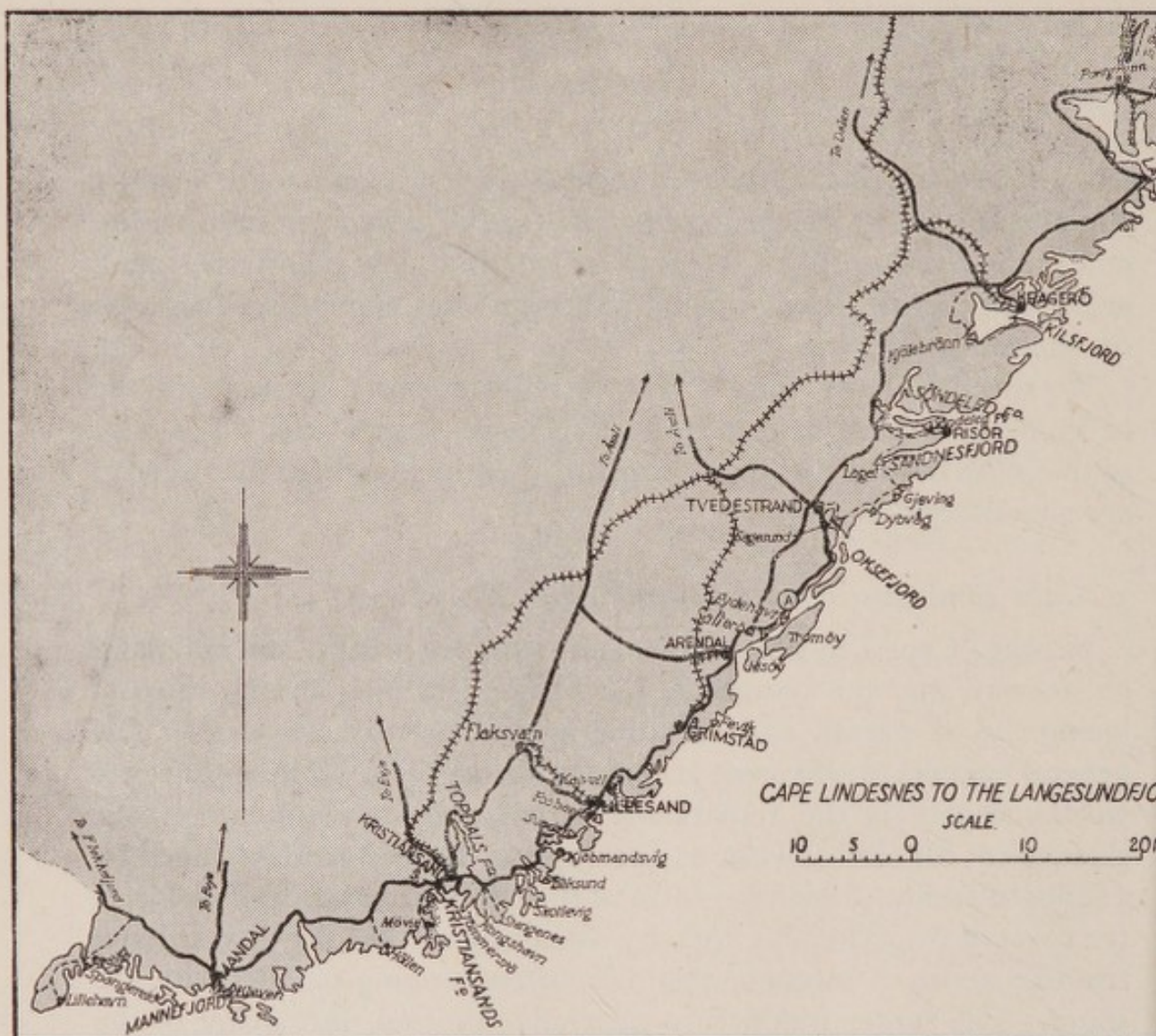
No specific mention is made of facilities at ports, those described in Volume II being marked by an *. The references after roads refer to the route numbers as they appear in Volume II, where the railways are also described.

1. *Cape Lindesnes to the Langesundfjord* (Map 12, p. 44)

Between Cape Lindesnes, the most southerly point of the mainland of Norway, and the Langesundfjord there is a long stretch of coast facing the Skagerrak and trending south-west to north-east. The general features of this coast are similar throughout. The most noteworthy aspect is the remarkable extent and development of the skjaergård; for almost without interruption the mainland is fringed by a series of reefs and islands. Most of the larger islands lie parallel with the coast of the mainland, thereby hindering access inland and giving rise to a series of intricate channels, often running parallel with the shore. The larger islands are generally forested, but many of the smaller ones are barren. The coast of the mainland is very similar to that of the skjaergård, consisting of low, undulating forested country with scattered patches of farmland. This type of country extends up to 10 miles inland before a steep rise begins (Fig. 17). In the south the coast is more barren owing to its more westerly aspect, which leaves it exposed to the open sea. There are no large fjords extending far inland such as are to be found on the west coast, but there are many inlets, of which the largest are the Kristiansandsfjord, Topdalsfjord, Oksefjord, Söndeledfjord, and Kilsfjord. Easily accessible beaches are rare.

Between Cape Lindesnes and the Kristiansandsfjord the direction

of the coast is approximately west to east. The islands of the skjaergård are large and numerous, but they are windswept and sparsely forested. Cape Lindesnes itself is a craggy headland at the southern extremity of a rocky and forested peninsula extending south-westwards from the mainland. The eastern shore of this peninsula is



MAP 12

served by a road, which can be reached from ports of call for coastal steamers at Lillehavn, Spangereid, Åvik, and Snig, leading to the main road from Farsund and Flekkefjord to Mandal (2 B, 3 E). There is also a considerable beach near Spangereid. The skjaergård is interrupted for a short distance by the Mannefjord, which leads to the port of Mandal* and its adjoining beach. The main road from Mandal to Kristiansand S. (2 B) can be reached from ports of call for coastal steamers at Tregde, Lunde, and Höllen (beach).

The Kristiansandsfjord and the Topdalsfjord together form by far

the largest inlet along the coast. The important town and port of Kristiansand S.* is at the head of the wide Kristiansandsfjord, the forested shores of which rise gradually to heights of about 300 feet. Along the western shore there are small beaches giving access to the road from Mövig to Kristiansand S.

Between the Kristiansandsfjord and Arendal there are many small islands, peninsulas, and channels, all parallel with the coast.

The coastal road from Kristiansand S. to the port of Lillesand* (2 L) can be reached from ports of call for coastal steamers on branch roads at Tømmerstö, Kongshavn, Stangenes, Skoltevig, Blik-sund (beach), Kjöbmandsvig, and Sundet. There are ports of call for coastal steamers at Fosbaek and Kalvell near Lillesand and a small beach north of the town.

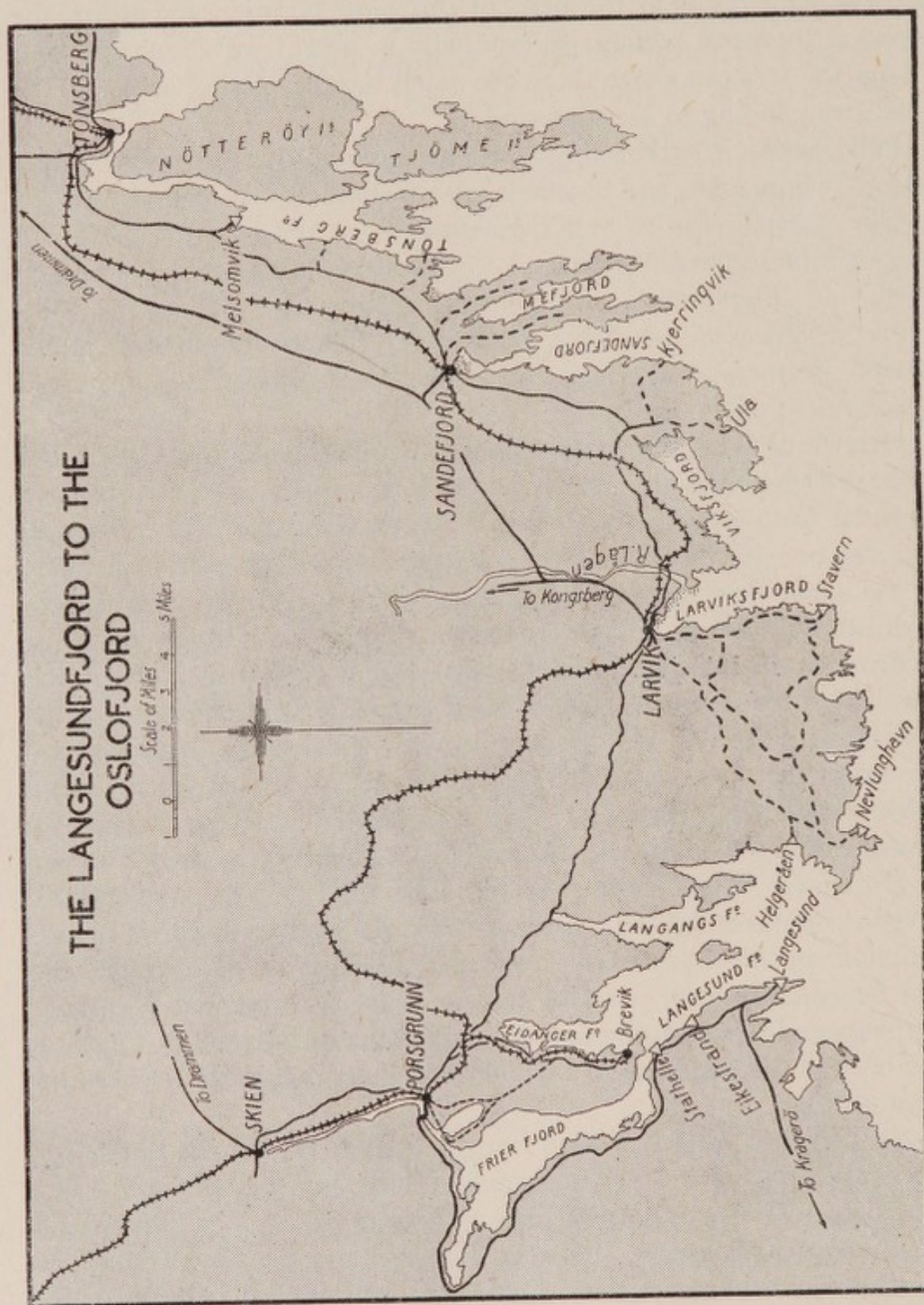
Grimstad* is on the western shore of the Vigkilen inlet, which has a beach at its head giving easy access to the roads from Grimstad to Arendal (2 A) and the branch railway to Grimstad. These routes can also be reached from a beach and port of call for coastal steamers in the small Fevikilen inlet. Beaches along the Grosfjord, south of Grimstad, also give access to the town.

From Arendal to Risör there is a series of large islands and channels parallel with the coast. The port of Arendal* is at the head of the Galtesund channel, which runs between the islands of Hisøy and Tromøy; the Tromöysund leads north-east from the port between the mainland and Tromøy. The new coast road from Arendal to Tvedestrand (2 A) can be reached from wharves at Salteröd and at Eydehavn, where there are aluminium works. The small port of Tvedestrand is at the head of the Oksefjord and is an important road-junction on the roads from Arendal to Risör (2 A). The coast road can be reached from ports of call for coastal steamers at Sagesund, Dybvåg, and Gjeving, and also from a beach and wharves at Laget, at the head of the Sandnesfjord which extends immediately west-south-west of Risör.

North-east of Risör*, which is at the eastern end of the Söndeled-fjord, the skjaergård consists of small islands, but the only access to a road before Kragerö* on the Kilsfjord is from a port of call for coastal steamers at Kjölebrönn. Between Kragerö and the Langesundfjord the skjaergård becomes more prominent again and it is not possible to obtain access inland from the rocky coast.

2. *The Langesundfjord to the Oslofjord* (Map 13)

The Langesundfjord is a broad channel much obstructed by many



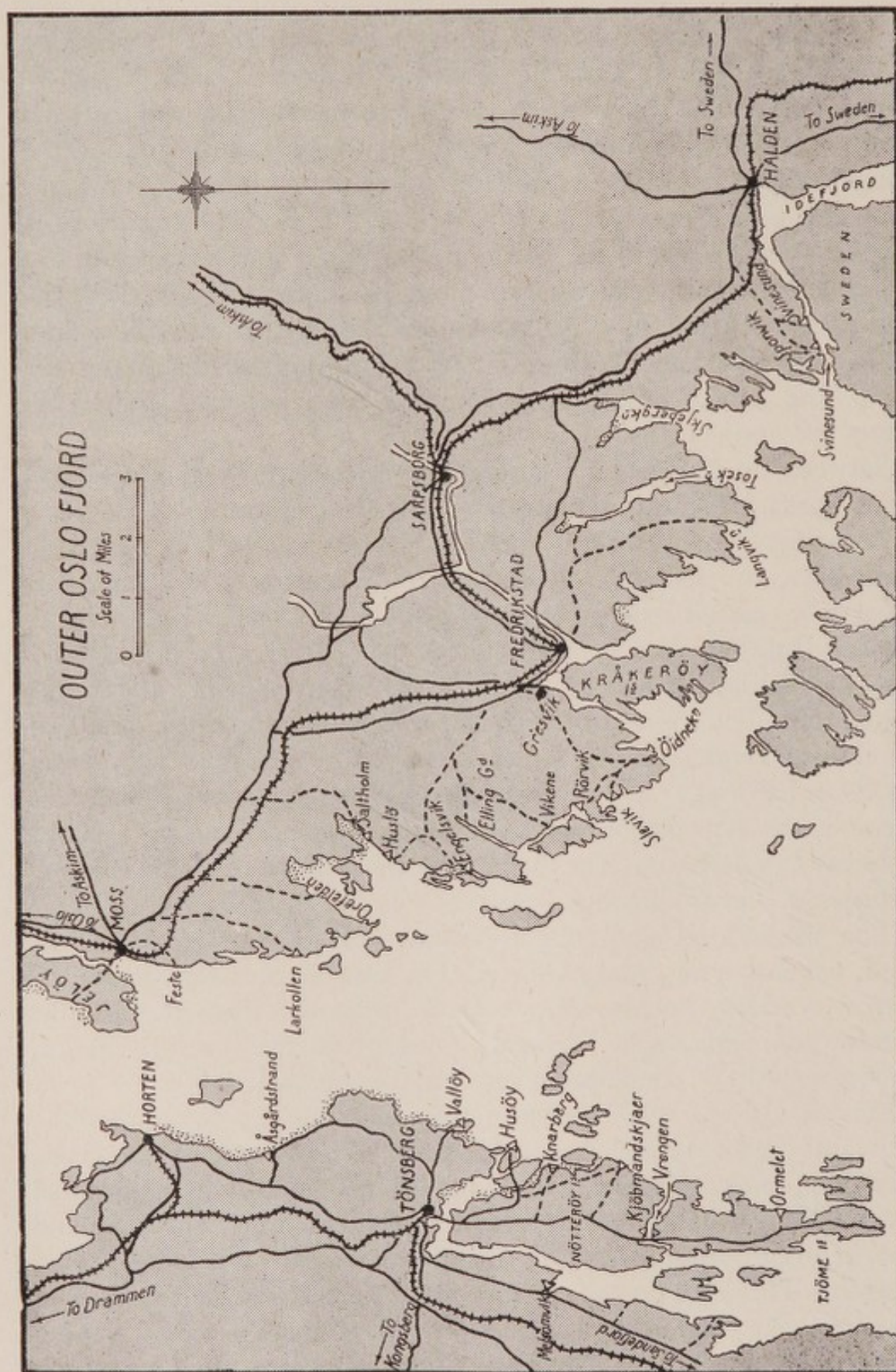
forested islands. Near its entrance there are wharves on the west at Langesund* and Eikestrand, with roads to Stathelle* and Skien and to Kragerö (2 A), and on the east at Helgeråen, with a road to Larvik (1 D). The shores of the fjord become steeper near its head where it branches to form the Frierfjord, the Eidangerfjord, and the Langangsfjord. The shores of these fjords are all forested and fairly steep and give routes along the coast and inland. The Frierfjord is important as it leads to the ports of Porsgrunn* and Skien* and has a number of commercial wharves along its shores. Brevik* is at the south end of the hilly peninsula separating the Frierfjord and the Eidangerfjord, and both road (1 A) and railway run inland from the port. The Langangsfjord gives access to the main road from Porsgrunn to Larvik (1 A).

Between the Langesundfjord and the Oslofjord there are several small fjords, which are separated by low-lying, forested country.

Immediately east of the Langesundfjord the coast is indented by small bays, and rocky islets lie offshore. The almost level, forested country is crossed by several roads leading to Larvik, which can be reached from wharves at Nevlunghavn and Stavern (Fredriksvaern). The Larviksfjord is a large bay with the important port of Larvik* at its head. The shores of the fjord are rocky except at the mouth of the Lågen river, where there are sandbanks and a small beach. Roads to the east (1 A, 1 E) cross the undulating, forested peninsula between the Larviksfjord and the Sandefjord and can be reached from the extensive beach at the head of the Viksfjord, which is much obstructed, and from branch roads at Ula and Kjerringvik.

The Sandefjord, with the important port of Sandefjord* at its head, has low-lying, rocky shores. The east shore is formed by the narrow Vesterøy peninsula, which is separated from the parallel Österøy peninsula by the Mefjord. These peninsulas are very similar, consisting of low-lying, hummocky and forested country.

East of Österøy the Tönsbergfjord penetrates deeply between the mainland on the west and the islands of Nötterøy and Tjöme on the east. The fjord is narrow, with many islands obstructing its channel and small bays along its shores, which are low-lying. The mainland rises gently through forest and scattered farmland to heights of over 200 feet. There is a port of call for coastal steamers at Melsomvik and a beach at the head of the Lahellefjord, where there is a road joining that from Sandefjord to Tönsberg. Tönsberg* is at the head of the fjord where there are extensive beaches and a channel, between the port and the island of Nötterøy, leading eastwards to the Oslofjord.



3. *The Oslofjord* (Maps 14 and 15)

The Oslofjord extends northwards from the Skagerrak for about 60 miles from 59° N. latitude. It is bounded on the south-west by the islands of Nötteröy and Tjöme, and on the south-east by the Swedish frontier. The fjord can be divided into outer and inner parts. The outer part, as far north as Horten, is broad and open; while the inner part branches to form the Sandebukt, the Dramsfjord, and the inner Oslofjord. The shores of the Oslofjord are nowhere very steep, the outer part being low-lying, undulating, and generally forested, while in the inner part rounded and forest-covered hills rise from the water's edge. There are many small, wooded, and rocky islands close to the shores near the entrance to the fjord and at its head, near Oslo.

Besides the numerous scattered farming communities in the region, there are the big industrial towns of Drammen and Tönsberg on the west, Oslo at the head of the fjord, and Halden*, Fredrikstad*, Sarpsborg*, and Moss on the east. These towns are all connected by road and railway and have good communication inland.

(a) *The outer fjord.* The outer fjord is about 25 miles broad at its entrance, but only 3 miles broad at Horten.

On the west coast the islands of Nötteröy and Tjöme are hilly, rising to about 200 feet, and there is considerable farmland as well as forest. A series of roads cross the islands, which are connected with each other and with Tönsberg by road bridges. There are ports of call for fjord steamers at Ormelet, Vrengen, Kjöbmandskjaer, Tenvik, Knarberg, and Husøy. Between Tönsberg and Horten* the coast is flat and forested with low hills rising inland. Small beaches extend along the greater part of the coast, and there are piers at Vallöy and wharves at Åsgårdstrand, giving access to a road from Tönsberg to Horten and Oslo (1 E, 1 A).

On the east, between the Svinesund and the mouth of the Glomma, the coast runs north-west. It is very indented by small inlets and there are many islands near the shore. These islands rise to about 100 feet and are generally forested. The mainland is undulating and forested, rising rapidly from the shore to about 300 feet. The lower land is well farmed. There are wharves at Sponvik and Svinesund on the Svinesund, with roads leading to Halden (1 J); and on the Idefjord, which runs south-east from Halden with Swedish territory on the west shore, there are wharves at Torp, Osdalen, Liholt, Hov, and Arebakke on the road (1 P) which follows the east shore to Halden. Most of the many inlets have beaches at their heads and there is also

a large bank, dry at low water, to the east of the mouth of the Glomma; there is, however, road connexion with Halden and Fredrikstad only from Skjebergkilen, Tosekilen, Langvikkilen, and Öidnekilen and from the wharf and beach at Gresvik.

From the mouth of the Glomma to Jeløy island the coast runs northward, with fewer offshore islands. There are still many small inlets with beaches at their heads and roads run inland from Vikene, Ellinggård, Huslö, Orefelden, and Feste. There are ports of call leading to roads (1 J) at Slevik, Rörvik, Engelsvik (wharf), Saltholm (quay), and Larkollen (pier). Jeløy island is only separated from the mainland by a canalized channel, which is crossed at Moss* by a road bridge. The island is forested and hilly, and the low-lying coast has several small beaches in the west, giving access to lanes leading to Moss.

(b) *The inner fjord.* North of Horten the fjord broadens before branching to form the Sandebukt, the Dramsfjord, and the inner Oslofjord. The main fjord, as far as Dröbak, is narrow and straight, with fairly steep, forested shores, rising to about 400 feet, and many small houses near the water.

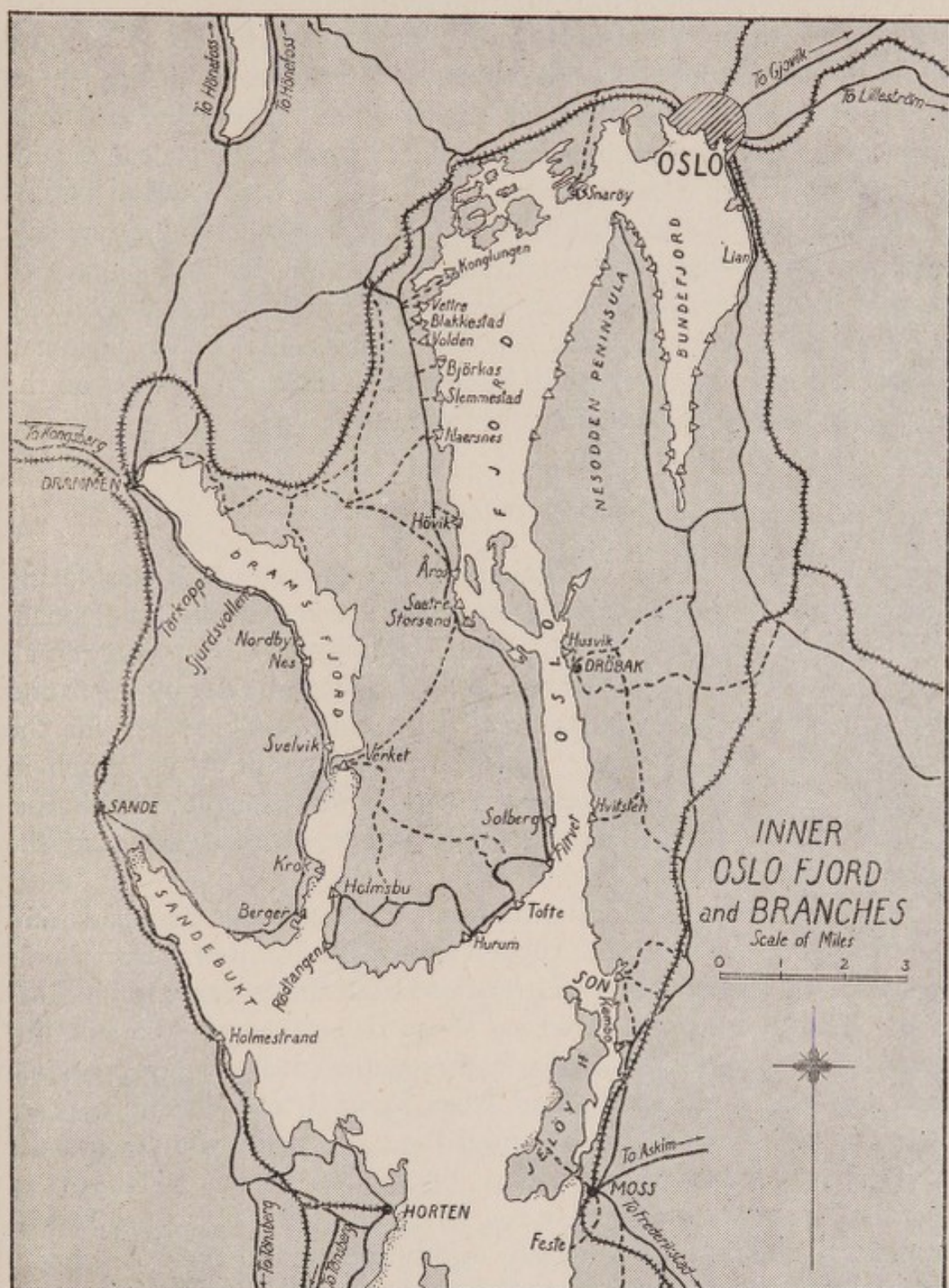
On the west there is a road (1 H) following the shore from Hurum to Oslo, with ports of call for coastal steamers at Hurum (wharf), Tofte (quays), Filtvet, Solberg, and Storsand.

On the east the main road (1 J) and railway from Moss to Oslo bear inland and can be reached by branch roads from wharves at Kambo, Son, Hvitsten, Dröbak*, and Husvik.

North of Dröbak the fjord broadens. The shores are still fairly steep, especially those of the Nesodden peninsula on the east, where there are several ports of call for fjord steamers. The west shore becomes flatter and fringed by many low, forested islands. The road from Hurum to Oslo (1 H, 1 A) runs near the shore with ports of call for fjord steamers at Sætre, Åros, Høvik, Naersnes, Slemmestad, Björkas, Volden, Blakkestad, Vettre, Konglungen, and Snarøy.

Oslo* lies in a small depression at the head of the fjord, with forested hills rising west and north of the city. The Bundefjord extends southwards from Oslo, with the Nesodden peninsula on the west and the mainland on the east. There are many ports of call along its fairly steep and forested shores. The main road (1 J) and railway from Moss to Oslo follow the shore only north of Lian.

Sandebukt is a small inlet running north-west from Horten. The west coast rises steeply to 600 feet, while the east coast is less steep and lower, rising to 300 feet. Both shores are forested, but there is scattered farmland. Sande is in a broad, well-farmed valley which



MAP 15

leads inland from the head of the inlet, where there is a large beach. There are roads on both sides of the inlet (1 A, 1 G) and a railway on the west from Holmestrand* and the south.

The Dramsfjord runs north-north-west from Horten. The fjord has fairly steep, forested shores with several level promontories, one of which at Svelvik almost blocks the channel. There are scattered farms along the shore, but except for factories at Berger, near the entrance to the fjord, there are no large industrial centres south of Drammen*, which is at the head of the fjord on the inflowing Dramselv. The road (1 G) from Sande to Drammen follows the west shore with wharves at Berger, Krok, Nes, Nordby, Sjurdsvollen, and Törkopp and beaches at Berger, Krok, and Svelvik. Roads (1 H) to Oslo can be reached from wharves at Rødtangen, Holmsbu, and Verket on the east, and there is also an extensive beach near Verket.

4. *Cape Lindesnes to Ognébukt* (Map 16)

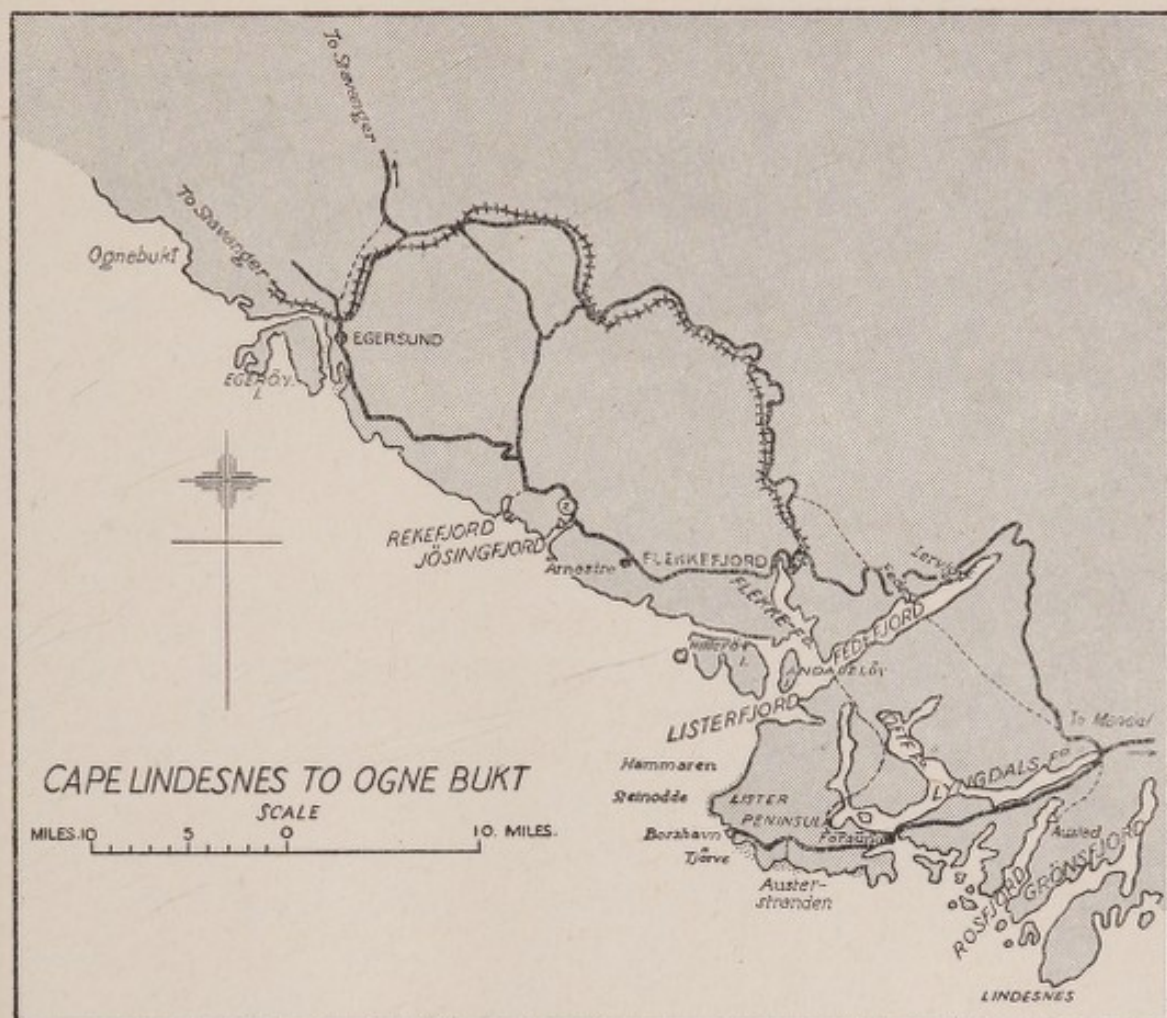
From Cape Lindesnes to Ognébukt the coast runs north-west facing the open sea. From the cape to Årnasira there is a skjaergård of small, rocky islands and the coast is indented by long fjords branching in all directions. North of Årnasira the coast is indented only by inlets and the skjaergård is reduced to small islets and reefs, except for the island of Egerøy (Ekerøy). The coast throughout varies much in height and is sometimes forested, becoming more barren northwards. There are several small beaches, but except where these occur the coast is rocky and difficult of access.

The Grönsfjord, extending between the Lindesnes peninsula and the mainland, has steep and rugged shores. A group of rocky islands separates the entrance to the Grönsfjord from the entrance to the Rosfjord. The shores of the latter are steep, rising to about 500 feet, but there is a port of call for small coastal steamers at Austad on a branch road leading to the main road from Mandal to Flekkefjord (2 B). Between the Rosfjord and Farsund there are many islands and the coast is very indented and rocky, but not very steep. The port of Farsund* is at the entrance to the Lyngdalsfjord. This fjord and its branch, the Oftefjord, penetrate deeply inland and their steep, and generally forested, shores rise to about 600 feet.

The Lister peninsula, lying west of Farsund, is very undulating. In the south-west it is low-lying, but in the north-east it rises to heights of about 800 feet. In the south-west there are several patches of marshland and extensive farmland, and the low-lying coast is sandy.

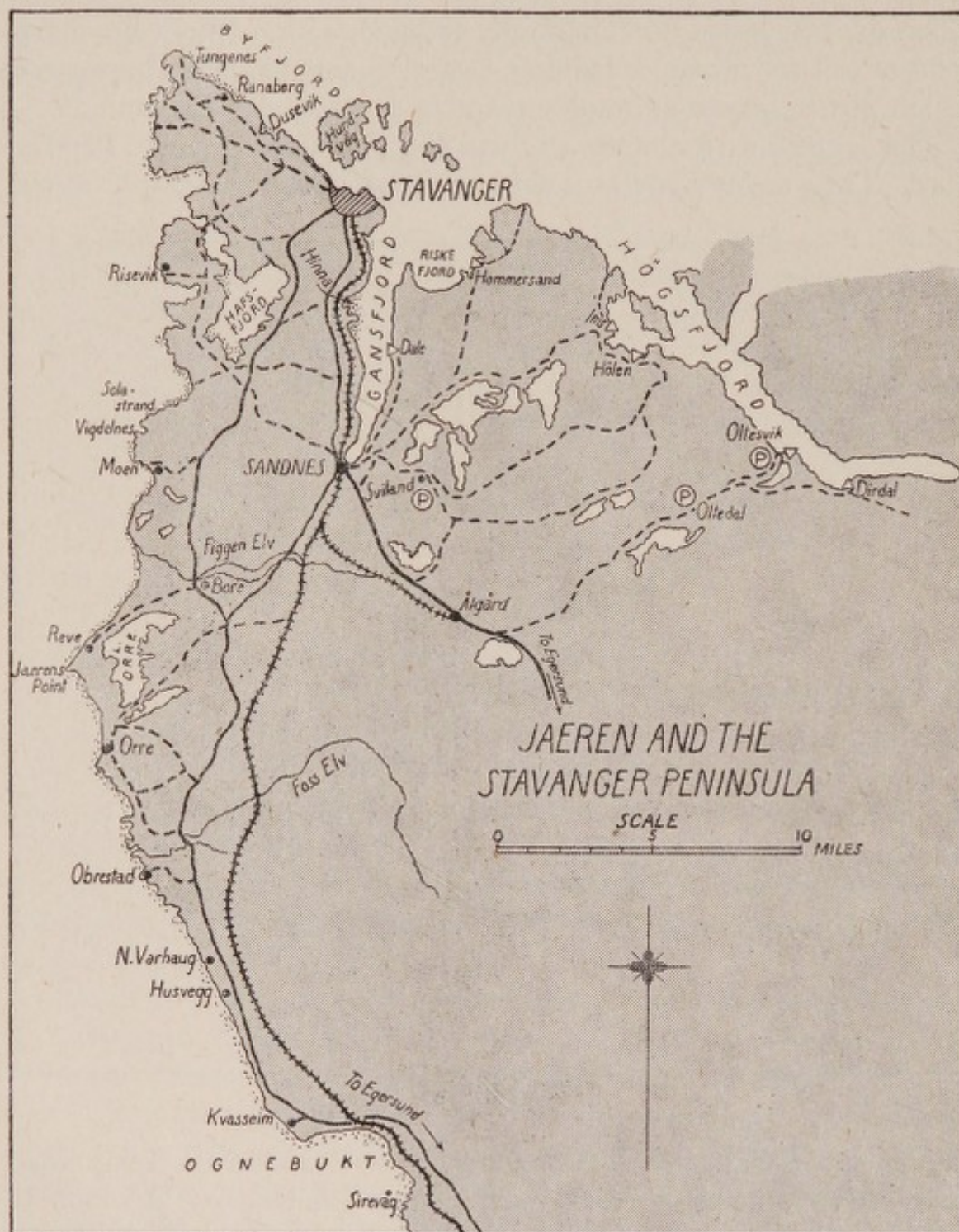
There are beaches at Austerstranden (wharf), Tjörve (pier), Borshavn (port of call for coastal steamers), east of Steinodde, and Hammaren which give access to motorable roads (2 K) leading to Farsund.

The Listerfjord branches to form the Fedefjord and the Flekkefjord. The narrow Fedefjord runs north-east between steep forested



MAP 16

shores, often rising to about 1,000 feet. Access to the main road (2 B) from Mandal to Flekkefjord can be gained from a beach at Lervig and from wharves at Fede and Lervig. The Flekkefjord, running north-west, has steep shores until near the port of Flekkefjord* at its head. The large, hilly islands of Andabeløy and Hiterøy lie north of the Listerfjord. The coast of the mainland behind these islands, and as far west as Årnasira, rises steeply to heights of about 800 feet. North-west of Årnasira the coast is craggy and treeless, rising steeply to about 600 feet, and is indented only by several small inlets. Of these the Jösingfjord is followed on its eastern shore by the main road from Flekkefjord to Egersund (3 A) and has an old zinc



MAP 17

factory with a wharf near its head. This road can also be reached by a secondary road from a wharf at Rekefjord.

The port of Egersund* is sheltered from the open sea by the low-lying island of Egerøy. Between Egersund and Ognabukt the coast is steep and rocky, but it does not rise above 100 feet. There are a few patches of poor farmland but very few trees, and the whole landscape is wild and inhospitable.

5. *Jaeren and the Stavanger Peninsula* (Map 17)

The coast of Jaeren (Jaederen) between the Ognébukt and Vigdelnes is different from any other part of the coast of Norway. There is a 28-mile stretch of sandy beach backed by sand-dunes and shallow lakes and giving access to flat agricultural land which extends several miles inland before being replaced by heath-covered hills about 1,000 feet high. The coast is generally treeless owing to exposure, although recently several tracts have been planted with fir.

There are no islands or fjords to break the even stretches of beach of the coast of Jaeren itself, but on the Stavanger peninsula there are offshore islands, stretches of rocky coast, sandy bays, and several large inlets.

The Stavanger peninsula extends northwards from Vigdelnes towards the Boknfjord (*v.i.* p. 56), with the Byfjord and Gansfjord on the east. It has low-lying agricultural land with several small stretches of sandy beach, especially on the west (Fig. 18). East of the Gansfjord the country is high moorland descending abruptly to the rocky coast of the Högsfjord.

The Ognébukt is steep and rocky south of Sirevåg, where it decreases abruptly in height and forms an extensive beach of white sand, backed by dunes behind which the main road (3 A) and railway from Egersund to Stavanger run near the shore. Near Kvasseim light, at the north-western entrance to the Ognébukt, two motorable lanes lead inland to the main road, which continues northward about half a mile from the beach and can be reached by two more motorable lanes from the coast at Husvegg and N. Varhaug. The railway is farther inland.

Approaching Obrestad lighthouse the beach is narrower and the coast less flat. Motorable lanes join the main road from the lighthouse and from the south side of the mouth of the Fosselv (river), which meanders across the plain. Having crossed the river the main road (3 A) bears inland and a secondary road runs about half a mile from the beach. At Orre church this road also bears inland because of the large shallow Lake Orre which lies behind the sand-dunes of Jaeren's Point. North of the Point the coast runs north-eastward and a secondary road from Reve follows it for about a mile before bearing inland to avoid the marshy land near the mouth of the Figgeneelv, which the main road crosses at Bore. North of the river the main road runs about 2 miles inland with several small lakes between it and the coast. Here

the only motorable lane from the coast to the main road runs from Moen, immediately south of Vigdelnes.

Vigdelnes marks the southern end of the Stavanger peninsula. The headland is rocky and rises quite steeply to 226 feet. Immediately to the north is the famous Solastrand bathing-beach, a sandy and sheltered bay from which a good motor road (3 A) runs inland to the main road. A secondary road (3 D) branches north-west from the main road and crosses the small peninsula between the open sea and the Hafsfjord. This road, which is joined by a motorable lane from Risevik, crosses the mouth of the Hafsfjord by a swing bridge. The peninsula is low and hummocky, and has good farmland.

North of the Hafsfjord the Stavanger peninsula is very narrow and low-lying. The coast has small sandy beaches on the west (notably Sandebukt) but is rocky on the east, except in Dusevik bay. Secondary roads from Tungenes and Dusevik converge southwards on Stavanger and can be reached from the beaches.

Stavanger* is built on a low promontory off the east coast, at the entrance to the Gansfjord. There are many low, rocky islands lying off the town, the largest of which is Hundvåg. The Gansfjord extends southwards from Stavanger with the port of Sandnes* at its head. The west shore of the fjord is low-lying, and rocky except for bays at Hinna, where there are beaches giving access to the main road (3 B) and railway between Sandnes and Stavanger. The east shore rises steeply to about 600 feet, and the narrow coastal terrace is followed by a road from the wharf at Dale asylum to Sandnes (3 F).

The Högsfjord extends south-eastwards into the mainland from the entrance to the Gansfjord. The shores of the fjord are steep, rising to about 1,000 feet, with forested slopes and rounded moorland summits. There are many lakes on the moors, some of which have been used for the generation of electric power at their outlets, as at the large stations of Oltedal and Oltesvik and the small one near Sviland. A series of roads (3 F) converge on Sandnes from ports of call for coastal steamers at Hommersand on the Riskefjord and at Ims, Höle (Hölen), Oltesvik, and Dirdal on the Högsfjord.

6. *The Boknfjord*

The Boknfjord extends between the Stavanger peninsula on the south and the Haugesund peninsula on the north. The fjord consists of a broad bay in which there are numerous islands. There are also many small fjords and inlets along the shores of the bay forming a very irregular coastline from which mountains rise, sometimes steeply,



FIG. 18. *Randaberg. Lowland typical of Jæren and the Stavanger peninsula*



FIG. 19. *The Stadland peninsula and Ervik bay*



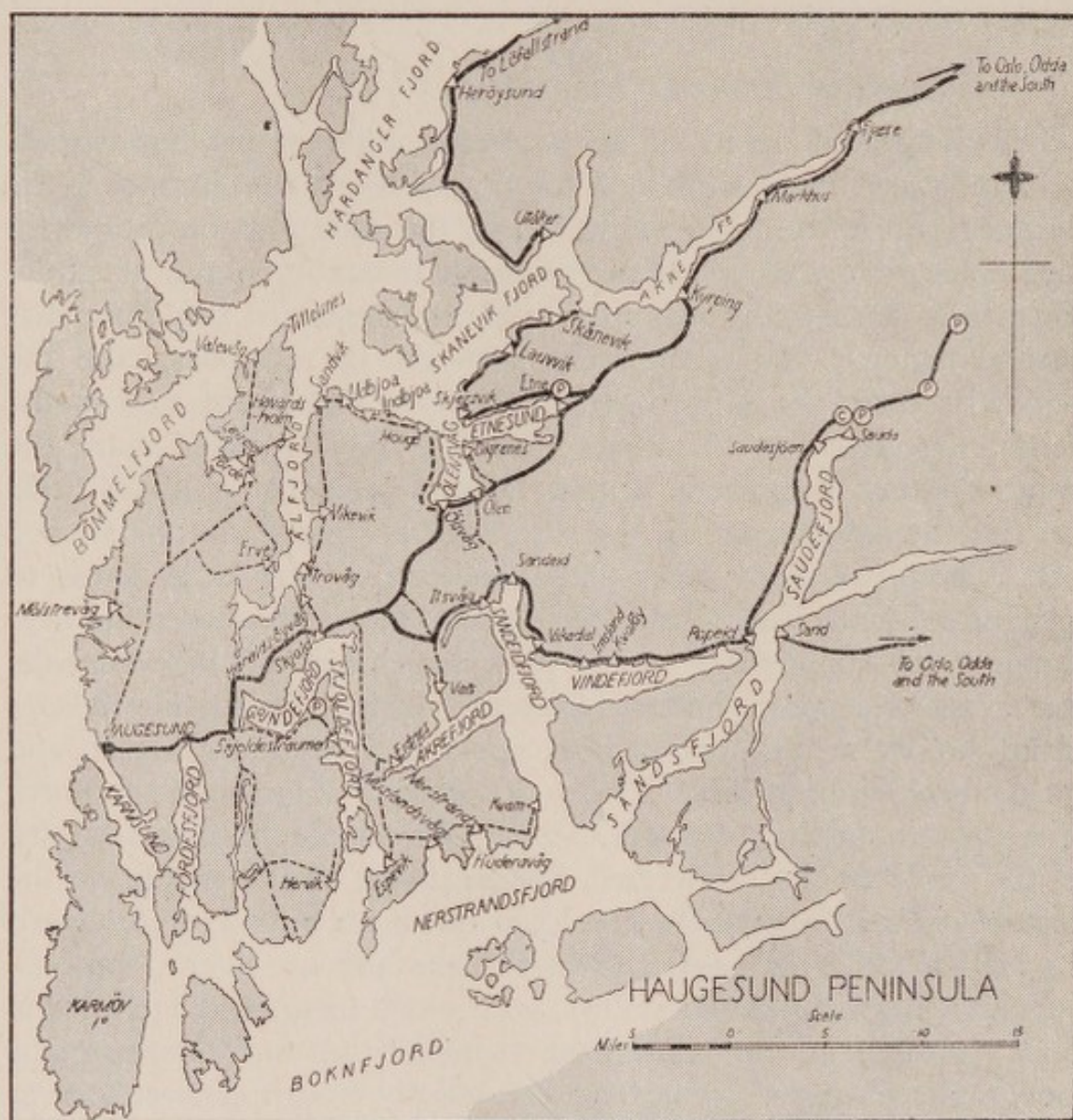
to heights up to about 1,000 feet. The mountains and large, hilly islands are forested and there is very little cultivation anywhere. There are no routes inland from the fjord except on the Stavanger and Haugesund peninsulas.

7. *The Haugesund Peninsula* (Map 18, p. 58)

The Haugesund peninsula lies between the Boknfjord, Sandsfjord, and Saudefjord on the south, and the Bömmelfjord, the entrance to the Hardangerfjord, the Skånevikfjord, and the Åkrefjord on the north. Several narrow fjords, which are generally frozen in winter, penetrate northwards and southwards and divide the peninsula into three distinctive regions: (1) In the west, between the sea-coast and the Skjoldefjord and the Ålfjord, which penetrate northwards and southwards respectively so that their heads are only $1\frac{1}{2}$ miles apart, the country is very irregular in height. Several peaks rise to about 1,000 feet, but the greater part of the land is bare, rugged, and below 600 feet. There are many lakes and marshes but very little forest or agricultural land, except scattered patches along the shores and near Haugesund. Haugesund* is the only large town on the peninsula. It is on the west coast, sheltered from the open sea by Karmøy, a large island similar to the mainland, except that it has more fishing and agricultural communities. Pyrites is mined at Vigsnes, to the north of the island. (2) In the centre, between the Skjoldefjord and Ålfjord on the west and the Vindefjord, Sandeidfjord, and Ölensvåg on the east, where the heads of the two latter fjords are only $4\frac{1}{2}$ miles apart, the land is still very uneven. Most of the hills are over 1,000 feet, but there are many broad valleys, with much forest and agricultural land. (3) East of the Vindefjord, Sandeidfjord, and Ölensvåg the topography changes. Mountains rise steeply from the coast to over 2,000 feet. There are very few valleys or stretches of low-lying land and cultivation is, therefore, sparse, though the mountain slopes are forested. Several lakes lying on the surface of the fjeld have falls at their outlets which provide power at Etne and Sauda; near Sauda there are three power plants supplying the electro-chemical works.

The communications of the district diverge from Haugesund. A road (4 A, 4 B) from Haugesund to Hellandsbygd, in the Sauda valley, crosses the peninsula to Ropeid (ferry) with intermediate ports of call for coastal steamers at Skjold, Ilsvåg, Sandeid, Vikedal, Imsland, and Kvaløy. From Ropeid this road follows the north shore of the Saudefjord, with wharves at Saudesjøen and Sauda, before climbing the

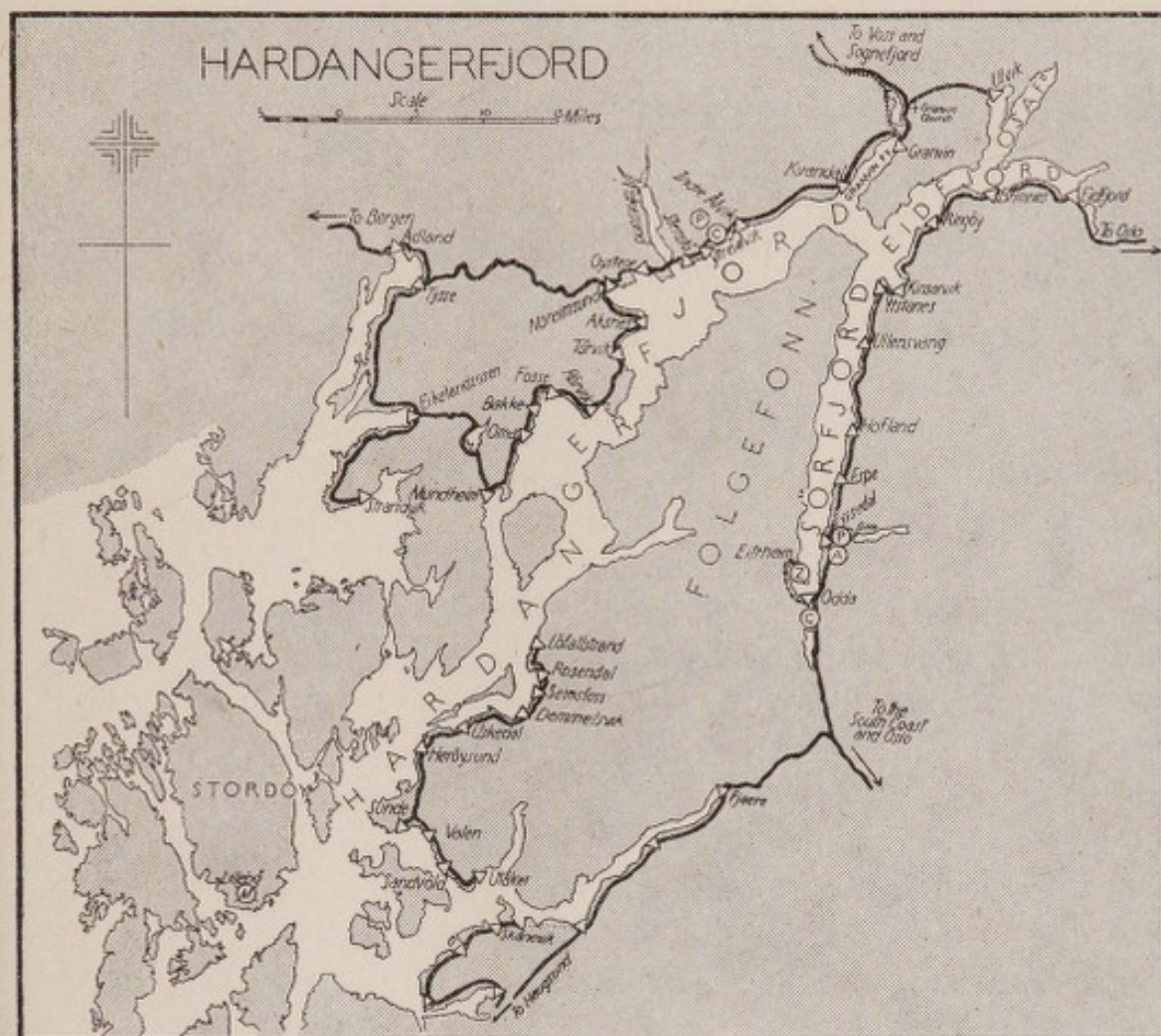
steep valley to Hellandsbygd. From Sand wharf, opposite Ropeid, a combined road and lake-ferry route joins the Odda to Oslo and the south coast road (4 C, 5 D). Branch roads (4 E) join the main road on



MAP 18

the south from ports of call for coastal steamers at Hervik, Espevik, Muslandsvåg, Huderavåg, Nerstrand (pier), Kvam, Eidnes, and Vats. Between Skjoldestraumen and Dals, on the Skjolddefjord, the channel is very narrow and is ascended by a lock. In the north a road from Haugesund leads via Fjaere (4 A) to the main road from Odda to Oslo with ports of call for coastal steamers at Ölsvåg, Ölen, Etne (beach), Markhus, and Fjaere. Branch roads (4 F, 4 G) join the main road from ports of call for coastal steamers at Haraldsøyvåg, Trovåg, Vikevik, Sandvik, Udbjoa, Indbjoa, Houge, Digrenes, Skjersvik, Lauvvik, and Skånevik. From Skånevik there is a ferry to Utaker

on the Bergen road (4 H). Other roads (4 F) from Haugesund lead to ports of call north of the town, in the western section of the peninsula at Mölstrevåg, Erve, Förde, Leireid, Havardsholm, and Valevåg.



MAP 19

8. *The Hardangerfjord* (Map 19)

The Hardangerfjord penetrates the mainland for 70 miles in a north-easterly direction, while its main branch, the Sörfjord, runs south-south-west for 23 miles. The main fjord is very varied in width, the north shore consisting, near its mouth, of several large islands separated by narrow channels which lead northwards to the Björnefjord. Pyrites mines are situated at Lillebø, on Stordøy, one of the largest of these islands. The shores of the fjord are generally steep, rising to about 3,000 feet, but there are many bays and small fjords where flat, fertile land is largely given over to cherry and apple orchards. The lower slopes are generally covered with pine forests,

above which there is a belt of summer pasture. The summits are, however, of bare rock, except where the Folgefonn ice-cap (5,423 ft.) covers 108 square miles of the mountain region between the main fjord and the Sörfjord. The Sörfjord is very narrow and straight. Near its entrance there are extensive farm-lands along both shores, but south of Hofland bare rock walls rise almost perpendicularly from the water's edge. The falls from a lake on the surface of the fjeld above the fjord provide power for electro-chemical works at Odda, aluminium works at Tyssedal, and zinc works at Eitrheim.

The population lives mainly in scattered farms and in tourist centres served by a series of small ports of call. There are no towns except the industrial centres of Odda, Tyssedal, and Ålvik.

The fjord is served by a series of roads which connect it with the Sognefjord, with Bergen and Oslo, and all the large ports on the south coast of the country. A road follows the south-east coast between Utåker and Löfallstrand (4 H), forming part of the combined road and ferry route from Haugesund to Bergen. There are ports of call for coastal steamers on this road at Utåker, Sandvold, Valen, Sunde, Heröysund, Uskedal (quay), Demmelsvik (quay), Seimsfoss, Rosendal (quay), and Löfallstrand. On the west coast a road at Mundheim wharf comes from Bergen via Tysse (5 E), and continues along the fjord to Granvin, with a connexion at Norheimsund (Noreimsund) from Bergen via Tysse (5 A). This road is sometimes over 100 feet above water-level and follows the coast closely, except where it cuts across the Ljonestangen peninsula by a gap about a mile inland, and where it crosses the narrow Fiskesund (Fiksensund) by the Fiske suspension bridge. There are ports of call for coastal steamers along the road at Oma, Bakke, Fosse, Rörvik, Törvikbygd, Aksnes, Norheimsund (wharf), Oystese (wharf), Steinstö (pier), Ytre Ålvik (wharves), Indre Ålvik (quay), and Kvandal and deltaic flats at Norheimsund and Oystese. At Ytre Ålvik a lake on the surface of the high fjeld provides power from its outlet, at the Bjölvefoss Falls, for an electro-chemical works.

A road (6 I, 5 H) from the Sognefjord, via Voss, branches at Granvin (Eide) church and reaches the Hardangerfjord at Granvin (wharf) and Ulvik (wharf). These villages stand on low-lying ground at the heads of branch fjords. There is also an electric railway between Voss, on the Bergen-Oslo railway, and Granvin.

A road follows the south shore of the Eidfjord (the inner end of the Hardangerfjord) and the east shore of the Sörfjord to Odda (5 D). From Eidfjord, where there is a beach, this road runs to Oslo (5 B), and

from Odda it is connected with Oslo and all the large south coast towns. At times it runs well above the water-level, but it descends to wharves at Eidfjord, Brimnes, Ringøy, Kinsarvik (Kinservik), Ytstanes, Ullensvang, Hofland, Espe, Tyssedal, and Odda.

9. *The Hardangerfjord to the Sognefjord* (Map 20, p. 63)

Between the Hardangerfjord and the Sognefjord the coast is cut up by numerous channels and small fjords which form many islands and peninsulas, and give rise to an extremely irregular coastline. The general direction of these fjords is from north-west to south-east with a few larger fjords such as the Fusefjord, Samnangerfjord, Österfjord, and Masfjord crossing this general direction. The outlying islands of the skjaergård and the peninsulas are lower than 1,000 feet, and generally bare and rocky with a few stunted trees. The coast of the mainland, together with the island of Osterøy and the Bergen peninsula, rises to about 2,000 feet and has extensive patches of woodland and fertile, cultivated soil in the lowlands.

Bergen* is the focal point of the region. The town is in a sheltered bay at the foot of fairly steep hills. Residential suburbs and industrial centres have developed on the peninsula and on nearby islands. Many roads converge on the town. From Strandvik wharf, on the Björnefjord, a road (5 E) runs north-east along the gently sloping, forested shores of the Fusefjord and Samnangerfjord. It often climbs above the shore, but descends to ports of call for small coastal steamers at Vindenes (quay), Skjørsand, Fuse, Eikelandssosen (Ekeland, wharf), Hope, Goupholm, Tysse (Tösse, wharf), Hage, and Ådland (wharf). There are connexions at Eikelandssosen and Tysse from Mundheim (5 E) and Granvin (5 A) respectively, on the Hardangerfjord. From Ådland the road crosses the narrow, hilly, isthmus which connects the Bergen peninsula with the mainland and continues to Bergen (5 A).

Another road from the ferry at Hatvik (5 F), on the Fusefjord, follows a valley inland and descends to the shore of the fjord again at Os (wharf), where the road joins from Halgjem wharf. This road continues inland from Os along a broad valley between broken, forested hills to Bergen. It can be reached from several branch roads (5 F) which run inland, sometimes following the shore, from the small fjords between the Björnefjord and Bergen. There are ports of call for small coastal steamers at Halgjem, Hagavik, Nordstrømmen, Hjellestad, Flesland, Mathopen, and Alvöen.

The narrow Sörfjord borders the island of Osterøy on three sides,

whilst its southern and eastern shores are followed by the Bergen-Oslo railway, which leaves the shore at Stanghelle for the narrow Vosselv valley, with its scattered farms and forest. Owing to the steepness of the shore the railway between Stanghelle and Garnes, and the road between Trengereid and Arne (5 A), are forced to follow the shore closely, though they are generally difficult to reach from the fjord. There are wharves at the industrial centres of Vaksdal, Trengereid, Garnes, and Ytre Arne. North-east of Bergen several roads (5 G) converge on the town from ports of call at Steinstö, Hyllje, Salhus, Melkera, and Ervik.

North and west of the Bergen peninsula the islands of Sotrøy, Askøy, and Manger and the Alversund peninsula are crossed by roads (5 J) leading towards the city.

The only route of the district which does not centre on Bergen is north of the Fensfjord. Here a road (6 J) runs from Matre, at the head of the narrow, steep, and forested Masfjord, to the Sognefjord. There are ports of call for coastal steamers on the Masfjord at Matre and Solheim and on the Sognefjord at Instefjord and Brekke.

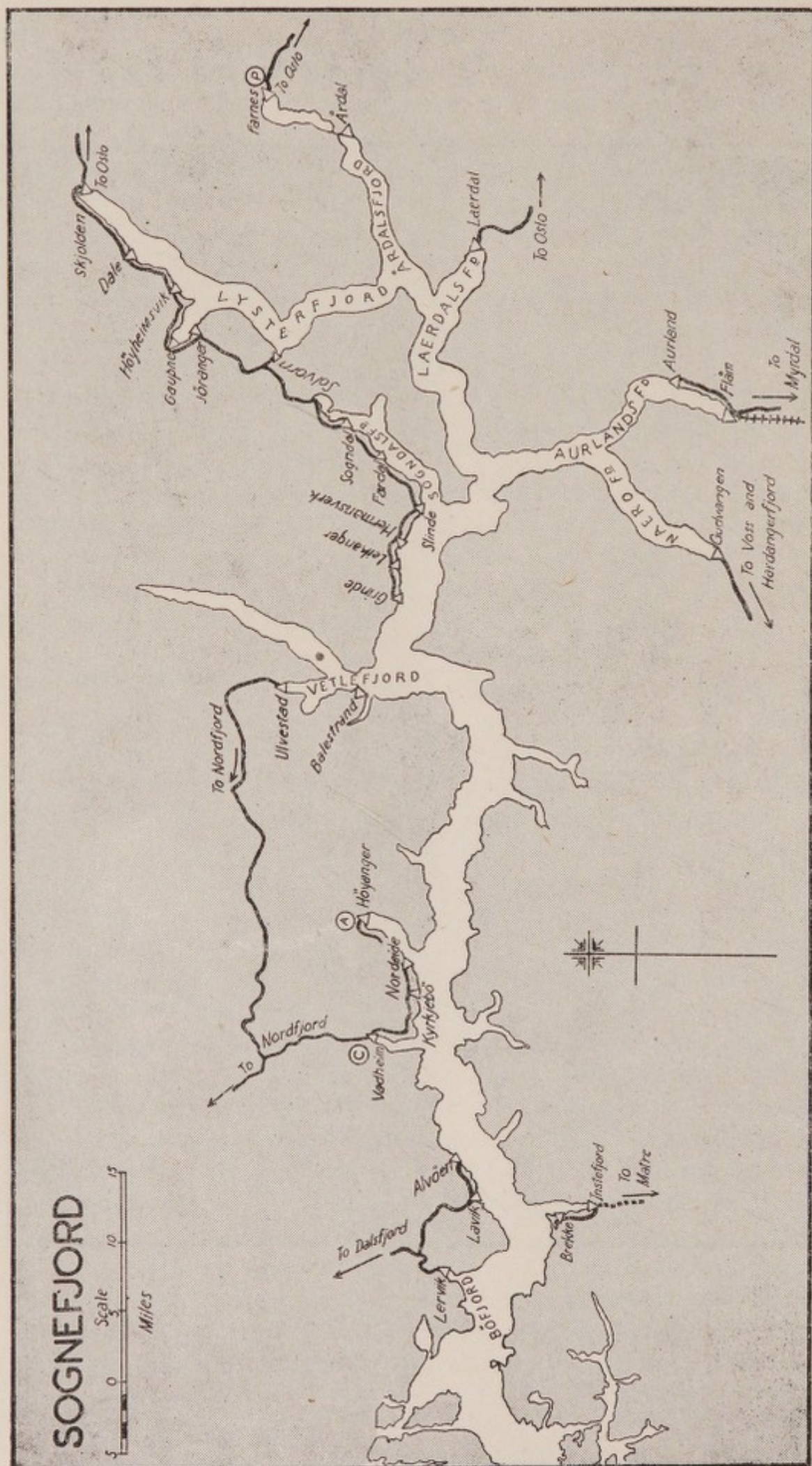
10. *The Sognefjord* (Map 21, p. 64)

The Sognefjord extends eastwards into the mainland for about 100 miles. It is hardly anywhere over 3 miles wide, while several of the many branches at its inner end are less than half a mile wide. The fjeld on either side of the fjord increases in height from about 2,000 feet at the seaward end to over 5,000 feet at the inner end. Many streams and waterfalls flow into the fjord. On the north these are fed from the great ice-cap of the Jostedalsbreen, which covers 580 square miles of the mountain region north of the Sognefjord. Except where the shores are too steep, forests cover the slopes below the grey, rocky, and often snow-covered high fjeld. Cultivable land is scarce and population correspondingly sparse, except in several broad, tributary valleys and along short stretches of coastal terrace.

Owing to their precipitous character, the shores are followed only by a few roads; but several important routes lead from the heads of the branch fjords. At the seaward end of the fjord these main routes come from the north. An unimportant road from the Dalsfjord branches and reaches the Sognefjord at Lervik and Lavik, where there are wharves, and then follows the shore for a short distance between Lavik and Alvöen quay (7 E). A road from the Nordfjord branches at Sande and reaches the Sognefjord at Vadheim (Vadejm, wharf) on the Vadheimsfjord (7 B), and at Ulvestad (wharf) on the



MAP 20



MAP 21

Vetlefjord (7 D). From Vadheim, where there are electro-chemical works, the road (7 B) follows the coast to Höyanger (wharves), at the head of the Höyangsfjord, where there are aluminium works. In the branch fjords this road is well above water-level, but on the main fjord it descends to a narrow, cultivated terrace with ports of call at Kyrkjebö (Kirkebö) and Nordeide. An unimportant road leads southwards from ports of call for coastal steamers at Brekke and Instefjord, on the Risnefjord, to Matre on the Masfjord (6 J).

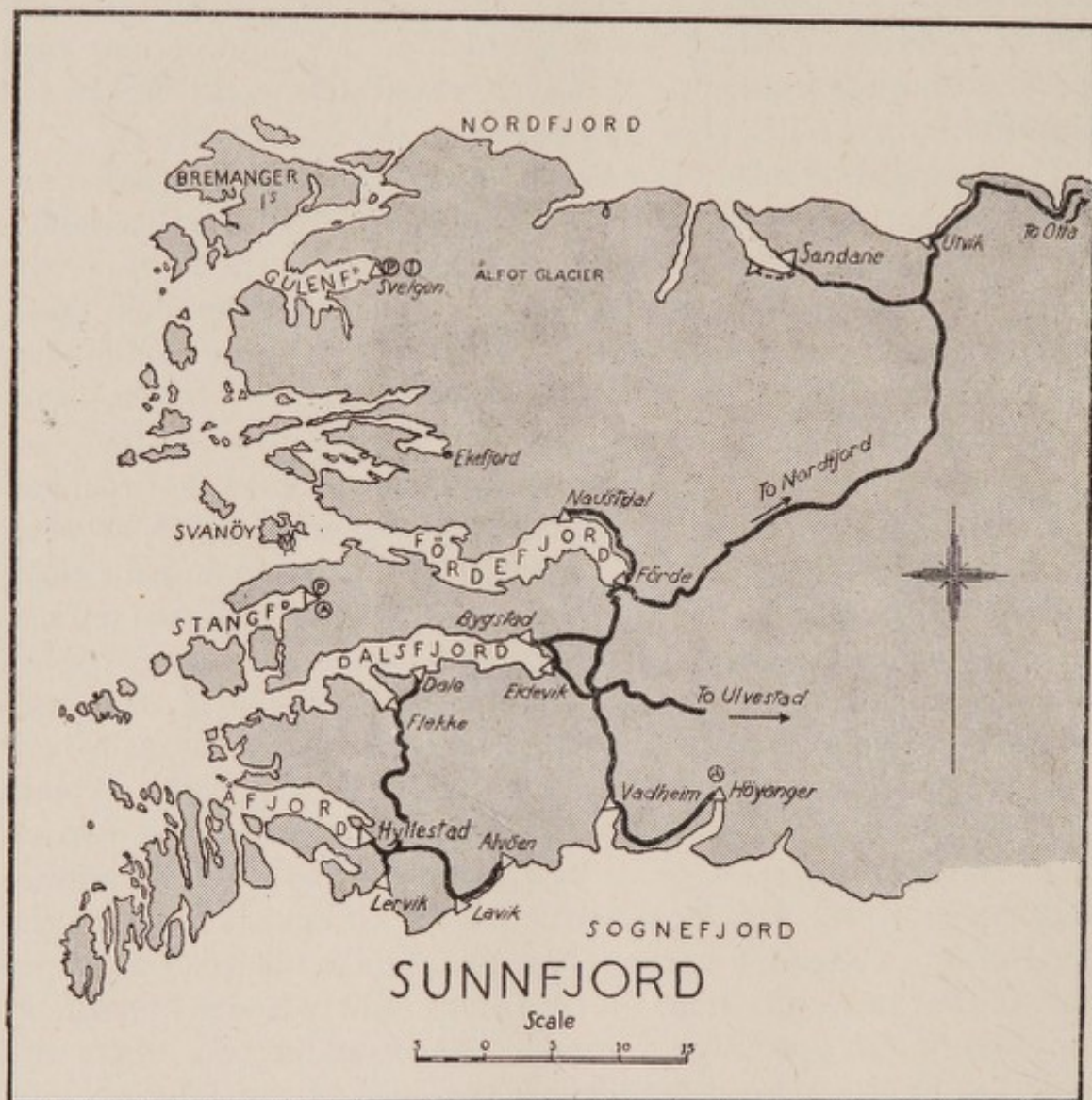
Communication inland is more direct east of Balestrand (Balholm), a tourist centre with large hotels, at the entrance to the Fjaerlandsfjord. A road to Otta and Oslo (7 C) follows the north shores of the main fjord and its branches (*a*) between Grinde, on the main fjord, and the head of the Sogndalsfjord. Along this section the road follows the coastal terrace of the main fjord with wharves at Grinde, Leikanger, Hermannsverk, and Slinde. On the Sogndalsfjord the coast is steeper and the road higher, except near the wharves at Fardal and Sogndal, where there are flat cultivated river mouths; and (*b*) between Jöranger and Skjolden on the Lysterfjord. Here the mountains along the shore are less steep and the road, following the cultivated terrace, is accessible from ports of call for coastal steamers at Jöranger (Marifjeren, pier), Gaupne (beach), Høyheimsvik, Dale (Luster), and Skjolden (wharf). A lane from the wharf at Solvorn joins the main road.

Other communication is from the heads of branch fjords. A road (6 I) from the wharf at Gudvangen, at the head of the narrow and majestic Naeröfjord, leads to Voss on the Bergen–Oslo railway and thence to the Hardangerfjord. From Aurland (wharf) on the Aurlandsfjord a road (6 H) runs above the shore to Flåm (wharf) at the head of the fjord, and thence the road and a railway lead to Myrdal, on the Bergen–Oslo railway. From the wharf at Laerdal, where the river has built a large deltaic flat at the head of the Laerdalsfjord (Lerdalsfjord), a road climbs the fjeld to Oslo (6 A). It is also possible to proceed by motor-boat from the wharves at the head of the Årdalsfjord to Farnes, on Lake Årdal, from which a road climbs the fjeld to Oslo (6 D, 6 A). There is a large electric power station opposite Farnes.

11. *The Sunnfjord* (Map 22, p. 66)

The stretch of coast between the Sognefjord and the Nordfjord is generally known as the Sunnfjord. It is rugged, deeply dissected by many short, narrow fjords and fringed by a skjaergård of small, rocky islands. Most of the islands and the mainland coast, with the

exception of the fertile inner ends of some of the fjords, are of bare, grey rock, with very little vegetation or cultivation anywhere. The barren fjeld rises inland to over 2,000 feet, and in the north the Ålfotbreen ice-cap lies at over 5,000 feet.



MAP 22

This region is very difficult of access, though there are roads from the heads of some of the fjords which join the road connecting the Sognefjord and the Nordfjord. The Dalsfjord, which is steep and narrow, is connected with the outer Sognefjord by a road from wharves at Dale and Flekke. This is joined by a branch road from Hyllestad (wharf), at the head of the Åfjord. The Dalsfjord is also connected from its head, where there are ports of call for coastal steamers at Bygstad and Eidevik and a beach, with the Vadheim to Nordfjord road. The wooded and gently sloping north shore of the Førdefjord between

Naustdal (wharf) and Förde (quay and beach) is followed by another road leading to the Vadheim to Nordfjord road (7 B). It has been proposed to continue the road from Naustdal to the Ekefjord. The Fördefjord is liable to freeze during hard winters.

The Sunnfjord power station and aluminium works are at the head of the Stangfjord, between the Dalsfjord and the Fördefjord. The Bremanger power station and iron-smelting works are at Svelgen on the Gulenfjord. Pyrites is mined on the island of Svanøy, at the entrance to the Fördefjord.

12. *The Nordfjord* (Map 23, p. 69)

The Nordfjord extends eastwards, under different names, for about 60 miles. The fjord has several branches, most of them southwards from the main fjord. The island of Husevågøy lies in the entrance to the fjord, where the shores are barren and rugged. Farther inland there is often a narrow coastal terrace, with scattered farms and forest, before the hills rise steeply to between 2,000 and 3,000 feet. The lower slopes are forested, but the flat summits consist of barren fjeld, which can only be penetrated along a few valleys leading from the fjord-side. The coastal plain is most easily accessible (*a*) along the north shore between Brygga and Nordfjordeid, (*b*) in the Gloppefjord, and (*c*) along the shores of the Innvikfjord (Indviksfjord), the innermost branch of the Nordfjord. Most of the population live in these three areas and at the heads of the other branch fjords.

The northern shore of the Nordfjord is followed by a road (7 A) with connexions from the Stadland (Stadt) peninsula (7 A), the Vanelvsfjord (7 F), the Voldenfjord (7 G), and the Hjørundfjord (7 H). This road follows the coastal terrace, at varying levels, between (*a*) Brygga and Nordfjordeid, with ports of call for coastal steamers at Brygga, Haugs, Kjollesdal, Stårheim, Naustdal, and Nordfjordeid (quays); there is also a deltaic flat at Nordfjordeid; and (*b*) Faleid and Toning in Stryn, with a wharf at Faleid and a deltaic flat at Toning. Between these two sections the road follows first a broad, cultivated valley and then the barren shores of the Hornindalsvand. The southern shore of the Nordfjord is followed by a road (7 B) with connexions from Rygg (wharf) and Sandane (wharf and beach) on the Gloppefjord, and the Fördefjord, Dalsfjord, and Sognefjord. It closely follows the shore between Utvik and Toning, with wharves at Utvik, Innvik (Indvik), Olden, Loen, and Visnes; there are also deltaic flats at Olden and Loen. From Toning a road (7 A) leads inland to Otta on the Oslo-Trondheim road and railway. There are small

electric power stations to supply local needs at Nordfjordeid, Olden, Utvik, and Sandane.

13. *The Nordfjord to the Storfjord* (Map 24, p. 71)

North of the entrance to the Nordfjord the general direction of the coastline is north-east. The coast is very cut up, with fjords running in all directions and a well-developed skjaergård of rocky islands, except off the Stadland peninsula. The hinterland of barren fjeld at about 4,000 feet is difficult to cross except along a few deep valleys. The lower slopes are wooded where the shores are not too steep, but in some of the fjords, such as the Geiranger, the rock walls rise sheer from the water's edge and vegetation is very scanty. Population is sparse; farms are strung along the coast wherever there is sufficient cultivable land and are clustered at the heads of the fjords and the mouths of streams. The only towns are Volden, Ørsten, and Ørskog.

The long, narrow Stadland peninsula juts into the open sea (Fig. 19). It has steep, rocky shores rising to remarkably flat-topped hills, about 1,500 feet high. At its seaward end there are two small bays with beaches at Ervik (wharf) and Årvik. The road from Ervik (7 A), joined by lanes from Årvik and from Drage wharf, runs inland to the Nordfjord past quays at Lekanger and a wharf at Selje. At Åheim (Åhjem, quay) it is joined by another road (7 F, in parts very rough and narrow) which skirts the steep, forested shores of the fjords from Folkestad (ferry) on the Voldenfjord. There are intermediate ports of call for coastal steamers (1) on the Dalsfjord at Steinsvik and Løvik, (2) on the Rövdefjord at Rövde, (3) on the Sövdefjord at Sövdebotn and Eidså, and (4) on the Vanelvsfjord at Fiskå (ferry), Sylte, and Slagnes (ferry). From Folkestad there is also a road (7 G) running south across the high fjeld to the Nordfjord.

The Vartdalsfjord leads eastward to the Storfjord and the Hjörundfjord. The latter is a narrow fjord penetrating south-east between very steep walls rising to over 4,000 feet. There are several breaks in these walls where streams flow into the fjord. At Öie, on a small branch known as the Norangsfjord, there is a quay and a beach from which a road (7 H, 7 A) climbs the fjeld southwards via Toning to Otta on the Oslo to Trondheim road and railway.

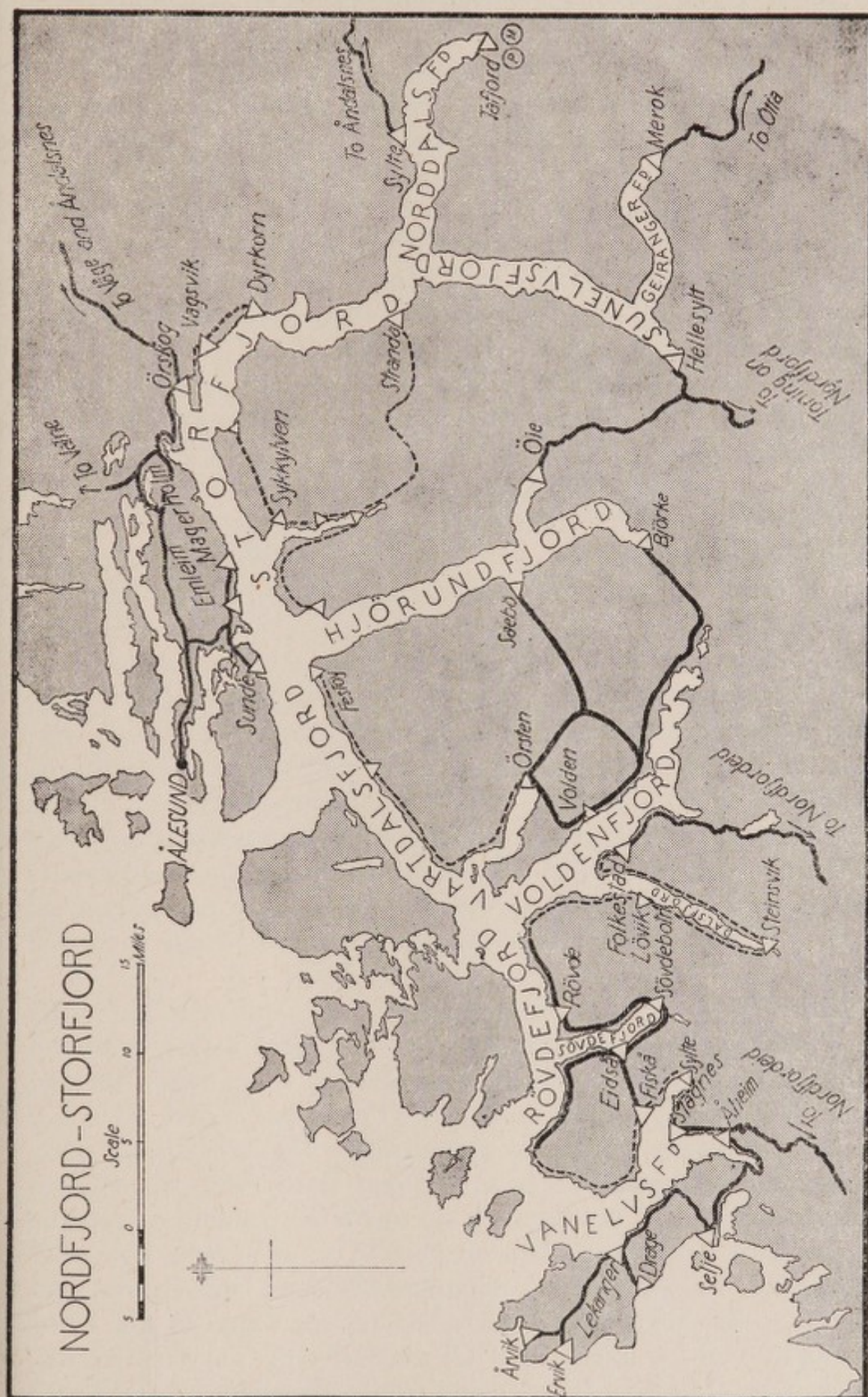
The Storfjord is long, narrow, and winding. At first there are woodland and several stretches of low-lying, well-farmed land along its shores. On the north shore this gives access to the Ålesund-Våge road (8 A) from the wharves at Sunde, Emleim, Magerholm, and Ørskog. Farther inland the sides of the fjord are increasingly steep.

with population and forest correspondingly sparse. From Örskog a road (8 B) follows the east shore for a short distance with wharves at Vagsvik and Dyrkorn. The fjord branches near its head to form the Sunelvsfjord (Sunnelv) and Norddalsfjord. The Sunelvsfjord and its branch, the Geirangerfjord, are very narrow and steep. Waterfalls cascade down the rocky walls, as at the Bridal Veil and the Seven Sisters Falls. From the head of the Sunelvsfjord a road climbs the steep fjeld from the wharf at Hellesylt to join the road from Öie to Otta (7 H), and from Merok (Maråk) wharf at the head of the Geirangerfjord, another direct road to Otta leads eastwards (7 I, 7 A). The Norddalsfjord is less imposing. There are several small cultivated flats, with ports of call for coastal steamers, near the mouths of inflowing streams; from Sylte wharf, on the north shore, a road crosses the fjeld to Åndalsnes (8 B). The head of the fjord is extremely narrow and steep, the falls in the valley providing power for the Tafjord electro-metallurgical works.

14. *The Storfjord to the Romsdalsfjord* (Map 25, p. 73)

The Storfjord and Romsdalsfjord run parallel with each other and towards their heads curve south-eastwards. The peninsula separating them has a rocky skjaergård off the coast, which consists of deeply dissected peninsulas and islands extending westwards from the mainland. Farther inland there is a broad stretch of barren fjeld lying at about 5,000 feet. With the exception of the north shore of the Storfjord the whole coast is cut up by small fjords and bays which provide farm-land for a scattered population. Ålesund and Åndalsnes are the chief towns of the district, but owing to the difficult intervening country they are as yet connected only by a combined road (8 A) and ferry service, the final road connexion between Våge and Veblungsnes being under construction.

Ålesund* is a port and industrial centre. It is at the seaward end of a chain of islands which are connected with each other and with the mainland by road bridges. These islands are forested and hilly, but are not very steep and there is considerable farm-land along their low-lying shores. Roads converge on the islands from (1) the south (8 A), from wharves at Sunde, Emleim, Magerholm, Örskog, Vagsvik, and Dyrkorn; (2) the north-west (8 D), from ports of call for coastal steamers at Hildre, Skjelten, Gamlejmshaug, Slyngstad, Eidsvik, and Tenfjord, and from beaches near Gamlejmshaug and at Sövik; and (3) the north-east (8 C, 8 A), from ports of call for coastal steamers at Vatne, Hovset, Årsnes, Ek, Rekdal, Fiksdal, Tomra, Remmen, and



MAP 24

wharves at Vestnes, Skorgenes, Sörsylte, Daustad, Vigebukt, Gjer-mundsnes, and Våge. On the unfinished stretch of road there are ports of call for coastal steamers at Voll and Indfjord (wharf).

Åndalsnes, which has both road (9 A) and railway connexion with Oslo, is on low-lying ground with beaches at the mouth of the river Rauma, on the south shore of the Romsdalsfjord. The forested shores of this fjord rise steeply to about 3,000 feet, but there are several patches of low-lying farm-land near the mouths of inflowing streams. Åndalsnes may be reached by road from the south-west (8 B) from Sylte wharf on the Storfjord and from the north (9B) from ports of call for coastal steamers at Norvik (wharf), Torvik, Tokle (pier), and Stein (wharf), and a beach at Hen. There is also a wharf at Veblungsnes, on the opposite side of the river mouth, connected by road with Åndalsnes (8 B).

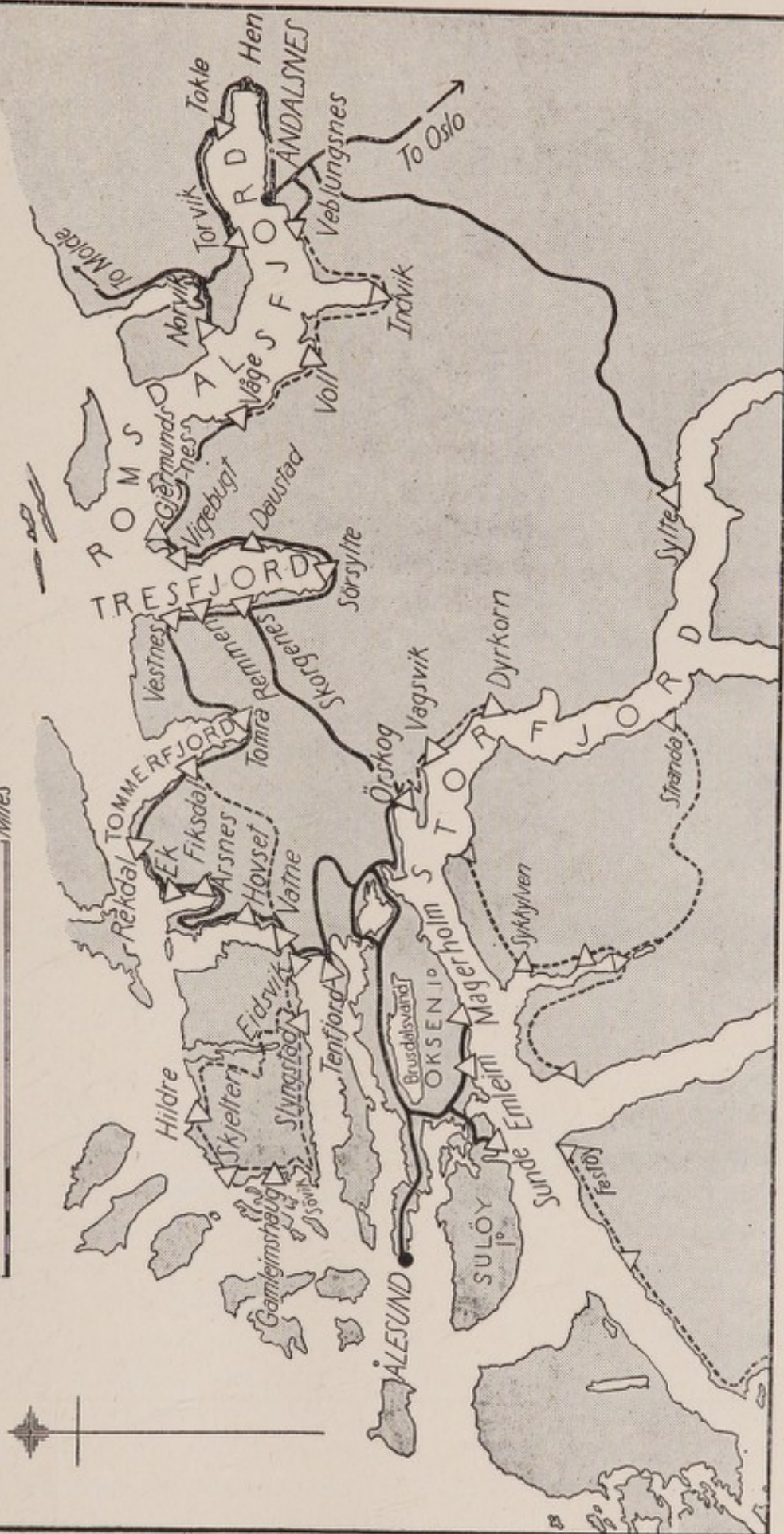
15. *The Molde Peninsula* (Map 26, p. 74)

The Molde peninsula lies north of the Romsdalsfjord, Moldefjord, and Langford, and west of the outer Tingvollfjord (Tingvoldfjord). It is joined to the mainland in the south by a narrow isthmus between the Langfjord and the Tingvollfjord, and its seaward end is fringed by many islets and reefs. The peninsula consists of four ranges of hills, rising to about 2,000 feet. These run roughly from west-south-west to east-north-east and are separated from each other by small fjords and valleys, which afford the main lines of communication. Transverse valleys and routes are rare. Except in the highest parts and along the north-west coast, which is barren and rocky, the peninsula is forested with coniferous and deciduous trees. Population and cultivation are confined mainly to the shores of the fjords where there is a coastal plain.

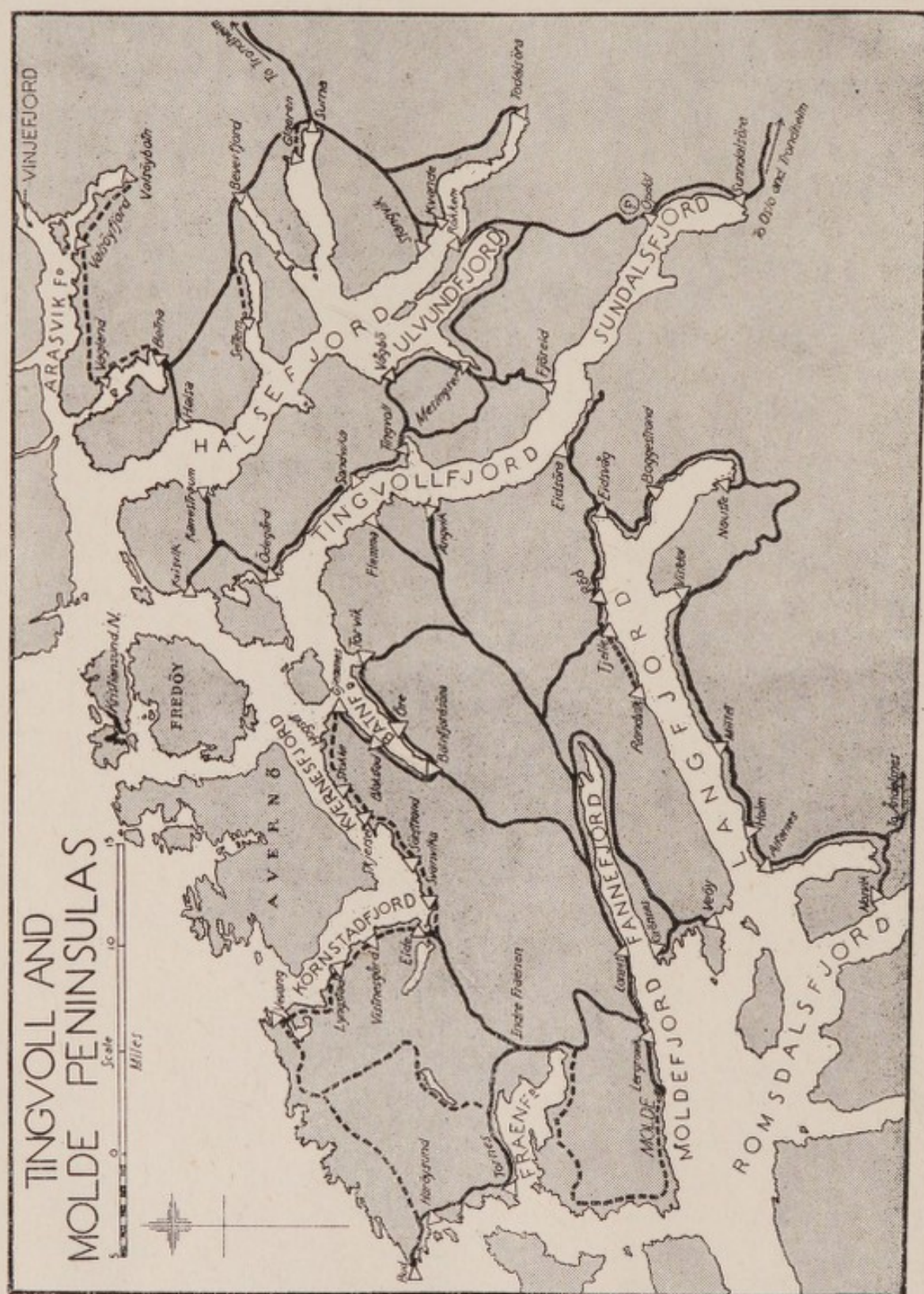
Molde*, the principal town and port on the peninsula, lies on the gently sloping northern shores of the Moldefjord amidst scattered farms and forests. It is served by a series of roads which diverge (1) northwards (9 E) to the head of the Fraenfjord, where there is a beach; here the road branches westwards to Bud wharf, past ports of call for coastal steamers at Tornes and Haröysund, where there is also a beach; and eastwards (9 EE) to the Kornstadfjord and the Kvernesfjord, along which there are ports of call at Vevang, Lyngstad, Vistnesgård, Eide, Svanvika, Sörstrand, Skjerset, and Stokke, and beaches at Svanvika and Hogset; and (2) eastwards to the Batnfjord (9 F), with ports of call at Gjemnes (ferry), Torvik, Blakstad, Öre, and Batnfjordsöra (beach), and to the Tingvollfjord (9 G) with

STORFJORD TO ROMSDALSFJORD

Scale
0 5 10 15 Miles



MAP 25



wharves at Flemma, Angvik, and Eidsöra. Molde is connected with Åndalsnes on the mainland by (1) combined road and ferry routes and (2) a circuitous road skirting the Fannefjord and Langfjord (9 B). There are ports of call for coastal steamers along these routes on the Moldefjord and Fannefjord at Lergrovik, Lonset, Grønnes, and Veö (Veöy, ferry), and on the Langfjord where flat farmed land at the mouths of streams forms breaks in the steep forested sides of the fjord, at Randvik, Tjelle, Röd, Eidsvåg (beach), Boggestrand, Nauste (beach), Vistdal, Mittet, Holm, and Alfarnes (ferry).

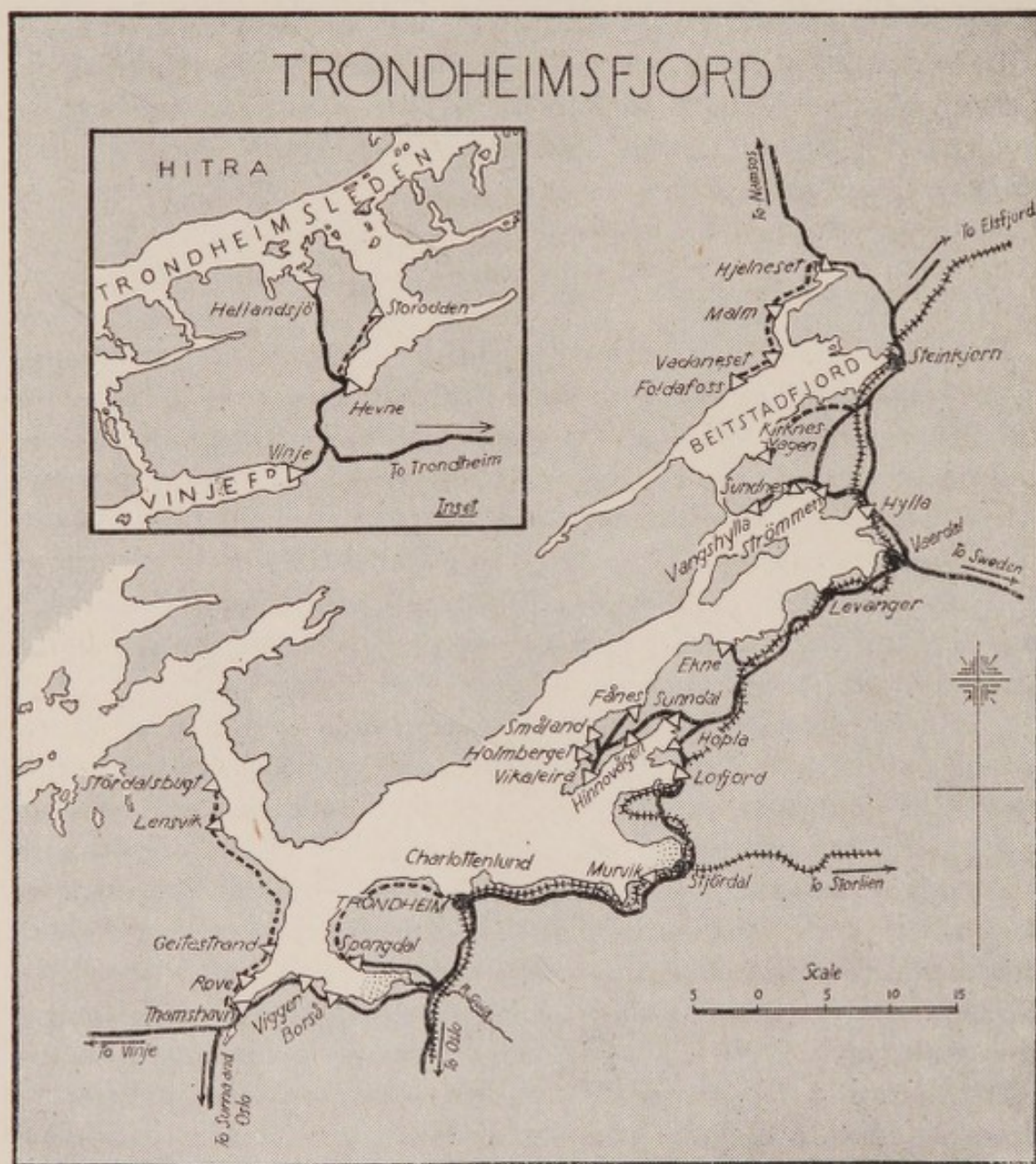
16. *The Tingvoll Peninsula* (Map 26)

The Tingvoll peninsula is long, narrow, and mountainous, extending north-westwards from the mainland. It is separated from the Molde peninsula on the west by the Tingvollfjord and from the mainland on the east by the Halsafjord (Halsefjord). At its seaward end Fredöy island and the islands which form the harbour of Kristiansund N. separate it from the open sea. The mountains of the peninsula are steep, forested, and over 1,000 feet high, but they are broken by several transverse valleys which can be reached from the low-lying shores of a number of small bays.

The main road from Kvisvik (the terminus of the ferry from Kristiansund N.) to Oslo and Trondheim via Sunndalsöra (9 C) runs along the peninsula, crossing from side to side through several of the transverse valleys. From Kvisvik the road climbs inland and is joined by another from Kanestraum wharf on the east, before descending to the west coast, where there is a port of call for coastal steamers at Ödegård. It follows the west coast past Sandvika wharf to Tingvoll bay, where there is a wharf near low-lying and well-farmed land, and then branches. One branch crosses the peninsula to Vågbö (pier and beach) and then follows the east coast to Meisingset (pier), the other follows an inland valley to Meisingset. Here a road joins from Fjöseide ferry on the west coast; the main road continues at the foot of steep mountains along the east coast to the deltaic flat at the head of the Ulvundfjord, where it is joined by a branch road from the ferry at Rökkem. It then recrosses the peninsula to Opdöl (wharf), where there is an electric power station. From Opdöl the road follows the steep west shore of the peninsula to Sunndalsöra (pier), situated on a deltaic flat at the head of the Tingvollfjord, whence the road runs inland along the deep Drivdal valley.

17. *The Tingvoll Peninsula to the Trondheimsfjord (Maps 26 and 27)*

The coast of the mainland in the Halsafjord and north-eastwards to the Trondheimsfjord is much indented by small fjords and inlets.



MAP 27

The shores are generally steep, rising in places over 3,000 feet to the high, barren fjeld of the Trollheim. The steep slopes of the sheltered branch fjords are generally forested, but the more exposed parts of the coast are of bare rock and scree. Off the coast there are many islands, which are of two types. The smaller ones lying close inshore have

steep, barren or forested shores, similar to the mainland; the larger ones lie well off the coast, in the three groups of Smölen, Hitra (Hitteren), and Fröya, each of which is low-lying and surrounded by countless small islets and reefs.

The entrance to the Trondheimsfjord is approached by the Trondheimsleden, which runs north-eastwards between the mainland and the island of Hitra.

Owing to the rugged coast and the high, barren fjeld beyond, penetration inland is difficult. A road from Halså wharf (9 I) runs inland for a short distance to Betna, where it is joined by a road which has followed the steep shores of the Valsøyfjord and the Arasvikfjord (9 I), with ports of call for small coastal steamers at Valsøybotn, Vagland, and Valsøyfjord. At Betna, where there is a port of call for coastal steamers, the road turns south to Surna and runs parallel with the shore of the Halsåfjord, but a few miles inland. It reaches the coast again at the heads of branch fjords with ports of call for coastal steamers at Settem, Beverfjord, Glaeren, and at Surna (wharf), where there is also a deltaic flat. The main road from Stangvik, Kvande (pier), and Todalsöra wharves, on the Halsåfjord (9 D), reaches Surna and thence runs inland along a deep, forested valley to Orkla and Trondheim.

Another road to Orkla and Trondheim (10 N) runs inland from the jetty and beach at Vinje, at the head of the narrow and precipitous Vinjefjord. This road is joined by branch roads from Hellandsjö wharf on the Trondheimsleden and from Storrodde (port of call for coastal steamers) and Hevne (Kyrksaeterören, 2 wharves) on the Hevnefjord, a branch of the Trondheimsleden.

18. *The Trondheimsfjord* (Map 27)

The Trondheimsfjord is entered from the Trondheimsleden by a narrow channel running south-east between steep, forested shores. A very poor, hilly lane follows the west shore of the channel and joins the main Orkla to Trondheim road near the mouth of the river Orkla, where there are sand-banks. The lane can be reached from wharves at Stordalsbugt, Lensvik, Geitastrand, and Rove, and from beaches at Lensvik, Selbekken, and Meland.

The physical features of the Trondheimsfjord are described in Chapter II (*v.s.* p. 32). Except in the Skarnsund and the western end of the Beitstadfjord, the whole of the south and east shores of the fjord are lined with small beaches. The larger stretches are at the mouths of the Gaula, Stjørdal, and Vaerdal and near Steinkjer; there

are also narrow, discontinuous stretches between Charlottenlund and Stjördal, where the railway runs close to the shore at heights below 30 feet, with the Northern Trunk Road (11 A) nearby. The road from Orkla to Trondheim (10 M) can be reached from quays at Thamshavn (industrial wharves), Viggan, Borså, Buviken, and Spongdal. The Northern Trunk Road, north of Trondheim, can be reached from ports of call for coastal steamers at Ranheim (pier), Hommelvik (quays), Murvik (wharf and pier), Langstein, Lofjord (wharves), Hopla, Sunndal, Hinnovågen, Vikaleira, Holmberget, Småland, Fånes, Ekne, Levanger*, Hylla, Strømmen, Sundnes, Vangshylla, Kirknesvågen, and Steinkjer (wharves). The road from Steinkjer to Namsos (11 A) can be reached from ports of call for coastal steamers at Foldafoss, Vadanaset, Malm, and Hjelneset, all of which are on a branch road (11 K) which is to be extended to Orland at the entrance to the Trondheimsfjord.

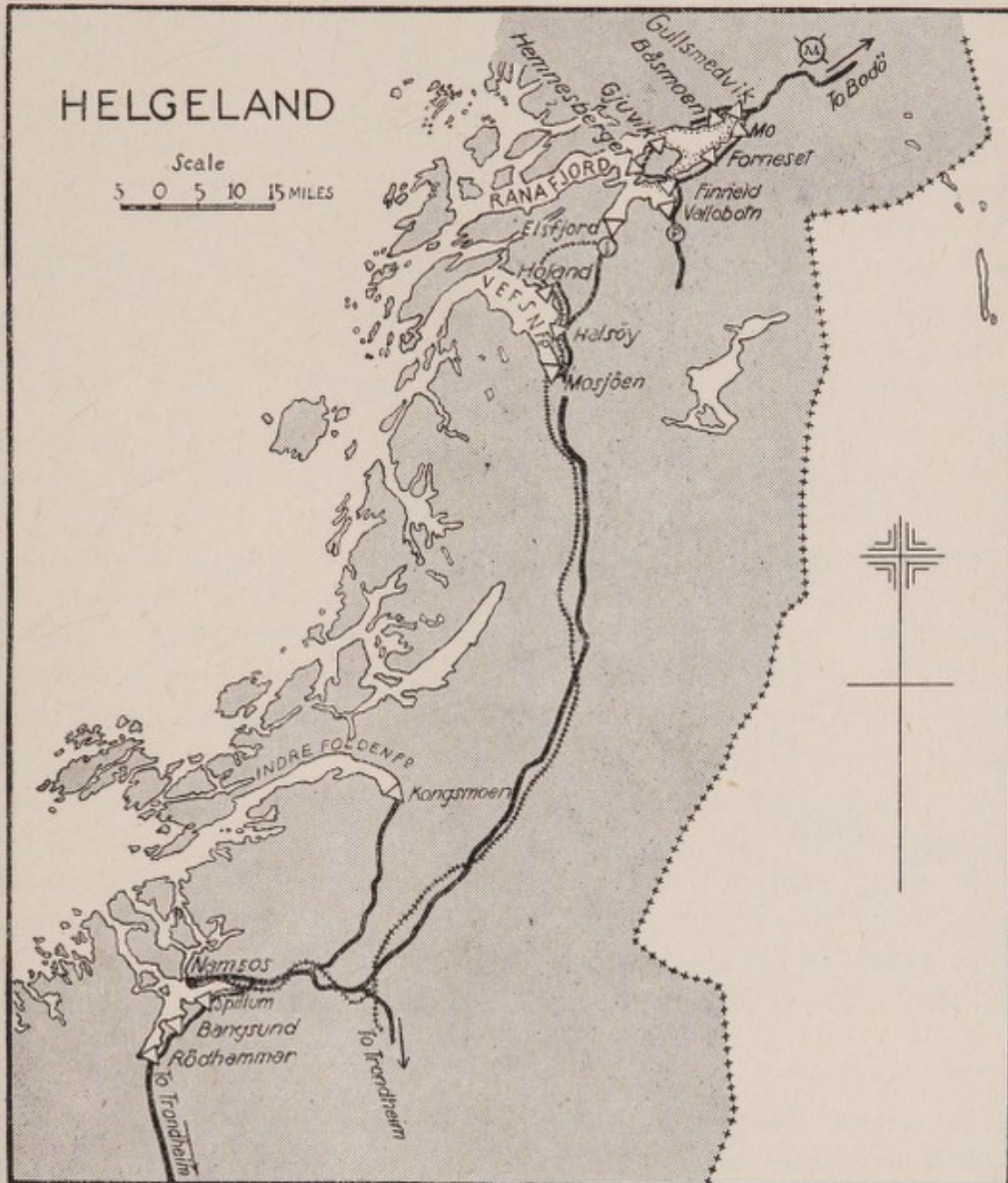
19. *The Trondheimsfjord to the Namsenfjord* (Map 28)

The coast runs north-eastward from the entrance of the Trondheimsfjord to the Namsenfjord and is very indented by small fjords and inlets which run inland in all directions. It is fringed by a skjaergård of rocky islands, the larger of which are hilly, with steep shores. The coast is generally steep and increases in height from about 1,000 feet near the Trondheimsfjord to about 2,000 feet near the Namsenfjord. At the southern end of this section of coast the Orland peninsula is low-lying and has considerable stretches of cultivated land. With this exception the coast is remarkably barren, with very little cultivation and forests only at the heads of the fjords.

There are many ports of call for small coastal steamers and several short coast roads, but the only through routes are from Namsos, at the head of the Namsenfjord. This narrow fjord runs south-east between shores which have a narrow coastal terrace before they rise steeply to over 1,300 feet. The north-eastern shore is formed by a large island, separated from the mainland near Namsos by a narrow channel. Namsos* is near the head of the fjord at the mouth of the Namdal where there are several beaches. Roads diverge from the town southwards to Trondheim (11 A), along the head of the fjord, with a wharf at Spillum, 2 quays at Bangsund, and a jetty at Rödhammar; northwards to Mosjøen and Elsfjord (11 A); and eastwards to the Swedish frontier (11 E, 11 D). The town is also served by a branch of the Nordland railway.

20. *Helgeland* (Map 28)

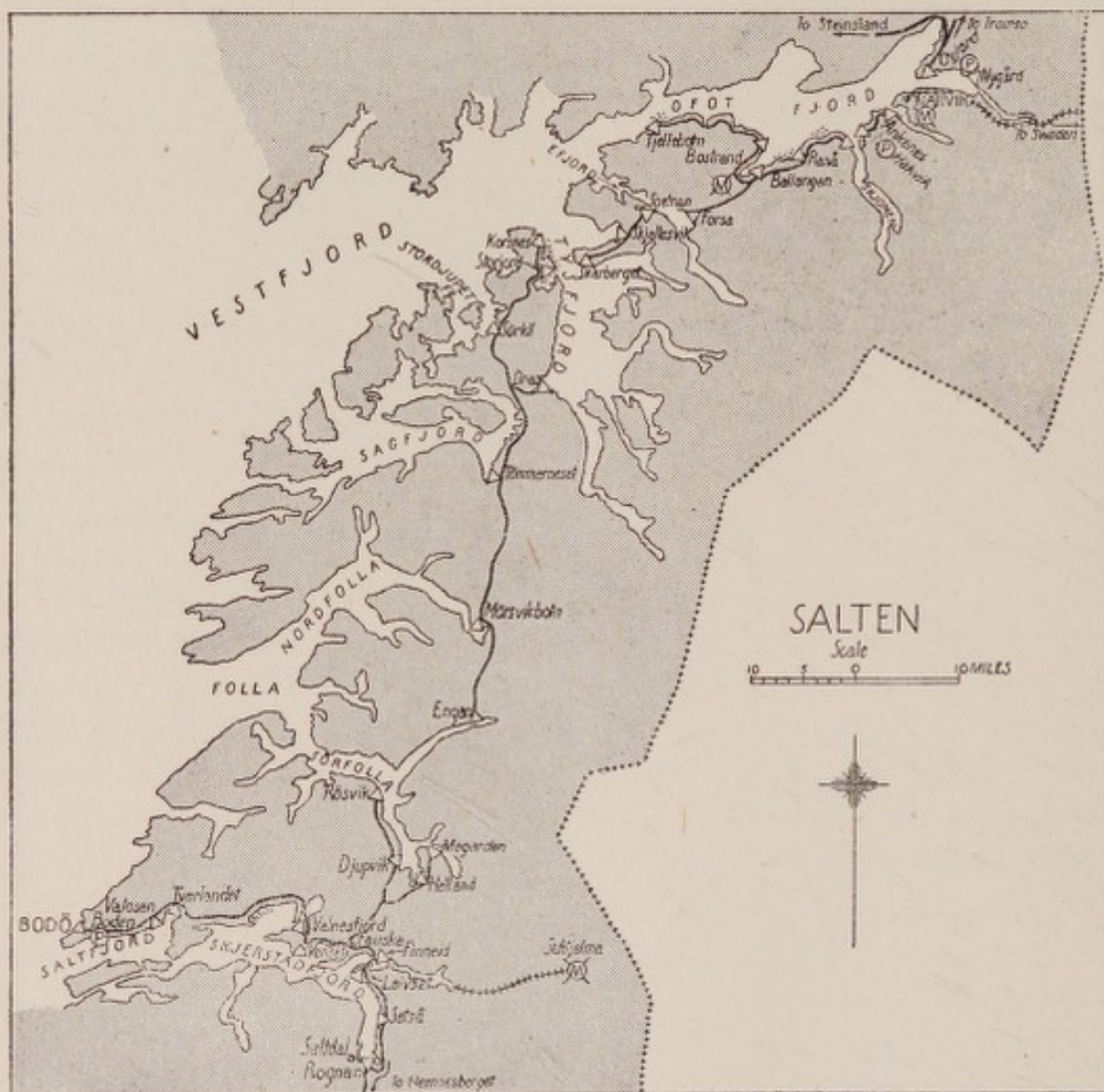
North of the Namsenfjord the coast runs north-north-east and is very indented by fjords and inlets. The larger, such as the Tosenfjord



MAP 28

and the Ranafjord (Ranen), run parallel to the main direction of the coast, as also do the channels which separate the many small islands from the mainland. Others cut across the general direction almost at right angles, so that the coast is divided into many small peninsulas. The mountains form part of the coastal range of northern Norway

and generally rise steep and barren to over 3,000 feet; the only forested areas are the sheltered parts of the heads of fjords. The many islands are also steep and rocky, but they frequently have a narrow coastal terrace along their shores, where there are scattered fishing



MAP 29

communities. Torghatten island is famous because of the hole worn right through its peak at a height of about 650 feet.

There are short stretches of motorable road along many of the peninsulas, and although there are many ports of call for coastal steamers all along the coast there are very few connexions with through roads. From Kongsmoen, where there is a wharf and a deltaic flat at the head of the steep and narrow Indre Foldenfjord, a road goes to Namsos (II F). The Northern Trunk Road (II A) and the Nordland railway follow inland valleys, but reach the coast at

Mosjöen* at the head of the precipitous and rocky Vefsnfjord (Vefsenfjord). A side road along the northern shore of the Vefsnfjord runs to Mosjöen with ports of call for coastal steamers and beaches at Holand and Halsøy. The Northern Trunk Road and the Nordland railway reach the coast again at Elsfjord, on a branch of the Ranafjord, where there are iron-mines. The Ranafjord is irregular in shape, the Nord Ranafjord being separated from the main fjord by the Hemnesøy peninsula. The shores of the fjord are steep, the inner parts being forested. The road is interrupted by a ferry from Elsfjord to Hemnesberget, from which it follows the shore of the Hemnesøy peninsula, with a branch from Gjuvik quay, and then the southern shore of the Nord Ranafjord to Mo, with wharves at Finneid and Forneset. The road can be reached from small beaches on Hemnesøy, at Finneid, at the mouth of the Dalselv, and at Mo. At Finneid a branch leads to Vallabotn, where there is a wharf and electric power station and beaches. The small port of Mo, near which there are pyrites mines served by Gullsmedvik pier, is in a small depression at the head of the Nord Ranafjord, where the main road crosses the mouth of the Dunderlandsdal and, before bearing inland, is joined by a road (11 H) which has followed the north shore of the fjord with a wharf at Båsmoen.

Between Ranafjord and Saltfjord the coast is cut up only by small fjords, generally bearing east. Although there is some low-lying land at the seaward ends of the promontories, which separate these fjords, the whole coast is bleak and precipitous. It is backed by the great ice-cap of the Svartisen glacier. This completely prevents movement inland but is important, as it feeds the stream at Glomfjord, with its large power station and aluminium works at Haugvik. These works can be approached by a road from Storvik which follows the north shore of the Glomfjord with ports of call for coastal steamers at Storvik, Reipa, Ornes, Neverdal (beach), and wharves at Haugvik and Glomfjord.

21. *Salten* (Map 29)

The coast of Salten is separated from the Lofoten and Vesterålen islands by the broad Vestfjord. Many large fjords pierce the coast so deeply that they almost reach the Swedish frontier. They run in all directions and are frequently connected by low-lying marshy, or lake-filled, depressions, so that the whole coast is a maze of intricate channels between islands and peninsulas. There are several low-lying promontories, but generally the coast rises abruptly to over 3,000 feet, with bare rock and forested lower slopes.

The Saltfjord, together with the Skjerstadvfjord, penetrates inland in an easterly direction. Steep ranges of mountains separated by deep valleys lead away from the shores of the fjords, which are very broken and have several large, low-lying, boggy promontories, especially on the north. The port of Bodö* is on such a promontory at the entrance to the Saltfjord. Steep hills rise behind the town and a small lake near their summit feeds the Boden electric power station. A branch road (111), leading to the Northern Trunk Road at Fauske, follows the north shore of the fjord. It can be reached from ports of call for coastal steamers at Valosen, Tverlandet, Valnesfjord, Venset, and Fauske, and from small beaches along the fjord, especially in Valnesfjord and Klungsetvik. The Nedrevand (Nervatnet) and Övrevand (Övrevatnet), used by lighters bringing ore from the terminus of the Sulitjelma railway to Finneid, are only separated from the Skjerstadvfjord by a narrow, shallow channel. The precipitous and forested east shore of the Saltdalsfjord, a southward extension of the Skjerstadvfjord, is followed by the Northern Trunk Road. The road can be reached from ports of call for coastal steamers at Saltdal (Rognan), Setså, Leivset, and Finneid (quay), and there are beaches at the head of the fjord which leads to a deep valley. At Finneid the road bears inland and follows the direction of the coast northwards, sometimes descending to the heads of fjords and running along their shores for short distances.

The Sörfollafjord is steep and sparsely wooded on its northern shore, but the south and south-west shores have a more gentle slope and are followed by the Northern Trunk Road to Sörfolla (Rösvik), whence there is a ferry to Engan on the precipitous Leirfjord. The road may be reached from ports of call for coastal steamers at Djupvik and Sörfolla, and from Megarden and Helland on a branch road which runs round the head of the fjord. There is a small beach at Sörfolla and others along the road.

The Northern Trunk Road (111 A) next reaches the coast at the head of the Nordfollafjord where there is a beach and wharf on the steep forested shore at Mörsvikbotn.

The southern shore of the Sagfjord rises very steeply through forested lower slopes to bare jagged peaks. The northern shore, which is formed by a large island, is less steep. A very narrow channel separates the island from the mainland and from the Innhavet channel. The Northern Trunk Road reaches the head of the Sagfjord at Tömmerneset (port of call for coastal steamers and beach). It follows the shore at the head of the fjord and along the Innhavet, with a





FIG. 20. *Kabelvåg (Lofoten Islands), with skjaergård and strandflat, and part of the Lofot wall rising in the background*



FIG. 21. *The rugged western shore of the Lyngenfjord*

branch road from Drag (wharf) on the Tysfjord, and crosses a peninsula to the Stordjupet. The shores here are less steep and the road often runs some way from the coast. It can be reached from a port of call for coastal steamers and a beach at Sörkil, whence it crosses a narrow peninsula to Korsnes on the Tysfjord.

The Tysfjord extends southwards with many branches and steep, forested shores. The road joins the fjord on the west near its entrance and can be reached from a port of call for coastal steamers at Storjord and a beach at Bogvika near Korsnes, where there is a ferry to Skarberget. From Skarberget the road follows the coast for a few miles and can be reached from a port of call for small coastal steamers at Skjellesvik before it crosses a hilly peninsula to the steep west shore of the narrow Efjord, across which there is another ferry between Soetran and Forsa. From Forsa the road crosses another steep peninsula, past the Björkåsen pyrites mines, to the Ofotfjord. The Ofotfjord penetrates so far eastward that one of its many branches is only 5 miles from the frontier with Sweden. Its shores are generally steep and forested, though there are a few low-lying promontories. The port of Narvik* is on one of these and from it the iron-ore railway leads inland to Sweden. Iron-ore is also mined at Fagernes, south-west of Narvik, and there are power stations at Nygård and Hakvik.

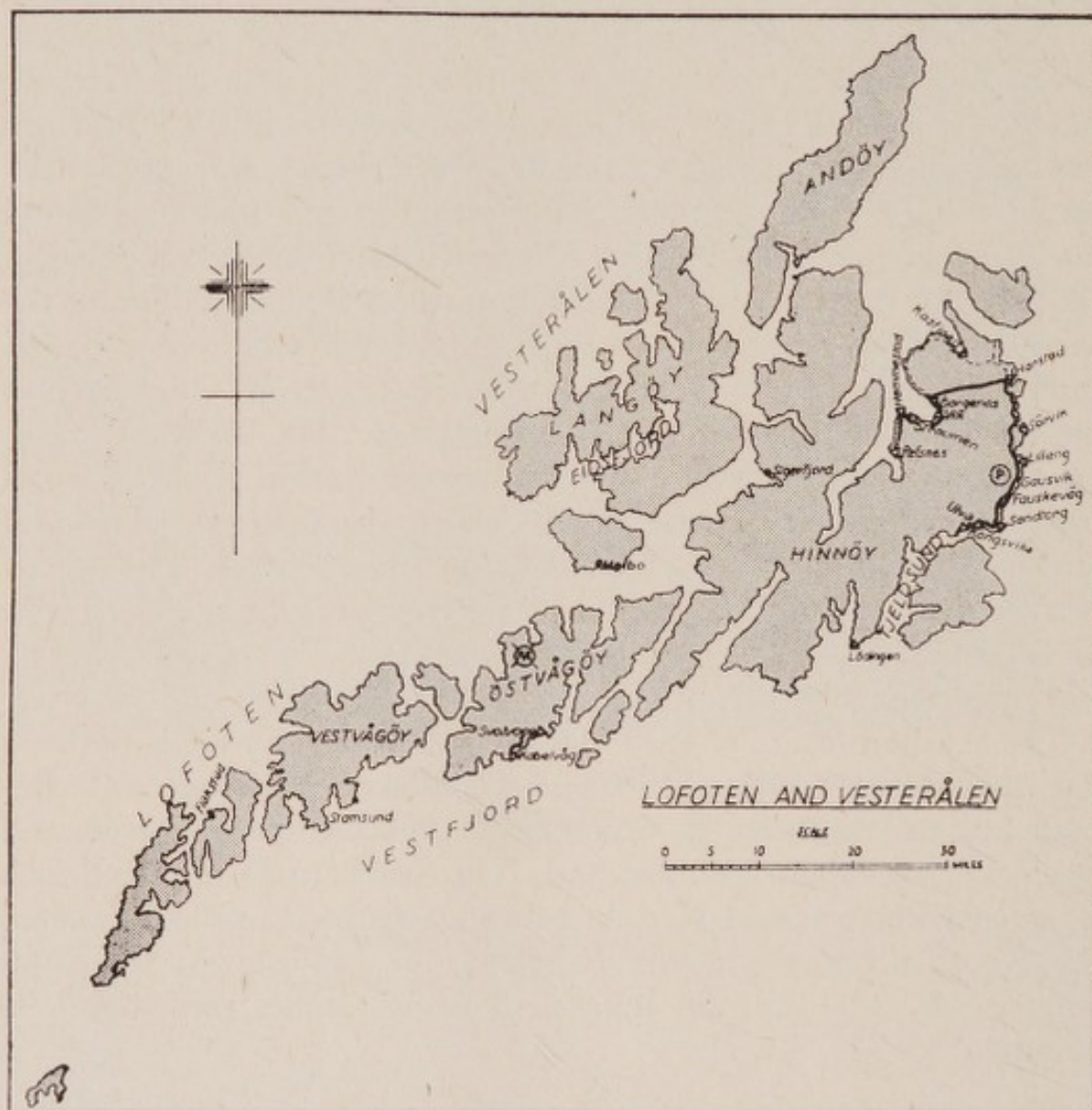
The southern shore of the Ofotfjord is followed by roads between Tjellebotn and Narvik. There is a secondary road between Tjellebotn and Ballangen (11 J), which can be reached from wharves and beaches at Tjellebotn and Bostrand. The Northern Trunk Road runs between Ballangen and Narvik, being interrupted by ferries across the Skjomen(fjord) and the Beisfjord. It can be reached from wharves at Ballangen and Ranå, and from beaches throughout its length.

22. *The Lofoten Islands, with Hinnöy, and the Vesterålen Islands*
(Map 30, p. 84)

Hinnöy and the Lofoten islands form a chain south-westwards from the mainland near Ofotfjord. The Vesterålen islands are a smaller group to the north of them.

The islands of the Lofoten group decrease in size towards the south-west but, excepting the north-east of Hinnöy, they have a similar topography throughout. Steep mountain ranges rise to jagged, irregular peaks often over 3,000 feet. From a distance the islands resemble a rock wall—the Lofot wall—over 60 miles long, but in reality they are cut up by countless narrow creeks and sounds

into sharp, serrated peaks lying behind each other. These are of bare, grey rock, snow-covered in winter and in summer bathed in the rays of the midnight sun. The shores of the islands are generally precipitous, but they are fringed by isolated patches of strandflat and by



MAP 30

islets of the skjaergård, both of which form sites for the many fishing villages and the huts occupied only in the fishing season (Fig. 20).

On Vestvågøy there are several open stretches of fertile land, where the farms are served by a comparatively good road system.

Svolvær*, the capital of the islands, is on a promontory on the southern shore of Østvågøy (Austvågøy). The port is joined by a road to Kabelvåg wharf on the west. Iron mines on the north of Østvågøy are connected with the coast by a mineral railway.

The south-western parts of the island of Hinnøy resemble the other

islands of the Lofoten group, but the north-east is different. Here the shores are not steep, the lower slopes of the mountains are covered with birch forests, and there is undulating well-farmed land. The port of Lødingen, at the entrance to the Tjeldsund, where there are wharves and a beach, is the centre of the telegraph service of northern Norway. From Kongsvika wharf a road (12 A) follows the eastern shore of the island to Harstad.¹ The road is accessible from wharves at Ulvik, Sandtorg, Fauskevåg, Gausvik, Lilleng, and Sorvik and from almost continuous stretches of beach along the Tjeldsund. There is an electric power station near Gausvik. Harstad* is the only large town on the islands and it has important fish-oil factories. It can be reached from the north by a road from Hemmestad wharf (12 B) and other ports of call for small coastal steamers at Refsnes, Straumen, Vik, Borgeles, and Kasfjord.

On the Vesterålen islands the mountains are neither so high nor so serrated as on the Lofoten group; level plains are more extensive, so that farming is quite important, especially along the more sheltered eastern shores where the farms are served by roads. In inland valleys and over large areas of Andøy the low-lying land consists of boggy and uninhabited moorland.

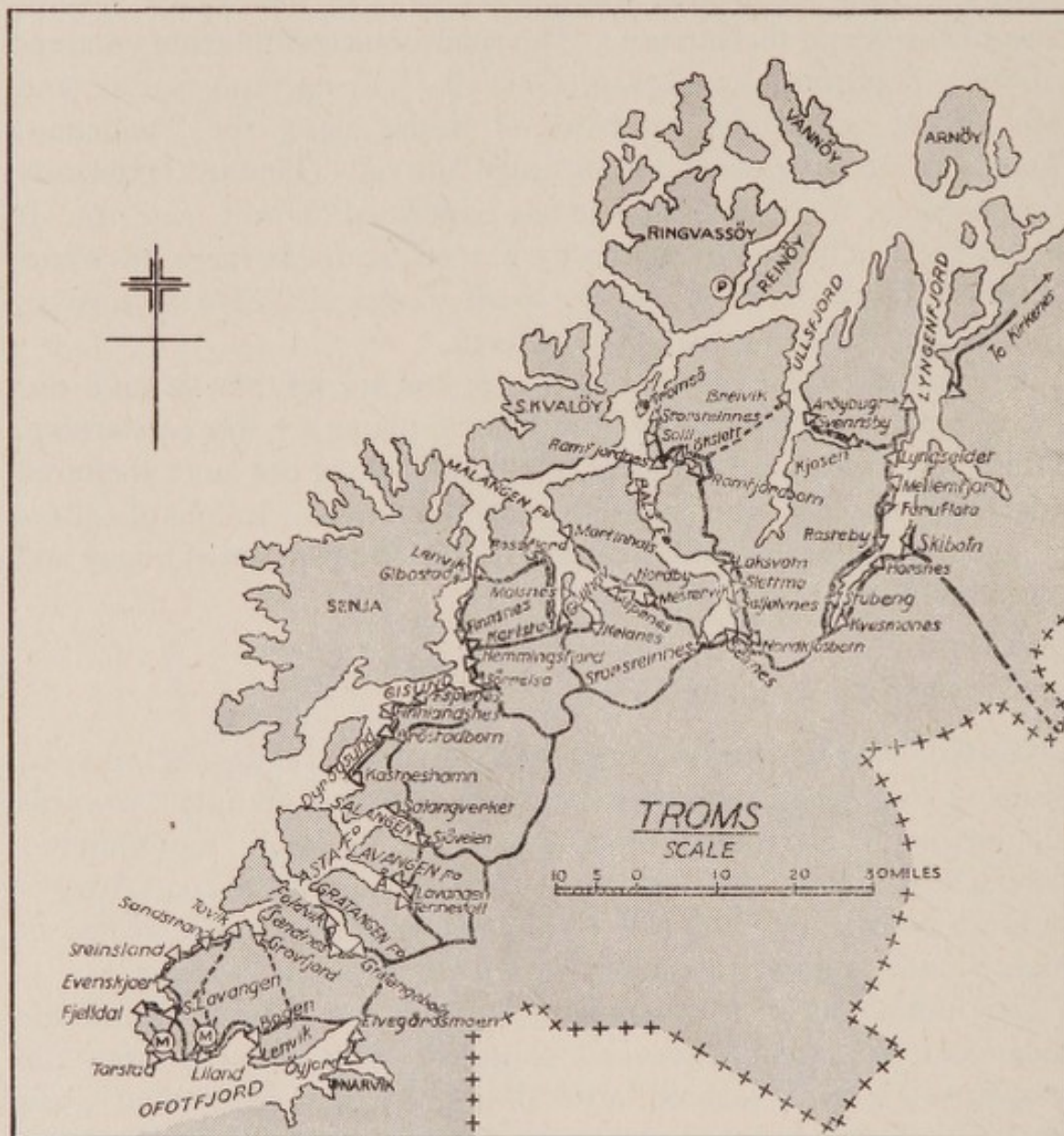
23. Troms (Map 31, p. 86)

North of the Ofotfjord the coast of the mainland is deeply indented by many long fjords, which increase in size and grandeur towards the north. It is fringed by a skjaergård of large, mountainous islands, which form the northward continuation of the coastal highlands of Nordland. There is also a discontinuous outer fringe of small islands, similar to the skjaergård of southern Norway.

The mountains of the mainland between the Ofotfjord and the Malangenfjord are massive and rounded, rising steeply from the coast through birch-covered lower slopes to barren fjeld about 3,000 feet high. Deep, forested valleys lead inland from the heads of the fjords and afford valuable routes across the fjeld. North of the Malangenfjord the land is divided into peninsulas by the deeply penetrating Malangenfjord, Balsfjord, Ullsfjord, and Lyngenfjord, and the mountains are steeper and wilder. Here there is less forest and the fjeld often rises to 4,000 feet, while the snow-covered peaks west of the Lyngenfjord reach over 5,000 feet.

¹ Only the roads and ports of call giving access to Svolvær and Harstad, the principal towns of the islands, are mentioned here. For further details see Vol. II.

The large islands of Senja, S.Kvaløy, Ringvassøy, Reinøy, Vannøy, and Arnøy are all mountainous, but the more northerly are not so lofty. Their western shores are generally steeper than their eastern shores, which are partly covered with birch forests and partly farm-land. Senja and S.Kvaløy are deeply dissected on their western



MAP 31

shores by small, rugged fjords. The island of Tromsøy, lying between S.Kvaløy and the mainland, is hilly and forested. The port of Tromsø* is on the east shore of the island. Electric power is provided for the island from the station on Ringvassøy.

The mainland is served by a good road system. The Northern Trunk Road (11 A) runs from the ferry at Öyjord, on the Ofotfjord, to Årøybugt on the Lyngenfjord, which is crossed by a ferry to Nord-

mannsvik. Many branch roads run from the coast to join the main road.

A road (13 A), skirting the shores of the Astafjord and Tjeldsund and the north shore of the Ofotfjord, can be reached from wharves at Tovik (3 jetties), Sandstrand, Steinsland (ferry), Evenskjaer (jetty), S. Lavangen, Fjelldal, Tårstad, Liland, Bogen (iron pier), Lenvik, and Elvegårdsmoen (Bjerkvik, 2 piers). There are many small beaches which give access to the road along the Tjeldsund and the bays of the Ofotfjord, and near Bogen a branch road joins from Grovfjord wharf. Iron-ore deposits are found along the shores of the Ofotfjord and mining is carried on at Liland and at the Bogen Mines at Evenes.

The southern shore of the Gratangenfjord is followed by a road (13 B) from Foldvik wharf past Sandnes wharf to the wharf and beach at the head of the fjord.

The northern shore of the Lavangenfjord is followed by a road (13 C) with ports of call for coastal steamers at Å, Lavangen, and Tennevoll, and a beach at the head of the fjord, from which the road runs inland. Similarly a road (13 D) runs along the northern shore of the Salangenfjord, past jetties at Salangsverket and Sjøveien and a beach at the head of the fjord. This road links the Lavangenfjord on the south to the Dyrøysund and Sørreisa on the north. Along the gently sloping shores of the Dyrøysund there are ports of call for coastal steamers at Kastneshamn, Bröstadbotn (beach), Finnlandsnes (jetty), and Espenes.

The Gisund leads between the mainland and Senja island. The shore of the mainland is not very steep and a road (13 D, 13 E) runs along the coast turning inland south of Sørreisa. There are ports of call for coastal steamers on the road at Sørreisa (2 piers and beach), Hemmingsfjord, Finnsnes (3 quays), and Bjorelvnes beach (Lenvik), and road connexions from Rossfjord and Karlstad (river ferry) on the Malangenfjord.

The Malangenfjord is steep-sided near its entrance, but its head ramifies and becomes less steep. The broad mouth of the Målselv is partly silted up and there are small beaches at the heads of the other ramifications. A road (13 FF) follows the right bank of the Målselv past Målsnes (2 piers) and Gullhav (river ferry) and joins a road from Keianes (port of call for coastal steamers). The north-eastern shore of the fjord is followed by a road (13 H) with ports of call for coastal steamers at Martinhals, Skutvik, Nordby, and Mestervik. At the head of the fjord it is met by a road from Aspenes (port of call for coastal steamers) before bearing eastwards to the Balsfjord.

The Balsfjord extends southwards from the island of Tromsö between steep, forested shores. A road (13 I) from Storsteinnes (beach and piers) follows the shore of the outer fjord and the north shore of the Ramfjord, where it is joined by a road (13 J) from Breivik, a port of call for coastal steamers on the Ullsfjord. There are ports of call for coastal steamers on the main road at Solli, Ramfjordnes, Lökslett, and Ramfjordbotn, where it bears inland before rejoining the Balsfjord near Laksvatn. The road continues along the east shore of the fjord, past many farms, to its junction with the Northern Trunk Road (11 A). It can be reached from ports of call for coastal steamers at Laksvatn (beach), Slettmo, Seljelvnes, and Nordkjosbotn (beach). The Northern Trunk Road follows the precipitous head of the Balsfjord from Storsteinnes (pier and beach), past Seltnes (port of call for coastal steamers), to Nordkjosbotn. At Storsteinnes it is joined by a road which follows the west shore of the fjord for a short distance with a wharf at Tennes (Balsfjord) and a branch road from Martinhals, on the Malangenfjord.

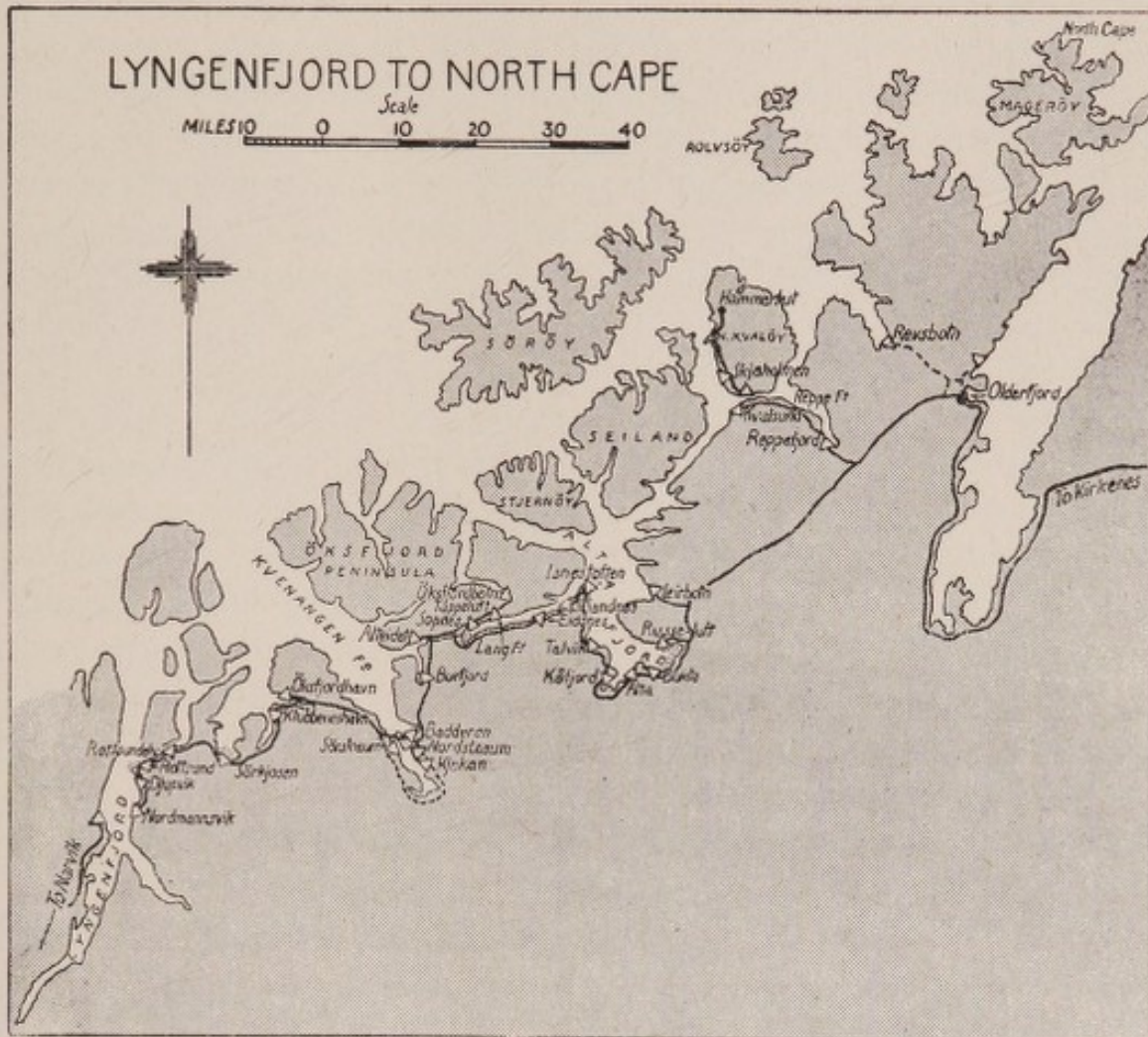
The rugged shores of the Lyngenfjord rise steeply through wooded lower slopes to barren fjeld and snow-covered peaks (Fig. 21). The Northern Trunk Road reaches the head of the fjord, where there is a beach, and where it is joined by a road (13 K) from the east shore, with wharves at Skibotn (junction of road to Sweden), Horsnes, and Kvesmanes. The main road follows the west shore of the fjord along a narrow coastal terrace past farms and a wharf at Stubeng; then it clings to the precipitous side of a mountain, where there is danger of avalanches. There are ports of call for coastal steamers at Rasteby and Furuflata before the terrace appears again, and the road is easily accessible from wharves at Mellemfjord, Lyngseidet, and Årøybugt. At Lyngseidet a road (13 L) joins from Kjosén, a port of call for coastal steamers on a branch of the Ullsfjord. This road has probably been extended to Svensby on the steep, forested east shore of the Ullsfjord.

24. *The Lyngenfjord (Lyngsfjord) to the North Cape (Map 32)*

North of the Lyngenfjord the only long fjords penetrating inland are the Kvenangenfjord and the Altafjord. The mountains which form the mainland become more massive and mamillated towards the north, where they form the western limits of the Finnmark plateau. The rocky coast generally rises precipitously to about 3,000 feet. There are very few trees, except at the heads of the fjords, which lead inland to deep, forested valleys.

The Öksfjord peninsula and the islands lying off the coast between

the Kvenangenfjord and the North Cape are dissected by many small fjords and rise steeply to very varied heights. The highest points are on the Öksfjord peninsula and Seiland island where ice-covered peaks rise to over 3,500 feet. N. Kvaløy is neither so steep



MAP 32

nor so high as the other islands; the port of Hammerfest* is on the shores of a small bay on its west coast. The south-western shores of Magerøy are steep and barren, whilst the north-eastern shores, and the North Cape, rise in sheer walls of dark rock to a flat, barren plateau, which is the western limit of Finnmark (Fig. 16).

Communications are very restricted, there are very few routes inland, and the only coastal road is the Northern Trunk Road (11 A), which has now been completed. From the ferry at Nordmannsvik, on the east shore of the Lyngenfjord, this road runs along the steep shores of the Lyngenfjord and Rottfjord with ports of call for coastal steamers at Djupvik, Rottfjord wharf, and Rottfjordelv, and a long beach at Rottfjord. The road then crosses several small peninsulas

and runs along the shores of the intervening bays with ports of call for coastal steamers and beaches at Sörkjosen (jetty), Klubbeneshavn, and a jetty at Sandelv. In the Kvenangenfjord the road is interrupted by a ferry between Sörstraum and Nordstraum, but there is a road under construction round the head of the fjord past the port of call for coastal steamers at Kjekan. From Nordstraum the road runs inland past Badderen wharf and rejoins the coast at Burfjord, where there is a beach and port of call for coastal steamers. From Alteidet wharf it crosses the narrow isthmus of the Öksfjord peninsula to the Langfjord, a long, wooded branch of the Altafjord; it follows the south shore of the Langfjord and then the west shore and the head of the Altafjord.

The hills are low and forested and there are many inflowing streams, including the mighty river Alta, which has built up extensive beaches at its mouth. In Langfjord there is a beach at the head of the fjord and the road can be reached from ports of call for coastal steamers at Öksfjordbotn (on the Öksfjord), Tappeluft, Sopnes (wharf), Eidsnes, Storsandnes, and Isnestofte. In the Altafjord there are ports of call for coastal steamers at Talvik (wharf), Kåfjord (copper works and wharf), Alta (Bossekop slate trade), and Bukta. The road bears inland from the head of the fjord to Olderfjord on the Porsangerfjord. It can, however, be reached by branch roads from ports of call for coastal steamers at Russeluft (beach) and Leirbotn (beach and jetty) on the Altafjord, from Kvalsund (ferry from Hammerfest) and Reppefjord on the Reppefjord (14 B) and from the head of the Revsbotn (14 C).

25. *Finnmark* (North Cape to the Finnish frontier, Map 33)

The coast of Finnmark is deeply dissected by the Porsangerfjord, Laksefjord, Tanafjord, and Varangerfjord. These long, broad fjords have few ramifications and their shores have generally low rock walls, although there are flat sandy stretches and forests near their heads. Outside the fjords the coast is sheer and rocky, with many open bays, unscreened by islands.

The outer shores of the Porsangerfjord have steep, bare walls about 650 feet high, but near the head of the fjord they are very irregular in height, rising in places to over 1,000 feet, while other parts are low and have extensive beaches and forests. Many small, flat islands lie near the head of the fjord. The Northern Trunk Road (11 A) follows the west shore from Olderfjord and has now been completed along the east shore to Börselv and inland to the head of the Laksefjord. It can be reached from ports of call for coastal steamers

at Smörfjord (wharf), Russenes, Kistrand, Ytre Billefjord (wharf), Indre Billefjord, Kolvik, and Hamnbukt (wharf), and beaches at Kistrand, the Billefjords, a series between Kolvik and Brennelv, at Roddeneset, and near Börselv.

The Laksefjord is short and has many inlets. The steep, bare cliffs of the outer fjord increase in height southwards, but the head of the fjord is again lower and coastal terraces and forest appear. The Northern Trunk Road skirts the head of the fjord and then bears inland from Ifjord to the Tanafjord. There are ports of call for coastal steamers at Kunes, Laksefjordbotn, Friarfjord, Ifjord, and Lebesby, and beaches at Kunes, Adamsfjord, and Ifjord.

The steep sides of the Tanafjord increase in height to about 1,500 feet near its head, where the fjord ramifies. There is a large, sandy spit at the mouth of the Tana river, but otherwise there are only small beaches at the heads of inlets. The Northern Trunk Road runs along the head of the fjord and can be reached from ports of call for coastal steamers at Vestertana, Torhopen, Smalfjord (wharves), Gavesluft, and Austertana.

The Varangerfjord is very broad near its entrance, but narrows rapidly near the port of Vadsö*. The northern shore of the fjord has no inlets, but it rises in steep cliffs of very irregular height in some parts, while elsewhere it slopes gently inland. The sheltered inner end of the fjord is covered with birch forests. A road (14 E) runs along the shore from Svartnes (ferry to Vardö*) and joins the Northern Trunk Road near the head of the fjord; it can be reached from a beach at Svartnes and a series of beaches which extend almost without interruption from Kibergneset to this junction. There are also ports of call for coastal steamers at Ytre Kiberg, Indre Kiberg, Komagver, Skallelv, Falkekjeilen, Krampenes, Store Ekkerøy, Jakobselv, Mortensnes (jetty), Nesseby (jetty), Gornitak, Nyborg (jetty), and Meskelv (jetty). The southern shore of the fjord is much indented by inlets and river mouths. It has many variations in height and is almost treeless except in the sheltered inlets. The Northern Trunk Road (11 A) runs near the shore to Kirkenes and can be reached from ports of call for coastal steamers at Karlbotn, Grasbakken, Burgöyfjord, and Neiden (wharf), and beaches at Karlbotn, Reppen, Burgöyfjord, Neiden, and near Kirkenes. From the east Kirkenes* and its iron-works can be reached from a road (14 F) with ports of call for coastal steamers at Tårnet, Karpbukt, and Jarfjord, where there are also small beaches. Another road (14 G) runs inland along the Pasvik river to Finland.

CHAPTER IV

CLIMATE

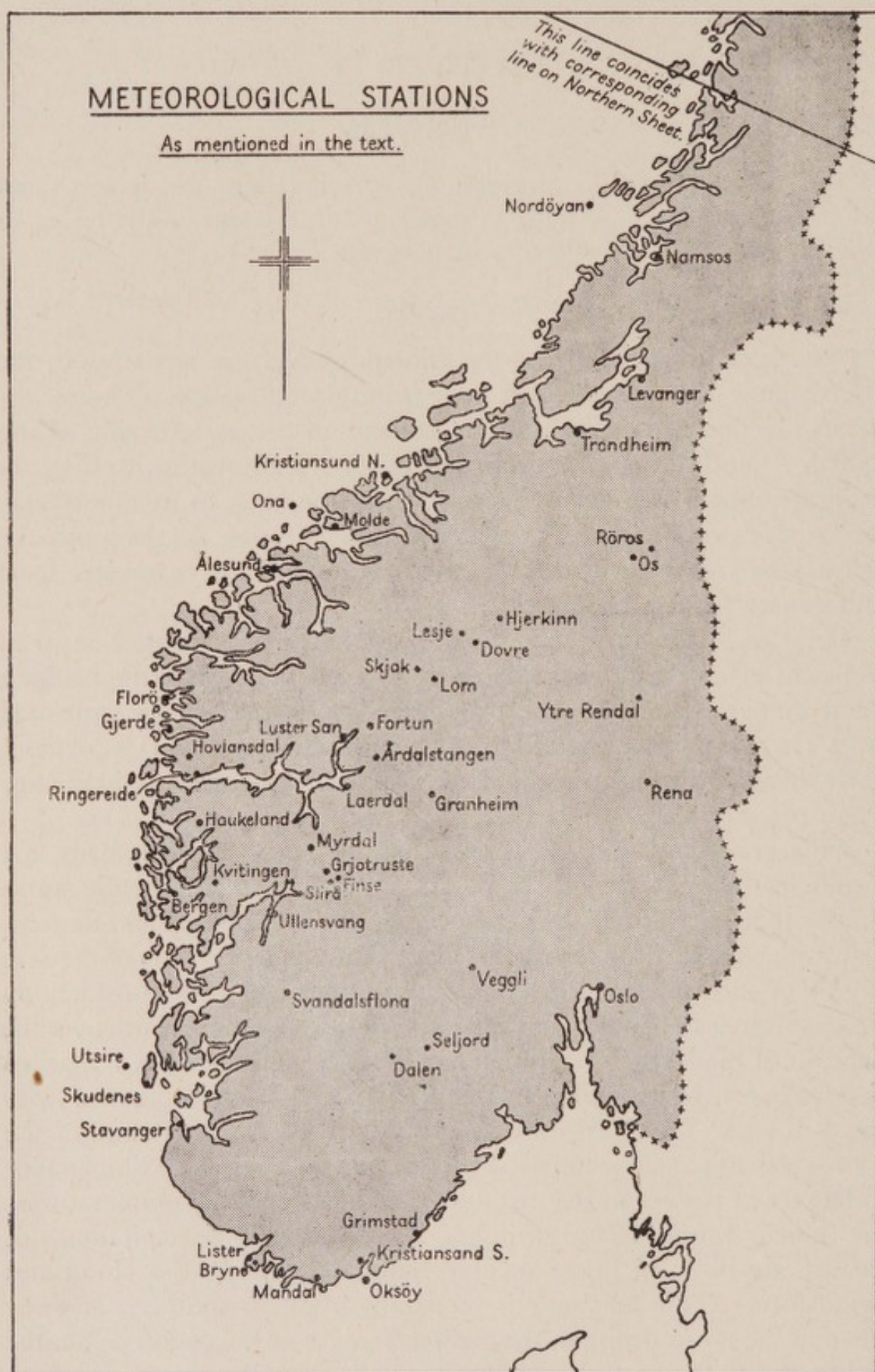
(All temperatures in degrees F., precipitation in inches, and altitudes in feet. All places mentioned in the text or the tables in Appendix V are marked on Map 34, pp. 94, 95.)

GENERAL

THE most original note of the climate of Norway is found in the striking differences which exist from place to place. These contrasts are due to the position of Norway on the eastern side of the North Atlantic where the sea-water is abnormally warm, to the prevailing winds which carry this warmth to the land, to its mountains, and to its extent through 13 degrees in high latitudes. In the south the greater height and width from east to west allow even greater local differences than in the north.

Because of the marked differences in climate which may occur in adjacent places, it is always dangerous to assume that the figures for a meteorological station represent conditions beyond a very restricted area. In making use, therefore, of available information, it is particularly important to bear in mind the main factors of this rapid change from place to place.

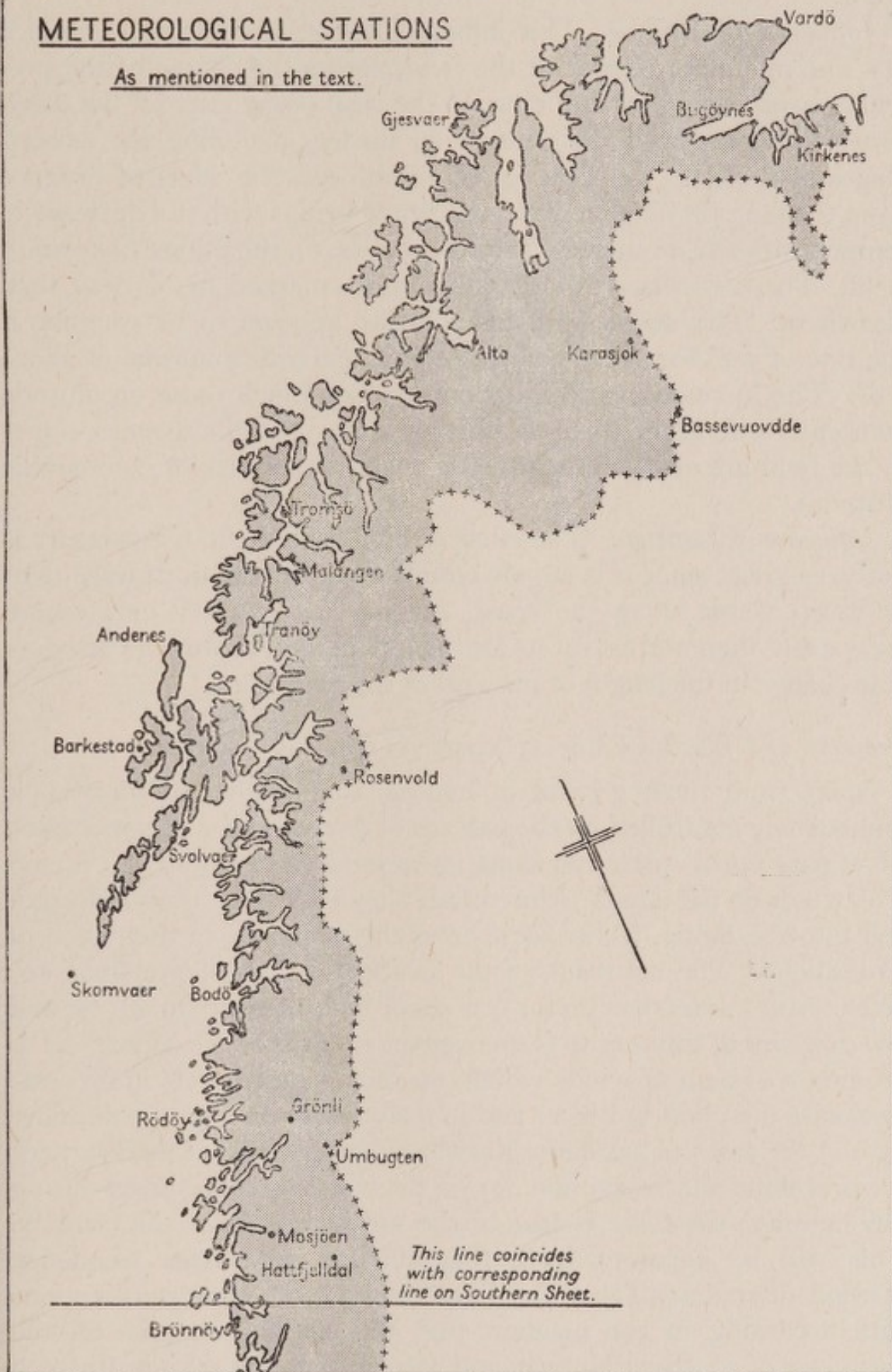
Influence of the Sea. As a result of the North Atlantic drift, the water in the open sea off the coasts of Norway is abnormally warm (more than 9° warmer than the average for its latitude) and its temperature changes little during the year. The shallow waters of the seas south of Norway are less abnormally warm and vary considerably from summer to winter. The westerly winds carry the warmth over the land until hindered by mountains. There is consequently a marked tendency for the climate to change from the coast inland, that is, from west to east. The local influence of the southern waters and of the fjords is insignificant compared with that of the open sea. The smaller influence of the sea in the east results in more extreme temperatures, in much more severe winters, in decreased precipitation, in fewer rain-days, in lower relative humidity, and in less cloud and wind-force. This tendency is more important in southern Norway than in the north owing to the greater breadth of the country. On the other hand, the rate of change inland is actually greater in some parts of the north where the winter warmth of the coastal districts is



MAP 34 (South Sheet)

METEOROLOGICAL STATIONS

As mentioned in the text.



MAP 34 (North Sheet)

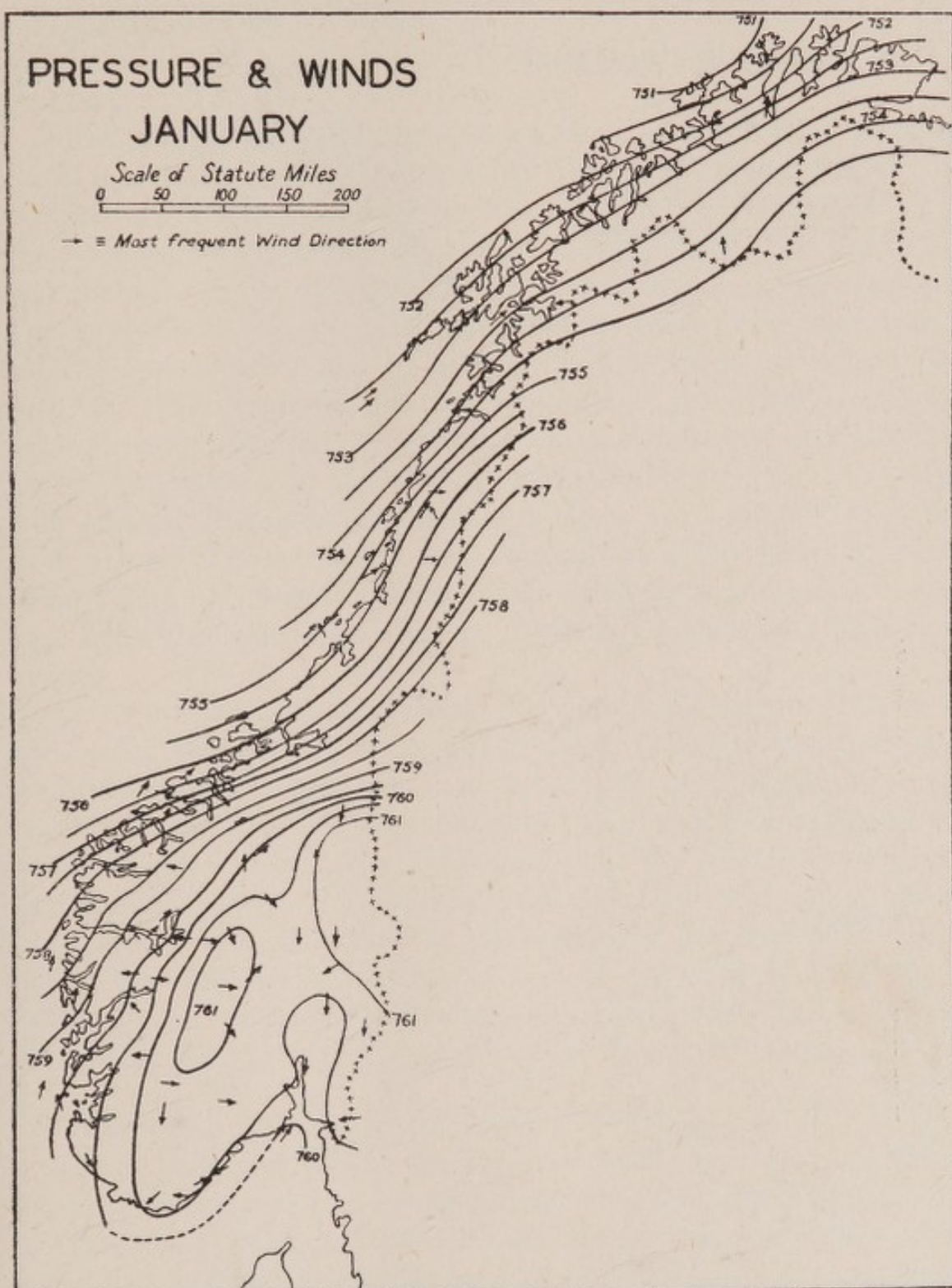
more abnormal, and consequently more confined to the immediate coast.

Influence of Altitude. This influence is considerable and twofold: (1) The mountain barrier of the fjeld, across the course of the prevailing westerly winds and close to the west coast, cuts off the maritime influences from the country in its lee, including the eastern slopes of the fjeld, and thus greatly reinforces the effect of distance from the sea. (2) The increase of altitude brings with it a decrease in temperature and an increase in precipitation on the higher or western fjeld. These effects are both rather more marked in Norway than elsewhere. The decrease in temperature appears to be roughly at the rate of 1.2° for every 300 feet compared with a normal of about 1.0° . The increase in precipitation depends much more on altitude combined with aspect than on altitude alone, and the western slopes of the fjeld are always much wetter than the eastern, at comparable altitudes.

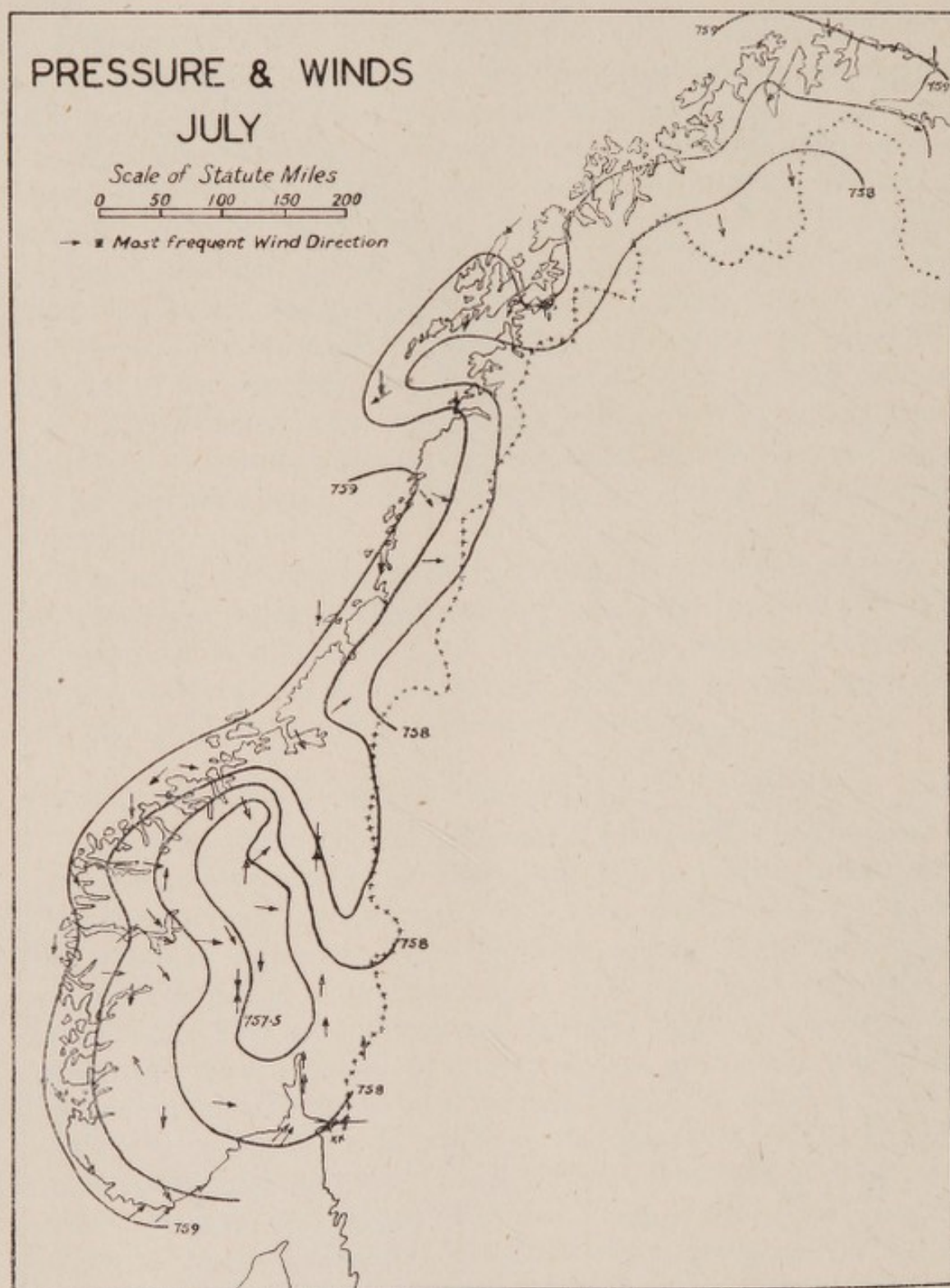
Influence of Latitude. The effect of high latitude on temperature is not very great, since it is largely counteracted by the northward drift of warm water along the coast, making the country everywhere far warmer than normal for its latitude. There is, however, considerable change in the length of day and of the seasons.

Pressure and Winds (Table 1; Maps 35 (a), (b))

Apart from these general influences, the weather of Norway is immediately controlled by the passage of depressions along its coasts. Most pass north-eastwards along its western shore and bring S. and SW. winds on the coasts. More rarely they pass along the south coast and into the Baltic, whilst some cross the peninsula in the region of Trondheim. The net result of the passage of these depressions, together with the tendencies for centres of high pressure in winter and low pressure in summer to form over the interior of the country, is to produce a system of winds which, on the average, circle in an anti-clockwise direction in winter and in a clockwise direction in summer around the mass of southern Norway. There is thus a tendency for the prevailing wind-direction during the winter to be reversed during the summer; the same is true of the northern part of the country. This will be apparent from the table of percentage frequency of wind-directions (Table 1). These winter and summer directions vary according to the position that the station occupies on the perimeter of southern Norway and according to the season. In very general terms it may be said that in the north (Vardö and Skomvaer)



MAP 35 (a)



MAP 35 (b)

the prevailing winds are SW. in winter and N. in summer; that on the west coast (Nordöyan, Trondheim, Bergen, and Skudenes) they are S. and SE. in winter, and N. and NW. in summer; and that on the south coast they are E. and NE. in winter and SW. in summer.

Wind-force is naturally greatest on the coast, where it averages 11 m.p.h.; it is rapidly reduced by friction inland, owing to the rugged relief of the country (average 4.5 m.p.h.). At stations near the open sea the percentage of calms is greatest in summer, but in the east there is a much greater total number of calms, and these occur mainly in the winter, e.g. Oslo. The average wind-force is greatest in autumn and winter along the extreme west coast, and it is here also that the greatest number of storms (force 8, or more) occur, the average rising to between 5 and 6 in each of the three winter months. During the whole year the west coast has an average of 20 to 30 days with storms, and only the summer months are comparatively free from them. The numbers vary enormously from place to place (Trondheim 33, Bergen 10 per year). Offshore many more storm-days occur; in winter an average of about 12 a month (force 7 or more).

In still and fine weather during the winter a local wind known as the *Sno* or *Elvegust* may blow, due to the draining of cold, heavy air from the surface of the fjeld into the valleys or fjords nearby. Its strength depends on the temperature of the air and the gradient down which it flows. The latter is steepest near the heads of the larger fjords, and in some of these this 'land-wind' blows strongly, and is very cold. It may also blow into the valleys of eastern Norway, and here it has been known to cause a fall of 20–30° in the temperature.

The strong winds in the coastal areas play a considerable part in preventing the growth of trees, except in protected places.

Temperature (Tables 2, 3, 4, 5, and 6; Maps 36, 37, and 38)

Air-temperatures in Norway show very clearly, both in their general distribution and in detail, the main tendencies described above. With distance and protection from open sea, winter temperatures become lower and summer temperatures higher (Map 36). The warmest and coldest times of the year tend to approximate more closely to the longest and the shortest days respectively. With increases in altitude, all temperatures tend to be lowered. There is also a slight decrease in all temperatures towards the north.

In winter the lowest temperatures are experienced in (a) the interior



MAP 36

of Finnmark, and (b) the district around Røros, i.e. the portion of the country farthest from the sea. In the interior of Finnmark at Karasjok (at an altitude of only 420 feet, but in latitude $69^{\circ} 25' N.$) there is a January mean¹ of 3.7° and a mean annual minimum² of -44° , whilst an absolute minimum³ of -60° has been observed. At Røros (2,067 ft.) the corresponding figures are 12.6° , -35° , and -60° . Here during December, January, and February the temperature rarely rises above freezing point (Table 2). Winter temperatures at greater altitudes are less severe, especially as the highest points are considerably nearer the sea than Røros. Finse, for example, on the Bergen railway, at an altitude of 4,022 feet (nearly twice that of Røros), has a February mean temperature of 16.2° and a mean annual minimum of -20° , 15° higher than that at Røros.

The highest temperatures in winter are found on the coastal islands (skjaergård) of the west, warmed by the warm sea-water and the air blown over it. These mild winter areas usually have their lowest mean in February instead of January. Thus Ona has a February mean of 36.1° and a mean annual minimum of 21° .

In summer (Map 37 b) the conditions tend to be reversed. The lowest temperatures for stations at equal altitudes are along the coastal strip, and there is an increase towards the interior. In summer, however, there is a steady and constant decrease in temperature with altitude, so that the minimum actual temperatures are found at the highest altitudes. The highest temperatures are found in the valleys immediately north of Oslo (July mean 63.1° , mean annual maximum 87° , and absolute maximum 95°).

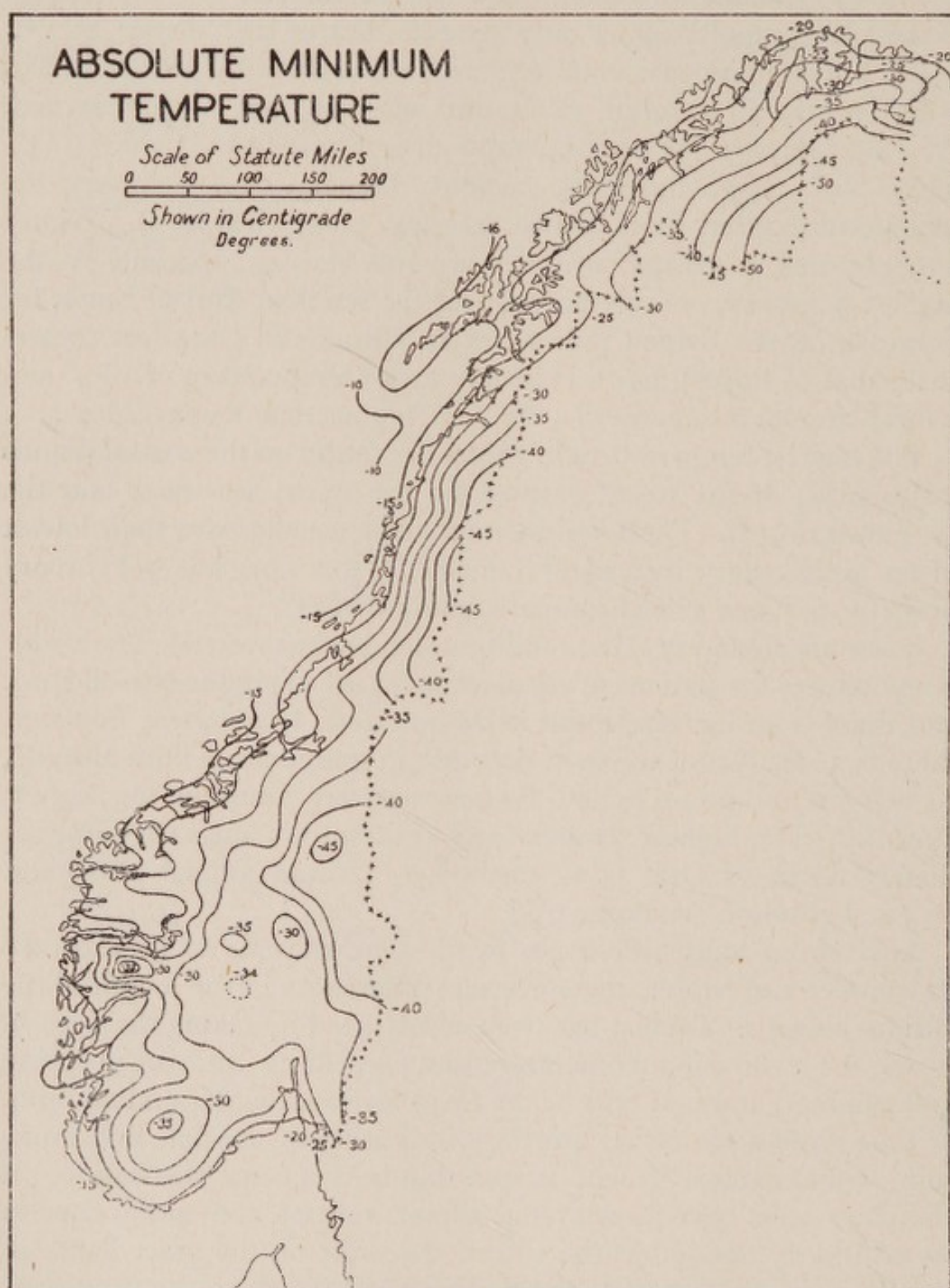
Apart from local differences in the temperatures to be expected in summer and winter, there are also differences in the length of the various seasons. Table 3 has been constructed by taking the date on which the mean daily temperature first exceeds 32° and 50° in spring and summer, and first falls below these levels in winter and autumn. It thus gives a somewhat arbitrary indication of the date and duration of the seasons. It will be seen that in this sense the stations on the outer coast have no winter at all and autumn and spring have to be arbitrarily divided at the end of the year; on the other hand, in the far north the winter lasts for almost 200 days.

In the mild coastal districts of the west the spring starts early, but

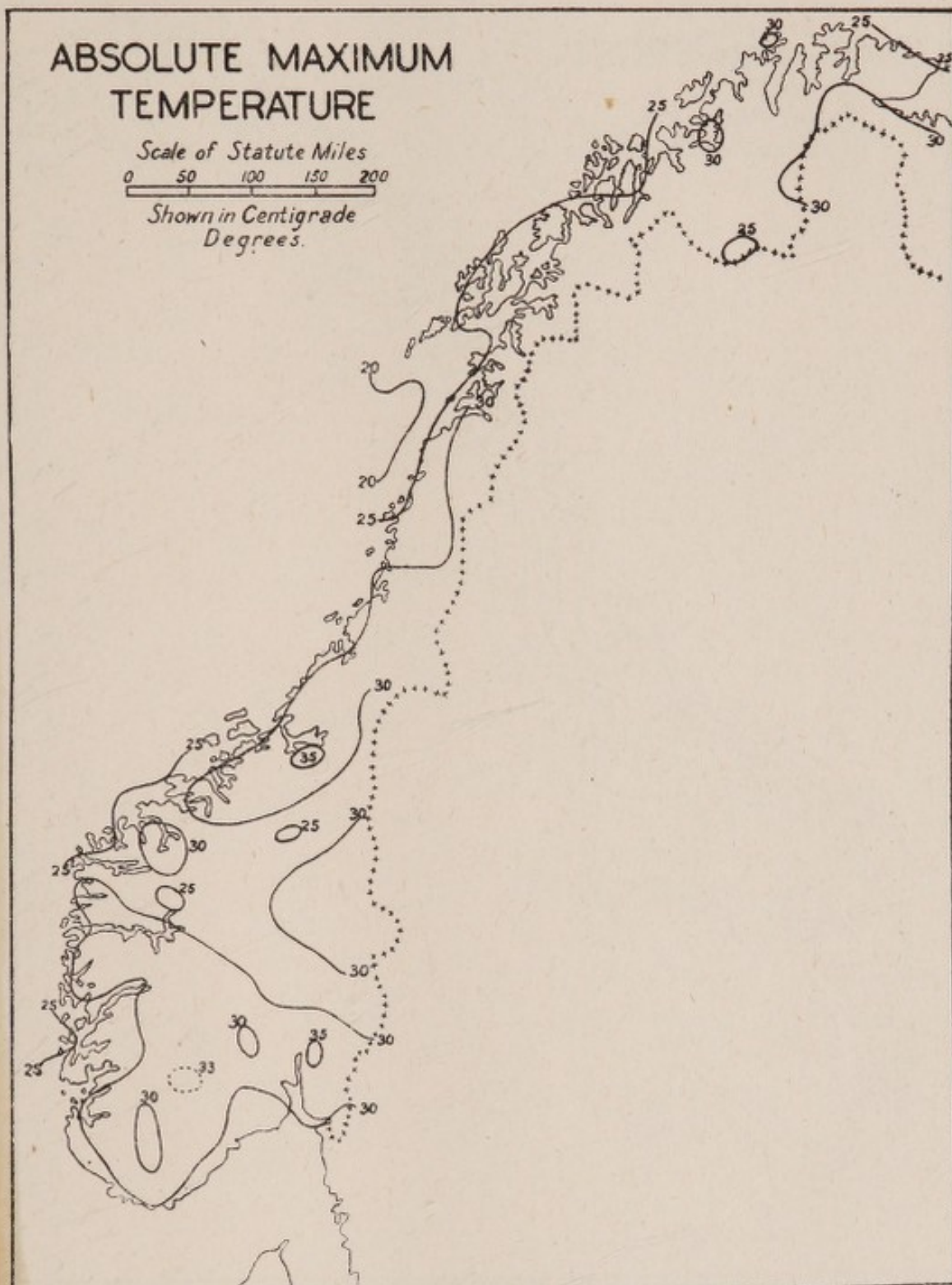
¹ January mean = the average temperature for the whole of the month.

² Mean annual minimum = the average of all the lowest temperatures observed in each year, i.e. the lowest temperature one may normally expect to encounter.

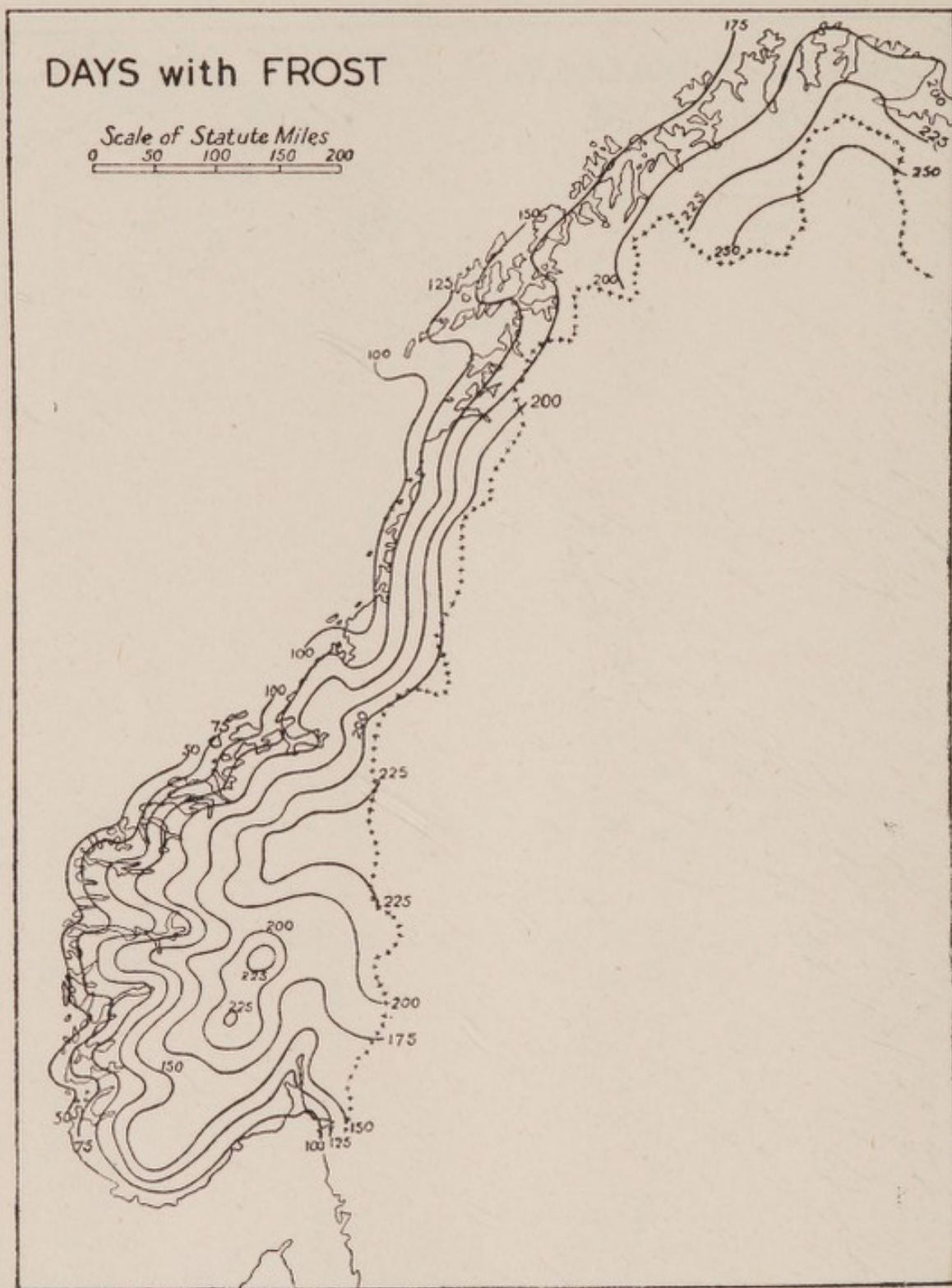
³ Absolute minimum = the lowest temperature ever observed.



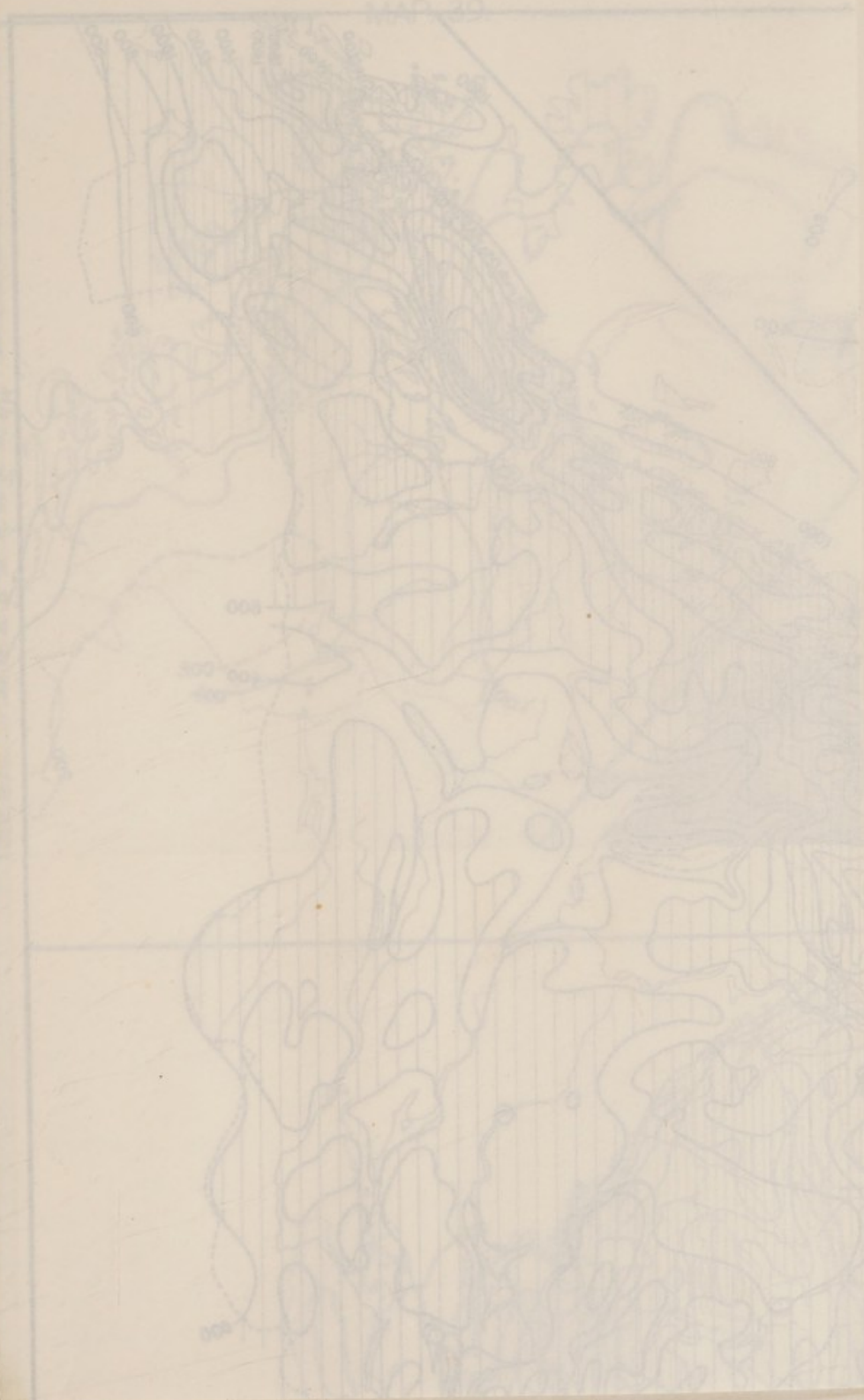
MAP 37 (a)



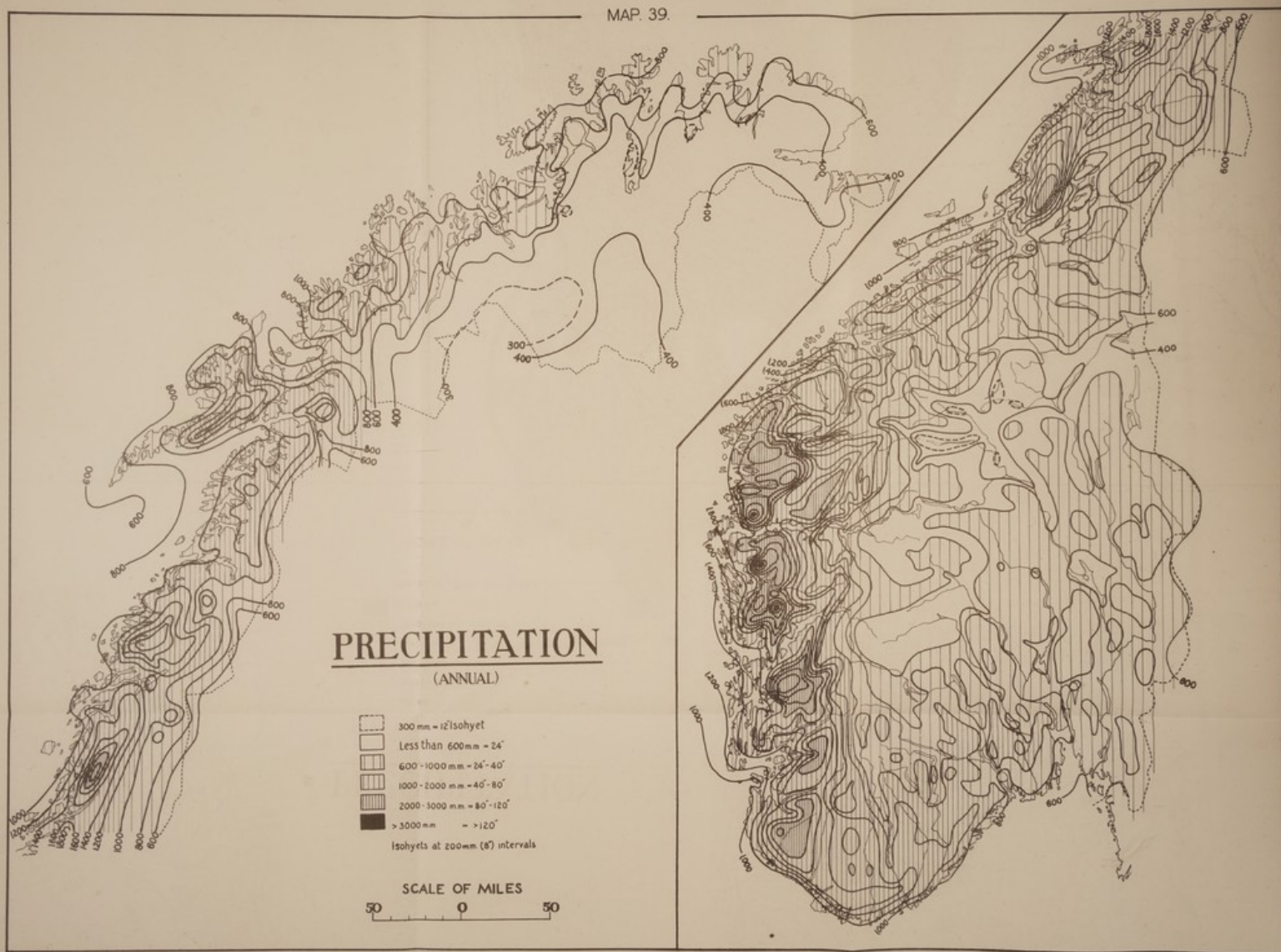
MAP 37 (b)



MAP 38



MAP. 39.



the rise in temperature is slow and the inner fjord regions and the eastern valleys, with their rapidly rising temperatures, soon overtake them. The vegetative period begins on the west coast in April, in the south and around Oslo in May, in the eastern valleys towards the end of May and the beginning of June, while the snow is still lying on the mountains, where spring does not start until about the end of June. In Nordland and Trøndelag spring commences in the middle of June and in Finnmark at the end of the month. Autumn falls in roughly the reverse order, beginning in Finnmark and in the mountains in mid-September and along the south coast in mid-October.

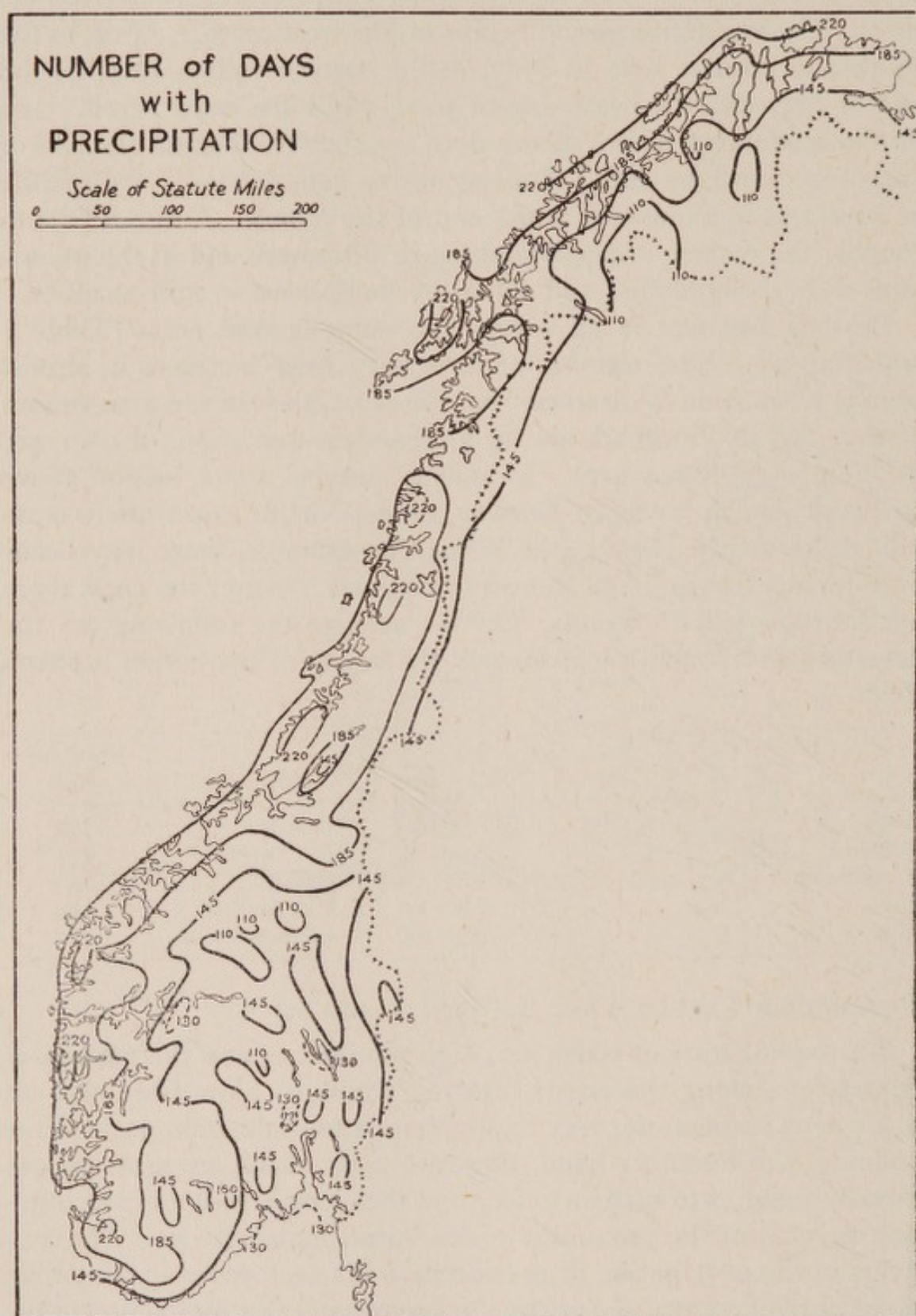
Frost is frequent in all except the outer coastal areas (Table 4 and Map 38). The number of days with frost increases in almost precise proportion to distance from the coast, and rises to a maximum of over 250 in Finnmark and to a secondary maximum of over 225 in the Dovre-Röros area. At inland stations some height above sea-level, and in northern Norway, except for the coast, there is no reliable frost-free period. At Röros, for example, frost may occur even in July on one night in every two years. Nearer the coast there are short frost-free periods. On the average the following are the dates of the first and last frosts and the length of the period between them.

	<i>Last frost</i>	<i>First frost</i>	<i>Frost free days</i>
Oslo	April 27	October 11	167
Bergen	April 19	November 4	198
Trondheim	May 11	October 8	150
Bodö	May 10	October 10	153
Alta	May 25	September 12	110

*Precipitation*¹ (Tables 7 and 8; Maps 39 and 40)

The conjunction of warm sea, high mountains, and the passage of depressions along the coasts, causing winds to blow from the sea to the land, explain the very high precipitation in certain parts of the country. On the other hand, there are parts which are protected by these mountains to such an extent that they have a very low precipitation in spite of the proximity of the warm, moist, sea air. The contrasts in the distribution of precipitation are even more striking than those of temperature and are due to a more complex interaction of the influences of (1) distance from the open sea, (2) altitude, and (3) protection or exposure due to altitude.

¹ Precipitation includes snowfall and rainfall.

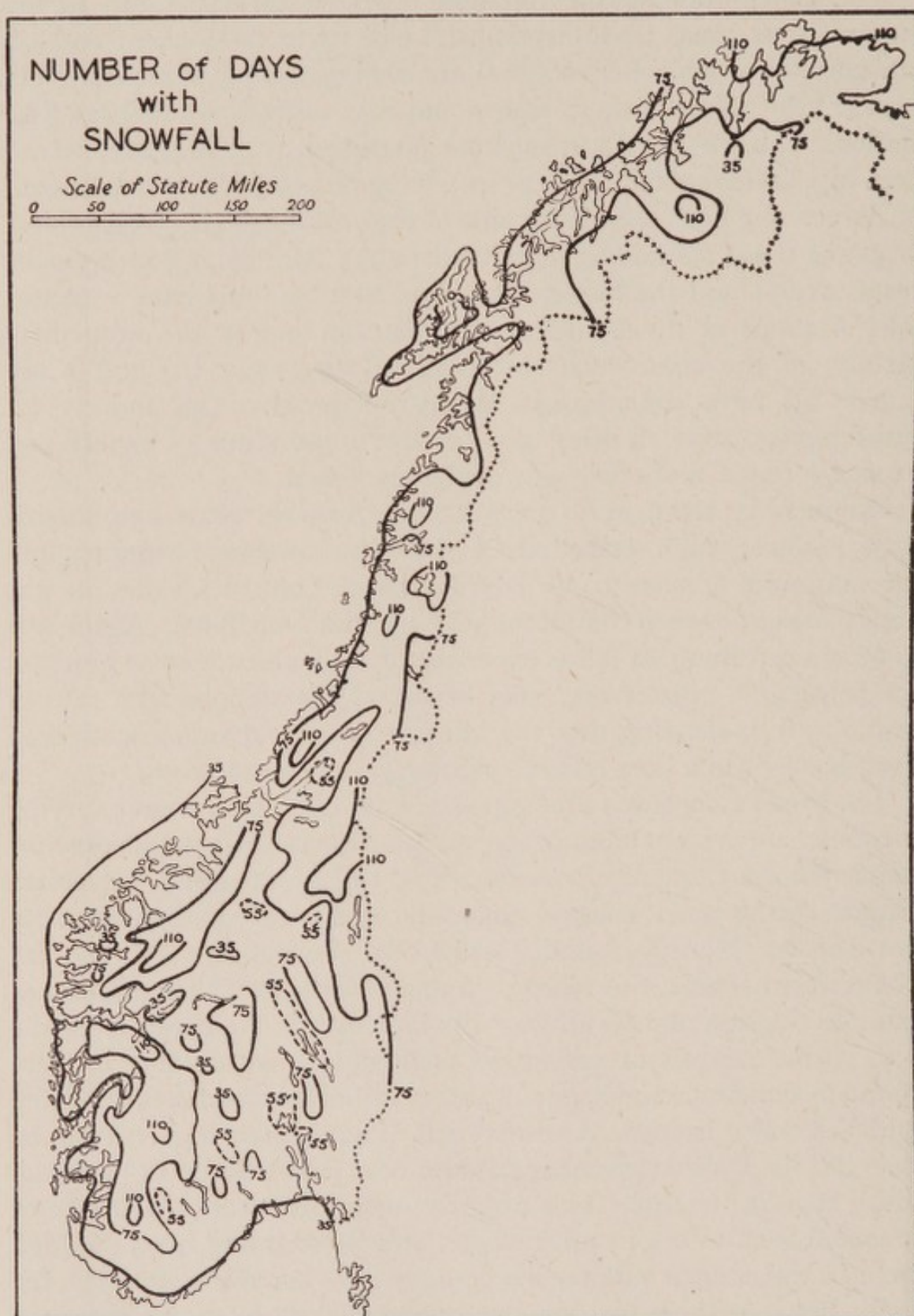


MAP 40

The distribution of precipitation is shown on Maps 39. In the extreme west, areas are indicated with falls up to 120 inches. At high altitudes, however, where stations are lacking, rainfall is undoubtedly greater than the maximum shown and may exceed 200 inches. The stations with the highest means are Kvitingen (123 in.), Haukeland (124 in.), and Hovlandsdal (123 in.), lying respectively east and north of Bergen and on the northern side of the entrance to the Sognefjord. None of these stations is very high (1,033 ft., 787 ft., and 400 ft. respectively), and the higher land close to them must have a greater fall. Stations at much higher altitudes but not in the immediate vicinity of the coast such as Svandalsflona (3,547 ft.) and Finse (4,016 ft.) have considerably lower precipitation (48 and 35 in. respectively), thus showing the decisive importance of aspect and exposure to the first onslaught of the sea winds.

On the other hand, at no great distance from the coastal mountains with these very high totals, falls of around 12 inches are common, and the minimum appears to be 10.6 inches at Lom in a valley on the high plateau between the Dovrefjeld and the Nordfjord. Again it is to be noticed that this fall is experienced at an altitude of as much as 1,247 feet (i.e. greater than that of any of the stations with falls of over 120 in.), showing that the altitude of an individual station in itself is one of the least reliable pointers to its precipitation.

The broad facts about precipitation, including these widely varying extremes, are evident from Maps 39. A fairly wide belt of high precipitation follows the entire coast south of the Lofoten and Vesterålen islands, being most marked along the west coast and particularly between the Nordfjord and Flekkefjord. Within this belt the fall is heaviest between the Nordfjord and Stavanger where the mountains are highest and lie athwart the direction of the winds from the sea. Other centres of very high precipitation within this belt are found in similar circumstances north of Trondheim and in the Lofoten and Vesterålen islands. A second belt of moderately high fall can be distinguished, although the maximum here (less than 40 in.) is much lower than in the first. This extends northwards from the Oslofjord area just west of the frontier where, after descending from the high fjeld to the eastern valleys, the country rises somewhat towards the east. Between these two belts and lying slightly to the north of the centre of the country can be distinguished a large shapeless area of low precipitation, which corresponds, not so much with the area of minimum altitude, as with that of maximum protection from the west. It is closely confined within the basins of the rivers draining into the



MAP 41

Gudbrandsdal and excluded from those draining to the western sea. In Nordland and in Nord-Trøndelag the coastal belt of high precipitation occupies the whole width of the country, but where, north of Tromsø, the coast turns east the rainfall is much less, and in the interior of Finnmark there is another area of very low rainfall, e.g. Bassevuovdde, near Karasjok, 11.9 inches.

Within the belt of maximum precipitation along the west coast, local changes take place with great rapidity. Precipitation increases very rapidly from the coast inland. The zone of maximum precipitation is reached very quickly, within about 25-30 miles of the skjaergård, and then there follows an almost equally rapid decline to the isohyet¹ of 40 inches which, in southern Norway, runs roughly north and south between Molde and Mandal, slightly east of the seventh meridian. Northwards of Molde and as far as Tromsø the same isohyet runs roughly parallel to the coast, but always well to the west of the frontier. East of this line variations are much less abrupt over the rest of the country.

The heavy precipitation of western Norway, because of the cyclones which frequent the coast at all seasons of the year, is very evenly distributed and spread out in falls occupying considerable periods. The number of precipitation-days² (Map 40) is high, ranging from over 150 at several places on the west coast to less than 70 in the interior of Finnmark. The number of precipitation-days varies as a rule in much the same way as the fall, being dependent on the same influences. The maximum number occurs not where the fall is highest, slightly inland, but in the islands and the extreme coastal belt. The number is also high in a broad area extending down the west coast, but is low in the northern part of the eastern interior and in Finnmark.

Certain seasonal differences can be detected in different parts of the country, both in amount of precipitation and to a less extent in the number of precipitation-days. In southern Norway, speaking very generally, winter is the wettest season in the west, and summer in the east. The country between is transitional. In northern Norway, in Nordland and Finnmark, the maximum fall occurs in autumn and summer respectively. Over most of Norway spring is the driest season.

¹ Isohyet = line joining places with equal rainfall.

² In Table 8 and in the text a precipitation-day is one on which 1 mm. or more falls. On Map 40 the figure is 0.1 mm., and the numbers of days are considerably larger for this reason.

Precipitation is usually brought by winds from different directions in different parts; on the southern part of the west coast by SW. sea winds; north of Ålesund by winds between SW. and NW.; on the south coast by those from the S. and SE. In eastern Norway the westerly winds descending the fjeld are relatively dry, even though on the west side of the hills they have brought much rain. The summer rain of this part of the country is mainly brought by E. winds.

Snowfall (Table 9; Map 41)

A considerable portion of the precipitation falls as snow, a fact of importance owing to its effect on communications over much of the country. It is important to know the depth of snow that lies and the time the snow-cover lasts. These are determined not only by the amount of snowfall, but also by the air temperature and other factors, such as sunshine, which affect melting and evaporation. Snow lying on the ground is often swept into drifts by the wind or may even be blown from the flat plateau surfaces of the fjeld into the neighbouring valleys. These purely local variations in depth are very important to traffic.

The amount of snowfall cannot be accurately recorded except in its water equivalent, and statistics do not distinguish snow from rain. It is useful, however, to consider the figures for precipitation which include the water equivalent. The amount of precipitation in winter and spring, say from November to April, when some of it is likely to fall as snow, decreases very rapidly from the coastal mountains towards the interior. At the same time, winter and spring temperatures become very much lower eastwards, especially in the interior, but also in the Oslofjord region. The depth and duration of the snow-cover depend on the balance between high snowfall but warm winters in the west, and low temperatures but small snowfall in the east. Altitude must also be taken into account since it affects both snowfall and temperatures. Snowfall, like rainfall, is heaviest on the windward flanks of the hills, and is reduced in their lee; but temperatures decrease almost uniformly with altitude and favour the accumulation of snow on the fjeld, whatever its snowfall. Finally, latitude is important. Winter temperatures decrease northwards. North of Trondheim the monthly mean temperature is below freezing-point until April, and north of Tromsø until May. Snowfall will therefore be much heavier in these districts, except on the smaller islands, than farther south.



MAP 42

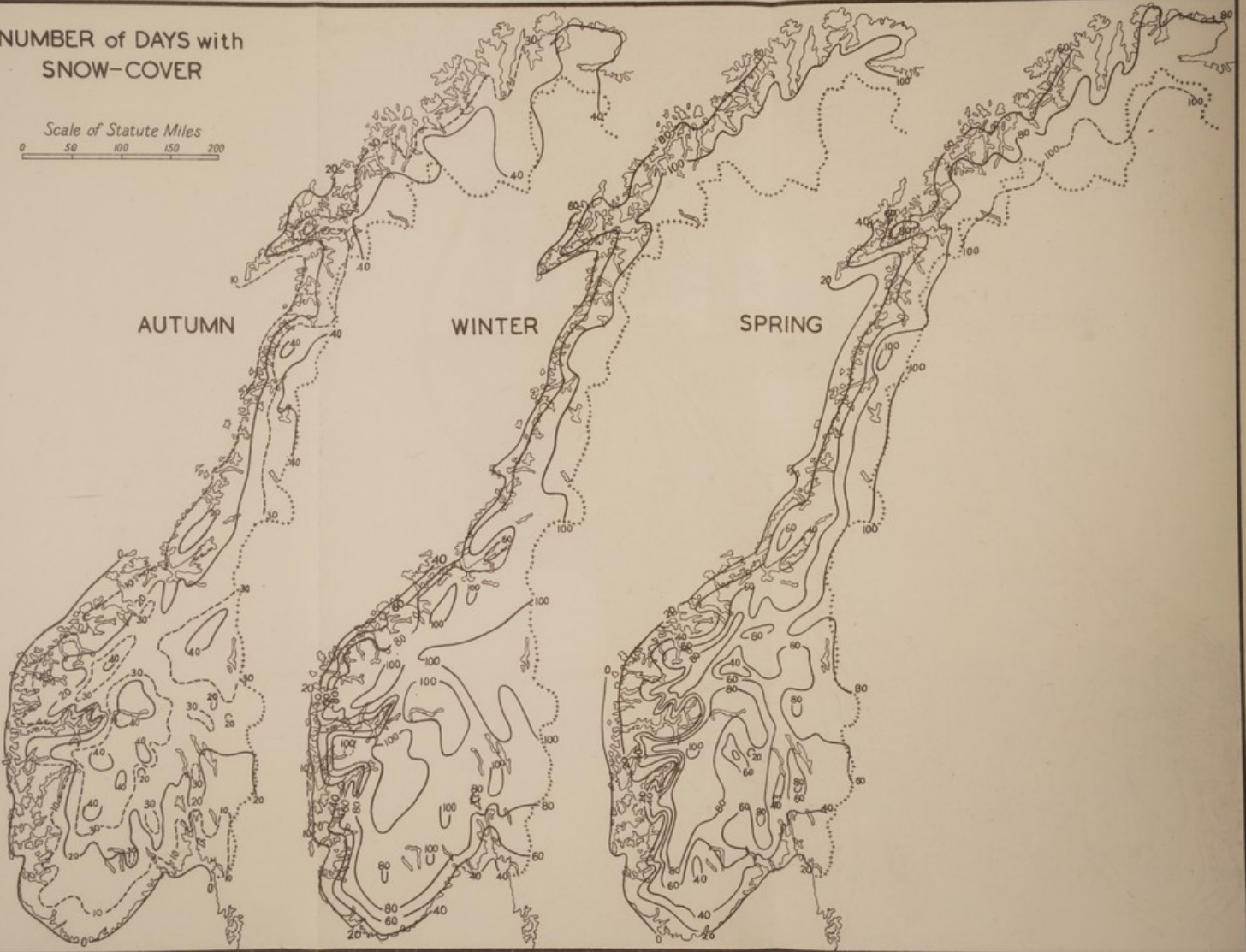
NUMBER of DAYS with
SNOW-COVER

Scale of Statute Miles
0 50 100 150 200

AUTUMN

WINTER

SPRING



The number of days on which snow falls is remarkably uniform all over the country (Map 41). Even on the mild west coast it falls on about 40 days in the year, while north of Trondheim the coast has about 60 days. Along the western part of the high fjeld there is a belt with a high number of snow-days; but it is interrupted in the region of the great fjords by a zone, lying slightly east of the zone of maximum precipitation, which has remarkably few snow-days (Laerdal). The maximum number of snow-days is found in the region immediately north of the Trondheimsfjord, where between 60 and 100 days have snowfall (Hattfjelldal 93), and in the far north (Vardö 99). Another, but rather less, snowy region can be discerned along the Swedish frontier.

Snow-cover (Tables 10 and 11; Maps 42 and 43)

The snow tends to lie longer, and consequently deeper, in the areas of higher altitude and higher latitude, eastwards and inland. The depth of snow-cover is due to accumulation rather than to the heaviness of separate storms. Where there is no continuous snow-cover, as on the west coast (Bergen), there can never be any great depth of snow. The maps (42) of the duration of snow-cover show that the snow lasts longest, over six months, in (a) Finnmark, (b) the interior of Nordland, (c) the high fjeld areas (excepting the mountains of the extreme west, which are exposed to warm winds from the sea), and (d) the higher parts of the eastern interior. The greater part of the country, except for a coastal strip, has a continuous snow-cover from the middle of December to March, and often, particularly in the higher areas and in Nordland, well into April and May. In Finnmark snow lies normally from early November to mid-May. Stations at medium altitude (up to 2,000 ft.) on the eastern slopes of the fjeld have between 175 and 200 days of snow-cover in the year. Around the coasts, even as far north as the Lofoten islands, the period is much shorter and is not so continuous. It is at a minimum on the west coast where there are about 20 days, mostly occurring, in discontinuous periods, during the three winter months. On the south coast, and in the Oslofjord and Trondheimsfjord there is usually a fairly continuous snow-cover, starting about Christmas and extending into the early spring.

The mean depth of snow-cover for each of the seasons is shown on Map 43 and in Table 11. It will be seen that although snow falls during the autumn the mean depth is very low. It is deepest on the high fjeld and in the interior of Nordland and Finnmark,

where temperatures have already reached low levels and the snow that has fallen therefore persists. Throughout the winter the depth of continuous snow-cover (see above) generally increases. The maximum depth is on the western part of the high fjeld since here the snowfall is heavier than in the east. The accumulation of snow on the ground continues throughout the spring until rising temperatures disperse it, so that in the high areas and in Finnmark the mean depth for the spring quarter is greater than that for the winter quarter. If the monthly figures for stations are examined it is found that roughly speaking the month with the greatest average depth of snow advances from February at stations where the average depth of snow is comparatively small, to March and even to April where much snow is the rule, as for example Myrdal (March) and Slirå (April) on the Bergen railway, Hattfjelldal (March) and Vardø (March) in the north.

These maps show that there is a very great local variation in the depth of snow to be expected—much greater than in the period during which it lies. Although in a particular locality there may be a close connexion between snow-depth and altitude, this connexion does not always hold; for example, the small average snow-depth on the Dovrefjeld, an area of low precipitation, is less than that of the surrounding areas on all sides, including the lower country to the north and south. Equally noticeable, but less surprising, is the area of very deep snow slightly to the east of the band of maximum precipitation. This area, narrow in the north in the Romsdal and the Jostedalsbreen, and compressed but intense between the head of the Sognefjord and the Jotunheim, broadens over the mountains south of the Sognefjord, and the Hardangervidda, and reaches a maximum in the Hallingskarvet and Hardangerjokel between which the Bergen railway passes. Over the rest of the interior medium depths prevail except in the inner Trondheimsfjord area where there is abnormally little snow. In northern Norway deep snow is found all along the Swedish frontier and in Finnmark, but only among the mountains of central Nordland (Hattfjelldal) does the depth approach that in the region behind Bergen. In the greater part of the interior of southern Norway, including the Dovrefjeld, the average depth is less in spring than in winter, showing that accumulation has stopped during March. In the areas of maximum depth and in the far north the average in spring is as great as or greater than in winter, showing that accumulation continues there until the end of March, and, at very high altitudes, even later.

The close proximity of these maximum and minimum areas gives very rapid changes in the amount of snow to be expected at places quite near to each other. On the western slopes in the south the complete absence of snow at the coast and the small amount even at the heads of the bigger fjords gives place quickly to very heavy snow on the western slopes of the fjeld, and this almost as quickly again to a fairly light covering once the crest is passed. Compare, for example, the average depth of snow-cover in winter (December, January, February) for Fortun at the head of the Sognefjord (151 ft.) 5.5 inches, Luster Sanatorium, only a mile or two away, but at 1,647 feet, 26.8 inches and Lom (1,247 ft.) or Skjak (1,391 ft.), on the eastern side of the summit, with 4.3 and 6.7 inches respectively. The road now connecting Fortun with Lom rises to a height of over 4,000 feet and, although there are no figures illustrating the depth of snow on this intervening stretch, it can easily be imagined that on the western slope the winter and, particularly, spring accumulation of snow must be very much larger than any of these figures. Yet Fortun and Lom are only separated as the crow flies by 37 miles. Between Trondheim and the Lofoten and Vesterålen islands the average increase from the coast to the interior is, if anything, more rapid, cf. March means at Rödöy (33 ft.) $2\frac{1}{2}$ inches, and at Grönli (820 ft.), in an interior valley, 60 inches.

Permanent Snow (Appendix II)

Several of the mountains of Norway rise above the limit of permanent snow, which in these latitudes is not very high. Such areas are commoner in the west where the mountains are high and the snowfall great, and in the north where temperatures are low. The snow-line is roughly at 6,000 feet in a small area just south of the Dovrefjeld and lower in all directions from that district. The most rapid decreases are westwards where it drops to as low as 3,300 feet. Northwards, near Trondheim, it descends to 4,300 feet, in the Lofoten and Vesterålen islands to 3,000 feet, and in parts of Finnmark to 2,500 feet.

Sunshine (Table 12)

The duration and intensity of sunshine in Norway depend, to a greater extent than in lower altitudes, on season and latitude. There is much cloud, especially on the west coast. Even the sunniest month, June, has an average cloudiness of 55 per cent. in the interior and rather more on the coast. The greatest amount of cloud occurs in autumn and the beginning of winter, and the brightest season is

spring when on the average the cloudiness is between 60 and 70 per cent. on the coast and not less than 55 per cent. inland. In the winter half of the year the possible amount of sunshine is much reduced owing to the short time during which the sun is above the horizon, the low angle of the sun, and the consequent interference of shadows caused by the high relief. In summer, on the other hand, the hours of sunshine are abnormally long and this compensates to a certain extent for the high degree of cloudiness. Table 12 gives the length of daylight at certain dates for the latitudes in which Norway lies. The length of time the sun is above the horizon varies at the winter solstice between $6\frac{1}{2}$ and 0 hours, and at the summer solstice between $18\frac{1}{4}$ and 24 hours. North of $67^{\circ} 28'$ (slightly north of Bodö) the sun fails to rise at mid-winter, and at Tromsö, $69^{\circ} 40' N.$, there are over 50 days of continuous darkness. On the other hand, the midnight sun appears as far south as $65^{\circ} 42'$ (south of Mosjøen) and at $70^{\circ} N.$ there are 73 days of continuous sunlight. If twilight¹ is included these limits are greatly extended, especially in the higher latitudes and in summer. At $60^{\circ} N.$ it adds 3 hours 32 minutes to the longest day, and at $70^{\circ} N.$ increases the number of light nights from 73 to 127. In winter and at the equinoxes twilight is much shorter. It adds 1 hour 55 minutes to the shortest day at $60^{\circ} N.$, but at $68^{\circ} N.$, where the sun remains below the horizon, there is twilight for 5 hours 18 minutes.

Fog (Table 13)

Two main types of fog can be distinguished: (1) Coastal or sea fog, which occurs during spring and summer, and, as it originates over the sea, is confined to coastal districts. (2) Radiation or land fog, which originates over cold land surfaces and is in consequence confined to the eastern part of southern Norway and to the autumn and winter.

In spring, fog is most frequent on the west and south coasts (3–5 days a month), but does not occur along the coast north-east of the Lofoten islands. In summer, the whole of the coast is liable to fog, especially the west and the north, and the more seaward parts where the average is about 5 days a month. In autumn, fog is mainly confined to the interior, especially to the eastern valleys and the Oslofjord (4–5 days a month). In winter, fog is less widespread in the interior, being concentrated mainly in the eastern valleys, and the Oslo region. Land fog, however, spreads at this season over the south coast from

¹ Sun 6° below horizon.

the interior and gives coastal stations 4-5 days a month (Lister, Oksøy). In cold, calm, winter weather, 'smoke-frost' may rise from the water in the heads of the fjords.

Fog is thus most common on the west and south coasts (spring and summer), on the north coast (summer only), and in the east, including the Oslofjord (autumn and winter). The annual frequency of fog diminishes rapidly inland and the interior is fairly free from it except for a little in autumn. On the extreme south coast and the southern part of the west coast (Oksøy, Bergen) there is some fog at all times of the year, but offshore there is very little in autumn.

Thunder (Table 14)

Thunder is nowhere frequent in Norway. It will be gathered from the table that the number of days with thunder increases with distance from the sea, if the exceptional figures for Mandal be left out of account. Thus the interior, both in the south and the north of the country, has more thunder-days than the west coast districts. There is also a tendency for an increase towards the south. Thunder is practically absent from the outer coastal districts towards the north (Skomvaer 1.2 days, Alta 0.8 day), but is more frequent in the interior of the south (Oslo 10.7 days). Inland it is very noticeable that thunder is a summer phenomenon connected with the heating of the land, and is completely absent during the winter months. On the other hand, there is a slight liability to thunder on the coast at all times of the year, where it is due to the passage of depressions and not to convection.

Sea Ice

The waters of the North Atlantic drift, spreading as far as North Cape, maintain throughout the year a high temperature (39° - 44.5°) and a high salinity (3.50-3.53 per cent.) which effectively prevent any formation of sea ice around the west and north coasts of Norway, even in the far north. Owing, also, to the current systems of the Norwegian Sea, drift ice, whether field-ice or icebergs, from the Arctic Ocean is always carried out into the North Atlantic via the Denmark strait and never visits the Norwegian coasts in spite of the proximity of important ice-fields.

In the waters of the fjords, which are fresher and cut off from the warm water of the open sea, ice may form, especially in severe winters and in the longer fjords. In the extreme north the fjords branching from the south of the Varangerfjord are usually frozen for from 3 to 5 miles from their heads, but the Varangerfjord itself remains open.

The inner arms, but not the main reaches, of the larger fjords as far south as Hardanger may freeze for a few weeks, but ports near the mouth are always accessible and it would not be difficult to maintain a passage to the heads of all inlets by ice-breakers.

Along the south coast, that is to say in the Skagerrak, a little drift-ice from the Oslofjord or farther east may be met in the spring. Ports east of Lindesnes are often partially frozen in winter, but are never closed except possibly to small craft. The Oslofjord is always kept open, except its head which may be closed in severe winters. The ice present in these fjords and harbours may, however, be sufficient to prevent the navigation of all but mechanically propelled boats.

Freshwater Ice

The duration and extent of freezing of lakes increase at all elevations with distance from the coast, but are modified by their size and exposure. Lakes at high altitudes are invariably frozen for long periods during winter, e.g. Djupvand (near Geiranger) at 3,200 feet is often frozen throughout the year. Lakes at low altitudes, particularly near the west coast of southern Norway, may not freeze at all in some years. On the other hand, lakes at low altitudes in the interior may be frozen every winter (e.g. Vangsvand at 145 feet near Voss on the Bergen-Oslo railway). Large lakes below 500 feet are seldom entirely frozen over.

Rivers freeze according to their velocity and volume, so that usually only the smaller streams entirely cease to flow.

Sea Surface Conditions

The frequency of winds of force 3 or less and slight or no swell for certain months is tabulated below:

<i>Month</i>	<i>Area</i>	<i>Chances</i>
January	Lindesnes to Lofoten islands	$\frac{1}{2}$ in 4
May	Lindesnes to Lofoten islands	1 in 4
June	Lindesnes to Sognefjord Sognefjord to Lofoten islands	2 in 4 1 in 4
July	Lindesnes to Vikna Vikna to Lofoten islands	1 in 4 2 in 4
August	Lindesnes to Vikna Vikna to Lofoten islands	1 in 4 2 in 4
December	Lindesnes to Lofoten islands	$\frac{1}{2}$ in 4

MAP 43

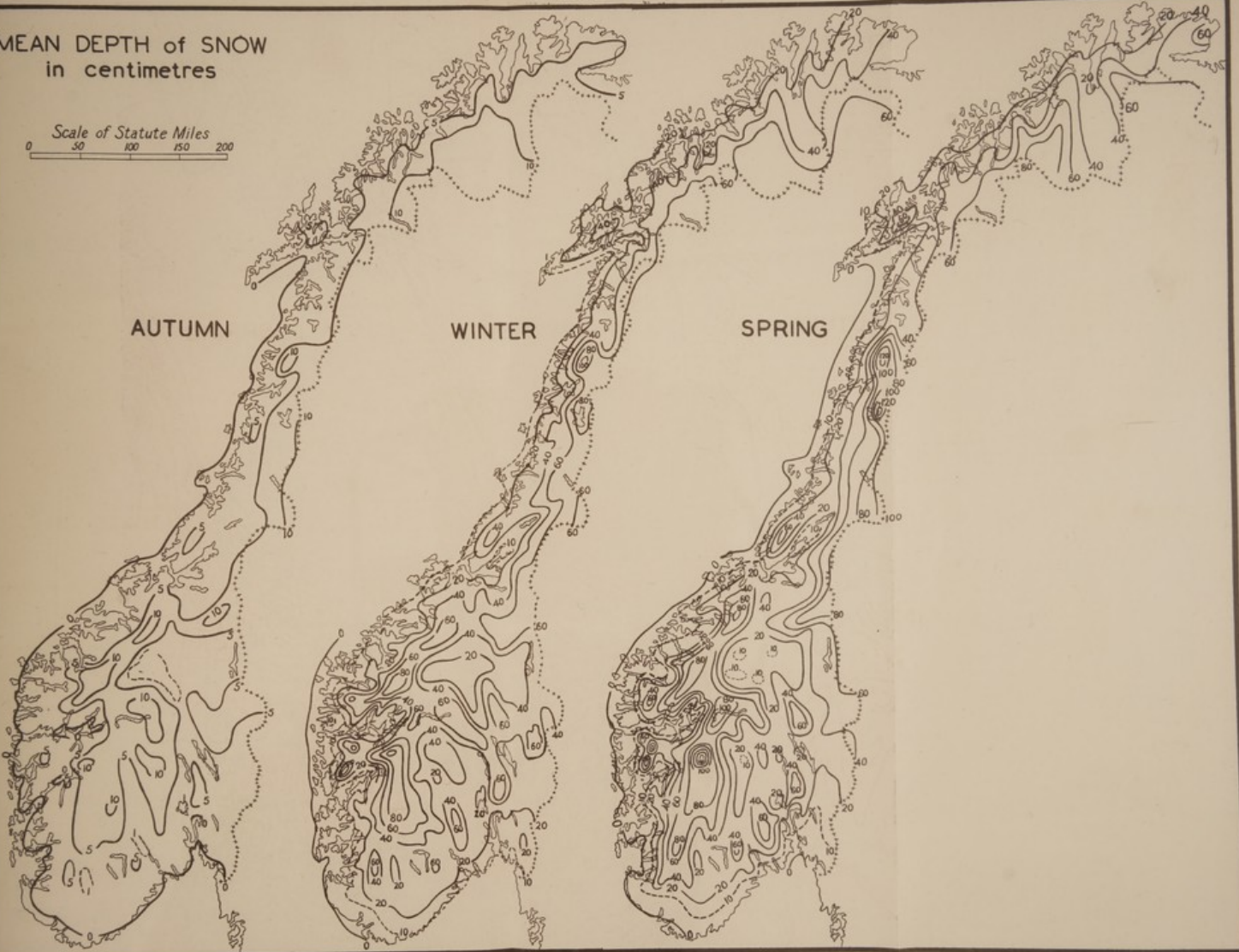
MEAN DEPTH of SNOW
in centimetres

Scale of Statute Miles
0 50 100 150 200

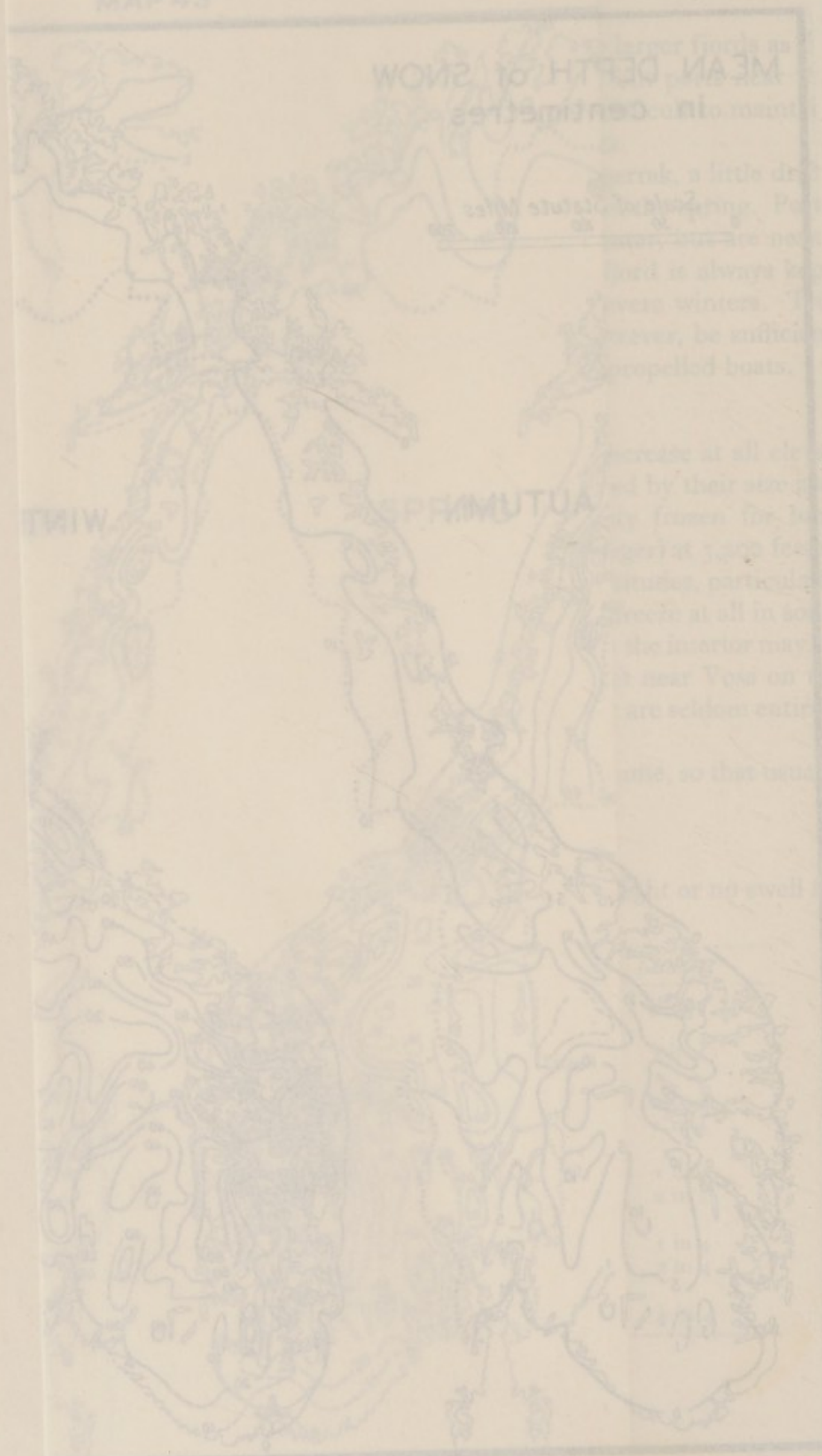
AUTUMN

WINTER

SPRING



MEAN DEPTH OF SNOW in centimeters



CLIMATES OF DIFFERENT REGIONS

The differences in the distribution of the various climatic elements give rise to several distinct regional climates: in southern Norway, (1) the west coast, (2) the eastern interior, (3) the fjeld, (4) the south coast, and (5) the Oslofjord; and in northern Norway, (6) the Trondheim depression and Trøndelag, (7) Nordland, the Lofoten islands, and southern Hinnøy, and (8) Troms, the northern coastal islands, and Finnmark.

Southern Norway

West Coast. The west coast climate is noticeable for the high degree of marine influence. It strongly resembles the climate of the west coast of Great Britain, in spite of its higher latitude. The winds blow from S. and SE. in winter, and in summer nearly half from N. or NW.—those at Bergen are obviously controlled to a great extent by local relief, Skudenes being a more typical station. These sea winds are largely responsible for the very mild temperatures in winter, and for the postponement of temperature maxima and minima. Bergen has mean extremes of only 76° and 14° , while the outer coastal fringe has even narrower limits. The mean coldest day at Bergen is 12 February and the warmest 30 July; the months with the lowest and highest means at Skudenes and Ona, although not at Bergen, are February and August. No month in this area has a mean temperature below freezing-point, and the number of days with frost is low (Bergen 73).

This mildness is closely confined to the outer coastal fringe and is most clearly exemplified in the islands and headlands, such as Ona and Skudenes. Bergen, with its slightly wider limits, is typical of conditions on the coast of the mainland. At the heads of such great fjords as the Nordfjord, Sognefjord, and Hardangerfjord, temperatures are considerably more extreme. Laerdal, at the head of the Sognefjord, and Ullensvang, on the Sörfjord, an arm of the Hardangerfjord, are good examples. Laerdal has mean annual extremes of 77° and 5° , a range more than ten degrees greater than that at Bergen. All these stations are near sea-level. Temperatures decline rapidly in the hills which occupy most of the area.

On this coast precipitation is high and increases rapidly with altitude on the first seaward slopes. The zone of maximum fall is, however, soon reached and the great fjords all penetrate beyond it into the rain-shadow area. Narrow bands of lower precipitation follow

them throughout their length, between the steep hills on either side. The number of rain-days also becomes smaller: e.g. Bergen (84.4 in.) 179 days, Laerdal (18.1 in.) 90 days. Laerdal is perhaps abnormal, but Ullensvang (63.2 in.) has 132 days. The west coast zone as a whole is characterized by high precipitation falling on a large number of days, well distributed throughout the year but highest in autumn and winter and lowest in spring and early summer.

Near sea-level in the west there are periods of frost in winter with intervals of mild weather when snow, which may fall quite heavily, disappears. Severe conditions may last for short periods in exceptional years, but they should only be temporary. The islands and outer coastal fringe have no continuous snow-cover, but there is a rapid change towards the heads of the fjords, except at sea-level or altitudes only a few feet above it. Above sea-level and away from the immediate neighbourhood of the fjords, many inches of snow-cover are to be expected.

Finally, the west coast experiences the most rapid changes in climate from place to place, mainly because of the great differences in altitude. Within 50 miles the mild, wet, maritime climate of the coast changes to the extreme, comparatively dry climate of the high fjeld. Every mile from the open sea and every foot above sea-level makes a difference.

Eastern Interior. The eastern interior is almost the converse of the west coast. Its climate is unmistakably continental. Winds are light, temperatures are extreme, rising to over 80° in summer and sinking to -30° in winter, rainfall is not heavy, with most in summer and least in winter. The warmest day is about 10 July, near the summer solstice, and the coldest about 5 January. The number of days with frost, about 160 in the year, is high even in the valleys. Snow-falls are not very heavy but continue for much of the year, so that the number of snow-days is high (about 50-60), the snow-cover is prolonged (from 150-180 days), and its depth, although not so great as on parts of the high fjeld, is considerable, having an average of 16 to 24 inches in winter and slightly less in spring.

Here also there are local differences due to altitude. In the hills between the Gudbrandsdal and the Österdal, and in those on the Swedish frontier, temperatures are lower, precipitation rather higher, and snow is deeper and lasts longer. This is particularly true of the hills east of the Österdal.

The Fjeld. The high fjeld, between the west coast and the eastern interior, has two climatically different zones, which have affinities with their bordering regions. These zones are (1) a narrow strip along the

west, including the high mountains which separate the great fjords, the steep western slopes of the main fjeld, and a small portion only of its eastern slope; and (2) the eastern slopes of the main fjeld including the whole of the Dovrefjeld.

Common to both are the low temperatures in summer and winter due to altitude (Jan. mean $12-18^{\circ}$, July $45-55^{\circ}$). The range of temperature on the fjeld is greater than on the coast but usually, except on the Dovrefjeld, less than in the east of the country (Finse, mean extremes 63° and -20°). The main difference between (1) and (2) is in precipitation, that in the west being high (over 40 in.) and in the east being remarkably low—so low that it includes, in the north, the area of minimum precipitation for the whole country, while in some of the valleys, where the rainfall is below 12 inches, a form of irrigation is employed (*v.i.* p. 288). Snowfall is heavier in the west than in the east, but all over the fjeld, owing to low temperatures, it lies for a long time (150 days or more). It covers the ground throughout the winter and into April in the valleys and on the lower slopes, and until May, June, and even July higher up, especially on the west where the cover is deep. The difference in depth of snow-cover in the two zones is striking (Mar. means, Grjotruste 72 in., Granheim 14 in.); the west is very deeply and the east comparatively lightly covered (Map 43). The Dovrefjeld and the region immediately west of it have, considering their altitude, an exceptionally small depth (Lesje 6.7 in. in Feb.). This difference between the western and the eastern fjeld is exemplified by the great difference in the extent to which the two railways crossing the fjeld are hampered by snow. While the Dovre and Røros railways have little difficulty, except along short stretches, on the Bergen railway great and continuous efforts have to be made, and considerable capital has been invested in tunnels, fences, and ploughs, in the struggle to keep the line open in winter and spring.

South Coast. The regions south of the west coast, and of the fjeld, are considerably affected by the Skagerrak and Kattegat. These have a much smaller influence than the waters off the west coast, but it is none the less appreciable. The south coast combines certain climatic features of the west coast and the fjeld; the climate of the Oslofjord is a modified version of that of the eastern interior.

Along the south coast temperatures behave much as they do on the west coast except that they are slightly more extreme. There are, however, no great fjords to introduce sea-level temperatures far inland, and the change to an inland climate is generally far less sharp since the relief is less abrupt, and the prevailing winds blow parallel to the

shore. At coastal stations, such as the island of Oksøy, off Kristiansand S., the warmest and coldest months are about 2° or 3° warmer and colder than at Skudenes. Marine influence is perceptible in the postponement of the annual maxima and minima. Frost is commoner than on the west coast, occurring on about 100 days all along the south coast as compared with between 50 and 75 along the west. Although altitudes inland are less than in the west, the decline of temperature in winter is rapid. Dalen (Telemark), 338 feet, has a January mean of 25° , 8 degrees lower than that at Oksøy. In summer the temperatures inland are not much higher than those on the coast, e.g. there is only 0.5° difference between Dalen and Oksøy in July.

Precipitation on the coast is fairly high (40–48 in.), but it declines towards the east. Inland, it increases to little more than 53 inches, except in the south-western Viddas behind Stavanger. A broad belt of moderately high rainfall follows the coast and the southern slopes of the fjeld, but even within this there is a distinct decrease towards the east.

There is appreciably more snow than on the west coast, and more days with snow-cover. Both increase fairly rapidly along the coast eastwards. While Stavanger (representing conditions in the west coast region) has practically no snow, Kristiansand S. has a February mean depth of 7.5 inches and Grimstad of 8.7 inches. Similarly, the mean number of days with snow-cover increases from 27 at Stavanger to 78 at Kristiansand S. The depth of snow along this coast is very variable from year to year. The highest and lowest monthly means for February at Grimstad during the years 1896–1915 were 50.4 inches and 0 inch respectively, so that in some years heavy snow-cover may be expected.

The Oslofjord. In the Oslofjord region, comprising the coastal strip roughly from Skien to the Swedish frontier, the changes already observed developing along the south coast towards lower precipitation, more extreme temperatures, and more continuous snow-cover, are all continued. The climate of this area is the continental climate of the eastern interior modified by the nearness of the sea, a factor most noticeable in an amelioration of winter temperatures, a slight increase in precipitation, and a reduction in the amount and duration of snow-cover, as compared with farther inland. It is, therefore, almost entirely in winter that the presence of the sea is felt. In January the temperature at Oslo is 12° higher than at Rena, and the mean annual minimum is only -2° as against -30° ; but in summer so far is the

sea from moderating the temperature compared with the interior that Oslo has the highest temperatures for the whole country: a July mean of 63.1° , a mean annual maximum of 87° , and an absolute maximum of 95° .

The Oslofjord itself is the only portion of southern Norwegian waters where sea ice has an important bearing on navigation.

Northern Norway

The three northern regions all consist of fairly narrow strips along the coast. In none of them is there very much space for the development of comparatively continental climates corresponding to that of the interior of southern Norway. Only in Finnmark does this take place, to a limited degree. All three have, therefore, a high degree of maritime influence, and differ from each other mainly as a result of latitude.

The Trondheim Depression and Trøndelag. Conditions here resemble those on the west coast farther south except that the mildness is less marked and winter temperatures are rather lower. The most important part of the region, round the inner parts of the fjord, including Trondheim itself, is comparable to other fjord-head regions. It is protected from the sea by a barrier of hills on either side of the narrow entrance, behind which a lowland spreads out around the fjord. In the lee of the highland the temperatures are fairly extreme for a place so near to the sea. Trondheim has a January mean of 27.3° and a July mean of 57.2° (cf. Laerdal, farther south, 29.5° and 61.0°) and has mean annual extremes of 82° and 0° , which are considerably higher and lower than those of Laerdal. In many ways temperatures are much the same as at Oslo, except that the nearness of the sea and higher latitude prevent it from being so warm in summer. It has 143 days with frost, considerably more than the rest of the west coast.

The region may be sub-divided into two belts according to the precipitation. The belt on the west, including the highlands north and south of the fjord entrance, has a high rainfall of well over 40 (Nordöyan 48.1 in.) and even over 80 inches. That on the east lies in a very pronounced rain-shadow in which some areas have less than 24 inches. Trondheim itself (31.1 in.) is between the two belts. Levanger with 28.6 inches is more typical. East of the fjord the rainfall increases again towards the Swedish frontier.

Snow, owing to the increasing latitude and lower winter temperatures, is a more important factor than on the coast farther south.

Trondheim has many more days with snowfall (74; cf. Bergen 42), and snow may fall in most months of the year. With lower winter temperatures and shorter hours of sunlight, snow lies longer (Trondheim 127 days; cf. Bergen 44). The snow-cover is usually fairly continuous from December to March, but there are short periods when it disappears, and it is more continuous in the inner part of the region. The mean depth of snow is greatest (10 in.) in February. Marine influence prevents the accumulation of snow to any depth nearer the sea.

Nordland, the Lofoten Islands, and Southern Hinnöy. In this region there persist the tendencies, already noted in Trøndelag, for the climate to become colder and the winters longer as latitude becomes greater, and for the conditions to be very different on the coast and a short distance inland.

The greatest effect of increasing latitude is perhaps to diminish the summer mean temperatures, which decrease fairly steadily northwards, as shown in Table 5. Winter temperatures, in places strongly influenced by marine conditions, are not much lower than those farther south. Skomvaer, a remote outpost of the Lofoten islands, is actually warmer in winter than Nordöyan, or even Lister on the south coast. This abnormal winter warmth, however, becomes increasingly confined to the coastal fringe. Hattfjelldal (728 ft.), in an interior valley, has a January mean of 15.8° , and a mean annual minimum of -34° . Its mean monthly temperature does not rise above 32° until May. Even at Bodö, on the coast, there are 4 months with means below freezing-point. This is not surprising, in spite of the warmth of the sea, in view of the low angle of the sun in winter. On the southern edge of this region sunlight on 21 December only lasts for about $3\frac{1}{2}$ hours, while in the Lofoten and Vesterålen islands there is continuous darkness for over 20 days.

The Lofoten islands (Svolvær), owing to their position, are exceptionally mild, but they also serve as a barrier to winds and currents and thus keep marine mildness away from the coast of the mainland behind them. Consequently to the north of the Lofoten islands there is a fairly abrupt drop in winter temperatures in the Troms and Finnmark region. The marine influence also postpones the coldest day of the year till late in February, and even till March in the Lofoten islands. In spite of it, however, frost is common and occurs on 125 to 200 days.

Precipitation in the Nordland region is nowhere as high as in the regions of high precipitation farther south. Areas of high preci-

precipitation are the hills north and, especially, south of Mo, and the eastern Lofoten, but on the average it is only here and there that the fall exceeds 80 inches. East of these areas precipitation rapidly declines, but the region is too narrow to have areas with very low fall, and all but a small part has more than 40 inches. The most falls in autumn, although rain-days seem to be most frequent in winter. The finest months are April and May.

Snow is a permanent feature of every winter except on outlying islands, e.g. Skomvaer. On the coastal fringe the snow-cover is discontinuous, although it is found on a large number of days in all the winter six months (November–April), e.g. Rödöy 89. Over the rest of the region it lies for from 140 to 200 days. Owing to the low winter temperatures more snow falls than rain. There is snowfall on 62 days at Brönnöy and 81 at Svolvær, while in the inland hills the number is greater (Hattfjelldal 93). Near the coast some snow is melted during mild winter periods, but not enough to stop considerable accumulations. At Svolvær, where the winter snowfall is heavy (Table 7), March (16 in.) has the greatest mean snow-depth. Near Narvik, owing to a local rain-shadow, the snow-cover is fairly shallow (Rosenfold 9 in. in February), but as a rule inland areas have fairly deep snow (Hattfjelldal 40 in. in March).

Fog is less frequent along this coast than on the coast farther south, except in the Ofotfjord and southern Hinnöy, which have frequent fog in summer (5 days a month), although little at other times of the year.

Troms, Northern Coastal Islands, and Finnmark. The climate of this region is distinct from that just described because of the barrier of the Lofoten islands and Hinnöy, and because the trend of the coast changes towards the east. The contrast between the northern and southern sides of the Lofoten and Vesterålen islands is noticeable in winter temperatures, since the north-eastern side shows much less benefit from the warm current. Andenes, on the northernmost tip of the Vesterålen islands, already has a February mean as low as 27.9° , and still lower means occur at Gjesvær (24.3°) and Vardö (21.4°) all coastal stations on islands or headlands. Towards the interior of the mainland the temperature falls more rapidly with distance from the sea, at places of equal height, than anywhere else in the country. Tromsø, Alta, and Kirkenes, at the heads of fjords, can be contrasted with the three coastal stations mentioned above (February means, 24.8° , 16.7° , 11.1°). Karasjok with its January mean of 3.7° is representative of the interior of Finnmark. In summer the position is

reversed, although the contrast is much less marked (Karasjok, July 55.0° ; Andenes, August 50.9°). Marine influence is also noticeable in the postponement of the annual minimum temperatures to as late as 20 February at Andenes, while at Karasjok it occurs a month earlier.

In contrast with the country farther south, precipitation is comparatively low and fairly uniform. In the interior over large areas it is less than 12 inches; at the coast it is rarely more than 32 inches, decreasing slightly north-eastwards. In this Arctic climate the greatest precipitation generally occurs in July at the interior stations and in September at the coastal stations, except for Vardö which shows an anomalous maximum in February. The least precipitation is in spring, and, at all stations, most of the winter precipitation falls as snow, as well as a large amount of that occurring in spring and autumn. Vardö is liable to have snow in any month of the year, and on 99 days altogether. The amount of snow falling is more on the coast than inland. Alta, for example, has only 60 days with snow, less than Trondheim. The duration of snow-cover, however, seems to be fairly uniform in Finnmark, at just over 200 days, but is less on the coast west of the North Cape. Barkestad, with 134 days, has probably the least for the whole region. The depth of snow, in spite of its prolonged duration and of the absence of occasional mild periods to disperse it, is not great as might be expected, owing to the lack of winter precipitation. Vardö, a coastal station, has 34 inches in March and the interior of Finnmark has about the same amount. On the coast of Troms there is less, namely about 16 inches in March.

CHAPTER V

VEGETATION, WILD LIFE, AND SPORT

NATURAL VEGETATION

NORWAY has a luxuriant vegetation, despite its northern position. It lies mainly within the area of coniferous forests which are characteristic of cool temperate regions. The high latitude and the infertility of the soil to a great extent are compensated by the retentive mildness of the climate, especially in the west, and its summer warmth. Trees, and conifers in particular, are the predominant feature of the vegetation as far north as the Arctic Circle. Their growth is rendered possible by the fact that winter winds, though strong, are usually comparatively mild and moist. The northern limit of trees is principally determined by the increasing prevalence of cold winter winds, which make their growth impossible.

There are two main types of forest, the coniferous and the birch. Each has its own particular plant associations. Birch grows at greater altitudes than coniferous forest, being found sometimes at over 3,500 feet. Few trees occur on the fjeld of west central Norway, where most of the country is above 3,500 feet, or in northern Norway, except in sheltered valleys (Map 50). Vegetation in these two regions mainly comprises shrubs, arctic plants, and mosses.

There are five vegetation regions in Norway: (1) south-eastern and eastern Norway, bounded by the fjeld on the north-west; (2) the fjeld region of the south-west; (3) the west coast fjord region from Lindesnes to the mouth of the Trondheimsfjord; (4) the Trondheim depression; and (5) the region north of the Trondheim depression.

(1) *South-Eastern and Eastern Norway*

This is the region of richest vegetation, which is especially luxuriant round the Oslofjord and the great lakes, Mjösa, Randsfjord, and Tyrfjord. The climate is continental.

The character of the vegetation is determined by the conifers, which form thick forests from sea-level to an altitude of 2,500–3,000 feet. Scotch pine (*Pinus silvestris*) and Norway spruce (*Picea excelsa*) are the most important conifers. The pine predominates on dry ground, and grows higher up the mountains than the spruce. Birch, rowan, and aspen are frequently found amongst the conifers. Some

central European deciduous trees are found on warm slopes, and in regions up to 1,600 feet. The most important are the oak, ash, lime, maple, elm, and lowland birch. Central European herbaceous plants are frequently found amongst them. Most prominent are the blue hepatica (*Anemone hepatica*), *Primula officinalis*, *Viola mirabilis*, and *Saxifraga granulata*.

Above the region of the central European deciduous trees there is a zone where conifers are found almost entirely alone. This extends to over 2,600 feet, but the upper limit is sometimes lower. It is highest in the most continental part of south-eastern Norway, namely in Österdal and Gudbrandsdal. In this coniferous zone very little other vegetation can survive unless able to grow in the shade of the conifers, but leafy mosses are very often found in the undergrowth. Some phanerogamous plants also grow amongst the mosses, such as bilberries and whortleberries; the former grow frequently in spruce forests, and the latter in the more open and dry spots in the pine forests. Juniper, ling, and black crowberry are found where the woods are more open and the soil is shallow. All these plants are widely distributed throughout Norway, from sea-level to high altitudes. Lichen, also, is found extensively on stones and trees in the coniferous belt, reindeer moss being the commonest.

There are many bogs and marshes in the coniferous belt, and where conifers themselves cannot grow, sphagnum, sedge, ling, bilberry, blaeberry, and cloudberry flourish. The vegetation tends to become more luxuriant when the slopes have richer soil, face southwards, or when there are deep watercourses. In such places are found more deciduous trees with their accompanying herbaceous plants, clumps of light green ferns, and tall, flat-leaved forest-grasses.

Above the limit of the conifers is a region extending to between 3,000 and 3,500 feet, where birch is the predominant forest tree. The rowan and bird-cherry are the only other trees which occur in this zone. Birch-trees grow farther apart than conifers and so allow other vegetation more room. This may be luxuriant on the warmer slopes, so that plants, which grow in the coniferous belt, are frequently found among the mountain plants. The tall, white ranunculus and large forget-me-nots are the most common of the latter.

(2) *The Fjeld Region of the South-West*

Two further belts of vegetation are found above the birch limit, namely those of willow and lichen. These form the transition between the south-eastern region and the true fjeld, which is almost completely

barren. There are no trees in the willow zone. Dwarf birch and willow shrub, however, form a dense growth of bushes.

In the lichen belt reindeer moss predominates. The only bushes found here are of the creeping species. Herbaceous arctic plants also grow in the willow and lichen belts. These plants are largely perennial, and often grow in large tufts: the white-blossomed *Dryas octopetala*, and several species of the blue Gentian being representative. Arctic heaths of different colours also form dense tufts, while saxifrages of various types occur frequently in rocky clefts. The *Saxifraga oppositifolia* is found up to the limit of perpetual snow at about 6,000 feet. The white *Ranunculus glacialis*, a favourite food of reindeer, occurs on high mountains, and thrives best where its roots can be continually moistened by water from the glaciers. Besides these flowers and tufts of coarse grass, crusty lichens and blackish brown mosses appear on stones up to about 6,000 feet. These arctic plants do not, however, grow on all mountains in the same abundance. Most of the fjeld country has a poor and uniform flora. Alpine plants occur in greatest abundance in the most continental part of the country, where the climate is dry and the summer is warm. The eastern part of the Dovrefjeld is famous for its arctic flora.

(3) *The Fjords of Western Norway*

The fjords of western Norway are barren and rugged with steep sides rising precipitously to considerable heights. These sides afford little soil for vegetation. The islands of the skjaergård lie at the mouths of the fjords. These islands, though not as steep-sided as the fjords, are rockier, more windswept, and even more barren. The climate of the fjord region is maritime except at the heads of the longer fjords where the influence of the sea is scarcely perceptible (*v.s.* p. 93).

The valley floors at heads of the fjords have good soil and space for cultivation, and permit the growth of a more luxuriant vegetation than on their steep sides. The species found are almost the same as those in the south-eastern regions of Norway, where the conifers determine the vegetation in the same way. The fir, however, predominates, while the spruce is rarely found unless planted. The same central European deciduous trees (chiefly oak, ash, lime, maple, elm, and lowland birch), as in the south-east, are found on the warmer slopes, accompanied by the same types of herbaceous plants. Pine and birch, however, are the commonest trees in this region, though their upper limit is lower than in the south-eastern part of the

country. The pine, for example, in the upper part of the Hardangerfjord, is only found up to about 2,000 feet and the birch up to 3,000 feet; in the central part of the fjord, at Strandebar, the birch scarcely reaches 2,000 feet. Nearer the coast the central European deciduous trees gradually disappear. The upper limits of the vegetation belts become lower as exposure to harsh climatic influences increases. Some arctic plants are even found on the lowlands of the west coast region. The skjaergård is barren on the seaward side, with occasional thickets of oak, birch, aspen, and rowan trees growing amongst the rocks on their more sheltered sides. The hills on the islands and along the coastal fringe are frequently covered with cross-leaved and Scottish heather. *Hypericum pulchrum*, *Narthecium ossifragum*, *Blechnum spicant*, and *Allosorus crispus* are frequently found amongst the heather. The foxglove is common in the coastal area, while its place is taken higher up the fjord by *Aconitum septentrionale*. Holly and ivy are the commonest woody plants on the west coast. Many mosses are found in this region; bog mosses and plants are especially common, since bogs are numerous both on the mainland and on the islands. The spotted orchid (*Orchis maculata*), *Erica*, and *Narthecium* are among the common bog plants found.

(4) *The Trondheim Depression*

Round Trondheim and in southern Nordland the vegetation resembles that of the south-eastern region. Spruce is the predominant tree, and all other vegetation is subordinate to it. On the lower ground, however, there are large tracts of cultivated land which form small islands in the sea of spruce forest. Even in the higher parts the spruce continues to predominate, though there are small woods of other coniferous trees, tracts of bogland, some cultivated fields, and the barren tops of mountains. The flora found in spruce woods consists, for the most part, of an undergrowth of mosses, bilberry, and a few other vascular plants, but the number of species is small. The upper limit of growth here is lower than in the south-eastern districts. That of the pine, which grows higher than the spruce, is about 2,000 feet in the interior, but is lower on the coast, being 1,100 feet in Hevne and 600 feet in the island of Hitra. The limit of the birch, which does not grow so extensively in this region, is between 3,000 and 3,300 feet in the inland valleys, and 2,000 feet near the coast. The coastal fringe has no forest and only a very scanty flora of common species. These have gradually tended to disappear north of the Stadland peninsula, and few are found in the Trondheim region.

(5) *Northern Norway*

North of the Trondheim depression the spruce woods become less frequent. The birch forms the most important forest tree, while pine is found only in the inland valleys. Most of the country, however, is unforested. The extent of the birch forest depends mainly upon altitude, and on the distance from the coast. Birch trees are found in inland valleys up to 1,600–2,300 feet, in coastal regions rarely above 1,300 feet, and in the willow zone only in the form of shrubs. In the birch forest the vegetation is frequently dense, southern and arctic plants being found together. The most luxuriant and varied vegetation grows only along the sheltered sides of the fjords, at the heads of the fjords, and inland along the larger valleys. Here plants preferring continental climates, whether of arctic or southern origin, occur. For example, the wild raspberry and wild strawberry are found in the Tysfjord. The arctic plants grow most profusely where the substratum consists of loose mica-schists, and are found in greatest abundance in Saltdal, Malselvdal, Lyngen, Alta, and Sydvaranger. A large number of arctic flowers which grow on the Dovrefjeld are also found in northern Norway. A few extreme arctic plants (e.g. *Gentiana involucrata* and *Ranunculus sulphureus*), however, have their southern limits in Nordland. The arctic raspberry (*Rubus arcticus*) is found in even the most northerly parts of Norway. The flora in the coastal regions of Nordland and Finnmark is uniform and poor in species, and west coast plants are almost entirely absent. Hardy plants like blaeberry, black crowberry, dogberry, bilberry, and whortleberry occur frequently. The cloudberry is a characteristic plant in the numerous large bogs which are found in this region.

Economic Plants

With the exception of the forest trees (Chap. XIV) there are few plants of economic value in Norway. Seaweeds and wild berries are the only two of any importance. The *Laminariae* are the most important seaweeds and are swept ashore in great quantities after an on-shore gale. These seaweeds have considerable value because of the salts of iodine which they contain. The *Alarici esculenta* and other seaweeds are much used as forage. Wild berries, as already indicated, grow in the forests and on the mountain slopes. These are now gathered in large quantities and sold in the towns as well as exported. The total crop of all the berries is worth about £100,000 a year and weighs

about 4,000 tons. The most important of the berries are the blae-berry, bilberry, blackberry, crowberry, cloudberry, whortleberry, mountain raspberry, and wild strawberry.

Peat

Peat bogs are extensive in Norway. It is estimated that the bog-lands below the tree limit cover over 8,100 square miles. Fuel-peat occurs in many of the bogs in thick strata, from 3 feet up to 20 feet thick. It is dug in the spring, when the danger of night frosts is past, dried in the open air, and finally prepared and compressed by specially constructed machines. Peat is used both for fuel and for moss litter.

WILD LIFE

Mammals

Animal life in Norway is composed of two main elements: animals of an arctic type and those of a more southern type and origin. It is difficult to define the exact geographical limits of these two types. In the most northerly parts of the country the land fauna, even near the sea, has much in common with that of the arctic islands. This arctic type is found throughout the country north of Trondheim and on the high fjeld above 2,000 feet to the south. The most characteristic arctic animals are the reindeer, the arctic hare, the arctic fox, the lemming, and the glutton (wolverene). They are found throughout most of northern Norway. The reindeer to-day are largely tame and are herded by the Lapps in Finnmark, Troms, and in other mountainous parts of the country. Wild reindeer, however, live in the mountains of Finnmark and in central and southern Norway. After a period of decline their numbers are again increasing. The arctic hare, or mountain hare, besides being found in northern Norway, also lives in most mountainous parts of the country. Its coat turns white in winter, except in Jaeren and Lister where it only turns partially so, in order to be less conspicuous against the bare country of these districts.

The arctic fox has a similar distribution to that of the hare. It only leaves the mountains in 'a lemming year'. The lemming is a small rodent with peculiar habits of migration. It is about five inches long and is covered with soft brown fur, spotted with dark brown and black. As a herbivore, it lives in the mountains, except in Finnmark where it is found at sea-level. At intervals varying from five to twenty-five years lemmings migrate towards lower land in vast numbers, passing over all obstacles, swimming rivers and lakes, and consuming any

crops they find. Wolves, foxes, bears, stoats, weasels, hawks, and owls follow their trail and destroy great numbers. Even reindeer, cattle, and goats join in the chase. The migration is slow and only by night, but nothing stops it until the lemmings reach the sea. They plunge in and, swimming onwards, perish in the waves, no doubt under the impression that they have encountered another lake or river.

The glutton, a member of the weasel family and about the size of a badger, is valuable for its fur. It is an enemy of the reindeer, both animals being found in more or less the same tracts of country. All these arctic animals must be regarded as survivals from a period in the history of the earth when they spread over the entire country.

The animals of southern Norway are of a more southern, central, and eastern European type and origin. These animals have immigrated and have supplanted the arctic animals, occupying their territory as the changes in climate made it possible.

The elk, red deer, roe deer, and reindeer are the only wild ruminants found in Norway. The first three of these are immigrants from southern and eastern countries. The elk, the largest land mammal in Europe, is found in most of the forest regions of eastern Norway. It travels up the valleys, and to the highland moors, but only rarely has it reached the western fjords where it has never stayed. It is found, however, near the fjords and coastal districts of Trøndelag and in Namdal. In Finnmark it occurs only sporadically, having immigrated from Sweden and Finland. In 1938 it was most numerous in the neighbourhood of Lake Mjösa and southward towards Oslo. The red deer is now only found in Namdal and along the west coast between Mandal and Otterøy. It is commonest between the Boknfjord and the Trondheimsfjord and in the Bergen region, in Romsdal, and particularly on the island of Hitra and on the adjacent mainland. The roe deer has immigrated from Sweden, and during the last thirty years has settled in south-eastern Norway and bred considerably. Its present distribution is bounded by the Oslofjord on the west, the Swedish frontier on the east, and Hamar on the north.

The bear, lynx, wolf, fox, otter, and different species of marten (pine marten, stoat (ermine), weasel) were until recently widespread, and often numerous. The larger beasts of prey, however, are now rare. The bear is almost exterminated, but is still found in the districts immediately north of Trondheim. The lynx, which is the only species of wild cat found in Norway, occurs in most large and unfrequented forests as far north as Vefsen. Wolves are found in the north and at Röros where there is still a small stock left. They have disappeared in

most other districts, and their numbers vary considerably from year to year.

The badger occurs in south-eastern and southern Norway. The beaver used to be widespread throughout the country. At one time it almost died out, but due to protection it has increased greatly and is now found in considerable numbers in some valleys of southern Norway, and particularly in those between the Mandal valley and the Skiensfjord. The hedgehog is found in the south-eastern parts of the country and in Sör-Trøndelag. Bats are confined to southern Norway, excepting the common long-eared bat, which occurs as far north as the Arctic Circle.

The white whale appears off the northern shores of Norway, and seals are found off the coast, the commonest being the harp-seal, the ringed seal, the common seal, and the grey seal. They are supposed to do much damage to the fisheries. The harp-seal and ringed seal visit Finnmark annually, coming from the high Arctic. The bearded seal and the walrus sometimes visit the far north. The common seal occurs all along the coasts. The grey seal is also numerous, and has large breeding-grounds in the Fröya islands.

Reptiles

All the reptiles found in Norway must have originally immigrated from the south. The lizard, slow-worm, the common viper (the only poisonous reptile in the country), and two species of non-venomous snake (*Tropidmotus natrix* and *Coronella Austriaca*) are widely distributed throughout southern Norway. Only the lizard extends as far north as Finnmark and to the highlands of the country. The viper is not found above the tree-line, and has its northern limit at the Arctic Circle. Non-venomous snakes occur as far north as the Trondheimsfjord.

Birds

Most Norwegian birds are migratory, breeding in Norway and wintering in more southern countries, but a few arctic island birds (e.g. the King eider, the Spitsbergen guillemot, the little auk, &c.) winter on the north and north-west coasts of Norway. Most of the migratory birds which breed in Norway are geese, waders, the common crane, curlews, snipe, sparrows, songsters, falcons and other birds of prey. There are three principal lines of migration: (a) southwards following the Oslo valley and thence through Sweden and Denmark; (b) eastwards from Finnmark through Finland; and (c)

along the coast, with its last point in Norway on the flat Lister peninsula and Jaeren, whence the flight is directed over the sea either to Britain or Denmark. There are also migrations within Norway. The mild climate of the south and west coasts causes birds such as the starling, blackbird, woodcock, duck, swan, &c., to winter there. Some of the sea birds also are driven in winter southwards and towards the west coast. It is consequently difficult to define the geographical limits of the birds of Norway.

Along the west and north coasts numerous colonies of sea-birds are found. The farther north the more numerous do these colonies become, until in the farthest north whole cliffs are covered with them and whole islands are occupied by their nests. The most important birds found in these colonies are various kinds of swimming birds, gulls, terns, guillemots, razorbills, puffins, kittiwakes, cormorants, and eider ducks. Other characteristic coastal birds are the sheldrake, the goosander, the heron, the lapwing, the curlew, the oyster-catcher, the shore pipit, the sea-eagle, and sea-parrot.

The birds of the lowlands, which are most numerous in the valleys in the east of the country, include the thrush, kestrel, green woodpecker, skylark, jackdaw, goldfinch, corncrake, wren, and many others. The partridge is the most important game-bird found in the lowlands of Norway. It prefers the more cultivated land, and is found as far north as Trondheim.

The higher land is inhabited, for the most part, by game-birds, the most numerous being black grouse, willow grouse, blackcock, hazel hen, hazel grouse, capercailzie, and ptarmigan. The black grouse (*Tetrao tetrix*) is the most widely distributed of these birds, being found practically throughout Norway, except in Finnmark. The willow grouse (*Lagopus albus*; Norwegian *rype*) is the commonest of Norway's game-birds, though not so widely distributed as the black grouse. The true home of the former is the whole of southern Norway, and the birch and willow regions of the rest of Norway. The blackcock (*Tetrao perdrix*) also has a wide range of habitat, being found in the pine woods of the east, on the islands and moors of the west, and in the boglands of the north. The hazel hen and hazel grouse (*Tetrao bonasia* and *bonasia europaea*) are also widely distributed, but, as they live largely in spruce forests, they are little found in the west. The capercailzie (*Tetrao urogalus*) occurs in pine woods throughout Norway from latitude 70° N. to the extreme south, but is rarer in the west than in the east. The ptarmigan (belonging to the genus *Tetrao*, Norwegian *dal* or *fjeldryfe*) inhabits the more wooded

mountains of northern Norway, although it breeds as far south as Lindesnes. This bird prefers for its habitat a marshy region where forest has been cleared at heights of over 1,000 feet. The woodcock is also found in wooded hills and morasses in the north. The common and jack snipe are found throughout the country.

Black duck, dotterel, golden plover, and ruff are all found by marshes and lakes throughout the country, while waders occur in the more northern regions. Birds which are known almost exclusively in the north are the Lapland bunting, snow bunting, snowy owl, and rough-legged buzzard.

Fish

Fish occur in most of the rivers and lakes. The commonest in the rivers of the west and north coast are char, salmon, and trout, all of which have derived from the sea, some in the glacial periods and others in later times. Trout has penetrated to the greatest altitude, and in most of the higher lakes is the only fish found. Pike is caught sporadically in fresh water along the entire coast, mainly near the sites of monasteries where it was obviously introduced by monks. In eastern Norway fish of eastern and central European origin are found as well as fish which have immigrated from the sea. The most common of these are the 'Sik' (*Coxegonus lavarekis*), grayling, perch, pike, burbot, and different species of carp of which the most numerous are minnow, roach, bream, and bleak. The grayling is the only one of these which has arrived on the west, being found in the Rauma river, but the sik occurs in Jaeren. Most of them have not reached very far up the valleys, though the grayling, perch, pike, minnow, and burbot have penetrated as far as the Røros district. Some of these southern fish are again found in the Troms and Finnmark regions, having come from Finland and northern Sweden.

There are two groups of sea fish, a southern, comprising many types similar to those around the British Isles, and an arctic. The most characteristic of the southern species are finbacks (rorqual), dolphins, grampuses, porpoises, most kinds of codfish (cod, coalfish, pollack, haddock, whiting, ling, and tusk), most flatfish, herring, sprat, and the Norwegian haddock. Of these the true codfish, the herrings and most flounders live in shallow water. Fish inhabiting deeper waters include the blue ling, argentine, and marcrurus. The mackerel species (mackerel and tunney) are the only southern visitors which disappear in the winter. Noteworthy amongst the arctic fish are the caplin (*lodde*), the little arctic bullhead (*Agromus decagonus*), and

the polar cod, all of which are common off the coast of Finnmark. The southern type of fish is also found in the far north. The Greenland shark comes into the fjords and coastal waters. For a description of the Norwegian fishing industry see Chapter XII.

SPORT

Shooting

The game laws of 20 May 1899 re-established the old Norse Law, whereby all shooting rights belong to the owner of the land. Despite this law there is little proper protection or preservation of game. The landowner (or tenant) is, with certain limitations, solely entitled to the shooting- and fishing-rights of his estate. The shooting-rights cannot be separated for ever from the estate or leased for more than ten years.

Foreigners are not permitted to take out a licence for small game shooting on the State common land. For elk shooting, however, the rights of both the State and county common lands are open to tender for both foreigners and Norwegians. A foreigner must pay the State 100 kr. annually or 50 kr. for a period of three days for shooting-rights outside his own property. This may be regarded as a game licence, as it does not give a title to the shooting-rights of the State common lands or any other State property. Foreigners who do not possess shooting-property of their own in Norway may get shooting-rights in the country in the following ways:

- (1) Elk and stag rights may be rented from private owners, or by tender in the case of State forests, the State and county common lands. These rights may be obtained through agents who have bought the rights with the object of sub-letting them.
- (2) Wild deer and small game rights may be rented from owners of private properties or rights.

The open seasons for shooting, with certain local exceptions, are generally:

Bear (this animal is protected in a great number of districts, and it is difficult to get bear shooting): 15 May–1 November.

Elk (about 1,100–1,200 are shot per annum): 26–30 September. The elk-hound is used in this sport.

Red deer (300–400 are shot annually, 100–150 in the Hitra district): 10–30 September.

Hare (hounds are used in this sport): 15 September–15 March.

Capercaillie, black game, hazel hen, woodcock: 10 September–31 December.

Grouse and ptarmigan: 15 August-14 March.

Geese, duck, snipe: 15 August-14 March.

Wild reindeer are regularly protected the whole year but may, under certain conditions, be shot.

Fishing

There are very good natural facilities for fishing in Norway. There are innumerable rivers, and about 200,000 lakes and tarns of which the majority contain fish of the salmon genus. The most important fish are salmon and trout (both the freshwater and sea varieties). It is calculated that salmon ascend about 160 Norwegian rivers. They begin to ascend these rivers in April and continue until the late autumn. Most of the fish arrive, however, between the end of May and the end of August, the larger fish coming first, and the grilse after midsummer. Large salmon, however, are commonest in the rivers of the west and north, whereas grilse are almost the only salmon found in many of the southern rivers. The British started to fish the Norwegian rivers with fly in the middle of the last century and have continued until the present day. Nowadays much of the river fishing is leased, especially the smaller rivers and the upper reaches of the large salmon rivers. The latter are most sought after because the salmon in the lower reaches do not bite so readily and do not remain so long stationary. Fishing, however, may still be rented quite easily, or hired out daily from a number of fishing hotels.

The angling season naturally varies considerably because of Norway's great length from north to south. Roughly speaking, July is the best month in the southern and western districts, and near Trondheim there is even good fishing in the second half of June, whereas in the northern districts the first half of August may be quite as good as July. The season may also vary in the different rivers, according to whether the river is 'late' or 'early', and it also depends on the climatic conditions. Local information is always advisable on such points. The best time for fly-fishing in the mountain lakes and rivers is in July and August.

The sea-trout (*Salmo trutta*) ascends many of the large rivers and most of the rivers when in flood. After the salmon it is the most important fish for sport. A larger type of this fish (weighing up to about 30 lb.) is found in certain rivers, and was formerly classified as a separate species (*Salmo exiox*). Except for this type, sea-trout weighing over 15 lb. are rare, and the bulk of the fish caught attains 6, or at the most, 12 lb. The sea-trout fishing takes place both in the large

salmon rivers, where it is caught in late summer together with grilse, and in the western regions, where this fish is found in large numbers and attains such a size that the sport becomes a sort of miniature salmon fishing.

Freshwater trout fishing has been largely carried on only by Norwegians, but it is, nevertheless, a good and inexpensive sport which can be indulged in practically throughout Norway. Trout is the most widely distributed freshwater fish in the country, being present in practically all rivers and streams as well as being the only kind of fish in thousands of lakes.

For fishing-rights in Crown lands foreigners must pay a fee of 25 kr.; otherwise it is possible to fish on a fixed daily licence, the price of which is generally very moderate. There is little need to secure fishing-rights in advance. They may be obtained from tourist hotels, of which over 100 possess fishing-rights.

Red char, grayling, and pike, although numerous, are not much fished in Norway.

CHAPTER VI

HYGIENE, DISEASE, AND PESTS

THE general level of health in Norway is good. Much of the credit for this must be given to a progressive and enlightened public health policy, the advanced state of which has in part been necessitated by the sparseness of the population. The chief illnesses and problems of public health are those common to the countries of north-west Europe and are very similar to those in England. The number of doctors in the country has increased considerably in recent years; in 1927 there were 1,674, and in 1938, 2,351 (including 150 women). About 100 doctors graduate each year from the University of Oslo, the only medical school, where the course takes seven to seven and a half years, as compared with five to six years in England. The number of inhabitants per doctor averages 1,350, varying from 550 in Oslo to 8,500 in some country districts. About 380 doctors are wholly or partly engaged in public health work.

The salaries of doctors appear low but are not so in comparison with other Norwegian public officials. The State Director of Public Health receives kr. 14,000 a year, the Medical Officer of Health of a large town kr. 9,000 to 12,000, and a District Health Officer kr. 3,500 to 7,500, depending on the time taken by official duties.

The Norwegian Medical Association is a strong body and active in raising the standard of medical practice, and in insisting that medical qualifications shall be the sole criterion of fitness in the appointment of public medical officers.

Medical Services

The health services in Norway are under the Ministry of Social Welfare. They are controlled by the Director of Public Health, who supervises all the medical activities of doctors, dentists, midwives, pharmacists, and hospitals; he also acts as professional adviser to the Government and submits to them medical budgets and health measures. The Central Health Administration includes departments dealing with tuberculosis, with mental diseases and with hospital architecture, and has a Health Institute preparing sera and vaccines and giving bacteriological aid in diagnosis.

District Health Councils. The country is divided into 700 rural and urban districts, each with a District Health Council. The health

council is a specifically Norwegian institution. It was established by an Act of 1860, in order to arouse public interest and responsibility in matters of health, and also to influence the settlement of questions of local hygiene. In the rural districts the health council consists of the district health officer (chairman), the municipal council or part of it, and, if necessary, two further members who do not belong to the local board. One of the members must be a woman. In towns the health council consists of the medical officer, who acts as chairman, the *ordfører*,¹ the municipal engineer, and four members, one a woman, elected by the municipal council. The District Health Councils are endowed with great and independent authority and may interfere in various public and private matters, aided, if necessary, by the police. If the decisions of a health council require financial expenditure, this must first be granted by the local municipal council if there is already no legal ruling determining the public funds from which the expenditure may be drawn. In the course of years the health councils have rendered great service.

District Health Officers. Each of the eighteen counties (*fylker*) has a county medical officer, and each town with a population exceeding 15,000 has a *stadsfysikus*, usually a wholetime official. In rural districts there is a District Health Officer (*stadslege*), in charge of from 1 to 5 *herreds* and possibly covering an area up to 4,000 sq. miles in extent. The *stadslege* is usually also engaged in private medical practice. This health officer is the key to the entire medical work of his district. He is appointed by the Central Ministry, cannot be removed from office, and is pensionable. He presides over the local District Health Council, is in charge of local health measures, and supervises all doctors, dentists, midwives, and pharmacists in the district. He usually has one or two nurses to assist him. He receives the monthly notification of certain diseases required from all medical practitioners and hospitals, summarizes and transmits this information, and compiles tables of births and deaths. He also makes an annual report on general health conditions in the district.

In rural districts the District Health Officer is responsible for treating the sick poor, usually for no extra fee apart from travelling expenses. In larger towns there are special officers for this, except in Oslo, where the poor have the right to choose their own doctors, who are paid for services rendered. In each area there is an official who decides eligibility for free medical aid.

¹ For definitions of Norwegian officials and terms used in local government see under Chapter IX, pp. 205-9.

Notification of Illnesses. Doctors have to notify the number of cases of various illnesses under their care. In addition to the immediate notification of eighteen epidemic diseases,¹ every medical practitioner in Norway sends in to the district health officer a monthly return of the numbers of cases of some thirty notifiable diseases treated by him in his private practice and in hospitals. These returns cover not only infectious diseases (including some not immediately notifiable), but also acute respiratory illnesses, rheumatic fever, scabies, venereal diseases, mental disease, and tuberculosis, with details of obstetrical operations and vaccinations. No payment is made to the doctor for these returns. Deaths are notifiable to a magistrate, and births to the Lutheran minister or to the head of the parish.

Hospitals. In 1938 there were 13,704 beds in 197 general hospitals, and also 5,781 beds for tuberculosis, 40 for leprosy, 120 for alcoholism, and 6,000 for the insane and feeble-minded. There is a State hospital in Oslo, attached to the University, the other larger hospitals being provided by the fylker. As in other Scandinavian countries there are very few voluntary hospitals or nursing homes. The public hospitals are good and the wealthy prefer them, though there are no private wards or other special facilities. Patients pay a small fee varying according to their means, the deficit being covered out of public funds. There are now some out-patient polyclinics for diagnosis. The medical staffs receive salaries and often used to be in private practice as well, but whole-time appointments are becoming the rule. The larger hospitals are administered by an official appointed by the Ministry. There is an increasing tendency to make use of the hospitals for medical, in addition to surgical, cases and the number of beds, though increasing, is still inadequate.

Dentists. There are about 1,500 dentists in Norway. They receive a four-year training course at Oslo. There are no dentists in the public health service, but extractions are included in the sickness insurance benefits.

Pharmacists. All pharmacists are under state control. In 1938 there were 273 pharmacies. The prices of the principal drugs are fixed annually by the Central Health Office.

Midwives. Midwives must hold an official diploma, granted after two years' training. They do no operations. In 1927 midwives

¹ Plague, yellow fever, cholera, small-pox, relapsing fever, typhus, typhoid fever (with paratyphoid), anthrax, dysentery, diphtheria, scarlet fever, poliomyelitis, epidemic meningitis, venereal diseases, encephalitis lethargica, puerperal fever, measles, acute haemorrhagic diarrhoea.

attended 93.3 per cent. of all births, and the system contributes largely to the low puerperal and infant mortality rates in Norway.

School Medical Services. The school medical services are good. A high proportion of children receive free meals and nearly all get a free summer holiday. The famous 'Oslo Breakfast' of bread, butter, cheese, fresh fruit, and milk, that is proving so popular in English schools and factories, is copied from the school meals provided in Norway.

Sickness Insurance. There is compulsory sickness insurance for those with incomes below kr. 5,200 (£250) a year. The benefit is 60 per cent. of the wages. The insured person has free choice of doctor, who is paid for each service rendered. Drugs are not an insurable benefit; this discourages that over-medication without which patients in England are often dissatisfied, and has enabled doctors in Norway to emphasize to each patient the greater value of regimen and hygiene than of drugs. The doctor must treat not only the insured but also his dependents. Including the latter, between 50 and 60 per cent. of the population are covered by this compulsory sickness insurance.

Measures against Infectious Diseases

Epidemic Diseases. The campaign against epidemic diseases is in the hands of the District Health Councils. The head of the house is responsible for notifying the District Health Officer or the nearest doctor; and the doctor treating the case must also notify it. Notification is usually by telegram or telephone. The case incidence of certain fevers with English figures for comparison is given in Appendix VI,¹ Table 2. The case incidence and mortality for diphtheria is strikingly low.

Vaccination. Vaccination against small-pox is available at least once a year in every district. It is largely done by assistant vaccinators; usually teachers or midwives. Nominally it is not compulsory, but confirmation or marriage in the national Lutheran Church and entry into a higher school is forbidden except to vaccinated persons, so formal compulsion is not needed. There is much vaccination of seamen in ports to escape quarantine regulations.

Tuberculosis. In addition to 5,781 beds in sanatoria there are many others in smaller hospitals for the tuberculous who must, under the law of May 1900, be isolated. Two important voluntary bodies, the National Anti-Tuberculosis Association and the Norwegian Women's Union for the Promotion of Health, supplement the work of the public health services. Tuberculosis is certainly commoner than in

¹ *v.i.* p. 354.

England, especially among the Lapps in Finnmark and among young adults, but the death rate is falling. In 1927 it was 133 per 100,000, and in 1938 it was 88. The figures for England and Wales were 97 in 1927, and 64 in 1938.

Venereal Diseases. Notification of venereal diseases has been compulsory since 1860, and health authorities have power to enforce treatment. Power is also given to search for and control all sources of infection. A London Ministry of Health Report in 1938 stated, however, that the coercive powers have not proved a major factor in influencing the results of anti-venereal measures. There is much venereal disease in seaports, where there are special facilities for treatment of all merchant seamen (*v.i.* p. 143). There is no general provision of free treatment apart from that under the compulsory insurance scheme. State regulation of prostitution has been abolished, the measures against it being comparable to those in England.

Mental Diseases

There are about 6,000 beds for the insane, feeble-minded, epileptics, and criminal lunatics. The State runs six asylums, two of which are for criminal lunatics, and the towns of Oslo and Bergen and the chief fylker provide others. In each herred the District Health Officer is in charge of all mental cases not in hospital. The rules relating to the disposal of the mentally sick are very similar to those now in force in England. Voluntary patients are admitted at their own request subject only to a promise to give three days' notice before discharge. Urgent cases are admitted temporarily on the certificate of one doctor (who must see the patient but who need not be specially trained in psychiatry), together with a supporting request from the nearest relative. If the doctor considers admission necessary for the safety of the patient or of others, and the relatives do not agree, then he may call on the police to act *in loco parentis* to supply the supporting request. After such an urgency admission, the question of further retention is decided in the next day or so by a psychiatrist.

Drinking-water and Sanitation

In the sparsely populated rural districts surface water is usually safe enough to be used for drinking without special treatment; contamination is rare. The majority of towns possess an abundant water supply from lakes or rivers. In rural districts residual matter is collected in cesspits and used as manure. The system of water closets is being introduced in most towns as sewage water is easily disposed of

into large rivers or into the sea. In Oslo the shallowness of the fjord and the poor tides necessitate special treatment of sewage water.

Formerly a type of Russian bath was common; these are becoming rare but there are public baths in most towns.

Health in Ports

Ships arriving at ports are subject to quarantine rules, administered by the Port Sanitary Commission. In principle, all ports are open to suspected ships, but the sanitary commission may send any ship to the nearest port equipped with necessary facilities; these quarantine ports are Oslo, Bergen, Stavanger, and Trondheim. In addition, ships in quarantine may be treated at Tromsø, and also at the disinfection and detention station at Vardö. There are centres for deratization at Oslo, Bergen, Stavanger, and Trondheim. The costs of quarantine are borne by the Norwegian State, except where they are incurred solely in the interest of the ship.

Norway leads the world in campaigning to improve the health and conditions of sailors at sea and on land. The Norwegian Red Cross has provided general dispensaries and facilities for recreation for seamen in nearly all ports. Venereal disease is still common in seaports, and centres for free treatment are provided in Oslo and Bergen. Members of any mercantile marine can obtain free treatment in any port, and on producing an official record card they may continue treatment started elsewhere. The chief steamship lines plying to Norway distribute a leaflet giving the times and addresses of free clinics in the ports which their ships visit.

The Working of the Public Health Services

Up to 1939 the system certainly worked well on the whole, though it has been somewhat handicapped by lack of money. About 4 per cent. of the State budget goes for health services, and this is voted without much opposition. About 14 per cent. of the population are treated gratuitously by the District Health Officers; and including hospitals and sickness insurance, about half the total medical attendance of the community is at the expense of public funds. The health officers are now well qualified and post-graduate courses are being provided for them. Doctors in general are co-operative in public health work, in which many of them are to some extent involved. The formalities of notification are sometimes found irksome, but the chief difficulty in putting health laws into effect is that, in a few areas, the police are lacking in keenness in enforcing them.

Mortality Statistics

Full figures are given in the section on vital statistics (*v.i.* p. 226), but certain points are worth emphasizing here for the light they throw on health conditions. The birth-rate is slightly higher than in England, but the death-rate is considerably lower (10.0 per 1,000 for Norway in 1938, as compared with 11.6 for England and Wales). The infant mortality and mortality under 4 years are very low indeed; they are bettered only by New Zealand and Australia.¹ Between 20 and 40 years the Norwegian figures are 30 per cent. higher than the English, probably because of tuberculosis; but in the older age-groups the advantage is again with Norway. The commoner causes of death in Norway in 1938 were cancer, old age, heart disease, cerebral haemorrhage, pneumonias, and tuberculosis. Appendix VI, Table 1, shows the death-rates of the commoner, and certain other, causes of death for Norway with the corresponding figures for England and Wales. Appendix VI, Table 2, gives a comparison of the case rates of certain infectious diseases in Norway and in England and Wales.

Notes of Special Features of Disease in Norway, with some advice on protection of Individuals against Illness

The notification returns show that the three commonest illnesses are bronchitis and broncho-pneumonia; influenza; and diarrhoeic illnesses (see also Appendix VI, Table 2). Respiratory catarrhs are probably not much commoner than in England. *Tuberculosis* is certainly commoner, and the incidence is likely to rise during the present years of poor nutrition. On the other hand, *bovine tuberculosis* and *abortus fever* have been practically wiped out by vigorous public health measures, and so raw milk is a much safer drink than it is in England—it certainly seems to taste much better. The work of Holst and Semb on the surgical treatment of tuberculosis, and that of Scheele and Heimbeck on the disease in young adults is well known. Heimbeck, at the Ullevåls Hospital in Oslo, has clearly shown that young adults can be successfully and safely protected against tuberculosis by the B.C.G. vaccine. *Leprosy* is not yet extinct, but there were in 1935 only 47 cases as compared with 160 in 1920.

¹ The infant mortality for Norway in 1938 was 37 per 1,000 live births; as compared with 53 for England and Wales and 78 for Scotland. The mortality 1-4 years for Norway in 1930-2 was 3.6 per 1,000 population; as compared with 7.2 for England and Wales.

Rheumatic fever is common, but the chronic rheumatic heart disease, so common in England, is rarely seen. *Typhoid fever* is not common and contamination of water is rare, but boiling or chlorinating any drinking-water which might possibly have been contaminated is an obviously wise precaution. In lemming years (*v.s.* p. 130), *lemming fever*, from drinking water in which the animals have drowned, is sometimes seen.

Tularaemia has occurred in Norway in the last ten years, in isolated cases and in epidemics. Some cases have been acquired from hares by people skinning or preparing them for eating, whilst others seem to have been acquired from lemmings. Other infestations of man are caused by biting-insects. It is not clearly established which biting fly transmits the disease, but these outbreaks occur in summer, and the primary lesion is seen in places exposed to bites. A red papule at the site of the bite breaks down and ulcerates with enlargement and maybe suppuration of the neighbouring lymph-glands. The onset of the illness is sudden, with fever and pains, and it lasts two to three weeks. In one form conjunctivitis and oedema of the eyelids occur. In the typhoidal type there is much fever and lassitude but no local lesion, and the illness lasts weeks or months and is often fatal.

The cases seen in Scandinavia are not usually fatal. Treatment is symptomatic.

Alcoholism is a real problem in Norway, and strict rules have been introduced to deal with it (*v.i.* p. 215). It is quite untrue that the consumption of spirits is in any way necessary to combat the severe cold; indeed, the taking of alcohol before or during exposure to cold is unwise as the feeling of warmth induced is deceptive and accompanied by a lessened resistance to cold. Though drunkenness is commoner, cirrhosis of the liver is rarer in Norway than in England or France, where the regular consumption of small non-intoxicating amounts is more usual than in Norway.

Scurvy was common until recently, and among Norwegian sailors *beri-beri* has been seen even in the last few years. Recent reports (July 1941) of dietary conditions are that only fish, bread, and potatoes are common; but these foods should protect against scurvy and rickets.

In summer, particularly in northern Norway, *mosquitoes* may be a serious nuisance. Methods of dealing with this are given on pages 146-50.

In cold districts *frost-bite* and *trench-foot* may occur. Frost-bite is caused by fierce cold alone (the critical level is 21° F.), whilst trench-foot is caused by cold and wet, coupled with muscular inertia, at

temperatures above freezing-point. In the first stage of both affections the skin is cold and white; if not treated this passes on to the second stage, in which the skin is red, swollen, and may show blistering. Deeper necrosis and moist gangrene may occur, but rarely extend beyond the midfoot. In the absence of sepsis, tetanus, or gas gangrene, the outlook is good, recovery taking about a month.

Clothes are the most important factor in prevention. They should be loose, and boots should be roomy enough for two or three pairs of socks. It is important to change wet socks. Gum-boots should be avoided except for short periods. Stamping and moving the toes inside the boots improve the circulation, and hot food and drink are of real value. After exposure, feet must not be warmed by placing them near a fire, or in hot water.

For treatment of the first degree, gentle rubbing, classically with snow, is good. Warmth or hot water must not be applied to the limb, though the trunk may be warmed. For any more severe degrees, tetanus antitoxin should be given in every case. With the patient at absolute rest, the affected part is thoroughly cleaned with tepid water with a soap of

Powdered camphor	25 grammes
Powdered borax	100 „
Soft potash soap to	1,000 „

After drying, a compress is applied soaked in

Camphor	1 gramme
Borax	15 grammes
Sterile water to	1,000 c.c.

This is changed daily till swelling has subsided, usually about a week. Blisters are cut away and covered with a gauze soaked in

Camphor	30 grammes
Ether to	1,000 c.c.

under the wet compress. Sloughs are left to separate by themselves. The pain is often relieved by the local application, but morphine may be needed. Potassium iodide (grains 8, thrice daily) is also of value for the pain. The prognosis is invariably better than might at first be expected, and surgery is probably never necessary.

The Mosquito Nuisance

It is a matter of importance to understand that in parts of Norway, particularly in the far north, mosquitoes may be so abundant as to

cause temporary incapacity. For instance, there is a record, from a naval surgeon, who served in the Navy in the White Sea (admittedly outside northern Norway, but essentially similar) in 1918: in the summer the mosquitoes 'rose up from the ground in a cloud', and the men refused to take opportunities of going ashore. Some who had to work ashore returned with their faces so swollen as to be almost unrecognizable, and with the eyes completely closed.

This mosquito plague, which is worse than anything ever seen in the tropics, is well known in every arctic country. It is partly explained because, soon after the general thaw, the surface of the ground is covered with innumerable pools of water, which cannot drain away because the soil below is frozen. These pools are distributed everywhere, not only in flat marshy valleys but all through the forests. Now this surface water, exposed to the sun for a large part of the twenty-four hours, may be very warm, even though it lies on frozen soil. It follows that the mosquitoes pass very rapidly through their aquatic stages.

The mosquitoes concerned are species of *Aedes* (*A. punctor communis* and others) and of *Theobaldia*. They spend the winter as eggs, from which the larvae emerge as soon as the thaw comes. They pass through only one generation in the short period of summer.

Three species of *Anopheles* occur in Scandinavia, of which *A. maculipennis* is both the commonest and the most widely distributed: it is evident that this is the species which formerly spread malaria, but locally acquired malaria is now unknown in Norway. In Norway there are few actual records, and all of them from the south.

It is impossible to provide definite facts about the date at which mosquitoes may be expected to become numerous. Since this is not possible until some weeks after the general thaw, the date of the last night-frost (Appendix V, Table 15) becomes significant. As a working hypothesis it may be assumed that trouble will begin, at or near sea-level, a week or two after that date. Similarly, one may safely say that mosquitoes will cease to be troublesome before the 'first night-frost' of autumn. Inland the mosquito season will be shorter than on the coast. It should be remembered that though the nuisance from mosquitoes is most severe in certain parts of northern Norway, it is also quite serious, at least in certain regions, in the southern part of the country.

The inconvenience arising from mosquitoes and other blood suckers varies greatly from year to year, very little trouble being caused in a cold, wet, and windy summer. It is, for instance, recorded

that a common arctic mosquito does not fly unless the temperature is 10° C. (50° F.) or higher: moreover, even if the temperature is congenial to the pest, a moderate wind will greatly reduce the nuisance.

Newly arrived people are more likely to be incapacitated by bites of mosquitoes, blackflies, &c., but even the inhabitants may experience great discomfort.

Other Biting-Insects

In many parts of Scandinavia biting-insects, other than mosquitoes, are very troublesome. Large clegs or horseflies (*Tabanus*, *Chrysops*, &c.) are often numerous, and many of them bite man: their only redeeming feature is that as they are large and slow they can easily be killed. Much more serious and difficult to deal with are the small midges (*Culicoides*) and blackflies (*Simulium*). The blackflies, which are small hump-backed flies larger than midges, are a serious pest. They will crawl through netting which would exclude mosquitoes. Moreover, they do not pierce the skin, as mosquitoes do, but rasp the surface: if they are numerous this produces a serious oozing which may readily lead to septic conditions of the skin. Most of the blackflies breed in running water, some of them in violent torrents, and as they do not fly far this limits their distribution.

Protection from Insect-Pests

Control. In very few places is radical control of mosquito breeding practicable, because of the great area of swamp and wet ground: in a district likely to be occupied permanently, it might be possible to carry out oiling or draining, so far as circumstances permit. The control of blackflies is almost impossible, for the larvae occur in torrents, and do not come to the surface, so that such a measure as oiling is useless.

Norway, particularly the northern part, is essentially a country in which control can hardly be effective and where one must concentrate on protection. It is to be remembered that, during the mosquito season, daylight is continuous or nearly so, and that the mosquitoes bite all the time. Protection is therefore necessary both during work and sleep.

Protection by Repellents. Individuals can be protected either by the use of repellents applied to the skin, or by covering the exposed parts of the body with veils, gloves, &c.

Little precise knowledge exists as to which repellent is most effective. The following formula is now used by the British Army: it is understood that it has been tested in several parts of the world and that it is found to be more repellent, and more lasting, than other formulae, but it has not been tested against the biting-insects of Scandinavia.

Oil of citronella	.	.	.	18.25 per cent.
Camphor	.	.	.	1.00 „
Cedarwood oil	.	.	.	9.00 „
Paraffin, durum	.	.	.	26.75 „
Paraffin, molle, white	.	.	.	45.00 „

This cream seems to have an effective 'life' of about 6 hours, and it does not stain clothes. It is issued by the Army in 1 oz. screw-top containers.

Other formulae recommended by various authorities are:

(a) Oil of citronella	.	.	.	1½ parts
Liquid paraffin	.	.	.	1 part
Coconut oil	.	.	.	2 parts
Carbolic acid	.	.	.	1 per cent.

The above is generally known as Bamber oil.

(b) Oil of citronella	.	.	.	½ oz.
Spirits of camphor	.	.	.	¼ „
Cedarwood oil	.	.	.	¼ „
Vaseline	.	.	.	2 „

It is at least possible that a locally distilled pine oil or turpentine may be available. Mixed with vaseline it might prove a valuable deterrent and should be tried.

Those with no experience may be inclined to describe these formulae as face creams, and to class them as cosmetics. But it should be clearly understood that under certain circumstances they are necessities, and that tough Norwegian fishermen and woodmen find it necessary to coat their faces, necks, &c. with *Mygöl* (mosquito-oil), which appears to be a locally distilled oil of birch-bark.

Protection by Clothing. Where mosquitoes or blackflies are abundant men must be provided with protective clothing. General experience in northern Scandinavia is that even if it is hot (as it can be), one needs thick clothes, and underclothes: without the two layers, great numbers of mosquitoes will bite the thigh, shoulders, or other places where the garment is stretched on the skin. One must either

wear two pairs of socks or put newspaper round the ankles under the sock.

For the hands and face gauntlet gloves and head nets should be provided. A head net is a cylinder of mosquito net, 22 inches long and 36 inches in circumference, with elastic round the top. A civilian wears this over a hat with a broad stiff brim, tucking the lower end inside the jacket. It is impossible to adjust a head net for use with forage caps or types of head-dress which have no brim, but it can be worn over a steel helmet. Certain types of net are provided with a hoop of cane or hard rubber which keeps the net away from the face and gives increased protection. In any case attention must be given to the proper use of head nets and their careful repair. The netting should be black, for this obstructs the vision much less than any other colour.

The mesh of mosquito netting is measured by counting the number of holes in one linear inch across the material, and in one linear inch on a diagonal and adding the figures together. A netting of 28-mesh is effective against mosquitoes, but to keep out blackflies and midges 'sandfly netting', which is 46- or even 53-mesh, is required. This obscures vision to a serious extent.

Protection of Tents and Buildings. The provision of mosquito nets and tents and bivouacs protected with mosquito netting is very useful. A considerable supply of wire mosquito-netting, as used for screening tropical houses, might prove valuable for the protection of doors and windows of buildings.

Men should be taught to use 'smudges' (small smoky fires) which require no imported material, and can be made anywhere from peat, moss, or twigs. It is even possible to make them in a room by building a hearth of slabs of stone, or by making the fire in an old petrol tin. The smoke may be painful to the eyes, but is less inconvenient than the insects.

The spraying of buildings and tents with an insecticidal solution is also important. Note that the spray is intended to kill, not to repel: this means in effect that it must contain pyrethrum extract. As it does not keep mosquitoes away it is wasteful and useless to spray it about unless there are actual insects to kill.

CHAPTER VII

THE PEOPLE

RACES

The Early People

DURING the latter part of the Great Ice Age most of Scandinavia was uninhabitable, being covered with ice. Portions of the northern and western coasts of Norway, however, seem to have become ice-free earlier than the rest, and here have been found stone arrow- or lance-heads of a special type known as 'tanged points', with which the earliest northern hunters secured their food and the skins enabling them to defy the cold. Archaeologists hesitate to assign a definite date for these tanged points, but a rough estimate, based on geological evidence, puts them at about 7000 B.C., in the Mesolithic cultural period, between the Palaeolithic (Old Stone Age) and the Neolithic (New Stone Age). No skeletons of these first Norwegians have yet been found, but it may be assumed from what is known of the rest of Europe at the same period that they were physically not very unlike ourselves, though probably somewhat taller, more muscular, longer-headed, and with more prominent jaws. Individuals more or less approximating to this type can be found here and there among the present population.

The two great discoveries of agriculture and of the domestication of animals were brought to Europe, together with the technique of making stone tools by grinding and polishing instead of chipping, by invaders from western Asia, who turned the wandering Mesolithic hunters into settled Neolithic farmers. This change was late in coming to Norway, whose people continued to live by hunting wild animals and gathering wild plants through most of the European Neolithic period, though they obtained polished axes and other new things from the south by trading. Only one skeleton is known from this period in Norway, and that is of the same type as the Mesolithic people just described. Skeletons found in Sweden and Denmark show that there were at least two races of people in the north at that time. One is a tall, slender type with long, narrow head, very much like the skeletons found in the burial mounds known as Long Barrows. This type belongs to the Mediterranean race, now seen most frequently in Spain and southern Italy, though it still forms an appreciable part of the population of north-western Europe, where it

seems to have been the main type in Neolithic times. These people probably reached Scandinavia by sea round the north of Britain.

The second type, rather shorter, of heavy build, with rounder heads, broad faces, and large jaws, seems to have come from central Europe. It is most common in Denmark, and is called the Borreby type, from a site where typical skeletons have been found. It is related to the Alpine race, whose present-day representatives are still found in their most typical form in central Europe.

Both these types have left their mark on the modern population. Both, and also a blend between them, continued to populate Scandinavia during the Bronze Age, which, in Europe, followed the Neolithic. Knowledge of metals did not penetrate to Scandinavia till it had become widespread over the rest of Europe, and, for a long time after they became known, metal tools were scarce and difficult to come by. In consequence, the Northern peoples became very skilful in the art of working in stone, producing some of the most beautiful stone tools and weapons in existence. The Scandinavian Bronze Age probably began about 1500 B.C. and lasted nearly a thousand years. It was a period of great prosperity, particularly in Denmark and the southern districts of Norway and Sweden, where a flourishing trade was carried on, exchanging local amber for gold and bronze objects from the south and west.

Meanwhile, the rest of Europe was gradually being flooded with a new type of people, part of a great movement starting, as most authorities believe, somewhere in western Asia, and bringing a knowledge of the working and use of iron. The period marked by this discovery and its spread is called the Early Iron Age, to distinguish it from our own epoch. The people whose coming initiated the Early Iron Age in Europe belonged to the race now called Nordic. They did not reach the north much before the seventh century B.C., but from then onwards they play an important part in the history of Norway, which they seem to have entered from Denmark.

From the skeletons of that time, which are very numerous, we know that these new-comers had an average height of 5 ft. 6½ in., and were large-boned and muscular, with long narrow heads (C.I. 71)¹ and rugged faces. They had apparently already blended with survivors

¹ Cephalic Index, the relation of the breadth of the head to its length, expressed as a percentage. Heads with an index below 75 are classed as long (dolichocephalic), those between 75 and 80 as medium (mesocephalic), and those over 80 as short or broad (brachycephalic). This is a matter of proportion only. The cephalic index is not in any respect a measure of intelligence, with which it has no connexion whatever. It is used by anthropologists as one means of distinguishing races.

of the Old Stone Age people, from whom they derived an increase in size of skull, in stature, and in general ruggedness of build and features which distinguishes their skeletons from those of other Nordics who came later. This massive type still survives in individuals.

Not until the Early Iron Age did Norway become extensively settled, previous groups having been confined mainly to the southwestern coast. There is continuity of physical type from that time until the present day.

The Present People

Over most of Norway the people of the present day (excluding the Lapps) are still predominantly Nordic, with less admixture of other stocks than anywhere else. This is especially striking in the east. There the inhabitants can claim direct descent from the Early Iron Age Nordics, who once occupied an immense area in central and eastern Europe and western Siberia, where they have now been replaced, altered, or absorbed by other racial types.

The typical Norwegian of to-day is tall (average from 5 ft. 6 in. to 5 ft. 9 in.), long-headed (average cephalic index in eastern Norway 75.5, in other parts slightly higher), and has a long, rather narrow face; the length from mouth to chin is specially noticeable. He has a fair skin, fair hair, and blue or grey eyes. Fair people are everywhere more numerous than dark, but there is in the south a minority of shorter, darker, less long-headed people who probably in part represent the earlier inhabitants, and in part are the descendants of people from western Europe brought as thralls by the Vikings. The survival of a pre-Iron Age type probably accounts for variations (chiefly in the form of the head) in the coastal and mountain people of western and north-central Norway, and in the far north there is a certain amount of mixture with Lapps.

The Lapps

The Lapps, who live in the north, are quite distinct from the Norwegians (Fig. 22). Their country, Lappland, extends across Norway, Sweden, Finland, and part of Russia, a territory occupying more than 150,000 square miles. It has no political existence, but it is nevertheless a real entity. The Norwegian part consists of the two northernmost provinces of Troms and Finnmark.

Although usually spoken of as respectively Norwegian, Swedish, Finnish, and Russian, the Lapps form a group apart, physically, linguistically, and culturally, from the other people of those countries

There has been, especially recently, a certain amount of intermixture, which makes it difficult to estimate their numbers accurately, but there are probably about 32,000 more or less full-blood Lapps. About 21,000 of these live in Norway, which had a population of 2,906,072 in 1937: Sweden has about 7,000 Lapps, and Finland and Russia less than 4,000 between them. The fact that in their seasonal wanderings they cross and recross the frontiers of these countries has sometimes led to international difficulties. There has been trouble also over their relations with the settlers, the Lapps maintaining that these new-comers have taken too much of the old pasture land, on which their reindeer depend. These questions are now dealt with by legislation, and on the whole the Lapps seem to have received a fair measure of justice from the various countries concerned.

Confusion sometimes arises owing to the fact that the Norwegians call them Finns, and the portion of Norway where they chiefly live Finnmark. For the people of Finland the Norwegians use the name Kvaens, a term which historically belongs to the northernmost branch of Finns only, and seems somehow to have acquired a derogatory sense, so that the Finns dislike it. The word 'Lapp' is Swedish. The Lapps' own name for themselves is Samen, and for their country Sabma, which means Fenland, a description not appropriate to their present habitat but perhaps reminiscent of an earlier home.

The Lapps are not, as is sometimes stated, the earliest inhabitants of Norway. There is evidence that they came to Europe from western Siberia, spreading first over Finland and north-western Russia. They probably did not reach Norway till about the ninth century A.D. Although they originated in Asia, they are not typical Asiatics, but in their physical features take a position midway between the Asiatic Mongoloids and the European Alpines. It is possible that they may represent an early generalized form from which both these stocks later diverged, afterwards becoming specialized in other ways.

A very marked Lapp characteristic is the shortness of their faces from nose to chin, due mainly to the fact that they have very small jaw-bones, both upper and lower. They do not show the great breadth of face combined with a flat profile that is characteristic of true Mongoloid peoples. Their heads are both short and broad, giving them an average cephalic index of 87, high in the brachycephalic division. Their skin, where its true colour can be seen through the coat of dirt which usually covers it, is yellowish-brown, but not darker than that of many Spaniards or Italians. Their hair and eyes are usually black or very dark brown, though there is a certain percentage, highest in



FIG. 22. *Lapps*



Finland, with light brown or ash-blond hair and blue or grey eyes. These have lighter skins than the others. It is clear, therefore, that the Lapps are a mixed people, and they probably were so before they arrived in the present Lappland.

They are of short stature, averaging about 4 ft. 11 in. for men and about 4 ft. 9 in. for women. This is mainly due to shortness of leg below the knee. Most Lapps accentuate it by being also bowlegged, which does not prevent them, however, from being good walkers and skiers. Their squat little figures and bow legs, together with their four-cornered or peaked caps and red and yellow fringed garments, make them, especially when encountered in a forest, look curiously like the gnomes of fairy tales. Their old-time garments of reindeer skin have now almost everywhere given place to clothes of European cloth and cut, especially for summer wear, but they still weave or embroider belts and trimmings of bright-coloured wools, which are worn by both men and women.

The Lapps speak a language belonging to the Finno-Ugrian family, allied to that of the Finns and of the Magyars of Hungary. Nowadays most Lapps speak also the language of the country in which they live. Many Norwegian and Swedish Lapps also speak Finnish, but few have any knowledge of English.

Culturally, the Lapps are divided into Mountain, River, and Sea Lapps in Norway, and Mountain, Forest, and Sea Lapps in Sweden, Finland, and Russia. Their original way of life is kept in its purest state among the Mountain Lapps, but these are now in the minority. The River, Forest, and Sea Lapps have given up their reindeer and have settled down, chiefly on the coast or on the banks of rivers, where they get their living by fishing. Many have adopted to a large extent the customs of the people round them, with whom they have intermarried, so that they no longer represent the true Lapp type, either physically or culturally.

The life of the Mountain Lapps centres round their reindeer. These animals are their wealth. A Lapp family can live fairly well with three or four hundred. An average-sized herd will number about a thousand head, but a rich Lapp may own as many as eight thousand. The reindeer supply them also with an important part of their diet. Its meat is eaten either fresh or dried, its blood is drunk, its milk is drunk or made into cheese. Its skin supplies—or did until recently—clothing, bedding, tent-covers, &c. Tools are made from its horns and bones, thongs and sewing thread from its sinews. The Lapps also use their reindeer for transport, both as pack-animals, and by harnessing

specially trained animals to sledges, on which they load their tents and other possessions when they migrate. Babies are slung in their wooden cradles on one side of a pack-reindeer; older children ride reindeer-back till they are too big, then they must walk like the adults, who never ride their reindeer. Long treks often entail great hardship, especially in winter.

Winter encampments are chiefly on the scrub-covered uplands and on the forest borders. In summer the Lapps migrate to the coast and to the islands, or to the inland mountains. Many Lapps come into Norway from Sweden every year and return in the autumn. There are two main reasons for their migrations: to find fresh pastures where there is good reindeer moss, and to escape from the myriads of insects which are the curse of Lappland in summer. Some Lapps herd their reindeer all the year round, others turn them loose in summer and go off to fish, returning to round them up in the autumn. All reindeer are ear-marked as a sign of ownership.

Apart from reindeer meat and milk, the Lapps live chiefly on rye-meal, mixed, in time of scarcity, with the soft inner bark of pine and fir trees pounded up. To this the Sea Lapps add fish and whale-meat, and the River Lapps fish, potatoes, and other vegetables. Berries keep good under the snow all the winter and are eaten in the spring. All the Lapps drink quantities of coffee, and it is not etiquette for a visitor to leave before taking at least two cups: it is more polite to drink three or four.

Most Lapps hunt: bears for their fur for wraps, and their flesh for food; wolves, lynxes, and wolverenes for their fur, which is sold to traders. They are very clever at carving in bone or horn, of which, in the olden days, they made many of their tools and also such things as spoons. They like to decorate the things which they make with engraved designs and pictures of reindeer. Bone and horn implements have now largely been replaced by trade goods, but they still make baskets out of birch-bark.

The old Lapp religion recognized various gods who were worshipped at shrines containing carved representations of the gods or curiously shaped natural stones. The priests, specially chosen and trained, were also prophets and medicine-men. They were very similar to the shamans of the tribes of Siberia, and, like them, acted as intermediaries between the gods and the people, communicating with the spirits after working themselves up into a state of hysteria by beating drums, fasting, and other devices. They also used the drum for divination.

The Lapps are now Christians and those in Norway belong to the Lutheran Church. In the middle of the last century a fanatical sect arose, the followers of a Swedish Lutheran, Laestadius. He went round the country preaching violently with much hysteria, which communicated itself to his followers, so that they began torturing and murdering 'heretics'. This was stopped by the Government, but there are still some followers of Laestadius, who give way to religious frenzy, singing and dancing wildly, and working themselves into a hysterical condition in which they are supposed to be 'possessed', just like the old shamans.

Many traces of the old beliefs still remain. In common with other northern peoples, the Lapps have a special reverence for the bear. Before starting on a hunt, ceremonies are performed, and when the bear has been killed songs of thanks are sung to him for not having injured the hunters, and prayers are said to his spirit not to take vengeance for being killed. There are certain unlucky days on which no one attempts to hunt bear. By a curious assimilation to the Christian calendar these are now saints' days, St. Mark's, St. Catherine's, and St. Clement's.

Lapps are creatures of mood, sometimes sulky, sometimes full of fun. They are very hospitable, but embarrassingly inquisitive, entering a visitor's tent or hut at any time to ask questions; capable of great exertion and endurance under necessity, but otherwise inclined to be inert; brave in the face of accustomed dangers arising from their difficult country and rigorous climate, but unwarlike.

There have been difficulties in the past about their education, because they do not like their children to be at school when they should be learning how to look after the reindeer. Special arrangements are now made for them, and many, if not most, read and write at least a little. Johan Turi, a Mountain Lapp, has written a most interesting book¹ describing the everyday life of his people and their seasonal migrations, illustrated with his own drawings. It has been translated into English and would be very useful to anyone who comes into contact with the Lapps.

LANGUAGE²

THE language spoken in Norway is one of the Nordic, or Scandinavian, branches of the Teutonic (or Germanic) language group. The

¹ Turi's *Book of Lappland*. English translation by E. G. Nash. Jonathan Cape, 1931.

² *v.s.* p. 6 for notes on the pronunciation.

other languages of this group are Swedish, Danish, Icelandic, and Faeroese, the two latter being in origin Norwegian dialects. During the Middle Ages when the Hanseatic League brought many Germans to Scandinavia all these languages were strongly influenced by German. When Norway was united with Denmark the Danish influence became predominant. Writers during this period used a language that was more akin to Danish than Norwegian, though it naturally contained many special Norwegian words for things and conditions peculiar to Norway. The spoken language became split into a great number of dialects. The old pure Norwegian forms remained in the country, and in the towns the vernacular became interspersed with foreign words. A middle-class language also arose, which was in reality the town vernacular strongly influenced by literary Danish; this gradually became the commonest form, especially in the south-east.

Soon after the severance of the Union in 1814 there was a reaction against the Danish influence and a desire to make the language more essentially Norwegian. In attempting to realize this desire two schools of thought developed. One school, represented by Knud Knudsen (1812-95), wished to modify the Dano-Norwegian orthography by introducing changes based on the spoken language; the other, represented by Ivar Åsen (1813-96), wished to construct a purely Norwegian language based on the dialects. Åsen's language has since been officially recognized and called *Landsmål*, to distinguish it from *Riksmål*, the language developed from the Dano-Norwegian. The conflict between the two views, which has had at times a strongly political and party bias, still exists, although during the last thirty years modifications have been made on both sides and it is hoped that a reasonable compromise will result.

In 1938 the position was that the *Landsmål* was supported by the West Norwegians, in the towns by the peasant immigrants, and by many of the elementary school teachers. Both forms of speech were officially recognized on an equal footing. In the schools the pupils had to read both languages, while the school boards had to decide which was to be the chief written language of each school. In the upper sections of the gymnasia the pupils learnt to write both forms, but there, also, one had to be selected as the chief. People speaking the two languages have no difficulty in understanding each other. In fact the differences are smaller than those which occur between certain English, French, and German dialects.

In recent years the vocabularies of both languages have been in-

creased by the introduction of international words of modern civilization. These have remained in their original form, whether of French, German, English, or Italian origin.

RELIGION

The State Church

There is in Norway an established State Church to which 96·8 per cent. of the population adhere. This Church is designated 'Evangelical Lutheran' and is based upon the Apostolic, Nicene-Constantinopolitan, and Lutheran creeds, the Augsburg confession, and Luther's shorter catechism. It is essentially national, not because of a peculiar national doctrine, but because it is endeared to national sentiment as an essential and traditional part of the old Norwegian culture. There might, however, be a considerable amount of secession but for purely geographical obstacles. Two trends of thought dominate the established Church; firstly, that of the ministers of the Church, who represent an advanced critical theological point of view, and, secondly, that of the lay-preachers, who have extreme evangelical views and little theological knowledge. A short summary of the development and growth of the Church in Norway shows how these two trends came into being.

Church History

The Norwegians were converted to Christianity in a wholesale and forcible way and accepted the Christ and the Christian saints as more powerful than Odin and his co-deities, giving the new-comers the attributes of the old. The Roman See controlled the Church at an early date and by various ruses gained some little power over the king as well as over the Church. The Church was left weakened by the Black Death, and before it regained its old strength the Lutheran Reformation was thrust on Norway by Denmark. The people soon adapted themselves externally to the new religion, because dogma and liturgy were largely above their heads, and, missing their saints, they resorted to witch-craft and black magic. The teaching of the new pastors appears, on the whole, to have been pure dogma, divorced from the needs of everyday life and without religious fervour. During the eighteenth century Norway was influenced by two types of thought from Germany, firstly by a form of pietism and then by a type of rationalism. The pietism, which tended to depreciate the value of institutional religion rather like the seventeenth-century

English puritanism, had a personal appeal for the peasantry. The rationalism assumed the form of religious indifference and affected the official classes and the clergy, who became more concerned with the education of the people than with their spiritual welfare. These movements led to a violent cleavage of opinion between the devout laity and the official clergy. It was in such circumstances that the evangelical movement started by Hans Hauge in 1796-1804 almost supplanted the Church in the lives of the people. Although Hauge and his followers were persecuted for a time, the movement, which was bound up with democracy as opposed to bureaucracy, had permanent results. In 1843 the position of lay-preachers was recognized, and this change in the official attitude led to the establishment of the Home Mission (*Indremissionen*). This in the early stages helped the ministers of the Church in their work, but in modern times has come to represent the opposition of the popular evangelical viewpoint of the lay-preacher to the advanced theological outlook of the clergy, who, on the whole, have little influence on the spiritual growth of the people. The peasants of the west, who are often emotional and have few occupations during the long winters, are more influenced by the lay-preachers than the less religious people of the east.

Until 1908 all candidates for the ministry received academic and theological training at Oslo University. After that date theological students were allowed either to go to the University or to the 'Congregational Faculty'. This latter institution was started and is still maintained by public subscription 'for the training of theologians on conservative lines' in opposition to the more advanced type of theology taught in the University. Until the beginning of the present century German thought was the predominant influence on the Church, but with the emigration of Norwegians to America and the close connexion with that country which ensued, American, and to a lesser degree British, views are becoming predominant.

Church Organization

While the congregations under the influence of the lay-preachers demand a greater measure of local and popular control, the Church remains under the control of the Storting and the King, who, as 'supreme bishop' (*summus episcopus*), exercises his authority through the ecclesiastical branch of the Ministry of Ecclesiastical and Educational Affairs. This ministry is of supreme importance and controls all ecclesiastical appointments. In making them it usually consults the clergy concerned, but sometimes acts without regard to the views

of the Church department. Appointments thus made tend to increase the struggle between the Liberal and Conservative elements in the church.

The administration is carried on by the Church division of the Church and Education Department, served by six offices: (1) the Office for Church and clergy, controlling all constitutional matters, and the duties, rights, and remuneration of the clergy; (2) the Rectories Office; (3) and (4) the First and Second Fund Offices; (5) the Office for Poor Relief and Public Institutions; (6) an Office of Revision for Public Institutions.

The Church is divided into seven dioceses: Oslo (with its see in Oslo), Nidaros (see in Trondheim), Hamar (see in Hamar), Agder (see in Kristiansand S.), Björgvin (see in Bergen), Hålogaland (see in Tromsø), and Stavanger (see in Stavanger). Stavanger is mentioned last as it was only re-established in 1925, although it was the third oldest bishopric in Norway.

Under the jurisdiction of the bishops there are 1,024 congregations served by about 700 pastors. On an average, there are about 4,000 persons to one pastor and it is difficult, therefore, for him to have personal contact with individual members of his congregation. In 1920 a law was passed instituting congregational councils, which were to be elected by parishes. These councils have advisory powers, and meet, when occasion arises, to decide on the introduction of new authorized hymns, forms of prayer, &c. In 1933 a diocesan council was established for each of the seven dioceses. These movements represent the work of the people who wish the Church to be more independent of the State.

The Norwegian Church costs the nation about 12 million kroner a year, that is 4 kroner per member, and for this sum they get free services, baptism, confirmation, wedding ceremonies, funerals, &c. The salary and old age pension of the clergy are fixed by law, and the clergymen are economically independent of the members of the congregations.

Members of other Christian communities, Unitarians, and Jews are permitted to celebrate religious offices and to assemble in public, without closed doors. Religious houses are not banned, but Jesuits are excluded from the kingdom. There are not many dissenters in Norway (91,459 in 1930), but the numbers of those not formally belonging to any Church has considerably increased. Anti-religious and atheistic materialism has spread chiefly among the working classes and in academic circles. The table immediately below shows

the confessions and the numbers of persons outside the National Church in 1930.

<i>Confession</i>	<i>Members</i>
Free Lutheran Church	15,971
Methodists	12,207
Congregation of Pentecost	7,858
Baptists	7,788
Adventists	3,325
Free Mission	2,871
Roman Catholics	2,827
Congregation of God	1,643
Free Congregation of Yarlsberg	1,528
Congregation of Jesus Christ	926
Congregations with adult baptism	630
Apostolic confession	458
Catholic Apostolic	280
German Church	253
Greek Catholics	248
International Association for Biblical Study	209
English Church	164
Other foreign Churches	153
Evangelical Congregation	120
Christian Scientists	92
Offshoots of the State Church	84
Quakers	81
Unitarians	69
Presbyterians	20
Minor Congregations	1,556
Unclassified dissenters	3,882
Persons without a religion	24,183
Mormons	667
Jews	1,359
Other non-Christian communities	7
Total	<u>91,459</u>

EDUCATION

THE problem of education in Norway, outside the towns, is fraught with difficulties because of the great distance which children have to travel. A village, in the English sense of the word, is uncommon in Norway, and the rural population consists of scattered farming communities, so that the nearest school may be several miles from a child's home. Despite these difficulties illiteracy is practically unknown except in isolated districts of Finnmark. Elementary education is free, the schools being maintained by local taxation aided by State grants; secondary schools are provided by the State or by local authorities, while a few are privately owned. In some secondary schools attendance is free. The elementary schools are supervised by the school directors and the secondary schools come within the

administration of the Council of Education, but both types are under the direct control of the Ministry of Ecclesiastical and Educational Affairs. The confession of the schools is the State religion, Lutheranism (*v.s.* p. 159), but this is not allowed to interfere much with the teaching of other subjects, and dissenters, Catholics, and Jews are not obliged to attend the classes for religious instruction.

Until 1939 the organization was based on Acts of 1869 and 1896, with amendments in 1920. These Acts covered a complicated and comprehensive system of education, but they were superseded in 1939 by a much simpler system which was accepted by the Storting in 1935. As it is uncertain to what degree it has been possible to bring the new system into force, it is necessary to state both systems.

(1) The old system, based on the Acts of 1869 and 1896, provided for both elementary (*folk* school) and secondary education. All children were obliged to attend a folk school between the ages of 7 and 14 years, unless they were receiving private tuition. In the towns the school year was 40 weeks and instruction was not permitted to exceed 30 hours a week, and it was often less as foreign languages, domestic science, &c., were voluntary subjects. The schools were divided into three age-divisions which could be subdivided into classes, each class not to exceed fifty pupils. In the country the compulsory school terms amounted to 12 weeks a year, and this could be brought up to 21 weeks by voluntary instruction. If the school was large enough it could be divided into two age-divisions, which could be subdivided into classes, each class not to exceed forty-five pupils.

In country schools with less than twenty pupils classes could be held in rotation in parents' houses, and ambulatory schools were permitted, spending a few months in one place. A school building was compulsory where there were more than twenty pupils.

The syllabus of subjects was religion, the Norwegian language (in which choice must be made between written *Riksmål* and *Landsmål* *v.s.* p. 158), arithmetic, elementary geometry, writing, singing, geography, history (including the administration of Norway), botany, zoology, the elements of physics and hygiene, manual work, drawing, and gymnastics (in which might be included preparatory rifle practice).

There were various optional schools for children who wished to continue folk-school education but who could not, or did not wish to, get a higher education. Such children could attend either Continuation Schools, which were under the charge of the folk-school teachers, or a Night School when they were older, or a County School, the

latter being run on more technical lines. There were also a number of privately run People's High Schools, which were rather similar to finishing schools. Working Men's Colleges for adults also existed. These were not technical colleges, for instruction took the form of lectures on general cultural subjects followed by discussions.

Those who desired a higher education could proceed to a Middle School, which was intended to give children between 11 and 15 a general education; this did in fact overlap with the folk-school education. The Middle School could also be used as a preparation for proceeding to the *gymnasium*. Gymnasias were schools designed to give a complete higher general education and to prepare for further studies at Oslo University. To this end the syllabus in the higher classes was divided into two branches, the language-history branch and the science, or 'real', branch. There was a leaving examination, the 'artium', which qualified students for University entrance.

The Royal Frederik University in Oslo, founded in 1811, is the only one in Norway. There are five faculties: (1) Law; (2) Medicine; (3) History, Philology, and Philosophy; (4) Mathematics, and (5) Natural Sciences. Before taking their final examination all students must pass a preparatory examination, the 'examen philosophicum', in which philosophy is a compulsory subject and five others are chosen by the candidate. There are various libraries and laboratories connected with the University, including the University Library, the Natural History Museum, the Zoological Museum, the Geological Museum, the Palaeontological Museum, the Botanical Museum, the Astronomical and Magnetic Observatory, the Meteorological Institute, and the Biological Marine Station at Dröbak. Other branches of the University outside Oslo are the Technical College at Trondheim, the Agricultural College at Ås, and the Commercial College at Bergen.

Training for elementary school teachers was given at special colleges of which there were ten in the country; training for secondary school teachers was given at the University and at the Pedagogic College attached.

(2) The new system, based on the Act of 1935, outlined school development for the ten years from 1939. A plan committee was appointed to deal with the various necessary changes, and the scheme is known to have begun in 1939. It is not, however, possible to say to what extent it has been developed or to do more than outline the changes.

The system is based upon a seven-year elementary, or folk, school

course for all children, in which English is to be taught in the top forms. Beyond this there is to be an adaptable system of higher schools, pupils entering either a five-year high school (gymnasium), which would presuppose a knowledge of English, or a three-year science school together with a three-year college course.

Winter high-school courses and science schools will also be established to help country children to reach the higher schools.

The organization of the University and the Working Men's Colleges is not apparently affected by the new scheme, but it will be essential to adapt the teachers' training colleges and possibly to build new ones.

CULTURE

The Middle Ages

Norway has a tradition of literature and art which extends back to medieval times, when the sagas were handed down from mouth to mouth by the skalds, or professional poets, whose task it was both to remember the old and create the new stories. Some of these sagas were finally written down in what is called the 'Edda'. This, known as the 'Poetic Edda' to distinguish it from a later 'Prose Edda', was discovered during the seventeenth century by Bishop Sveinsson, who attributed it to Saemund Sigfussen and suggested that it was probably written during the twelfth century. It is a collection of verses on mythological and religious subjects and written in a simple style which loses in translation because it is written in conformity with certain metrical and other conventions. The later, or 'Prose Edda', was written by Snorre Sturlason and appeared about 1220. It comprises old legends, folk law, and religious thoughts with, in addition, an essay on the art of writing poetry. Norwegian art, represented mainly in carving (Fig. 23), was well developed during early medieval times and is best exemplified in carved ships now preserved in the Viking Ship Hall near Oslo. With the spread of Christianity a new religious poetry sprang up which, with the folk-poetry, has preserved the continuity of Norwegian literature. With Christianity is also associated the widespread building of churches. Near the coast these were generally of stone, which was the usual building material of the foreign clerics who were asked to come to Norway to give advice and help. Trondheim and Bergen Cathedrals are the best examples of these. In the interior, however, wooden churches were built by local craftsmen; these are known as 'stave churches', and despite the frequent accidents from fire there are still several left (Fig. 24). They

are characterized by their unique carvings which are akin to those found on old Viking ships, and frequently have no relation to Christian thought.

The Period of Union with Denmark

During the union with Denmark from 1537 to 1814 the cultural life of Norway seems to have been stifled by the Danish overlordship and to have come to an almost complete standstill. The only outstanding names are those of Peter Dass (1647-1708) and Ludvig Holberg (1684-1754). Dass was a cleric and a poet, writing mainly about Norwegian life and scenery. Holberg lived most of his life in Denmark, and his work is as much Danish as Norwegian both in style and in its subsequent influence. His writings generally have a moral and educative trend, but he is best known as a dramatist, in which sphere his comedies are still well known in Norway, although during his life he was chiefly concerned with the founding of the Danish theatre. Throughout the union with Denmark music as a national art was almost dead. It is true that during the eighteenth century concerts became a fashionable form of entertainment; but most of the artists were visiting foreigners, or amateurs of the upper classes, and there was no national composition. During the latter half of the eighteenth century a national consciousness began to emerge which expressed itself in the production of descriptive poems, as well as in the beginning of scientific research, which resulted in the founding of Oslo University in 1811.

The Nineteenth Century

The national revival resulted finally in the break with Denmark in 1814. This was followed by a burst of patriotic enthusiasm which expressed itself through literature, music, and the arts. This was sometimes rather an undisciplined enthusiasm, as in the case of the first overflow into lyrical poetry, and also in the architectural atrocities of the last century. It was not until 1830 that any true literary renaissance took place. This was especially associated with Henrik Wergeland (1808-45) and Johan Sebastian Welhaven (1807-73). These two men were rivals, both in the political and artistic world, and their rivalry resulted in a fierce battle of written words in which Welhaven seems to have kept a more rational outlook. Wergeland was strongly national in his ideas, though, as he did not oppose the Swedish union, his nationalism was probably not so bigoted as his opposition to Welhaven led people to suppose. Welhaven was an

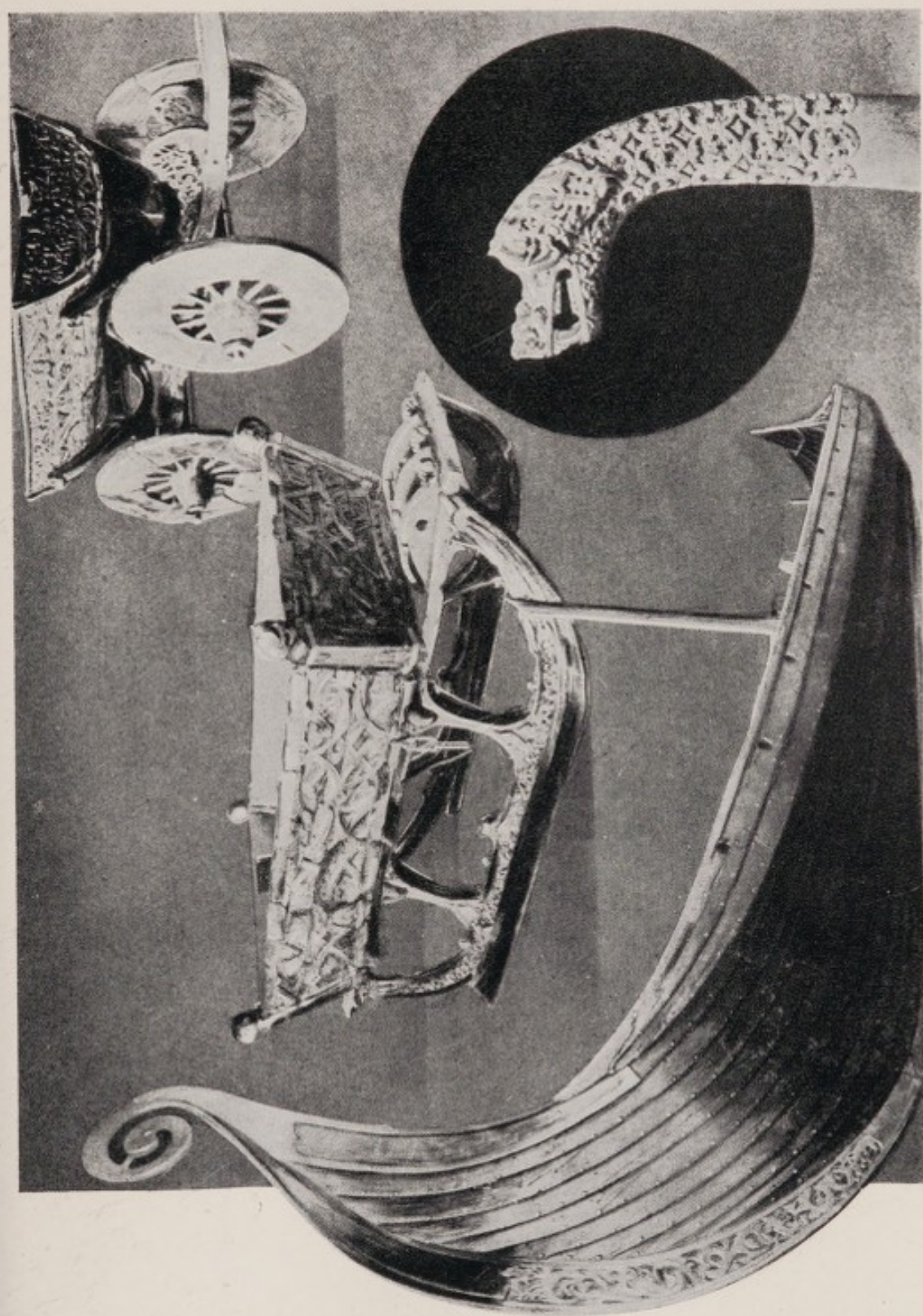


FIG. 23. *The Oseberg Relics*



internationalist and believed that Norwegian culture and policy should be enriched by contacts with other countries and not by an isolationist policy. In the struggle resulting from these rival opinions both poets had a remarkably large output and between them may be said to have founded the new intellectual life of Norway.

The national renaissance found expression in the 1840's in a general interest in folk-lore. Folk-poetry was collected, folk-songs written down and published, and Norwegian dialects studied and analysed (*v.s.* p. 158).

The period of literary 'self-absorption' lasted until about the 1870's, when a strongly realistic current became evident, which is best expressed in the problem dramas of Hendrik Ibsen (1828-1906) and Bjørnstjerne Björnson (1832-1910). Both these writers were passionately concerned with social and moral reform in Norway, but they were complete opposites in their methods of approach. Ibsen was gloomy and pessimistic and sought to teach his fellow countrymen by revealing to them their sins and shortcomings. Björnson saw in Norway material for a great and glorious future, and throughout his work runs a spirit of true optimism; it is largely due to his writings that his country achieved independence in 1905. Ibsen and Björnson, and later Gunnar Heiberg (1857-1929), were the first to concern themselves with the national theatre, and under them the theatre developed a strong propagandist tendency for reform. Among the players with whom they worked the genius of Johanne Dybwad gave life to the stage over a period of fifty years.

The post-1814 renaissance did not leave the musical world untouched. Waldemar Thrane (1790-1828) was the first national composer to win fame with his opera *The Highland Adventure* (*Fjeld-Eventyret*). He was followed by Ole Bull (1810-80), a violinist and composer of national romances. The lyric composer Halfdan Kjerulf (1815-68) and Rikard Nordråk (1842-66), the composer of the national anthem, both took some of their tunes from folk-music, but it was Edvard Greig (1843-1907) who used it with such skill in his own compositions, as in the music to Ibsen's *Peer Gynt*. Contemporary with Greig was Johan Svendsen (1840-1911), whose rhapsodies and arrangements of folk-music have a charm and spirit of their own. Christian Sinding (*b.* 1856) is more varied in his composition and in many works is influenced by the style of Wagner.

Norwegian art during the nineteenth century remained an art of emigrants, as artists were compelled to go abroad for their education, and notably to Germany. Thus at Dresden a Norwegian school of

painters was built up by J. C. C. Dahl (1788-1847), who was Professor of the Academy and famed for his landscape paintings. Later Norwegians congregated at Düsseldorf, where they were led by Adolf Tidemand (1814-79), a painter of peasant life, and Hans Gude (1825-1903) a landscape painter, who later became Professor of the Academy at Berlin. In the 1870's a group of Norwegians gathered at Munich; some, like Eilif Petersen (1852-1929) and Hans Heyerdahl (1857-1913), modelling themselves on the old masters, others, like Erik Werenskiöld (1855-1938) and Gerhard Munthe (1849-1928), following the French impressionists.

The Twentieth Century

In accordance with the rapid development of Norway during the twentieth century, literature and the arts are rich and varied. This is no doubt due to the very high standard of education throughout the country, for, in spite of geographical obstacles, illiteracy is very low, and even in the remote country places the younger generations can read and write, often even attaining a knowledge of English. Descriptions of peasant life still draw many writers, with Olav Dunn (b. 1876) as the greatest name. Fru Sigrid Undset (b. 1882) has created outstanding works in her novels of medieval life, which won for her the Nobel Prize. Other well-known novelists include K. Hamsun, Bojer, Falkberget, Kr. Elster, S. Christiansen, and Fangen.

In the theatrical world attempts have been made to encourage dramatic art. The Government and large cities make grants towards the expenses of three Norwegian theatres: the National Theatre and the Norwegian State Theatre at Oslo, and the National Stage at Bergen. Oslo, Bergen, and Trondheim are still, however, the only cities where there are theatres, and there is no permanent opera company in the country, although there are cinemas in most ports and several of the inland towns. Amongst the best known of the modern playwrights are Nils Collett Vogt, Nini Roll Anker, and Nordahl Grieg. The National Theatre at Oslo has been the principal stage round which have gathered such artists as Johanne Dybwad, Ragna Wettergreen, Egil Eide, Hank Åbel, and Ingolf Schanche; and of the younger generation of actresses G. Egede-Nissen and T. Segelcke.

The development of art during the twentieth century has passed through various phases, influenced first by one trend from the continent and then by another. There are few outstanding names beyond Edvard Munch (b. 1860), whose work in varied mediums has had



FIG. 24. *Fantoft Stave Church*



FIG. 25. *Modern timber building*

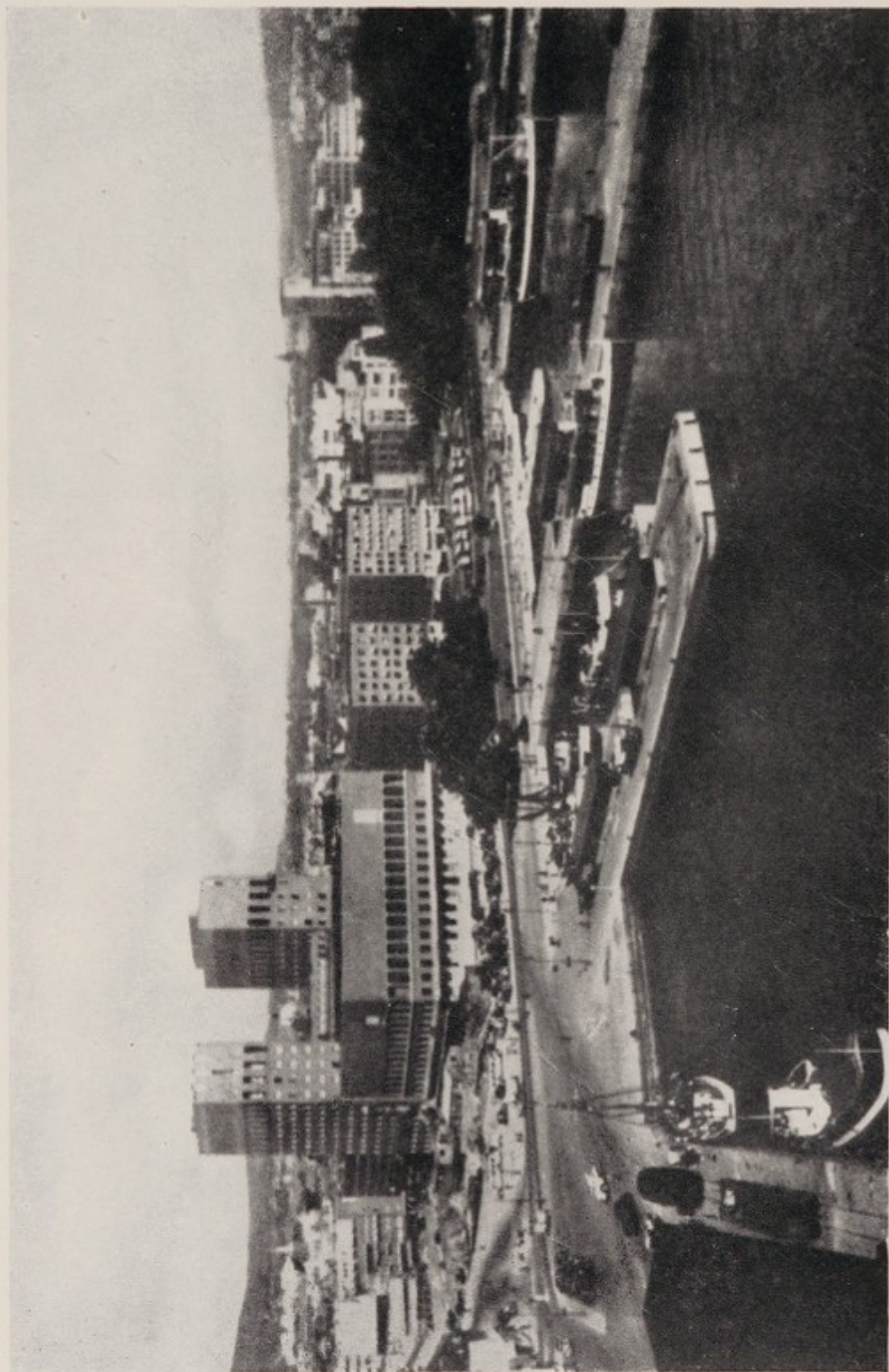


FIG. 26. *Modern Oslo. Piperviken quays and the Town Hall*

a wide influence, and Gustav Vigeland (*b.* 1869), a sculptor whose virile treatment of bronze has won for him great national fame. Since the founding of the Technical College at Trondheim there has been a great development of architecture. A simple, dignified style has been evolved for the many public buildings which have recently been erected. Skilful use has frequently been made of timber, which is of course the natural building material for Norway (Figs. 24 and 25).

Broadcasting

Broadcasting now plays an important part in the cultural life of Norway, despite the technical difficulties of transmission presented by the geography of the country. The Norwegian Broadcasting Corporation (N.B.C.) arranges its programmes to cover three main purposes: the spreading of popular knowledge, bearing in mind the isolated conditions of many of the people; the reporting of topical events; and entertainment.

Wireless lectures are both technical and more general. A series is generally arranged in conjunction with the University on a wide range of scientific subjects. Another series, for which study notes are issued, deals with problems such as social welfare, industrial peace, international affairs, the position of women, municipal and State administration, temperance, hygiene, folk-lore, history, &c. Statistics show that there have been groups of listeners, totalling over 35,000, working on the various series during the winter half-year. School broadcasts are also of increasing importance, especially in the rural areas. Emphasis is placed on practical subjects, especially in connexion with the life of the nation, such as fishing, agriculture, lumbering, and similar subjects.

Reports are given on trade and commerce, on international and European affairs through special correspondents abroad, as well as the popular running commentaries on sport. Reports are also arranged in co-operation with other Scandinavian countries.

Music is the most popular form of entertainment. Both light and classical music are frequently played, explanatory talks and lectures being given in conjunction with the performances. The theatrical department aims at producing good plays both by Norwegian and foreign authors, besides providing more popular entertainment and sketches. It is hoped to promote interest in amateur theatricals by giving instructive lectures on production and stage management. The N.B.C. is represented on a committee which hopes to start a travelling National (State) Theatre.

Scientific Research

The cultural development of Norway since 1814 has not only influenced the arts but has also resulted in the development of various branches of scientific research. A great deal of early research was undertaken in connexion with geographical exploration, although the studies of geology, terrestrial magnetism, atmospheric electricity, and the 'Aurora borealis' have developed independently. During the first part of the nineteenth century many expeditions of discovery were made in arctic waters, and in 1876 the North Atlantic Expedition under H. Möhn and G. O. Sars inaugurated scientific exploration in Norway. This expedition resulted in the development of marine research, for which permanent stations have since been established at Dröbak on the Oslofjord, at Herdla near Bergen, and at Trondheim.

The most famous names in the field of Norwegian exploration are those of Fridtjof Nansen (1861-1930) and Roald Amundsen (1872-1928). Nansen first achieved fame by his ski journey across Greenland in 1888. In 1893 he started on the famous expedition during which his boat, the *Fram*, frozen fast into the ice, was allowed to drift with the Arctic currents, while Nansen and Johansen went off in sledges towards the North Pole. Nansen did not himself undertake any other large expeditions but turned his brilliant mind to research and politics and was the instigator of some of Amundsen's journeys. Amundsen was both scientist and explorer. In 1903-6, while making the first expedition through the north-west passage, he was engaged on the study of terrestrial magnetism. His next expedition was planned for the North Pole, but at the last minute, learning that Peary had forestalled him, he changed his plans and went south, where he himself forestalled Scott at the South Pole. His plans were interrupted by the War of 1914-18, but in 1918 in a new ship, the *Maud*, he went north again and traversed the north-east passage. Later Amundsen took up the idea of using aeroplanes in Polar research and in 1926, with Ellsworth as companion, he flew over the North Pole in an Italian built airship.

Besides these world-famous expeditions there have been many other lesser ones. During recent years many of these have been in the Antarctic, where exploration and research have been made particularly in support of Norwegian whaling interests.

Recently, scientific research has been directed more and more to utilitarian objects. There is a research station for mining at Kongsberg, for agriculture at Ås (near Oslo), and a College of Veterinary

Science at Oslo. Research in technology is centralized at the Technical College of Norway at Trondheim. Of special importance to foodstuff industries is the State Institute for Vitamin Research at Bygdøy, which was started primarily for testing cod-liver oil. The De-No-Fa company at Fredrikstad has laboratories for research into oil problems, while large laboratories at Stavanger research into canning problems. There are also laboratories connected with the wood-pulp industries.

With all these institutes for research, it is possible for Norwegians to attain a high standard of purely technical knowledge, besides the literary and scientific background, which is provided by the University of Oslo.

The Press

The history of the press begins about 1760, but its influence on public opinion was negligible until after 1814. Until near the end of the nineteenth century the press kept clear of party politics, but, during the conflict over the union with Sweden and the period of extension of the franchise, there was a widespread demand for a party press and one that could also furnish information on economic questions. At the same time there was a change from the one-man editor-manager-printer to a departmental system, whereby the important newspapers employed an editor and a staff of professional journalists.

The daily press has increased enormously, the number of different dailies now being over 200, most of which have a strong party bias. For the majority of dailies the circulation is naturally small, often a matter of a few thousand copies. In Oslo, however, several papers have a large circulation; the *Aftenposten* (conservative) shows an average morning issue exceeding 90,000; *Arbeiderbladet* (labour) over 60,000; *Tidens-Tegn* (moderate-liberal) over 40,000, and *Dagbladet* (liberal) over 35,000. The largest daily outside Oslo, *Bergens Tidende*, has an issue approaching 40,000.

The publication of periodicals has increased even more than that of daily papers, in response to the demand from all fields of professional and technical work. There is now practically a complete range of trade journals, besides numerous organs for cultural movements, current affairs, hobbies, &c.

The central organization of the Norwegian press is the Norwegian Press Federation, founded in 1911. The Federation of Norwegian Newspaper Proprietors, founded in 1910, is for proprietors outside

Oslo. Professional journalists have formed local organizations throughout the country. The central organization for distributing home and foreign news is the Norsk Telegrambyrå (N.T.B.) in Oslo, acquired by the newspapers in 1918. The bureau has correspondents all over the country and branch offices in Bergen, Trondheim, and Bodö. It co-operates with the big European news service organizations and is affiliated to the 'Bureau central des agences alliées' in Paris. The N.T.B. has its own picture service and is equipped with modern devices such as private wireless, teleprinters, &c.

CHAPTER VIII

HISTORY

THE physical character of a country such as Norway must always be the predominant factor in determining the form of its settlement, especially in those early days when internal communications, where they existed at all, had not yet even begun to be developed. The settlers on the shore of a fjord or lake had some freedom of movement by water, but this was denied to the dwellers in inland valleys. Land sufficiently productive to support human life was in many parts to be found only in small patches, often in narrow river valleys separated by lofty mountains. Under conditions such as these the unit of early settlement was the individual family or family group, living in comparative isolation and largely self-contained, as, indeed, to a large extent it still remained in the earliest historic period, which, as regards the internal state of Norway, scarcely begins until the ninth century.

The Viking Age

But many years earlier the Viking expeditions of the Norwegians had made them notorious throughout north-eastern Europe. The geographical conditions which led to those expeditions are clear enough. The inhabitants of Norway were, from very early days, accustomed to make extensive use of their huge system of natural waterways—the straits at the mouth of the Baltic, the landlocked waters of the fjords, and the calm channels between the coast and the skjaergård. To men so accustomed to navigation and newly released from long winter darkness, the North Sea, in summer weather, was an easy highway to lands where adventure and plunder could be found. Apart from the fact that the natural wealth of Norway was not great, there is less certainty as to the economic and political factors which gave impetus to the Viking movement. There seems, however, to have been little prospect for the younger members of the family of a chieftain if they remained on the ancestral estate, so that many sought their fortune on the seas. It is, moreover, well established that in the days of Harald Håfager many of the more high-spirited chiefs, together with their followers, sailed away from Norway in order to escape from what they regarded as tyranny. Such an exodus, if on a smaller scale, is likely to have occurred at other

times, for the sea always offered a means of escape to the discontented and rebellious. Although the more spectacular activities of the Vikings are the better known, it is probable that a considerable amount of legitimate trading was carried on by them.

Danes, as well as Norwegians, took part in the various expeditions. It is not by any means easy always to distinguish between them, but the direction taken by expeditions originating in Denmark and Norway respectively was largely influenced by the geographical position of each country. The eastern coasts of England lay invitingly near to the former, but it was natural that the early expeditions starting from the western coast of Norway should strike across to the Shetlands and Orkneys; from these islands the way was open southwards to the coasts of Scotland and Ireland, and the Faeröe Isles, Iceland, and even Greenland were accessible towards the north. The movements of the Vikings have been shown to have proceeded, subject to circumstances, on a definite plan. Their first visits were usually short raids, made in summer, and having no apparent object other than pillage. Later they would winter in the strongholds they established, and in some instances spread thence far over the lands they had threatened. The ultimate phase of the Viking movement is the absorption of the Scandinavian settlers by the peoples of the lands in which they settled; but the stage of settlement was not always attained.

The first recorded appearances of the Vikings were upon the Dorset coast in 787 and at Lindisfarne in 790. The doubtful honour of these appearances has been claimed on behalf of both Danes and Norwegians, but there seems good reason to believe that the latter were already only too well known on the islands and shores of Scotland. The 'Viking Age' is usually said to have ended early in the tenth century, but the overseas voyages did not cease abruptly and they continued long after that date. Thus, the first landing in Greenland was made by Erik the Red in the latter half of that century, and Leif's famous voyage to the shores of North America took place in about the year 1000. But more settled conditions in Norway and, especially, the conversion of that country to Christianity led to the abandonment of the wilder excesses associated with the early Vikings.

Amongst the Norwegians, the Viking movement owed its origin largely to the particular circumstances of a single section of the community, and the sea-rovers were never more than a fraction of the people, the majority of whom went their uneventful ways as farmers and fishermen in the same way that their ancestors had done and the *bönder*, their descendants, do to-day. Although there has been some

tendency to overrate the effects of these voyages on the social and political history of Norway, among them may be found the germ of the modern eminence of Norwegians in the mercantile marine of the world, or, again, of the distinguished part played by them in exploration, especially in the polar regions. But, at the time, the activities of the Vikings sapped a good deal of their country's strength; the wealth obtained was not distributed equally, and the men who enriched themselves overseas did not as a rule leave their taste for warfare there. Although the Hebrides, Orkneys and Shetlands, as well as the Faerøe Islands and Iceland, continued for centuries to be Norwegian colonies, they brought little material benefit to their mother country. Under more fortunate conditions and wiser management they might have formed the nucleus of an important colonial empire, but this was never achieved.

Early Organization

By the ninth century Norway had become divided into about thirty independent districts or *fylker*. The word *fylke* is said to be connected etymologically with *folk*, and this suggests that a *fylke* was originally the territory occupied by a tribe or a subdivision of a tribe. But the basis of society was still the individual family, and the continuity of possession of its lands was fostered by the prevailing system of inheritance, the *odel*. Under this the family lands, although in theory divisible among all male descendants of the same degree, in practice passed at death to the representative of the original ancestor subject, nevertheless, to some form of compensation to other members of the family and to their rights of pre-emption and redemption in the event of an attempted alienation to a stranger. At the head of the *fylke* was the king, who presided over the religious ceremonies of the tribe and led the *hird*, or band of warriors, in defence of its territories. Some not very clearly defined allegiance might be owing to him, but it was as his equals that the freemen, at the *ting* or assembly of the *fylke*, declared or interpreted the laws and customs of the tribe and applied them in the settling of disputes. Liberty and independence, enjoyed in such full measure by the freemen, was altogether denied to the unfree, the *troell*.

There seems to have been a tendency for two or more *fylker* to become united. Such unification was, of course, most likely to be achieved where the natural conditions were especially favourable to the process, as in the rich and fertile Trondheim depression. This region had been settled at a very early date, and a stage on the road

to political organization was reached when the tribes of eight fylker in the neighbourhood of the fjord came together in what has been described as a peasant community. It seems that each fylke settled its own affairs at its own ting, but all were united for purposes of worship, for administration of justice, and for dealing with such other matters as concerned the community as a whole.

The Tronders prospered, and so were generally too well content with their immediate surroundings to be affected by those influences which lured men from other parts of the country on Viking expeditions. They were peaceable and, so far as is known, the contacts of the tribal league with the outside world were entirely unaggressive. Their country was so situated that its communications with the north, east, and south were relatively easy. It seems, therefore, at least possible that the ideas underlying the foundation and continuance of this social league might ultimately have led to national unity centred on the Trondheimsfjord. But such unity—when at length it was reached—came neither from the centre of the country nor as the result of evolution. It came, in fact, from the south and was imposed by force.

National Unification

Harald Håfager (the fair-haired) was the first to bring all the settled parts of Norway under one rule. Apart from a somewhat doubtful chronology, the facts relating to his times appear to be well established, and the history of the country is henceforward comparatively full and authentic. Harald was descended from the kings of Vestfold, a small district on the west side of the Oslofjord; but the power of his father, Halfdan the Black, extended over the fylker at the head of the fjord and farther north. Halfdan died, and the early years of his young son's reign—which began somewhat later than 864—were occupied in establishing a hold over his inherited kingdoms. These lay in that part of Norway most in contact with the outside world and therefore likely to be influenced by events in countries where the process of consolidating the petty kingdoms into a larger national unit was already well advanced, if not actually accomplished. Such events, and especially the achievements of Charlemagne, had their effect on Harald, who became filled with the ambition to extend his lordship over the whole country.

Accordingly, when his own kingdoms had been made secure, Harald marched along the easy route through the Gudbrandsdal to the Trondheim territories. These were quickly subdued, but the tribes

farther south-west resisted him more strongly: nevertheless, he was soon master of all the country as far south as the Sognefjord. But several more years elapsed before the chiefs of the fiercer peoples of the western coast were met and routed in a great battle at Hafsford, near Stavanger: such of the chiefs as refused to submit were forced to flee to the Faeröe Isles or the islands off the coast of Scotland, whence they continued to raid the Norwegian shores until Harald defeated them in their own waters.

The subjugation of one petty kingdom by another was not unusual in Norway. When this happened, the king of the conquered fylke remained, almost as a matter of course, undisturbed in office, for this right was, under the odal system, regarded as inalienable from the accepted head of the family in which it was vested. Some form of tribute would probably be rendered by the defeated king, but neither he nor his tribe were likely to be particularly affected by the altered status of their community. But the victories of Harald were followed by a drastic internal reorganization. The means by which he sought to make his will supreme over the conquered peoples were, briefly, as follows:

- (1) Every defeated enemy was required, as a condition of his life being spared, to take an oath of fealty to the king.
- (2) The lands of all those who had fled from Norway were confiscated.
- (3) The fylke-kings were replaced by *jarls* appointed by Harald and removable at his pleasure.
- (4) All lands were to be subject to a tax or rent, the collection of which, as well as the duties of local administration, was entrusted to *lendermenn* appointed by the king.
- (5) A 'nose-tax' (poll-tax) was made payable.

The National Kingdom

Harald had succeeded in making Norway into one kingdom, but its break-up was inherent in the disposition—made by him some years before his death in about 933—under which his favourite son, Erik Blodöks, became his successor, but only as over-king over a considerable number of other sons, to each of whom a kingdom was given. The almost inevitable consequence was that Erik tried by force to make himself king, like his father, over the whole country. His methods included the murder of at least two of his half-brothers and were generally so ruthless that in 934, Haakon, a younger son of Harald, was summoned from England. Supported by the powerful Earl

Sigurd, he was so enthusiastically welcomed in the Trondheim district that Erik was forced to flee from Norway.

Haakon's promise to restore to the Norwegians the rights and liberties of which they had been deprived was, for the most part, fulfilled. He organized the *leding*, a system of national defence based on the provision by each coastal district of a warship together with crew and equipment. More neighbouring fylker were included in the Tronder association, and a previously existing union of shires south of the Sognefjord was also enlarged by the inclusion of other south-western fylker. Each of these associations had its common laws and its own ting, at Frosta and Gula respectively. These 'law districts' corresponded with natural divisions of Norway, as did also a third such district, the Uplands and Vik, which comprised the fylker lying to the east and to the south of the main watershed of the country. Although his attempts to convert his subjects to Christianity were a conspicuous failure, Haakon's reign was generally peaceful. Nevertheless, there was throughout a loosening of control by the central authority established by Harald. The landowners, relieved of the burdens and obligations laid upon them, tended to revert to their former state of independence. Moreover, considerable portions of the country ceased to be under the king's immediate rule, notably in the north—where Earl Sigurd, as his deputy, exercised wide powers—and in the Uplands and in Vik, where certain vassal kingdoms were allowed to remain under other sons of Harald or their descendants. In 961 Haakon was slain in combat with invaders from Denmark who, led by the sons of Erik, had been troublesome towards the close of his reign.

In the years that followed Norway was much disturbed until the arrival of Olaf Tryggvåson, the grandson of one of the murdered half-brothers of Erik Blöðoks. Brought up in Russia, Olaf had taken to the sea at an early age, and had become a famous Viking leader. His magnificent appearance and great personal strength and energy commended him to the Norwegians, who accepted him as king. In 997 he founded Nidaros, which afterwards became the city of Trondheim, for many years the capital of Norway. Olaf had been baptized in England, and with fanatical zeal he entered on the task of converting his fellow countrymen to Christianity. Whatever may be the probable sincerity of a conversion effected by such a 'heathen vassal of the new faith', who supplemented his missionary efforts by bribes, cajolery, or force, in a very short time all the principal men of Norway and very many others became professedly Christian. But all this rested on Olaf's personal popularity and force of character, and

neither in matters religious or secular did he establish any organization likely to have much permanent value. He was, however, a picturesque, if ruthless, figure, and his position as one of his country's national heroes was made the more assured by the manner of his death. After a reign of only five years he perished gloriously in a fight off the island of Swöld, where, with a few ships, he encountered the navies of the Kings of Denmark and Sweden who, with Erik, son of Earl Haakon, had combined against him. These three then proceeded to divide the kingdom between them, but, except in some of the more southerly districts, an effective power over the whole country was exercised by Earl Erik and his brother, Earl Svend. This state of affairs lasted until about 1015, when Svend, his brother having already died, was forced to flee from Norway by Olaf Haraldson, a descendant of Harald Håfager, who, at the age of about 20, had returned from expeditions overseas.

Olaf II was endowed with a high courage, a clarity of intent, and a steadfastness in endeavour which made him well able to deal with the difficult tasks which confronted him. He came to a country which, though for the most part nominally Christian, had no ecclesiastical organization and only a few churches and priests. Moreover, the central power established over it by Harald was in process of disintegration, though Olaf Tryggvåson had proved it to be still capable of a temporary revival.

The object of Olaf was the double one of establishing both the royal power and the Christian Church on a national basis. But such policy was in direct opposition to the interests of the local chieftains, especially the lendmenn, who had come to regard themselves as entitled by hereditary right to the districts assigned to them. Olaf met their claim, which was a direct challenge to any policy of strong centralized government, by entrusting local administration to men entirely dependent on himself and of lower birth and status than the lendmenn. This change was resented by the lendmenn and by the general body of the freemen, who disdained to transfer to a mere royal servant the respect and obedience formerly accorded to the head of the local great family.

The establishment of a national Church served by priests appointed by the king was, also, obnoxious to a local chief who had presided over the religious ceremonials of his tribe, and to whom there may even have extended some of the veneration pertaining to his most ancient ancestor, the tribal deity. Nevertheless, Olaf succeeded in making Christianity the common faith of the land; he was a great church

builder, and the conversion of a district was almost invariably followed by the erection of a church.

He strictly enforced the laws and gave the country comparative stability and peace. The enmity of the great families, however, led them eventually to throw in their lot with Knut of Denmark, who claimed the overlordship of Norway. His more bitter enemies among the Norwegian chiefs assembled their forces, and Olaf was decisively defeated and killed in the battle of Stiklestad in 1030. This victory served mainly to increase the influence of Denmark, and the rule of Svend Knutson, as viceroy, was so harsh and oppressive that, on Knut's death in 1035, he was driven from Norway, and Magnus, the young son of Olaf, was brought from Russia, where he had fled.

Olaf II is generally regarded as the first to awaken a national consciousness, and in retrospect he came to be regarded as the national champion. His zeal for the Church and the Christian religion caused his memory to be sanctified and, in accordance with the spirit of the age, stories were told of signs and wonders wrought by him in death as well as in life. Thus he, who while living had been merely 'Olaf the Fat', became 'Olaf the Holy', and, by a later generation, was canonized and made the patron saint of Norway. In the past the overlordship of a king of Denmark had evoked no special feelings of resentment: it had, indeed, been rather welcome than otherwise to many a territorial magnate, as authority exercised from a distance was less effective than under a king established in the country. But such an attitude was altogether inconsistent with the newly awakened consciousness of Norway as a united and independent kingdom, and some of the men who had been foremost in procuring the downfall of Olaf were among the first to scheme for and to welcome the return of his son Magnus.

On the death of Hardeknut in 1042 Magnus inherited the crown of Denmark. He appointed Knut's nephew, Svend Estridson, as his viceroy, but the latter strove to establish his independence, and in this he received some countenance from Harald Hådråde, a half-brother of Olaf and a famous warrior. Harald, however, became reconciled to his nephew, and they together ruled Norway. After the death of Magnus in 1047, Harald made frequent, but unsuccessful, attempts to bring Denmark into subjection. He was slain in 1066 at Stamford Bridge while engaged on an invasion of England. Norway enjoyed peace and a considerable measure of prosperity under Olaf Kyrre, the son of Harald. Although there was as yet no true commercial class, a considerable trade, fostered by the leading men of the country,

began to develop, and Bergen—a town destined later to rise to outstanding commercial importance—and Stavanger were founded in this reign. Olaf III was succeeded in 1093 by his son, Magnus Barfod; he reigned for ten years, much of which time was spent in expeditions overseas.

The growing national consciousness no longer tolerated the former practice of breaking the kingdom up into several smaller kingdoms, but there was no repugnance to the rule of the undivided kingdom by several joint kings. Accordingly, Magnus was succeeded by his three sons, Eystein, Sigurd, and Olaf. Such plurality of kings might have led to a weakening of the central power, but this tendency was to some extent obviated by the early death of Olaf and by the fact that Sigurd was for a number of years absent on a crusade, in which he gained considerable distinction. He survived the peace-loving Eystein, and reigned alone for the last eight years of his life, which ended in 1130. He was the last of the line of Harald Håfager to have undisputed supremacy over the kingdom, and with him may be said to have passed what has been described as the 'classical period of Norwegian history'.

The death of Sigurd was followed by a long period of internal disorder. That king had done all that he could to ensure the succession of his son, Magnus, but Harald Gilchrist, reputed to be a natural son of Magnus Barfod, was put forward by some of the leading men as a rival claimant. After a brief period of joint rule Magnus was deposed altogether. Harald was killed in 1136, and the great families, divided into factions, gave support to one or other of his descendants as claimant to the throne, so that the several next kings, or joint-kings, were largely dependent on that faction which, for the time being, had the upper hand in Norway. Under these circumstances, the power of the aristocracy inevitably tended to encroach on that of the king. The political influence of the Church, also, was becoming much greater, especially after 1154, when the establishment of an archbishopric at Trondheim caused it to be more amenable to the influence of Rome.

The power of the great families, and of the Church, is shown by the circumstances under which Magnus, the son of Erling Skakke, was chosen king in 1161. His father, though a powerful chief, was not of the royal blood, and the choice of the young Magnus was, therefore, contrary to all precedent; it was accordingly deemed expedient for him to be crowned by the Archbishop of Trondheim. This was the first occasion on which the spiritual authority had taken any direct

part in the making of a king of Norway, and the Archbishop made the most of it to render the title to the kingship dependent—nominally, at any rate—on the goodwill of the Church. The leading motive for the exaltation of Magnus V seems to have been the desire to put an end to the disorders of the kingdom by establishing on the throne the person most likely to receive the support of the aristocracy and of the Church. Erling, as regent, exercised a wise and beneficent rule, and the position of Magnus seemed sufficiently established until the coming of Sverre as leader of the Birkebeinar.

These Birkebeinar were one of the armed bands of adventurers who, as supporters of some pretender to the throne, had added to the disorders of the country. Their fortunes were at a very low ebb, when they found in Sverre an able leader. He came from the Faeröe Islands, and was probably of humble origin. But as kingly birth was advantageous to an aspirant to the throne, he claimed to be a grandson of Harald Gilchrist, and was accepted as such by his followers. In the struggle which ensued Magnus was forced in 1180 to flee to Denmark, and in 1184 was decisively defeated and killed at Fimreite on Sognefjord. Sverre, a man of outstanding ability, now proceeded to consolidate his power by concentrating in himself a control over both Church and State much greater than that enjoyed by earlier kings. This policy may to some extent have been forced on him as there was no section of the community on whose loyalty he could place much reliance, but more likely it was the result of deliberate choice. In pursuance thereof the powers of the territorial magnates were curtailed in various ways, notably by the appointment of a body of new officials. Sverre soon made it clear that, unlike his immediate predecessor, he was not prepared to hold his kingdom merely as a 'fief of St. Olaf'. He was perfectly willing to be regarded as ruler by divine right, but by right bestowed on him direct from on high and not through the medium of any ecclesiastical personage. Such an attitude brought Sverre into collision with the Church, but the papal displeasure and excommunication weighed upon him no more than did the hatred of many of his subjects. He had set out to make the royal power supreme over both national Church and State, and his efforts in both these directions had been mainly successful by the time of his death—which actually occurred in bed!—in 1202.

Sverre often had to contend with armed risings, and towards the close of his reign the Croziermen, aided and abetted by the clergy, had been particularly troublesome. After his death the land was more than ever torn by internal faction, and it was not until 1217 that, with

the support of the Birkebeinar, his grandson, Haakon Haakonson, established over his rivals an ascendancy which enabled him to become king; pretenders to the throne were, however, not finally crushed until 1240. Haakon IV lived until 1263, and during his long reign the country, exhausted by the events of previous years, settled into tranquillity. It was in his time that Iceland was made directly dependent on the mother country, but the attempt to deal similarly with the Scottish islands was so unsuccessful that the Hebrides were soon afterwards ceded to Scotland by Magnus VI, who succeeded his father. The title of Lagaböetr (the Law-Mender), by which the new king came to be known, indicates his principal achievement: this consisted in the supersession of the old local laws by a body of law applicable to the kingdom as a whole. The revised legislation showed clearly the importance of the newer class of officials as well as the increased powers of the king. The trade privileges granted by Magnus to the merchants of the German Hansa laid the foundations of a system which eventually crippled Norwegian commerce. The relations of the Crown with the old aristocracy were somewhat improved, but the continued usurpations of the Church led to quarrels which came to a head during the regency which followed the king's death in 1280. Erik, his son and successor, died in 1299. His only child, the 'Maid of Norway', had perished on her ill-fated voyage to Scotland, so that the crown passed to Haakon Magnusson, his brother. The latter dealt drastically with the nobles who, during Erik's reign, had shown some tendency again to encroach on the royal power. He even went so far as altogether to do away with the already impoverished lendermenn who, as a class, had been so prominent in earlier times. Their influence had, however, already faded into insignificance since they were no longer regarded as the natural leaders of the land-owning classes. Haakon V left no son, so that, on his death in 1319, the Crown of Norway passed, through his daughter, to the reigning house of Sweden.

Sverre's conception of a strong central authority, supreme over a national Church and State, had been strictly followed by those of his descendants who had ruled over Norway for a century. But the strength of the Crown had been achieved at the expense of all the other constituent elements of the nation. The old territorial families, shorn of their wealth and ancient prestige, had become indistinguishable from the general body of small landowners. These latter had been deprived of all effective share in the government of the country, and so no longer retained a national outlook. The new nobility,

enriched by lands taken from their previous owners, were too much connected with the court to have any independent influence; from them, moreover, were derived the higher officials who, in effect, administered the country on behalf of the king. The Church had increased in temporal wealth, but its priests had become amenable to foreign influences which were not always consistent with the national welfare. In view of all this the stability of the nation rested almost exclusively on the strength of a royal power which now became essentially weakened by the union with Sweden.

Economically, also, there existed in the fourteenth century factors which were very inimical to the welfare of Norway. Under the later kings of Sverre's line there had been a considerable measure of prosperity, but the policy adopted by them led eventually to the almost complete transfer of the foreign trade from the native to the German merchants: a process which was greatly accelerated by the establishment in about 1346 of a factory of the Hanseatic League at Bergen. The native artisan class, moreover, tended to be swamped by a considerable influx of foreigners. Trade with the colonies established in Iceland and Greenland had dwindled as the result of unwise attempts in the previous century to establish something in the nature of a monopoly in favour of the mother country. Finally, the population of Norway—estimated then to have been about 300,000—is said to have been reduced to the extent of one-third by the Black Death and subsequent plagues. Much land went out of cultivation for lack of workers, and the general economic effects of these visitations were particularly disastrous in a country naturally so thinly populated and in which, under Christian influences, the emancipation of a considerable number of troells had already led to a shortage of labourers.

The First Union with Sweden

The young child Magnus VII, hereditary king of Norway as the grandson of Haakon V, was elected king of Sweden in 1319, so that the two kingdoms became nominally united. From that date until the present century the history of Norway is almost inextricably linked with that of other parts of Scandinavia. The union with Sweden rested solely on the fact that Magnus was king of both countries, and it was attended with so little success that an arrangement was made in accordance with which Haakon, the younger son of Magnus, became king of Norway. His wife, Margrete, was a daughter of Valdemar, king of Denmark, on whose death in 1375 Olaf, the young son of Haakon and Margrete, was chosen by the Danes as his grandfather's

successor. King Haakon VI died in 1380 and Margrete acted as regent for her son in both Norway and Denmark. An able woman, she succeeded in remaining in power over both these countries even after the death of Olaf in 1387.

In Sweden, Albert of Mecklenburg, in favour of whom Magnus had been deposed, had become so unpopular with his nobles that they invited Margrete to take over the reins of government. She, accordingly, sent an army into Sweden, and in 1389 Albert was defeated and captured at Falköping. Some years elapsed before all opposition in Sweden was overcome, but Margrete was already *de facto* mistress of all three countries. In order, however, permanently to establish the union of the three kingdoms, it was necessary for her nominee and great-nephew, Erik of Pomerania, to be accepted as king over all of them. He had been proclaimed king of Norway in 1389, but he was not formally recognized as king of either Sweden or Denmark until 1397, when the Swedish, Danish, and Norwegian representatives assembled at Kalmar declared the three countries to be 'eternally' united under the rule of one sovereign.

The Union of Kalmar

The Union of Kalmar provided for a community of interests in regard to defence and foreign relations, but for the government of each country according to its own laws. The three kingdoms were indeed closely allied in language and customs, but their external interests lay in different directions, and their internal political tendencies were in various respects dissimilar. The difficulties of intercommunication added an obstacle to unity. It is, also, sufficiently obvious that Denmark, with her much larger population and more advantageous position, was likely to become predominant in any partnership of the Scandinavian countries. The provinces of Halland, Skåne, and Blekinge belonged to Denmark, which thus possessed the extreme southern peninsula of modern Sweden, and the coastal lowlands from modern Gothenburg south and east to a point opposite the southern extremity of Öland Island. Bohuslän, south of the Oslofjord, was, however, included in Norway. Sweden had, accordingly, no coastline on the Kattegat, but, for her, the partnership proved to be of comparatively short duration, since the Swedes asserted themselves so vigorously against the union that from about 1470 they were governed by native regents, and in 1523 the connexion with Denmark was finally ended. On the other hand, the

union of Norway with Denmark was destined to last for more than 400 years.

Even after the coronation of Erik, the real authority remained with Margrete. Her object was to effect a complete fusion of the three countries, and, accordingly, it was her policy for all important posts in each of the kingdoms to be held by Danish nobles. After her death in 1412 this policy, continued by her immediate successors, was one of the principal grievances which led to the revolt of Sweden against the union. It was a cause of resentment in Norway also, but there, as has been seen, the classes from which a national movement might have come had ceased to take an active share in government, and any feeling of resentment found no effective outlet. So the administration of the country by men appointed by kings of Danish or German origin tended more and more to relegate Norway to a condition of dependence on Denmark.

In 1439 Erik was deposed and his nephew, Christopher of Bavaria, was placed on the throne of the three kingdoms. He died in 1448, and his successor, Christian of Oldenburg, was unable to establish his power over Sweden. On the marriage of his daughter in 1468 to James III of Scotland, the Orkneys and Shetlands were given in pledge as security for her dowry: they were never redeemed. In Christian's time the activities of English sailors led to much friction, but his successor, Hans, entered in 1490 into a commercial treaty with England. Then, with the help of England and other countries, he set about the task of reducing the powers of the Hansa, which, under earlier kings of the union, had almost completely stifled the native Norwegian commerce. These efforts were so far successful that the terms of the treaty concluded at Malmö in 1512 show that the fortunes of the League were already waning. This policy towards the Hansa was continued with success under Christian II, who, during his period of governorship in Norway, had seen the evils attendant on the assumption by the German traders of excessive powers in local government in towns such as Bergen. The hostility of the Hanseatic League was, indeed, an important factor in the events which led to the departure of Christian from Denmark, shortly after the final secession of Sweden from the union in 1523.

In 1525 the Danes set up the Duke of Holstein as king under the title of Frederick I. He soon became a convert to the Protestant religion, and Lutheranism spread widely throughout Denmark. The Norwegian State Council had supported the election of Frederick, but his zeal for Lutheranism quickly roused the hostility of the

ecclesiastical party. Nevertheless, the deposed Christian II, though the professed champion of the Church of Rome, received no effective support when, in 1531, he landed in Norway with a forlorn hope that the country would rally to him. Frederick died in 1533, and Christian III was chosen as king by the Danish Rigsråd. He was a fanatical Lutheran, and the Norwegian Church party, under the leadership of Archbishop Olaf Engelbriktsson, strove by every means to procure the election of a rival candidate. The opposition leader, Vincents Lunge, was killed, but the momentary success of the Archbishop and his adherents was abortive. The fact is that the views of people of all classes were hopelessly divergent.

Subjugation to Denmark

The attempt to reject him having failed, Christian abolished the council of regency and set up a viceroy and a chancellor, both Danes, in Norway, which thus became practically, though not nominally, a province of Denmark. There was, however, no opposition, but this apparent apathy may very well have been due less to any lack of independent feeling than to the fact that the population—scarcely more in number than in the years before the Black Death—was so largely scattered in remote settlements that the people only gradually became acquainted with the new conditions. The Reformation seems to have followed a somewhat similar course. This was forced by Christian III on Norway, and it has been suggested that it had to be 'encouraged' by methods suggestive of those adopted by the first two Olafs in the Christianization of the country. But it is more probable that the spread of Lutheranism was very gradual; it excited no violent opposition, and for many years Roman practices were alternately discontinued and resumed according as the priests, perambulating their vast parishes, happened to be, or not to be, close at hand.

Norway had practically ceased to exist as a national entity, and for a long period she almost disappeared from history. Nevertheless, during the long reign of Christian IV (1588–1648) there were signs of returning internal prosperity and the consequent alleviation of the state of poverty which had contributed to the country's increasing dependence on Denmark. Already relief and encouragement had been given to the native artisans when, in the years 1557 to 1559, the domination of their foreign rivals at Bergen was broken. The export of timber had given an increased activity to the coast towns, but the greater part of their commerce was still in the hands of foreigners, and the

Dutch had a virtual monopoly of the carrying trade; this, however, was often conducted in ships manned by Norwegians as well as built of timber grown in the forests of Norway. The saw-mill industry—later to become important—dates from the early sixteenth century.

The country was concerned only indirectly with the various wars in which Denmark under Christian IV became involved, though the remote northern territory of Nordland entered into history when, in 1611, one reason for the declaration of war against Charles IX of Sweden was that he had taken the title of king of the Lapps of Nordland. But the Norwegian fylker of Jämtland and Härjedalen were lost to Sweden by the peace concluded in 1645. The disintegration of Norway seemed to be imminent when, in the disastrous war waged by the Danes under Frederick III, the district of Trondheim was ceded to the Swedes in 1658; the Norwegians, however, asserted themselves, and the greater part of the lost territory was restored in the following year. An important result of these wars was that Denmark was permanently excluded from the opposite shores of the Kattegat and the Baltic, which thenceforward remained Swedish.

The events of 1660 in Denmark enabled the king, supported by the clergy and the middle classes, to impose his will on the nobles, whose powers and privileges were much curtailed, and the crown became strictly hereditary. Under the new order thus established, the status of Norway was improved, administrative duties were entrusted principally to Norwegians, the oppressions of the nobles largely ceased, and the country entered on a period of comparative prosperity. Especially worthy of note is the growth of her maritime trade during the wars of the Dutch with the English and French. Norwegian men and ships took part in the wars waged between Denmark and Sweden; many ships were lost, but the country itself remained undisturbed until in 1717, and again in 1718, it was invaded by Charles XII. The object of such invasion seems to have been to afford the Swedish king some conquered territory with which he might, in the crisis of his fortunes, be able to negotiate with his enemies. But the terms of the treaty of peace made at Stockholm in 1720 left Sweden so weakened that her power was no longer a threat to her neighbours in Scandinavia. In the long period of peace which followed, the number of small landowners steadily increased, and fresh lands were brought under cultivation; the towns flourished, and the population grew, although even so late as 1801 it was less than 900,000; overseas trade continued to expand, especially in the latter half of the eighteenth century when England was almost always at war.

Napoleonic Times

Although the last quarter of the eighteenth century had been a time of unprecedented commercial prosperity, the 'continental system' of Napoleon involved Norway in difficulties which became almost overwhelming. Her interests lay entirely with Great Britain, on which country her import and export trade was mainly based. But the British seizure, in 1807, of the Danish fleet was followed by a declaration of war by Denmark, so that Norway became subjected to a strict blockade by sea, and there was fighting on her land frontier with Sweden, the ally of Britain. Communication with Denmark was, moreover, so hazardous that a regency commission, under Prince Christian August, was appointed to administer affairs in Norway. The work of this commission was greatly hampered by the necessity of constant reference to Denmark imposed by Frederick VI, who now succeeded to the Danish throne. Nevertheless, it contrived to deal with the most urgent needs of a country confronted with economic chaos and on the verge of starvation. The plight of Norway was the direct consequence of her dependence on Denmark, and the minds of many Norwegians, and of Swedes also, were turning in the direction of a union of their respective countries. All hope of a peaceable unification was, however, to be frustrated by the policy of aggression towards Norway followed by the man who was destined soon to be ruler over Sweden.

Charles XIII, though not long king, was already old, and the fact that he was childless raised the question of succession. After much intrigue the choice of the electors eventually rested on Jean Bernadotte, who, though of humble origin, had risen to be a Marshal of France. From the time of his election in 1810 Charles John, as the new crown prince was styled, became the real ruler of Sweden—for the king was now too ill to wield much power—and he had, before long, determined on the acquisition of Norway. This project eventually received the blessing of Great Britain and other Powers in consideration of the promise of Swedish aid against the forces of Napoleon. Norway was again subjected to a blockade and, in the time of dreadful scarcity which ensued, a national bankruptcy occurred.

The Peace of Kiel

The promise made to his allies was, in the summer of 1813, fulfilled by Bernadotte at Leipzig and elsewhere, but in the autumn he led his forces against the Danes with such success that peace was

concluded at Kiel in January 1814. By this treaty the king of Denmark, for himself and his successors, renounced all rights in Norway, and it was declared that such rights should henceforward be vested in the king of Sweden and his successors. The Norwegian dependencies—Iceland, Greenland, and the Faeröes—were, however, reserved to Denmark, and so became lost to their mother country. Although a union with Sweden on the basis of a complete equality might have been acceptable to the Norwegians, the terms of the treaty of Kiel aroused their bitter hostility. Norway was neither a party thereto nor had she been consulted as to her wishes, and it was claimed that, although the king of Denmark might surrender his sovereign rights, he could not effectively transfer them. It was further argued that sovereign power, if surrendered, reverted to the people, who accordingly had the right to decide for themselves the form of the future constitution of their country.

Prince Christian Frederick had in the previous year come to Norway as viceroy. He was next in succession to the Danish king, and, as such, considered himself entitled by right of inheritance to the Norwegian kingdom; nevertheless, he was induced to accept for the time being the title of Regent. Representatives from all parts of the country were brought together at an assembly which met in April at Eidsvoll: there a constitution was drawn up and the Regent was elected king. Some hope had existed that the powers of Europe would not allow the union to be enforced on Norway by war, but this hope proved ill founded. The country was invaded by the Swedes, but after little more than a demonstration of hostilities a convention was signed. Charles John promised recognition of the Eidsvoll constitution subject to such amendment as was necessitated by the union of the kingdoms. Christian Frederick abdicated, and Norway was declared 'a free, independent, indivisible, and inalienable kingdom, united with Sweden under one king', under the Act of Union (*Rigsakt*) of 6 August 1815.

The Second Union with Sweden

The union thus consummated, which was maintained from 1815 to 1905, was purely personal in the sense that the king was the sole connecting link. His rights and powers were defined by separate constitutions, one for each State, and these were by no means identical. The two States had separate, and materially different, systems of government, separate military forces, financial systems, and tariffs (there was, indeed, a tariff-boundary between the two), coinages,

codes of law, &c. The economic interests and political outlooks of the two countries were widely diverse, and in some respects antagonistic. In Sweden the tone of the political system, until far in the nineteenth century, was distinctly autocratic, and that of the social system aristocratic; in Norway the preponderating principle was that of democracy. There was not even unanimity in regard to the exact nature of the union. The Norwegian view was that the two States were intended to be on a footing of complete equality; this was denied by the Swedes, who claimed that Norway was, at the outset, no more than a ceded territory, to which autonomy had been granted as an act of grace. Norway, moreover, was the less wealthy and less populous member of the union. Although, when the history of the union came to be reviewed about the time of its dissolution, Sweden was able to claim that she had always been willing to treat the disputes between the kingdoms in a spirit of concession, the Norwegian reply was that Sweden was in no position to make concessions: that the term was inapplicable in respect of transactions between two States of equal standing; and, further, that the majority of the disputes concerned matters which properly were at issue only between Norway and the king of Norway, not between Norway and the king of Sweden and his subjects. Such an argument serves to show the inherent impracticability of the union.

The fact that the union provided for only one foreign minister was an early source of dissension, for in 1821 Charles John (then Charles XIV) aroused strong feeling by inquiring through the foreign ministry how the Powers would view his use of force against Norway to compel a revision of the constitution. Nothing came of this: indeed, it is a feature of the whole period of the union that revolutionary changes proposed by the Swedes came habitually to nothing. After the accession in 1872 of Oscar II, who proved to be a skilful keeper of the peace, the situation was for a while less strained. Frederick Stang, for many years leader of the conservative party in Norway, had also done much to rectify relations between the two States. But in 1880 he resigned, and the Liberals became increasingly powerful. In 1883 the king gave way in a controversy, into which a powerful body of adverse Swedish opinion had thrust itself, over the Norwegian desire that the minister and councillors of state should have the right of access to the *Storting* (the Norwegian parliament) and of participation in its debates. This practice connoted the establishment of the principle of ministerial responsibility in Norway.

As the economic position of Norway grew stronger and her foreign

relations more extensive, on the basis of her important and increasing mercantile marine, new points of dissension emerged and old points were revived. The question of a 'pure' Norwegian flag, excluding the symbol of the union, was disputed for more than twenty years before the king allowed it in 1899. The participation of Norway in the management of diplomatic and consular affairs again became an acute question. More than one honest attempt was made to settle it, but all came to a deadlock, Norway claiming as a right what Sweden would only concede under guarantees. The position, since 1835, had been that the Norwegian minister in attendance at Stockholm should be present when the Swedish foreign minister was doing business with the king. There was no Norwegian foreign minister. In 1885 Sweden made changes in the administration of foreign affairs which appeared to the Norwegians to place their representative in a weaker position: Sweden offered to rectify this, but demanded in return such guarantees as a common budget for foreign affairs and the maintenance of the Norwegian army and navy at a certain standard. As for the consular service, its control had been vested in the foreign ministry in 1858. Norway claimed that whereas she had, as a matter of convenience, formerly employed as consuls the persons who represented Sweden, the divergent economic policies of the two States, and the condition of competition between them in certain branches of trade, demanded that separate services should be set up.

In 1892, and again in 1898, these questions brought the two states to the verge of war. In 1902, however, a joint commission laid down the practicability of two entirely separate consular systems, and in 1903 an official communiqué announced an agreement under which two essentially identical codes of administration were to be worked out for the two systems. But disagreement supervened, and negotiations finally broke down upon the demand by Sweden that the Swedish foreign minister should be able to dismiss a Norwegian consul.

Dissolution of the Union

In May 1905 a new measure to create an independent Norwegian consular service was passed by the Storting and vetoed by the king. The ministry resigned; the king refused to accept their resignation or form another government. The Storting then claimed that the crown had failed to exercise its constitutional function, that Oscar II thereupon ceased to be King of Norway, and that the union with Sweden

was thus dissolved (June 1905). Sweden demanded an explicit popular expression of desire for the dissolution. She got that for which she asked, for the Norwegians, by a referendum, confirmed the action of the Storting by 368,211 votes to 184. A treaty concluded at Karlstad in September 1905 defined the terms of the separation, and included the following provisions: any future disputes between the two States which could not be settled by direct diplomatic negotiation were to be referred to the permanent court of arbitration at The Hague, provided that they did not affect the vital interests of either. A 'neutral' zone was established on either side of the frontier (*v.s.* p. 3). No military or naval works of any description might be maintained or established therein, save in the event of joint action against a common enemy. In virtue of this convention Fredriksten and other Norwegian fortifications were dismantled. Those at Kongsvinger and within a radius of 6 kilometres were not to be in any way augmented. Regulations as to the migration and rights of the Lapps in the northern territories of each State were laid down. The transit trade of either of the States in passage through the territory of the other was safeguarded against delays, increase of tariffs, and other disabilities. Provisions were also made concerning the regulation and use for navigation, power-works, &c., of lakes and waterways common to the two kingdoms.

In Norway, after the dissolution of the union, there was a measure of opinion (represented by some 33,000 votes, or roughly one-tenth of the total vote on a referendum) in favour of setting up a republic. But the Norwegian peasantry, in the absence of any aristocracy to stand between it and the Government, had developed a certain intimacy with and fidelity to the Crown; moreover, it was felt that European opinion generally would view the continuation of the monarchy with more favour than the establishment of a republic. The Storting selected Prince Charles, the second son of the then Crown Prince Frederick of Denmark, as a candidate for the throne; he was elected by referendum, and, assuming a name famous in medieval Norwegian history, was crowned under the title of Haakon VII in June 1906.

The Swedish objection, from the point of view of foreign relations, to the dissolution of the union, and incidentally to the previous proposals for a dual foreign ministry, is very frankly stated by a Swedish writer as follows:

'The great value of the late union to Sweden was that it gave her not only the opportunity to direct all her defensive forces against an attack from Russia, but that Norway, in the event of her defeat, could have been

converted into a fortress of the finest possible kind. The difficulty for an enemy to bring forward large masses of troops and provisions would be almost insurmountable on account of the geographical nature of Norway and western Sweden, but now everything is altered; for Sweden's back is again bared to attack as it was before the union.'

It is hardly possible to generalize about the feeling which was left between Norwegians and Swedes after the dissolution of the union. Shortly before the event, it generally seemed that the Norwegians disliked the Swedes, and that the Swedes liked the Norwegians. On the other hand, an eminent Norwegian wrote that 'we cannot think of the possibility of Sweden being attacked without instantly hastening to its help with all our might'. After the dissolution, the Storting offered an olive branch to King Oscar in proposing to elect as king a member of the Swedish royal family, but the king, who felt that Norway had dethroned him under a false pretext, refused it. And with whatever affection, or tolerance, the Swedes may previously have regarded the Norwegians, such sentiment was replaced, according to an official Swedish publication, by a 'deep feeling of animosity', which was subsequently 'converted into a powerful national movement' directed towards the strengthening of the kingdom in whatever directions it might have suffered by the dissolution of the union.

After the Dissolution

At the time of the dissolution of the union with Sweden, the liberal and allied element had been predominant in the Storting. There followed an almost uninterrupted succession of liberal ministries, though their continuance in office frequently depended on the support of other parties, notably during the period 1909-12 when there was a coalition between the liberal and conservative parties. The number of persons qualified to vote was greatly increased by the grant of votes to women, who by the year 1913 had obtained complete parliamentary, as well as municipal, franchise. Women have also been made eligible for many, though not all, public and semi-public appointments, and a position of nearly complete legal equality of the sexes has been established.

In the year 1911 the Norwegian flag was hoisted at the South Pole by Roald Amundsen, whose success was the culminating point of a notable series of polar explorations by Norwegians, such as Fridtjof Nansen and Otto Sverdrup. The earlier expeditions had been directed towards the Arctic, but at the close of the nineteenth century Norwegian explorers wintered on the Antarctic mainland, and interest

in these most southerly regions was intensified after Peary had reached the North Pole in 1909 (*v.s.* p. 170).

The War of 1914-18

The outbreak of war in 1914 brought the Scandinavian countries into close collaboration, despite the lack of an identical outlook. Norway, though her interests and sympathy lay undoubtedly with the Allies, adopted an attitude of strict neutrality. Nevertheless, the general course of the war, and particularly the increasing pressure of the blockade, tended to place the resources of the country more and more at the disposal of Great Britain, and Norwegian shipping and timber, especially, made an important contribution towards the ultimate victory. Certain elements of friction were inherent in the necessity, imposed on the Allies by the conditions of the war, of restricting or prohibiting the export of certain commodities, notably fish and copper, to Germany, but each difficulty as it arose was treated with a measure of tact and understanding sufficient to preclude any dangerous development. The years of, and immediately after, the war were, in fact, a period of unprecedented prosperity throughout Norway. Thus, for example, land values in the rural districts were nearly trebled, and freights from foreign trade rose to six times their previous annual total, despite the loss of a large proportion of tonnage; considerable impetus was also given to the development of industry, in which the amount of invested capital was trebled or even quadrupled. On the other hand, the national debt increased enormously, and not all the public expenditure was well advised; speculation was rampant and there was much private extravagance; the cost of living and also the level of wages rose considerably. The country was, consequently, very vulnerable to the reaction which set in after the war when profitable markets for the large accumulations of stocks could no longer be found, and Norway's economic position was further impaired by the fall of the currency and also by the weakness of many of the banks, of which a considerable proportion were only established during the war. The timber and mining industries suffered very heavy losses, and the distress of the Norwegian fisheries and shipping was aggravated by the disputes with Spain and Portugal which arose out of the prohibition policy adopted during and after the war.

Political Parties

There was before the present century little in Norway comparable with the conditions prevailing in countries where the industrial

revolution had occurred at a much earlier date. In consequence the Norwegian workers were late in organizing themselves, and more years elapsed before labour became an important political factor.

The first national trade union was founded in 1882, and the Norwegian Federation of Trade Unions in 1899. The labour party was first represented in the Storting in 1903. Trade unionism grew during the years of industrial expansion which followed, and in 1914 the membership of the federation numbered 67,604. The practice of collective bargaining, already well established, was confirmed and extended when, from 1907, the Norwegian Employers' Association recognized collective agreements on a national scale. The workers showed themselves strongly opposed to compulsory arbitration, but they agreed to mediation under the terms of the Trades Disputes Act, 1915. The enormous war-time expansion of industry and resultant difficulties with the workers led, however, to the passing, in August 1916, of the Industrial Disputes Act by which, in effect, arbitration was made compulsory in any dispute between workers and employers if it was of a kind in which the public interest might be seriously involved. A protest strike was launched by the Federation of Trade Unions against this measure, and its passing left feelings of deep resentment in labour circles.

After the general election of 1918 the labour members of the Storting joined with the conservatives in exerting on the liberal government pressure which eventually led to the establishment of proportional representation, and in 1920 Otto Halvorsen, the conservative leader, succeeded Gunnar Knudsen in the premiership. Immediately, however, most formidable troubles arose with labour. The influence of the Russian revolution in 1917 had caused the extremists to gain the upper hand, and in 1919 the Norwegian labour party joined the Third International and sent a representative to the executive committee at Moscow. The force of revolutionary feeling existing in Norway was evidenced in December 1920 by the 'revolutionary' railway strike, and in May 1921 by the national strike. But the railwaymen soon capitulated, and the fiasco in which the national strike ended brought considerable odium on the labour leaders, as well as on their Russian instigators. The more moderate labour leaders seceded from the party and formed the social democrat party.

In the autumn of 1923 the labour party withdrew from the Third International. Their left wing, however, became organized as a communist party, and this continued orientation towards Moscow was largely responsible for the victories of members of the more conserva-

tive parties at the municipal elections in November 1925, and for an attempt to set up a non-party government with Dr. F. Nansen at its head; but this attempt failed and Lykke, the conservative leader, entered into office with a programme of economic reconstruction. Amendments to the Trades Disputes Act in 1927 were strenuously opposed by labour, and in that year the social democrats returned to the party.

Victories at the election of 1927 gave the labour party fifty representatives in the Storting. The liberal and the agrarian parties both declined office, and eventually a labour government was formed in January 1928 with Christopher Hornsrud as premier. This, however, survived only for a fortnight, as widespread panic and financial chaos followed the announcement that with the Government the interests of the workers were paramount to all else, and that complete disarmament was contemplated. With the support of other parties, a liberal government, under Mowinckel, was kept in office during the period of acute depression which set in after 1929, and measures for the alleviation of economic distress naturally took first place in the programmes of the several political parties at the election of 1933. Unemployment had by then reached its highest point, so that the labour party with its 'work for all' slogan obtained two-fifths of the votes polled and 69 of the 150 seats in the Storting. Nevertheless, the liberal ministry was continued in office with the support of the conservatives—to whom the financial proposals of the labour party were particularly obnoxious—and the agrarians. But eventually the Government was defeated when, on its refusal to accept a budget increase put forward by the agrarians, that party voted with labour. The cabinet thereupon resigned in March 1935 and was succeeded by an all-labour government with Johan Nygårdsvold as prime minister.

The interests of the labour and agrarian parties were in many respects different, but the efforts of labour were directed to 'practical, as distinct from demonstrative, politics', and the necessity for agrarian support in the Storting was recognized. The wider economic policy of labour tended, moreover, to include many of the reforms required to meet the needs of agriculture. The Nygårdsvold cabinet, in short, adapted itself well to the limitations imposed by the lack of an absolute majority in the Storting. The willingness shown by the Government to modify its more far-reaching proposals caused the atmosphere of political tension to be relieved, with the result that at the election of 1936 the votes polled by the labour party slightly increased and the Government was confirmed in office. The rapid

recovery in recent years of trade and industry in Norway is indicated by the relevant statistics (*v.i.* p. 308). Having regard to the former attitude of labour towards the maintenance of armed forces, it is interesting to note that, in 1937, the Government procured in the Storting an additional vote of 21 million kroner to be used for the purposes of defence, and also that—in view of the then already deteriorating international situation—this vote was increased in the following year.

Foreign Relations

Norway's relations with other countries had, as a whole, been good. In 1920 she became a member of the League of Nations, which body was, especially after the admission of the U.S.S.R., strongly supported by the labour party; there was, however, in more conservative circles a tendency to regard the League with less favour. Nevertheless, sanctions were loyally enforced against Italy, despite a resulting loss of trade. The rich coal-fields on the islands of the Spitsbergen archipelago had aroused the cupidity of the United States of America as well as of several north European countries, including Great Britain and Germany. The sovereignty of the Norwegians over the archipelago—known to them as Svalbard—was, however, affirmed in 1920 by a treaty to which all the rival claimants then subscribed or afterwards acceded. The adhesion of the U.S.S.R., although delayed until 1924, went some way to allay apprehension of Russian designs, though suspicion from time to time arose about such matters as the use which might be made of aerodromes in Lapland, or the possibility of the seizure of a port, such as Narvik. Labour was, however, generally well disposed towards the Soviet for reasons which made it naturally hostile to political developments in Germany.

A long-standing dispute over Greenland was brought before the International Court of Justice at The Hague. Denmark's claim—based on rights which had been lost to Norway by the Peace of Kiel—to sovereignty over the whole of Greenland was denied by the Norwegians, who contended that it could not possibly extend to the eastern parts, which constituted a kind of 'no-man's-land' in which their hunters and sealers had time-honoured interests. A temporary settlement was arrived at between the two countries in 1924, but this broke down in consequence of Norwegian annexations of certain areas in 1931 and 1932. The decision of the International Court, given in 1933, upheld the claim of Denmark, and much bitterness was thereby aroused in Norway.

Nevertheless, a general policy of co-operation with the Scandina-

vian countries and with Finland was pursued, and this policy, on its economic side, was in 1930 widened by the inclusion also of Belgium, the Netherlands, and Luxemburg in the Oslo Convention, which is described in the protocol thereto as 'a first step towards a lowering of economic barriers'. This Convention was renewed in 1937, but the trend of events in Europe caused its lapse, as from 1 July 1938. In the following year an attempt to set up an economic union between Norway, Denmark, and Sweden also proved abortive.

A recurring source of friction between Norway and Great Britain existed in the alleged infringement by fishermen of territorial waters as defined by the Norwegians, but the situation was from 1934 eased by the establishment of the Norwegian and British Fishery Board of Inquiry, consisting of one representative of each country, with its head-quarters at Tromsø. It is said that the Norwegian labour party was prone to regard with suspicion any foreign country not under a labour government, and it is a fact that its press tended to see current events from the point of view of Moscow. The attitude of the labour government towards this country was, therefore, to some extent detached. Nevertheless relations between Great Britain and Norway remained generally on a cordial footing, especially in matters of trade, and the latest figures show that the United Kingdom still retained a very substantial share of the Norwegian overseas trade (*v.i.* pp. 312, 317).

CHAPTER IX

ADMINISTRATION

CENTRAL GOVERNMENT

THE Government of Norway is, in form, a limited and hereditary monarchy.

Norway had been a dependency of Denmark for so many years that, in 1814, the framers of the constitution had little in the way of native institutions on which to work. They therefore borrowed largely from constitutions of strong democratic tendency, and the result of their labours was the constitution in the form approved by the national council at Eidsvoll and embodied in the constitutional law dated 17 May 1814. The existing Norwegian constitution is founded on that law which has, however, undergone from time to time considerable amendment under section 112 of the constitution. Nevertheless, it is specifically provided by that section that amendments must not be at variance either with the principles or the spirit of the constitution. Even so, amendments can be submitted only at the first or second ordinary session of the Storting after a new election, and can be adopted only by a majority of two-thirds at the first or second ordinary session of the Storting after the next election.

The constitution consists of 112 sections and is divided into five parts as follows:

- (a) Form of government and religion (sections 1-2).
- (b) The executive power of the king, and the royal family (sections 3-48).
- (c) Citizenship and the legislative power (sections 49-85).
- (d) The judicial power (sections 86-91).
- (e) General provisions (sections 92-112).

Executive

The king is the supreme executive authority, but his person is sacred and responsibility rests, not on him, but with the council of state (cabinet) in conjunction with which his executive powers are normally exercised. This council, which is the responsible ministry, is composed of a minister of state and not less than seven other councillors, appointed by the Crown and usually, although in special circumstances not necessarily, members of the Storting. The councillors

must be Norwegian citizens not less than 30 years old, and Lutherans. Since 1915 women have been eligible. It is usual for the minister of state to hold one of the important ministries, and in 1938 the members of the council were the heads of the ministries for, respectively, (1) foreign affairs; (2) finance and customs; (3) justice and police; (4) national defence; (5) commerce, industries, and fisheries; (6) ecclesiastical affairs and education; (7) public works; (8) social affairs; and (9) agriculture. The heir to the throne, on attaining the age of 18, may attend the council of state, but does not share its responsibility, and has no vote. The minister of state countersigns all orders issued by the king, except military commands. The king is commander-in-chief of the army and navy, though he may not alter the numbers of the forces or place them at the service of another power without the authority of the Storting.

Legislature

The legislative power is exercised by the Storting, which, since 1919, is composed of 150 members of whom one-third are representatives of the towns and two-thirds of the rural districts. Each member receives an annual salary of 7,000 kroner, and all Norwegians, except certain government servants, are now qualified for membership if they have attained the age of 30 and have resided in the kingdom for ten years; but, with the exception of an ex-councillor of state, no person may represent an electoral district in which he is not entitled to vote. Women, although eligible for more than a quarter of a century, are seldom elected, and as recently as 1938 there was only one woman member. Since 1870 the Storting has met each year; it assembles about the middle of January and normally sits for five to six months. The king has not the right to dissolve the Storting, which hitherto has been elected for a period of three years; up to and including the year 1936, elections were held before the end of November in every third year, but in April 1938 the electoral period was altered to four years, so that the next election became due in 1940 instead of 1939. The Storting meets as a matter of right and without summons from the crown, though the king may convoke an extraordinary session. There is a somewhat peculiar provision under which, at the first regular session after a general election, the Storting divides itself (i.e. without reference to the electors) into two chambers. One-fourth (38) of the members form a body called the *Lagting*; the remainder (112) constitute the *Odelsting*. Bills are presented first in the Odelsting, and, if passed there, are presented to the

Lagting, which thus acts as a check on the larger body. The Lagting, on consideration of a bill, has power to approve or reject, but not to amend it. If it rejects a bill twice, the two chambers sit together, and the bill, in order to pass, requires a two-thirds majority of the whole Storting. On receipt of the king's approval a measure becomes law; if he does not approve it, the Odelsting is entitled to a statement of his reasons, but the same Storting may not resubmit the measure to him. On the other hand, a measure passed without change by three Stortings after three successive general elections becomes law despite the royal veto. All Norwegian subjects—including women, since 1913—have the right to vote at the Storting elections, provided they are at least twenty-three years of age, have lived in Norway for five years, and are still resident there; certain persons are, however, disqualified from voting, as, for instance, those who may be in receipt of poor relief at the time of the election. Election is proportional and the ballot is secret, but special facilities are given to electors who, for an approved reason, cannot attend the poll. By-elections are not needed, as substitute representatives are chosen at the ordinary elections. Opinion expressed in the Storting is 'privileged'. No decision either of the Storting or of its sections can be made unless at least half of the members are in attendance. It is considered to be the duty of members to vote.

State Finance

The financial year is from 1 July to 30 June. It is, perhaps, worthy of note that the annual budget is adopted as a resolution of the Storting, i.e. it is not passed as a law at separate sessions of the Odelsting and Lagting. The various items are voted separately and not, as in England, on the principle that the budget as a whole is either adopted or rejected. Up to and including the year 1924-5 the budget was arranged on a *gross* basis, but since that year it has been based partly on the *gross* and partly on the *net* system. As from the year 1932-3 other modifications have, moreover, been made in the arrangement of the budget, and it is claimed that this now gives a true survey of the State finances. The fact that such alterations have been made should, however, be remembered when later years are compared with those prior to 1925-6 (Appendix VII, Table 1).¹

Expenditure

The years immediately after 1913-14 showed substantial increases in expenditure. For the year ending June 1914 it had amounted only

¹ *v.i.* p. 355.

to 123·4 million kr., but during the following three years it rose gradually until a total of 233·7 million kr. was reached in 1916-17. Thereafter the rate of increase was so greatly accelerated that for the next year the total was 502·1 million kr., and in the year ending June 1921 the high figure of 745·7 million kr. was attained. Expenditure tended to decrease in the following years, and by 1926-7 it had fallen below 400 million kr., a figure which was not exceeded in any year prior to 1935-6, when it rose to 430·6 million kr. A decided upward tendency was manifest in the subsequent years. As may be seen in Appendix VII, Table 2, practically all items of current expenditure for recent years show substantial increases on the figures for 1913-14, especially in regard to public instruction, social purposes, State constructions, agriculture, commerce, and State trading: the 'Deficit on State's trading enterprises, properties, &c.', constitutes, moreover, a new and formidable item. There is also a large increase in the capital expenditure on State trading and in redemption of national debt.

Revenue

As appears from Appendix VII, Table 3, the main sources of the State income are (a) the taxes on capital and income, (b) the customs receipts, and (c) 'other consumption taxes', of which the various excises are the most productive.

(a) Taxation on capital and income dates in Norway from 1892. It is based on the net value of the capital and income as assessed in accordance with the relative Finance Acts. All persons resident or permanently domiciled in the kingdom are liable thereto, as also are companies and other bodies domiciled there. Persons resident abroad and foreign companies, &c., are also ordinarily liable in respect of either real or personal property within the kingdom and of income derived therefrom or from an undertaking carried on or managed in Norway. Persons liable to taxation and domiciled in the kingdom are liable, as a rule, in respect of capital and income abroad, but capital in real property or plant is exempt, and only half the income derived therefrom is taxable. Agreements with other countries may, however, be entered into with a view to the reciprocal avoidance of double taxation.

Persons domiciled in the kingdom are exempt from tax on incomes of less than kr. 2,000 and on capital under kr. 5,000, and certain deductions are allowed in respect of both income and capital when in excess of these amounts. The taxes on both income and capital are graduated

and, including the special emergency tax which has been operative since the year 1932-3, the rates for ordinary taxpayers range from 0.3 per mille to 6 per mille on capital and from 2.6 per cent. to 57.5 per cent. on income. To meet the cost of old-age pensions, a surtax at the rate of 1 per cent. has also been imposed on all persons earning a minimum of kr. 800 in towns and of kr. 600 in rural communities.

(b) Since 1881 the tendency of the customs tariff was towards protection, and this trend, which became accentuated in 1897, led eventually to a system which, since the revision of the tariff in 1905, may be regarded as completely protective, though moderate in degree. Under the customs tariff of 1905 maximum, as well as minimum, rates of duty were fixed. The minimum rates were designed to give both agriculture and industry a reasonable degree of protection. The duties at the higher rates (four times that of the minimum or 50 per cent. of the value of goods not subject to any duties) have hitherto been imposed only on imports from countries with which a 'tariff war' was being waged; they are, however, available for use against any foreign country which gives treatment less favourable to the goods and shipping of Norway than to those of other countries. The tariff is subject to annual revision. Certain articles are taxed purely for revenue; among these are sugar, coffee, tea, wine, spirits, and tobacco.

(c) Excise is charged on the products of certain industries within the kingdom; of these the most important are the distillation of spirits, the brewing of beer, and the manufacture of tobaccos. On spirits the excise is calculated on an alcohol strength of 100 per cent. and, together with a surcharge, amounts to kr. 4.72 per litre. Beer is grouped into three classes, corresponding to an alcohol strength of (1) less than 2.5 per cent., (2) from 2.5 to 4.75 per cent., and (3) more than 4.75 per cent.; for these respectively the excise rates are 20, 30, and 45 öre per litre. The rates on cigars, cigarettes, and tobacco rise according to the value of the goods. Other articles subject to excise are chocolate and sugar goods, jewellery, gloves, silk goods, perfumery, fine footwear, and the finer kinds of glassware.

In addition to the above-mentioned principal sources of income, there is a productive tax on petrol and on motor-car tyres. Among other miscellaneous sources of revenue it may be noted that a 'turn-over tax' at the rate of 1 per cent. was imposed in 1935. There is also an 'entertainments tax', and a foreign commercial traveller is required to pay kr. 50 for a licence which will enable him to pursue his activities for a period of fifteen days.

National Debt

The figures relating to the national debt are set out in Appendix VII, Table 4.

Prior to 1914 the moneys raised by State loans were principally spent on the construction of railways, and the total national debt on 30 June of that year was only 357.3 million kr., of which 94.1 per cent. had been borrowed in foreign countries. During the following years, however, the enormous development of State undertakings led to a corresponding expansion of debt, which reached a peak of 1,731.6 million kr. in 1925, though only 41.3 per cent. of this sum was represented by external debt. Thereafter the debt shows a decreasing tendency, and in and after 1933 it remained below 1,500 million kr.; these figures, however, are not strictly comparable with those for the earlier years because Government bonds, to the value of about 70 million kr., held by Government banks in respect of unpaid capital subscriptions have been omitted from the internal consolidated debt. In 1938 the total of the national debt was 1,428.7 million kr.; of that amount 45.7 per cent. was accounted for by external borrowings, of which about 50 per cent. was in dollar-loans of the United States. The debt was then 490.3 kr. per head of population, as compared with 628.8 kr. in 1925 and 144.6 kr. in 1914. In addition to the direct national debt, the State is ultimately liable for the deficit, estimated at about 500 million kr., on the State Pension Fund.

State Properties

The principal items in the State balance account for the year ending in June 1938 are: (1) railways, 1,105.1 million kr.; (2) postal and telegraph services, 172.2 million kr.; and (3) power-stations, 113.1 million kr. The figures stated represent net capital values.

That Norwegian credit remained good is shown by the fact that during the year 1938 business in the Norwegian 3 per cent. Conversion Loan of 1888 was transacted on the London Stock Exchange at prices ranging from 90 to 101 $\frac{1}{8}$.

LOCAL GOVERNMENT

Municipalities

In accordance with the principle established by the Act of 1837 relating to urban and rural district councils, local affairs are administered mainly by the municipalities. The primary units into which Norway is divided for purposes of local government are the *by* (town

or city) and *herred* (rural district), of which there are 65 and 695 respectively; a rural district comprises one or more of the ecclesiastical parishes. The by and herred are grouped into eighteen *fylker* or counties (Map 1). Each municipality is a territorially defined community having its own institutions but subordinate to the State.

The municipalities, either alone or in conjunction with the State, have very wide responsibilities; these include such matters as school education, relief of the poor, hospitals and other institutions, roads, and electricity works; some municipalities even engage in trading enterprises. Two or more local authorities not infrequently co-operate in some of the larger undertakings, notably in the construction of hydro-electric power-stations. The administrative functions of the by and herred are much more important than those of the fylke, which is concerned more with supervision than with direct administration.

In every urban and rural district a council is elected by proportional representation by male and female Norwegians of the age of 23 and over who have been in the country for at least five years and are duly entered in the municipal roll. The members of each council elect a quarter of their number to act as an executive committee (*formannskap*), and a chairman (*ordfører*). The formannskap exercises very wide powers, and the ordfører is the legal representative of the municipality. In towns a *borgermester* is regularly appointed; he is a permanent salaried official, and his position is not unlike that of a town clerk. In the smaller rural districts most of the work is done by the chairman of the council.

These town and district councils do not act, like English local authorities, in terms of specific powers conferred and specific duties imposed on them by the central legislature, but by virtue of a very wide and generalized power to act in the interests of the community. It follows that they need to be controlled to some extent from the centre, and the method employed is peculiar to Norway.

In each fylke there is a council (*fylkesting*) composed of the chairmen of all the town and district councils in its area. It meets as a rule only once a year. Much more important is an official known as the *fylkesmann*, who is appointed by the king and fills a dual role. In so far as he administers the fylke in accordance with the decisions of the fylkesting he is a local officer, but he is also the chief representative of the central government in the fylke, and as such is used to control the acts of the town and district councils. The rule is that every positive decision of a district council must be submitted to the fylkesmann

for his approval. If the decision has not been passed by a two-thirds majority, or if the fylkesmann has remarks to make, the matter is referred back to the council; if the two-thirds majority is still not forthcoming, the minority can demand that the matter be put before the government for final decision. Corresponding provisions apply to towns, except that there the fylkesmann has no authority to approve.

Public health and education are dealt with by special elected bodies and officials under similar controls (*v.s.* pp. 138, 162).

The police system is centralized, and the local police officials are local representatives of the Ministry of Justice and Police. Nevertheless, a considerable part of the cost of the local police forces is borne by the respective municipalities.

Municipal Finance

Financial, as well as administrative, responsibility for many of the public social services rests with the municipalities, sometimes with, and sometimes without, State aid. Thus poor-law administration devolves almost wholly on the municipalities, and its cost constitutes the largest item of their expenditure. On the other hand, the cost of elementary education is shared, more or less equally, with the State. It is sufficiently obvious that the financial burden thus placed on the municipalities is very great; it amounts, in fact, to a sum approximately equivalent to three-quarters of the State expenditure. Municipal finance is, accordingly, a subject of importance and one which latterly has given rise to acute difficulties.

The main source of revenue—88·9 per cent. in 1935-6—is the tax on capital within the municipal district and on income derived, directly or indirectly, from that capital. The rate of the tax on capital varies from 1 per mille to 4 per mille. The tax on income was normally limited to 12 per cent. of the assessable income; but, in consequence of the economic difficulties of the municipalities during the post-war years, the maximum has been raised to 20 per cent. A surtax also is levied on major incomes. In the year 1936-7 only 53 of the 759 then existing taxation districts had a rate not exceeding 12 per cent., and the average assessment for the whole kingdom was 16·39 per cent. In order to balance their budgets the municipalities had resorted to borrowing on a large scale. The liabilities thus incurred amounted in 1926 to 1,507 million kr., but by 1937 this total had been reduced to 1,228 million kr.; several municipalities had, however, compounded with their creditors. A considerable number of municipalities had to be placed under government administration, and

some stability to municipal credit was afforded by the establishment, with funds provided in part by the State, of the Municipal Bank of Norway.

The other principal source of municipal income is the tax on real property, which in 1935-6 yielded 9.2 per cent. of the aggregate revenue. The maximum rates at which this tax may be levied are kr. 7 per kr. 1,000 in urban municipalities and kr. 4 per skyldmark in rural districts, but in the latter a county tax may also be charged at a rate not exceeding kr. 5 per skyldmark; these maximum rates may, however, be exceeded if the sanction of the treasury is obtained.

The total value of municipal capital, principally real property, was 1,759 million kr. in 1935; approximately one-third of this sum was represented by interests in electricity works, which class of undertakings accounted in 1938 for about 42 per cent. of the municipal liabilities.

LAW

Judicial System

In each town or district there is a conciliation council (*Forliksråd*), consisting of three members elected by the urban or rural district council. It is an important feature of Norwegian practice that no dispute may be brought before a court of justice unless an attempt has been made to settle it amicably before such a council. These councils also act as courts of civil justice in small matters.

The normal court of first instance, which also hears appeals from conciliation councils, is the *Byrett* or the *Herredsrett*, of which there exists one in each town or district respectively. It is held by a professional judge, who must be a trained lawyer, but need not have practised at the bar. In the towns he is called a *Byfogd*, in the districts a *Sorenskriver*. He often sits with two lay judges, but exceptional cases may be tried by three professional judges. Judges of first instance also act as notaries public. Appeals from the *Byrett* or the *Herredsrett* go first to a court of appeal (*Lagmannsrett*) of which there are five, at Oslo, Skien, Bergen, Trondheim, and Tromsø respectively, and finally to the supreme court (*Höiesterett*) in Oslo.

Criminal cases are first brought before an Examining Court (*Förhørsrett*) held by a town or district judge, whose duties are comparable to those of an examining magistrate in England; that is, he must satisfy himself whether there is a case to go forward against the accused and he takes depositions to assist in the further conduct of the prosecution. If then the charge is one for which the maximum penalty is imprison-

ment for five years or less, it goes before a *meddomsrett*, presided over by the town or district judge together with two lay judges, who do not act merely as a jury but have the same powers as himself. More serious cases and appeals from the decisions of these courts go before a *lagmannsrett*, composed of a regular judge of that court, two subordinate judges, and a jury of ten, more than six of whom must agree for a conviction. The *Höiesterett* is the court of final appeal on matters of law, and can alter the sentence awarded by the lower court. Prosecutions are always instituted by government officials, the Advocate-General, one of the twelve State Advocates, or a *Politimester*. Pardons are granted by the king on the advice of the Minister of Justice and Police.

In each of fifty-five police districts there is a *Politimester*, who has under him one or more deputies (*Politifullmektig*). A subordinate official is the *Lensmann*, or sheriff, who is further responsible for a number of varied duties connected with law and administration. The police have in minor cases the power of imposing fines, or imprisonment for non-payment, without recourse to a court of justice. Most criminal cases are dealt with in this way. Delinquents rarely appeal from their decisions.

There is no distinction between barristers and solicitors in Norway.

Private Law

For purposes of private law Norway belongs to the northern family of nations, the other members being Iceland, Denmark, Sweden, and Finland. Not only do their legal systems have a general affinity born of a common civilization and habits of life, but in recent times many of the most important statutes in matters relating to contracts, commercial law, and family law have been drafted by joint commissions and enacted in identical terms by the various legislatures. None of these countries has, however, a complete Civil Code, much less one common to all of them, and even where they are governed by uniform statutes the interpretation varies in the different countries. There is no common Court of Appeal, and so judicial precedents, which in any case are not so binding as in England, cannot be trusted to give the same results. Moreover the jurists, whose opinions enjoy great authority, have different national traditions, and although the most important parts of the law are now governed by statutes, recourse is constantly had to local and trade custom, which plays a greater role in the northern countries than in most other countries in the same stage of civilization. Norwegian law has the greatest affinity with the

laws of Iceland and Denmark. It is very enlightened, up to date, pays great respect to individual freedom, and its rules seem to present few obstacles to harmonious and progressive development. There is a good legal literature.

The Northern laws occupy a position between English and Continental law, for although their failure to receive Roman law and the absence of comprehensive codes make them in some degree strange to the continental lawyer, they have come under the influence of continental, and especially of German, jurisprudence to such an extent that it is much easier for one bred in continental legal habits of mind to understand them than for an English lawyer. In such matters, however, as commercial law and the law regulating the sale of goods English law has not been without influence on them, and, generally speaking, an Englishman, particularly an English lawyer with a knowledge of the elements of Roman law, and still more a Scots lawyer, would, if he trusted his own notions of right and wrong, not be in any danger of making serious mistakes in his business dealings with Norwegians.

It is of course impossible to describe Norwegian law in any detail here, but it may be useful to give a few hints about (1) Sale of Goods, (2) Acquisition of Land, (3) Liability for damage to persons and property, and (4) certain topics of Family Law.

(1) *Sale of Goods*. Sale of goods is governed by much the same rules as in English law, with two important exceptions. The buyer is in a stronger position than in England, for he is entitled, without express warranty, to receive goods which are of good quality according to the usages of the locality and trade in question. The maxim *caveat emptor* has a much narrower application than in England. Secondly, the risk of destruction of the goods sold does not pass to the buyer, in the absence of an express term to the contrary, until delivery, unless he is bound to take delivery at the seller's place of business; in that case the risk passes as soon as the seller has them ready in a deliverable state. If the risk has passed, the buyer must pay the price, even if the goods have been damaged or destroyed, but only, of course, if there has been no fault on the part of the seller. Generally speaking, the same persons will be able to pass a good title as in England.

(2) *Acquisition of Land*. In Norway, as in many other countries, it is advisable to employ a lawyer if it is intended to acquire land. Registers are kept and, generally speaking, a purchaser or lessee may assume that the person registered as owner is able to give a good title. It may be necessary, however, to get the consent of a number of per-

sons besides the owner if land is to be acquired by purchase or on lease. In particular, the person in possession may have only a life-interest, and not only his consent, but that also of the person entitled after his death, may be required if the purchaser is to be fully protected.

In addition, there exists in relation to most of the land owned by peasant farmers a right known as *odelsrett*, by virtue of which, if the land is sold out of the family, the vendor or the person nearest in succession can insist within five years on buying it back at a valuation. This right does not attach to mines or factories, but it does extend to cover forests, corn-mills, saw-mills, and brickworks. To purchase land free from *odelsrett* might require the consent of a large number of the members of the family, perhaps of all living descendants of the vendor, but the king can authorize the State or a commune to acquire ownership free of *odelsrett*, where it is of special interest for the public.

If land is owned by a person under the age of 21, the guardian must convey. He needs the consent of the *overformynderi*, which exists in each town or parish, and is responsible to the fylkesmann for supervising the conduct of guardianships. A minor is also restricted in his capacity to deal with chattels.

Husband and wife are said in Norway to make all their property common, unless they keep what each of them owns entirely or partly separate by a marriage contract. But so long as the marriage subsists, the position hardly differs from that in England, for each spouse retains full control and administration of the property he or she owned before the marriage. Thus each can give a good title to the property which was hitherto separate. The community only begins with the termination of the marriage and then operates so as to entitle each spouse, or, if it terminates by the death of one of them, to entitle his or her representative and the other spouse, to one-half of the aggregate property of both. Each spouse has full capacity, but if one of them wishes to alienate land which serves as the common residence or furniture used in common, the consent of the other spouse is required. This consent is also needed in several other cases, for instance where the other spouse or the children have a *de facto* interest. But if the consent is unreasonably withheld, the fylkesmann can give his consent instead.

(3) *Damage to Persons and Property.* As a general rule, a person is liable for damage caused by him only if he has been wilful or negligent; and if the plaintiff's carelessness has contributed to the accident, the damages payable will be reduced so as to make each party pay a

sum proportionate to his share of the blame. But there are many cases where a person is liable to pay for damage even where he has not himself caused it negligently. Thus he is liable for damage wilfully or negligently caused by his servants in the course of their employment, and also where he or his servants have caused damage in the conduct of a specially dangerous trade or operation. Liability for motor or railway accidents, for example, is not dependent on negligence, but falls without further evidence upon the person who owns or controls the car or the railway. It will be obvious that the use of such instruments accounts for a high proportion of the damage caused to persons or property.

(4) *Family Law.* The Norwegian law of marriage and divorce is one of the most liberal in the world. It resembles English law so far as concerns the notice to be given of intention to marry, the free choice left to the parties whether they wish to be married civilly or in the face of the Church, and the granting of divorce for conduct in breach of or inconsistent with the marriage bond. Norwegian law differs in allowing divorce by mutual consent in certain circumstances. The spouses may agree to separate, or one of them may demand a judicial separation if the other has been guilty of certain marital offences or if in a general way it has become unfair to expect them to live together. If they live apart for one year after such a legal separation, whether judicial or by mutual consent, they can demand a divorce from the administrative authorities. If either resists the application, two years are necessary. If the separation was only *de facto*, but has endured for three years, the authorities have still a discretion to dissolve the marriage.

Although betrothals are common, a promise of marriage cannot be specifically enforced, nor, as a general rule, can damages be recovered for breach of promise. If, however, a man has seduced a woman under promise of marriage, and then refuses to marry her, he can be given two years' imprisonment and made to pay full damages.

Norwegian law is especially favourable to the illegitimate child, who is in every respect regarded as having the same relation to his mother as her legitimate children. For almost all purposes it is the same with the father, if he recognizes the child as his own or is adjudged its father. Generally speaking, it will be left with its mother, but the father will have to assist in its maintenance according to his station in life as well as hers. A man will, of course, not be adjudged the father of an illegitimate child unless he has had intercourse with its mother during the possible period of conception, but if that is the case, he will

be required to pay towards its maintenance even though the court finds that the mother is a loose woman who has had intercourse with other men during the same period. Thus it may well happen that several men will be in the same position of having to contribute towards a child's maintenance without being adjudged its father.

TRADE UNIONISM AND LABOUR CONDITIONS

Trade Unions

In February 1938 the Norwegian Federation of Trade Unions (*Arbeidernes Faglige Landsorganisasjon*) consisted of 33 national unions, 11 of which were industrial unions, and 18 district trades' councils. These councils, in addition to local unions affiliated with their respective national unions, also comprised unemployed workers' unions with a total of 6,736 members not belonging to any national union. There are unions for the majority of types of wage-earners, including most industrial, transport, municipal, and agricultural workers, fishermen, and shop assistants and clerks. In October 1938 the membership of the federation had reached 339,959. The trade unions can organize strikes, but when strikes and lock-outs arising from disputes between employees and workers endanger the community, arbitration is compulsory by law. For purposes of wage negotiations, disputes, and strike-pay, the federation is strongly centralized, the National Executive Council having power to assume leadership in disputes of importance and to call sympathetic strikes. The federation has its own bank which enables it to finance the building of labour, or people's halls through a central fund. Together with the Norwegian labour party, it also maintains the Workers' Educational Association.

The federation supported the movement which led to the establishment of an eight-hour day. It was also instrumental in procuring the Workmen's Protection Act of 1935, by which minimum summer holidays of nine days with pay were fixed; an extension to fourteen days has since been obtained by most industrial workers. The trade unions are paying increasing attention to the provision of holiday facilities for their members.

In the political sphere a large number of trade unions are collectively affiliated with their local labour parties, and both the national unions and the federation give financial support to the labour press and to labour campaign funds.

The Norwegian Federation is affiliated to the International Federa-

tion of Trade Unions, and the national unions all belong to their respective Trade Internationals.

Employment

The number of people employed in the various industries is given in Appendix VIII (*v.i.* p. 357). The average daily wage in industry during the years 1929-36 was between 11 and 12 kr. per day. In 1937 the average daily wage increased to 12.59 kr., in 1938 to 13.82, and in 1939 to 14.04. Since 1936 there has been a serious increase in the cost of living.

The economic depressions of the last twenty years have created considerable unemployment during certain years, particularly in 1921, 1926-7, and 1932-4. Relatively favourable years of employment include 1923-5, 1929-30, and 1936-7. The Labour Exchanges Act, 1906, enabled such exchanges to be maintained by the municipalities with State support, and the number of applicants for employment per 100 vacancies at public labour exchanges during each year between 1929 and 1937 have been as follows:

1929	1930	1931	1932	1933	1934	1935	1936	1937
640	640	960	1,138	1,191	1,109	942	796	599

Social Insurance, &c.

National Health Insurance is, under the Act of 1930 and its amendments, compulsory for every wage-earner over 15 years of age whose income is less than kr. 6,000 per annum. This insurance, to which contributions are made by the workers as well as by employers, municipalities, and the State, covers illness, birth, and death. In 1935 751,660 people were insured under this scheme. There is also legislation affecting all undertakings on an industrial scale or employing mechanical power. Generally every labourer or other employee in such works is entitled to free medical treatment, and also to receive compensation from the National Insurance Bureau (*Rikstrygdeverket*), for accidents incurred when at work, as well as for certain industrial diseases. The principle of accident insurance has also been extended to fishermen and seamen. Workers are also protected under an Act of 1936 which consolidated and amended the earlier 'Factory' Acts. The position in regard to unemployment relief is somewhat anomalous. Under an Act of 1906 and its amendments this form of relief continued to be based on the trade union unemployment funds, mainly derived from members' contributions, but a certain percentage (up to 50 per cent. in cases not exceeding 4 kr. a day) of the amount paid out is

refunded by the State and the municipalities concerned. In 1938 the question of a statutory unemployment scheme, on a compulsory basis, was under consideration.

PROHIBITION

TOWARDS the middle of the nineteenth century the influence of the temperance movement proved so strong that the number of distilleries in Norway fell from nearly 1,400 to 40 in the decade ending in 1850. From 1871 the sale of spirituous liquors was restricted to local monopoly stores (*samlags*), and the number of these had, under a system of local option, been so reduced that in 1914 they existed in only thirteen towns. Thus the national consumption of alcohol had already reached an abnormally low level when, in 1916, prohibition was introduced for spirits, and soon afterwards for wines containing more than a low percentage of alcohol.

These purely war-time measures assumed another aspect when, after a plebiscite in 1919, the Government proceeded to introduce legislation, and a prohibition law was passed in 1921. But difficulties with foreign countries ensued, and in 1923 the Storting, by a small majority, repealed the prohibition against the importation of strong wines. After a plebiscite in 1926 had resulted in favour of the abolition of the prohibition on spirits, the sale thereof was legalized as from May 1927.

By a law passed in 1922 all trade in wines was placed under a Wine Monopoly dependent on the Government. The functions of this body were afterwards enlarged, so that in 1938 the entire production, importation, and wholesale trade in spirits and wines of all kinds had been centralized in the Wine Monopoly. The retail trade carried on by the monopoly is dependent on a licence from the local municipal authorities, as is the serving of spirits, wines, and beers. The sale and serving of spirits are by law permitted in towns only. The rural municipalities are generally prohibitionistic, and numerous country districts and twenty-one towns have been voted absolutely dry.

The annual consumption of alcohol in Norway was, for the five years ending in 1936, only 1.79 litres per head; nevertheless drunkenness remains a difficult problem. As compared with France and, to a smaller degree, with England, the tendency is to drink less from day to day, and considerably more on special occasions, with the corollary that drinking on such occasions is often excessive.

In addition to the general legislation on the consumption of alcohol, special Acts impose obligatory abstinence in specific occupations,

so that consumption of beverages containing more than 2·5 per cent. of alcohol is forbidden to soldiers, railway servants, tram-drivers, chauffeurs, and others when they are on duty and during the eight hours immediately before. It may be noted that this regulation in effect limits drinking to weak beer, as all strong beers, wines, and spirits exceed the specified alcoholic content. Moreover, under the Motor-car Acts any person in charge of a car in whom analysis of the blood shows 0·5 mgm. per c.c. (50 mgm. per 100 c.c.) of alcohol is considered drunk irrespective of whether his behaviour is altered, and he is sent to prison without any option. Many well-known people have been punished in this way. This figure of blood alcohol can be produced by half a bottle of red wine, by a large bottle of beer, or by 1½ whiskies. A consequence is that alcohol is not taken until the car has been put away in the evening, and no one takes his car when going out to dinner or to a party.

CHAPTER X

POPULATION

Population Statistics

A DECENNIAL census is taken in Norway. In 1930 the population was 2,814,194 and in 1937 it was estimated to be 2,906,072. The following table gives the 1930 figures for each county (*fylke*), the areas of the rural and urban districts, and the average densities of population, rural and urban, per square mile.

Counties	Total population	Area in square miles		Average density of population per sq. mile	
		Rural	Urban	Rural	Urban
Östfold	167,030	1,495·0	7·1	81·5	6,348·5
Akershus	236,939	1,933·4	0·5	120·9	6,344·0
Oslo	253,124	..	6·2	..	4,082·6
Hedmark	157,942	10,143·0	0·7	14·7	11,314·3
Opland	137,710	8,852·3	1·6	14·4	6,529·4
Buskerud	143,073	5,373·6	28·0	19·8	1,299·1
Vestfold	134,107	866·5	5·1	105·6	8,382·5
Telemark	127,754	5,423·6	7·9	16·2	5,050·3
Aust-Agder	73,816	3,375·2	5·3	16·4	3,416·7
Vest-Agder	81,233	2,633·7	8·7	20·9	3,007·4
Rogaland	173,258	3,360·6	6·4	29·6	1,148·5
Hordaland	164,376	5,822·5	..	28·2	..
Bergen	98,303	..	13·5	..	7,281·7
Sogn og Fjordane	91,808	6,881·7	0·2	13·1	7,025·0
Møre og Romsdal	165,064	5,473·3	6·2	23·5	5,842·7
Sör-Trøndelag	174,946	6,918·2	13·0	17·0	4,189·0
Nord-Trøndelag	96,016	8,118·2	1·1	10·8	7,254·5
Nordland	186,920	13,947·7	9·0	11·8	2,482·9
Troms	97,467	9,784·8	0·9	8·5	15,693·3
Finnmark	53,308	18,097·3	3·4	2·4	2,685·3

Distribution of Population

There are few towns or villages in Norway. Not more than 80 towns have a population of over 1,000. Villages as known in Britain seldom exist. In 1930, 2,013,680 people lived in rural communities and 800,514 in towns. The reason for the preponderance of rural over urban population is clearly indicated by the occupations of the people. This is illustrated by the following table of occupations of persons over 15 years of age:

Agriculture and forestry	336,364
Fishing and hunting	75,977
Industries	309,813
Trade	145,839
Transport	108,422
Professions	66,247
Total persons earning a livelihood	<u>1,042,662</u>

Besides the above there are 729,023 people engaged in domestic occupations, e.g. wives and servants. These figures rather hide the importance of agriculture, since most fishermen and many people connected with mining, quarrying, and the timber industry have small farm holdings. There has, however, been a movement to the towns during the last 100 years, the urban proportions being 9 per cent. (1801), 13 per cent. (1855), 28 per cent. (1900), and 30 per cent. (1930).

Only 30 towns in Norway have over 5,000 inhabitants. These are:

Oslo	272,000	Arendal	10,400
Bergen	105,000	Tromsø	10,350
Trondheim	56,000	Halden	10,300
Stavanger	48,000	Narvik	9,900
Drammen	25,800	Porsgrunn	8,900
Kristiansand S.	18,780	Rjukan	8,500
Ålesund	18,350	Moss	8,300
Haugesund	17,200	Kongsberg	7,300
Skien	15,600	Kirkenes	7,000
Kristiansund N.	14,650	Notodden	6,200
Fredrikstad	14,100	Sandefjord	5,930
Sarpsborg	12,400	Hamar	5,920
Tönsberg	12,000	Lillehammer	5,380
Horten	10,800	Bodö	5,150
Larvik	10,400	Gjøvik	5,100

Most towns of any size are found along the coasts and fjords. The most densely populated areas are (1) the region lying on either side of the Oslofjord; (2) the belt of country north of the Oslofjord along the three great valleys of the lower Österdal, Mjösa, and Dramselv and Randsfjord; (3) the coastal belt from Oslofjord to Flekkefjord; (4) Jaeren, and the region round Stavanger; (5) the coastal zone from the Boknfjord to the north of Bergen; (6) the coastal region of Möre and Romsdal; (7) the Trondheim depression, and (8) parts of the Lofoten and Vesterålen islands. The Oslofjord region is important because of its agriculture, forestry, and industry; the Trondheim depression for much the same reasons, though it is less industrialized; the southern coastal belt from the Swedish border to Flekkefjord because of its association with timber and the timber industries.

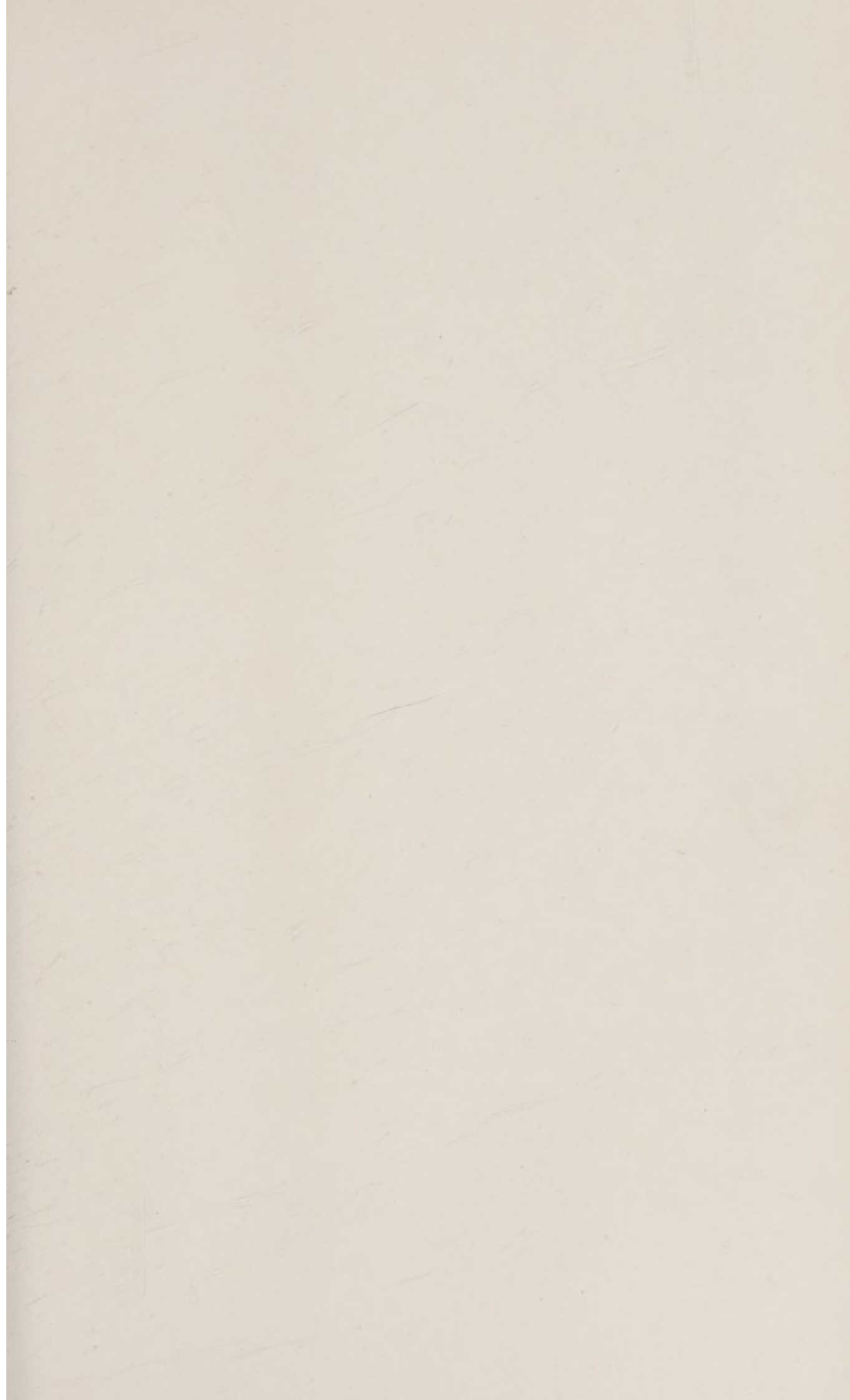




FIG. 27. *Sör-Fron (Gudbrandsdal). A small farm typical of the middle and lower reaches of the eastern valleys*



FIG. 28. *Flâm. An agricultural settlement in a constricted valley on the west coast*

Jaeren is an agricultural region, though it is also connected with the fish-canning industry. The population on the west coast between Stavanger and Trondheim is employed mainly in fishing, the fishing trade, and in agriculture. The towns on the coast of northern Norway have mostly fishing and mining communities, but some trade with Sweden. The valleys are mostly inhabited by farmers in their lower and middle courses, and also by industrial workers where the larger or swifter watercourses provide suitable water power sites.







Agricultural Population

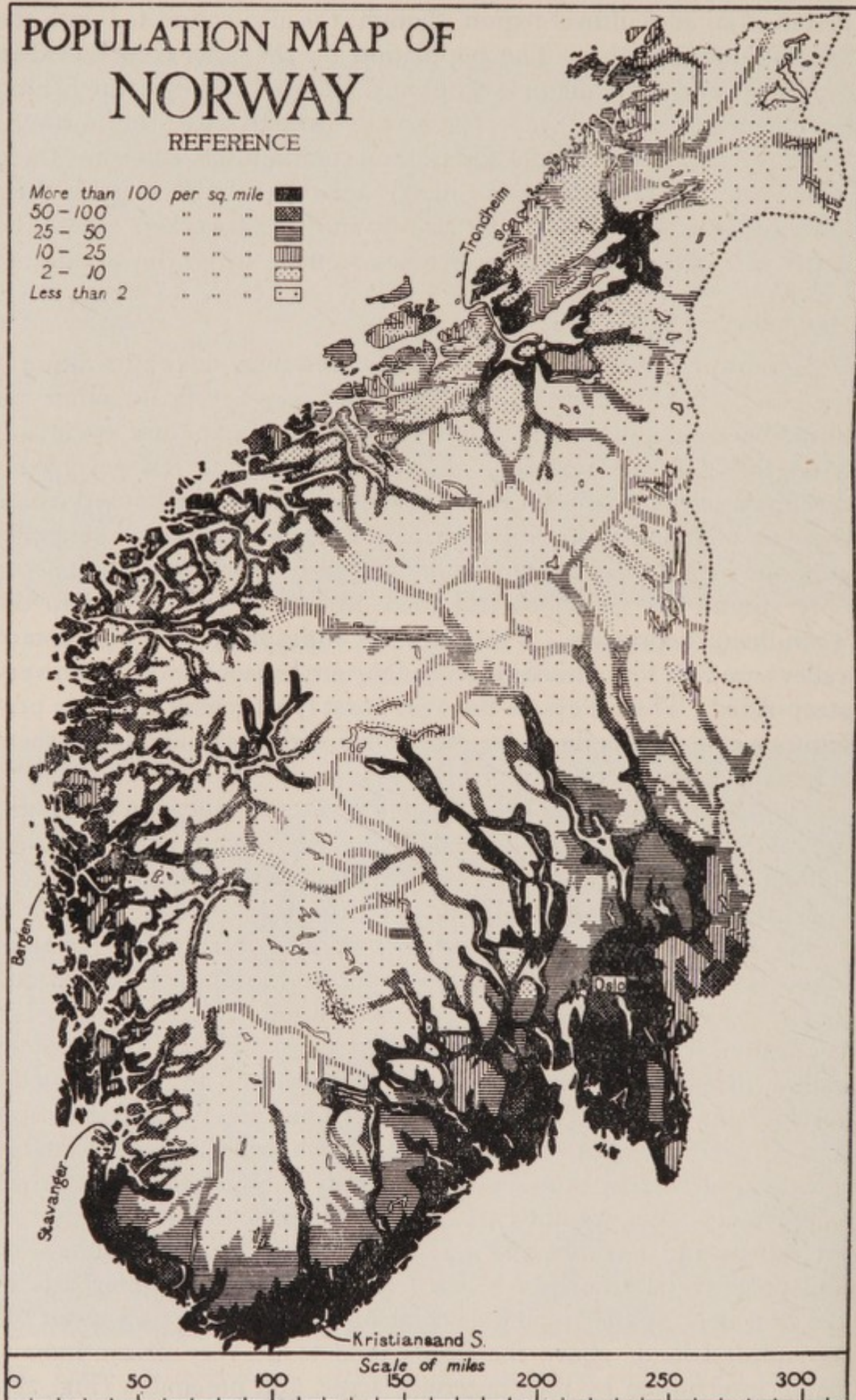
Agricultural settlement will be considered first, since cultivation is the basic occupation of the country. Norway is a difficult country to farm, because much of it is barren fjeld or precipitous mountain. More than half the surface is above 2,000 feet, and few permanent dwellings are found above this height. Agriculture is practised where there is soil to cultivate, and settlement follows. Farming is generally confined to flatter regions and valleys. The former are rare and occur only around the Oslofjord and Lake Mjösa, in Jaeren, and in the Trondheim depression. The latter are widespread, but the eastern valleys are best for cultivation since they are broader and seldom very steep-sided. The valleys of the west coast fjord region are more precipitous and as their floors are often filled with fjords and lakes, there is less room for habitation and cultivation.

The middle and lower reaches of the eastern valleys in particular are intensively farmed and settled. The farms are not in clusters, but in long lines often far apart. The farm buildings are numerous, often consisting of as many as twenty or thirty together. At the edges of the farmland there are frequently small-holdings which belong to farm labourers. The farms are normally on the lower slopes of the plateaux and valleys, with forest above them, where solitary farms, worked in connexion with forestry, are scattered (Fig. 27). In the western valleys dwellings are more dispersed as they tend to be on agricultural land, which itself is very scattered. This is so because the lower and middle stretches of the valleys, which had the most suitable agricultural land in the east, are generally submerged. This leaves only embayments, terminal and lateral moraines, the heads of fjords, strandflats and terraces, and certain corries, fit for cultivation. The valleys above the fjords are less fertile than their counterparts in the east, because they tend to become more gorge-like; as a result the agricultural lands above the fjords tend to be very discontinuous, being interrupted by rock outcrops, scree, and precipices (Fig. 28).

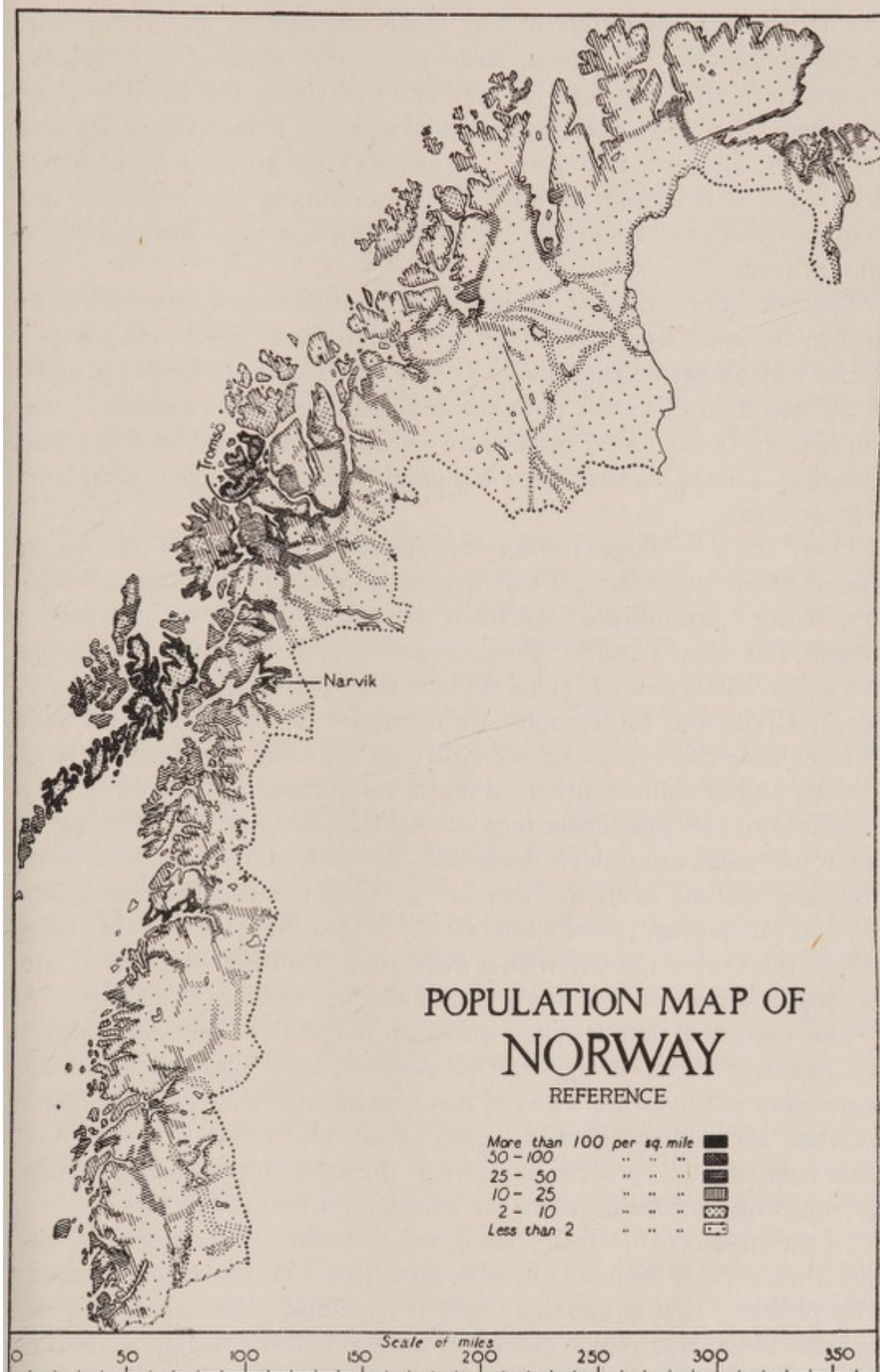
POPULATION MAP OF NORWAY

REFERENCE

More than 100 per sq. mile	
50 - 100	
25 - 50	
10 - 25	
2 - 10	
Less than 2	



MAP 44



MAP 44

The location of dwellings in the west, and sometimes in the east, is also influenced by floods, stone-falls, and avalanches. Houses, especially in the west, are frequently built above the flood-level of the rivers, and away from valley walls so as to avoid avalanches and stone-falls, and are, therefore, not always close to their agricultural land when it is subject to such dangers. In the west, hamlets are frequently some considerable distance apart, and there are numerous solitary farms.

The population density of agricultural lands is lowest on the best land in the east, where generally it varies little, being about 360 per square mile of agricultural land. In the west and in the upper reaches of the eastern valleys the population is more dense, as many as 550-600 persons being found per square mile of agricultural land in some parishes. This is because there is a great shortage of agricultural land in these areas.

There are few villages in Norway, because until recently the people tended to live on farms with their families and so to form small self-supporting communities. In most regions there are no villages or shops. The tourist traffic, however, has caused the growth of shops and a few villages in the fjord regions near tourist hotels. Vik (Eidfjord), Ulvik, and Gudvangen are examples of this type of growth. Villages have also sprung up recently near the more important railway stations and at route centres. Such developments have been mainly restricted to the west-coast region. Åndalsnes, Otta, and Toning in Stryn are good examples. Åndalsnes has only developed as a town since the opening of the railway in 1923, and is now a meeting-place of road, railway, and steamer services. Otta is important as the junction of the Dovre railway with a main road from the west coast, and Toning in Stryn as a meeting-place of steamer services and roads.

The industrial settlements, which are dependent on water power and have sprung up in agricultural regions, have hardly affected the population as the farmers do not buy much from them. Co-operative societies for collecting milk, eggs, bacon, and other farm-produce have been started in some regions in the east, but usually are only transmitting stations between the countryside and the city.

In the nineteenth century the fjord and eastern mountain valleys with their strictly limited cultivable land, had become over-populated. The problem was temporarily solved by emigration to the U.S.A., and also to the Norwegian cities and timber districts, which were then developing and becoming prosperous. Most of the remote properties were then deserted. Intensive emigration continued until about 1910,

but the depopulation of the rural areas has been stopped by the closing of the U.S.A. to large-scale immigration and by the depression in the timber and other industries. The problem confronting the country districts has accordingly again become that of providing for an increasing rural population.

Recently, however, there has been more migration from the west to the larger farms in the east. The fjord parishes have generally little agricultural land and farms have been already subdivided to the economic limit, so that younger sons who do not inherit property must settle elsewhere. In the fjord regions farmers have a relatively good command of money since they are more frugally minded, while the easterners are more spendthrift. There has been little movement from the farms in the east which are larger and permit of subdivision.

Fishing Population

A large number of the people earn a living from the sea, by fishing, hunting, and sealing, by the industries connected with them, or in the mercantile marine. Fishing in Norway being mainly seasonal, the fishermen usually require another occupation, and this is generally farming. Fishing settlements are often found where there is cultivable land near the coast; such land is not always easy to find, for during the Great Ice Age most of the coast was swept bare of soil. Scattered patches of agricultural land are found, however, along the coast between the Boknfjord and the Hardangerfjord. The spring fisheries are good off this coast, and the island of Karmøy, in particular, affords good building-ground, harbours, soil for cultivation, and peat for fuel. Much the same is true of the coast of Möre and Romsdal from which the big herring-fisheries operate in November and December. Here the coast and islands afford good building-sites and patches of agricultural land, particularly between Ålesund and Molde. Ålesund and Kristiansund N. especially are important centres for the fishing trade.

North of Trondheim it is impossible to combine fishing and farming to any great extent since the soil is poor. The cod-fishing off the Lofoten and Vesterålen islands is important, and is seasonal, the best months being January–April, after which date the fish move north off the coast of Troms and Finnmark. The fishermen live in huts on the islands during the season before migrating northwards. Some of them have permanent dwellings farther south, while others live in small towns and ports on the north coast such as Hammerfest, Vadsö, and Vardö, or at the heads of fjords.

The fish is largely marketed and treated in the towns on the southwest coast. Bergen is the most important, although some fish is exported from Trondheim, Kristiansund N., Haugesund, and Stavanger. Originally the lack of grain caused the northern fishermen to bring their fish farther south to barter for grain. As Bergen has been, until recently, the chief grain port, its hold on the fishing trade has always been great. Another reason for bringing the fish south is that much of the cod is sun-dried, and the northern part of the country is climatically not so suitable. Finally, the development of fish-canning has caused a considerable increase of population in the Stavanger region during the last hundred years.

Industrial Population

The towns on the south coast of Norway have grown up as a result of the timber industry, since the beginning of the seventeenth century when much timber was exported for shipbuilding. The industry does not greatly add to the population of the forest regions, which remain sparsely populated, but causes an increase along the coast at the mouths of the big rivers flowing through the forest areas, since timber can be floated down these rivers. This development is clearly seen in the Glomma valley, the middle stretches of which are richly forested but poorly populated (c. 15 per square mile), while the coastal region at the mouth of the river, dependent on the timber trade, is well populated (c. 126 per square mile). The lack of population in the forest areas is not so strange as it may seem at first sight because large tracts are owned by farmers who fell the trees in winter when agricultural work is at a standstill.

The growth of the towns has increased because of the development of the timber trade and industries, such as wood-pulp and paper-making. The long row of towns extending from the Swedish frontier to Flekkefjord are all at the mouths of watercourses, owe their development to them, and are largely dependent on them. The larger these rivers are, the larger the towns at their mouths will be. The most important are Halden, Larvik, Skien, Arendal, and Kristiansand S., all with a population of over 10,000. Risør, Mandal, and Egersund have each about 3,000 inhabitants and lie at the mouths of smaller rivers.

The development of water power has an ever-increasing influence on settlement. Industries tend to grow up near the sources of power. Numerous industries for which raw materials have to be imported have been developed in Norway because of the cheap water power. The older sites are most frequently found in Telemark because they

were cheap. The modern sites are growing up principally along the fjords on the west coast where the power sites may be more expensive to develop, but where transport is cheaper, e.g. Sauda, Odda, Ålvik, and Höyanger (Figs. 30 and 31).

Numerous small settlements dependent on mining exist throughout Norway. These have grown up either at the site of the ores themselves or, if the coast is near, at some suitable loading site, frequently at the head of a fjord. Examples of the first category are Röros and Lökken, and of the second Kirkenes and Thamshavn.

Route Centres

There are few other types of towns than those already mentioned. The most important are route centres, and of these the most outstanding are Oslo, Bergen, Trondheim, and Stavanger, the largest towns in the country.¹

Oslo, despite the natural advantages of her site, did not develop as a great nodal centre until she became the capital in 1814. One of the most important features influencing the growth of a route centre here is its situation at the head of the Oslofjord, which penetrates not only a long way inland but far into the best agricultural regions of Norway and affords good communication by sea with northern Europe. From it there are easy routes by the valleys to most of the country south of Trondheim.

Bergen has been for centuries, and still is, a centre for sea communications rather than for land routes. The town is situated centrally on the coast of south-west Norway in important fishing-areas and in a good position for trade with Europe, and especially with Britain and Iceland. The town is on a sheltered peninsula, not too far from the open sea, from which it is easily accessible, though well protected by islands. There are also numerous good approaches both from north and south between the coastal islands. For these reasons Bergen is an excellent route centre for the fjord regions, particularly for the Hardanger and Sognefjord, and has long been the principal trade centre of the west coast of Norway. Communications by water are important in the island and fjord regions round and near Bergen since there are few good roads. The topography of the fertile Bergen peninsula itself permits quite a dense network of local roads, but through-road communication to the main Norwegian road system is difficult and there is no direct road connecting Bergen with Oslo. A railway joins Bergen to Oslo despite the physical features.

¹ See also Vol. II.

Trondheim,¹ because of its geographical advantages, is not only an important nodal centre but the market for its fertile region. It is at the mouth of the wide Nid valley which leads to the Gaula valley and thence south to Oslo. By following the shores of the Trondheimsfjord (1) eastwards, the Stjördal valley affords a good through-route to Sweden; (2) northwards, easy access is gained to valleys leading to Elsfjord, and thence to Saltdalen; (3) westwards to Thamshavn, where the Orkla valley affords an alternative route to Oslo and the west coast near Kristiansund N. Roads follow all the valleys mentioned, while railways run to Oslo, Mosjøen, and Sweden. The site of the town near the mouth of the Trondheimsfjord and its good harbour at the outflow of the river Nidelv facilitate sea communications.

Stavanger is a centre for both sea and road communications. The sea routes afford connexions with Norway north and east of Stavanger, with Great Britain and with other western countries. Its site near the north end of a peninsula which extends northwards towards the Boknfjord has encouraged its growth as a centre for local sea routes. Traffic by sea is especially important in the Boknfjord region, since the country is too rugged for land routes. In the Jaeren region, to the south and south-west, roads are of the utmost importance because the coast is difficult for shipping close inshore. Jaeren is flat and well cultivated, and permits a fairly dense network of roads, both coastal and inland, connected with the main Norwegian road system by two roads to Flekkefjord and then by one road to Kristiansand S. There is also a railway to Flekkefjord with a branch, of only local importance, to Ålgård, the wool collecting centre.

Some of the towns in northern Norway have developed because of trade with Sweden, e.g. Levanger, Mosjøen, and Narvik. Narvik is especially noteworthy as in 1898, before the opening of the Swedish iron-ore railway, it had only fifty inhabitants. In 1939 its population was over 9,900.

Vital Statistics

The population has increased considerably since the beginning of the nineteenth century, as the following table shows:

1801 . . .	883,487	1875 . . .	1,813,424
1815 . . .	885,431	1890 . . .	2,000,917
1825 . . .	1,051,318	1900 . . .	2,240,032
1835 . . .	1,194,827	1910 . . .	2,391,782
1845 . . .	1,328,471	1920 . . .	2,649,775
1855 . . .	1,490,047	1930 . . .	2,814,194
1865 . . .	1,701,756		

¹ See Map 7.

The decennial increases during the past fifty years were, in percentages:

1881-90	1891-1900	1901-10	1911-20	1921-30
4.1	11.7	6.6	10.6	5.9

The excess of births over deaths is high but has, on the whole, tended to diminish recently. The yearly average was over 13.3 per thousand in the decade 1901-10; 11.1 during 1911-20; 7.9 during 1921-31. For the years 1931-8 the yearly averages were as follows:

	1931	1932	1933	1934	1935	1936	1937	1938
Excess of births over deaths per 1,000 .	5.42	5.41	4.62	4.71	4.03	4.21	4.69	5.81

The average annual death-rate was 14.1 per thousand during 1901-10; 13.7 during 1911-20; 11.2 during 1921-30. The yearly death-rates for 1931-8 were:

	1931	1932	1933	1934	1935	1936	1937	1938
Per thousand . . .	10.87	10.61	10.15	9.90	10.34	10.42	10.42	9.96
Actual number of deaths . . .	30,674	30,102	28,943	28,340	29,747	30,100	30,217	29,013

These are exceptionally low. The birth-rates, on the other hand, are high although they have decreased considerably during the present century. The average annual birth-rate was 27.20 per thousand during 1901-10; 24.8 during 1911-20; and 20.1 during 1921-30. The yearly birth-rate for the years 1931-8 were:

	1931	1932	1933	1934	1935	1936	1937	1938
Births per 1,000 . . .	16.29	16.02	15.77	14.61	14.37	14.63	15.11	15.77
Actual number of births . . .	45,989	45,451	42,114	41,833	41,321	42,240	43,808	45,957

The percentage of illegitimate births was high during the third quarter of the nineteenth century, but fell during the last quarter. Of the total living number of children born in 1901-10, 6.9 per cent. were illegitimate, in 1911-20, 7.0 per cent., in 1921-30, 6.9 per cent., and in 1931-38, 6.9 per cent. The number of marriages in relation to the number of population has increased slightly. During the present century the number of still-born children has decreased a little. In the last eight years 2.19 per cent. of the children born per annum have been still-born.

The proportion of women in the country was extremely high in 1769,¹ when there were 1,108 women to 1,000 men. The ratio fell until in 1865 there were 1,036 women to 1,000 men. The proportion then rose in 1910 to 1,076 women to 1,000 men; the increase was probably due to the fact that at the end of the nineteenth century more men than women emigrated to America. By 1930 the proportion had decreased to 1,051 women to 1,000 men.

Emigration

Emigration from Scandinavia has taken place from very early times. Norwegians during the Viking age occupied the shores and founded many of the towns of Ireland, and took possession of the western and northern islands of Scotland and the northern Scottish counties of Caithness, Sutherland, and part of Ross. From Ireland, Norwegians settled in Westmorland, Cumberland, and Galloway, penetrating far into the south-west of Scotland and into some parts of Wales. In the Hebrides, Norwegian was spoken for centuries, but was supplanted by Gaelic after the Hebrides were added to the Scottish kingdom in 1263. In Orkney and Shetland traces of Norwegian dialects remain, and it is possible that some Scandinavian dialect has affected the pronunciation of English in Aberdeenshire. There is still a considerable Norwegian element in the population of Great Britain, particularly in the north and west of Scotland, where conditions are similar to those in south-west Norway and have favoured the survival of Norwegian types. Norwegians also settled in Normandy at the end of the tenth century.

Emigration from Norway in recent times has mainly been to North America and chiefly to the United States. During the hundred years, 1835 to 1935, 866,694 persons (60 per cent. men) left Norway. About 1870 the number of emigrants became very great, reaching 28,804 persons (or 15 per cent. of the population) in 1882. Emigration continued on a large scale until between 1893 and 1899, but it reached another high figure (26,784) in 1903. From 1911 onwards the number began to decrease, and during the War of 1914-18 was lower than in any year since 1840; in 1918 the number was only 1,226, after which there was an increase until the adoption of the American Immigration Law of 1924 (amended in 1927), which limited the number of immigrants from Norway to about 2,000 a year. The numbers emigrating to America and Canada during 1931-8 were as follows:

¹ The year in which the first reliable census was taken

	1931	1932	1933	1934	1935	1936	1937	1938
United States . . .	708	351	299	392	364	418	591	696
Canada	62	53	21	35	22	51	14	26

The emigrants from Norway to North America are largely farmers. They have, on the whole, retained their national characteristics and institutions. The main stream of emigration used originally to pass across Canada, up the St. Lawrence, over the lakes to Chicago and Milwaukee, and thence into the prairies or the forest regions. The largest Norwegian population lives in Minnesota, Illinois, Wisconsin, Iowa, and North and South Dakota. From these States new waves of emigrants went westward into Montana and Washington. In 1930 there were 347,852 Norwegian-born persons in the United States, distributed as follows:

New England 8,860	South Atlantic 2,591
Massachusetts 5,454	West South Central 2,292
Connecticut 1,806	Texas 1,490
Middle Atlantic 55,697	Mountain 15,350
New York 44,882	Montana 8,991
New Jersey 7,870	Idaho 2,148
Pennsylvania 2,945	Colorado 1,261
East North Central 74,228	Utah 1,698
Ohio 1,650	Pacific 56,483
Illinois 30,256	Washington 31,429
Michigan 7,201	Oregon 7,450
Wisconsin 34,391	California 17,604
West North Central 131,904	
Minnesota 71,562	
Iowa 12,932	
N. Dakota 31,337	
S. Dakota 13,061	
Nebraska 1,691	

During the past few years the number of Norwegians emigrating to Canada has been large. Few have come direct from Norway, but many more from the United States. There are about 93,000 persons of Norwegian descent in Canada, about 42 per cent. of whom were born in Canada, 36 per cent. in Norway, and 22 per cent. in the U.S.A. The Norwegian settlements are chiefly found westwards of Winnipeg in Manitoba, Saskatchewan, Alberta, and British Columbia. Recent emigration from Norway to countries other than North America has been sporadic and not very important. It has been to some extent connected with Norwegian missions, with their four main spheres of action in Zululand, Madagascar, Santalistan in Bengal, and in the

Hunan province of China. There has also been some missionary activity in South Africa. Elsewhere emigration has been partly connected with commerce and whaling, which has led to vigorous Norwegian enterprise in the South Atlantic and Antarctic. There has been a little emigration to Australia. In South America, mostly in the Argentine, there has been an influx of Norwegian business men and civil engineers.

CHAPTER XI

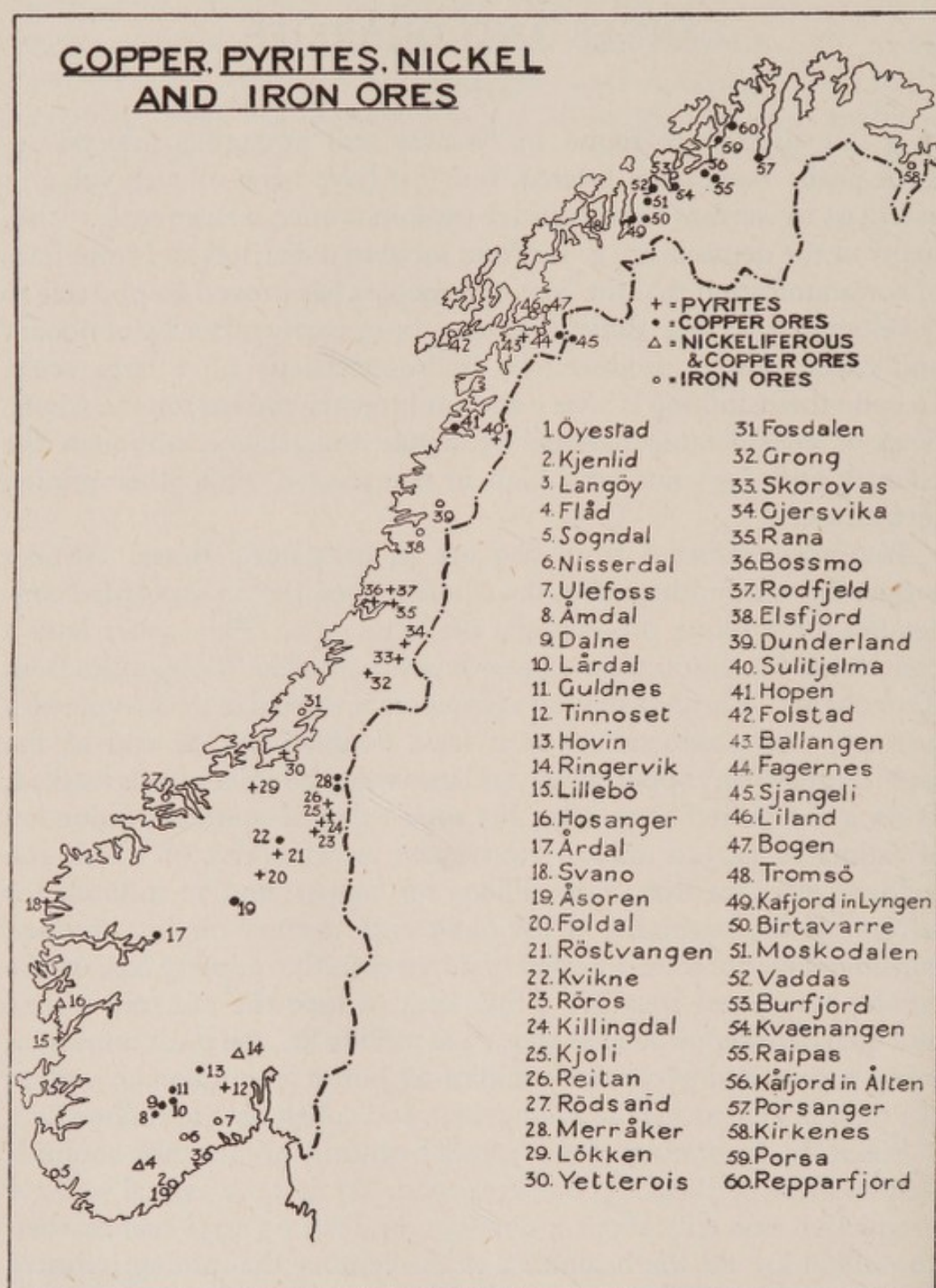
MINES AND QUARRIES

MINES

MANY metals are found in Norway and numerous mineral deposits have been located, but few have been of such value or extent as to warrant remunerative exploitation on a large scale. Also, many of the deposits are so far from inhabited districts and from lines of communication that the cost of transport has proved an obstacle to development. These difficulties have been partly offset by abundant and cheap power, produced by hydro-electricity on a large scale. Despite them, mining is a very ancient industry and has, on the whole, been of considerable national economic importance, although the country still does not rank high in comparison with other mining territories.

Iron was extracted from bog ore in prehistoric times. Mining proper dates from the end of the Middle Ages, the first recorded concession for working ore-deposits being in 1490. Some years later a concession was granted for copper deposits situated '8 long miles from Trondheim'. The industry, on a larger scale, started in the seventeenth century, and production was at least doubled by the end of the eighteenth, when copper, silver, and iron were the chief metals worked. During the period 1623-1814 the total value of mineral production is estimated at 340 million Norwegian crowns (kr.), of which 160 millions were for iron, 110 millions for copper, and 70 millions for silver. At the beginning of the nineteenth century mining declined considerably, but after a period of depression the industry has, on the whole, progressed steadily. From 1814 to 1900 the minerals mined and quarried were valued at about 350 million kr., the most important being copper and pyrites (169 million kr.), iron (73 million kr.), silver (52 million kr.), nickel (18 million kr.), and cobalt ore (10 million kr.).

Since the beginning of the present century mining has boomed, despite some periods of great depression. At first the annual value of production was only about 4.5 million kr., but by 1938 had reached 50 million kr. At the beginning of the century the mining industry employed about 2,750 persons and in 1913 about 8,000; in recent years over 11,000 persons have been engaged in mining proper and over 8,000 in quarrying. Improvements in mechanical working and methods of production, influenced by the development of



MAP 45

hydro-electricity, have mostly been responsible for these results. Statistics of the number of mines and of workers employed by the mines, and the value of mineral production in 1938, are summarized in Appendix VIII (*v.i.* p. 357), and the output of ore in Appendix IX, Table 1 (*v.i.* p. 358).

Pyrites (cupriferous and non-cupriferous)

Copper pyrites, cupriferous iron pyrites, and non-cupriferous iron pyrites are extensively worked in Norway. Pyrites is Norway's most important mining product, nationally and internationally. Nationally because the mines employ the greatest number of hands and have the highest output value, and internationally because the annual tonnage exported represents about one-fifth of the total European trade. The output has increased considerably since the War of 1914-18, although there was a slump in the industry at first. The output and export figures for 1913 and 1938 clearly indicate this increase; in 1913 445,000 tons were mined and 426,000 tons exported, and in 1938 the figures were about 1,011,000 and about 717,000 tons.

Pyrites (both cupriferous and non-cupriferous) contain sulphur, iron, copper, and other metals such as zinc and nickel, as well as gold and silver in small quantities. The treatment is complicated, because these widely differing substances have to be separated. There are three chief methods of treatment:

1. By the oldest method either the sorted raw ore was crushed to furnace size or the sulphides were concentrated *en bloc*. The product was then sent to the sulphur consumer and roasted; the calcined mass to the leaching plants where copper and other minerals were extracted; and the residue, a good iron ore ('purple ore'), to the iron-works. This method was expensive and wasteful.
2. Selective flotation is especially well adapted where the raw ores are rich in copper but poor in sulphur, or too fine-grained. Chalcopyrite, sphalerite, and non-cupriferous pyrites are gained as separate products. This method is used with great success at the Sulitjelma mines, where 90 per cent. of the copper in the ore is gained as bessemer copper.
3. By the new Orkla method native sulphur is produced. The ore is smelted with quartz and limestone, the iron slagged off and lost, the copper and other metals are concentrated in a matte, and the different sulphuric gases brought to react by catalysers condensing native sulphur. The preliminary concentration of

the metals in a matte permits an effective extraction of the copper and minor metals. About 50 per cent. of Norway's output of pyrites is treated by this method.

Until recently Norwegian pyrites was usually exported as raw material. In 1937, however, only about half of the total production was exported raw, the other half being treated by the Orkla method. The type of cupriferous pyrites marketed and exported contains about 40-48 per cent. sulphur, about 35-45 per cent. iron, and 1.7-3.5 per cent. copper. Some grades, however, have a copper percentage as high as 6. Pyrites with a lower value of both sulphur and copper are worked, but this is mixed with higher grades so that a type of pyrites more suited to the manufacture of sulphur dioxide and sulphuric acid is produced. The non-cupriferous pyrites contains about 40-50 per cent. sulphur and 35-45 per cent. iron, and up to 0.7 per cent. copper.

Most of the pyrites known in Norway is genetically connected with eruptive rocks of the Caledonian mountain chain, and frequently occurs in metamorphosed slates. The most important deposits are found in northern Norway,¹ where, for the sake of convenience, they can roughly be divided into two groups, those in Nordland and those near Trondheim. There are also isolated deposits along the west coast of southern Norway.

Nordland. The most important Nordland deposits are at Rana, Bossmo, Rodfjeld, Sulitjelma, and Ballangen. Of these only the last two are definitely known to have been working before the outbreak of war in 1939.

The Rana, Bossmo, and Rodfjeld mines are near one another, not far from Mo. It is possible that the Rana mines, which are owned by Nord Rana Mofjellets Grube, were working pyrites in 1939. They are capable of producing annually about 5,600 tons of sulphur and 400 tons of concentrate with 24 per cent. copper, as well as zinc (*v.i.* p. 238). The mine at Bossmo, which was open a few years ago but has now ceased working, had an annual production of about 20,000 tons. The Rodfjeld mines were opened in 1913, but closed after only a few years.

The Sulitjelma mines, which are of great importance, are near the Swedish frontier, east-south-east of Fauske. They started production at the end of the nineteenth century, but smelting ceased in 1920. The works were reorganized in 1928 and new smelting and flotation plants, which treat all materials and produce a rich copper matte,

¹ The regions where copper is found with little or no pyrites will be discussed later.

were installed. Since then, 94,000 tons of pyrites, containing 49 per cent. sulphur and 0.71 per cent. copper, have been produced annually, as well as 5,000 tons of metallic copper. Recently zinc concentrate has also been produced and exported. The company operates a private mineral railway, 16 miles long, from the mines to Skjönstå.

The Björkåsen mines at Ballangen (6 miles west of Narvik) have been working cupriferous pyrites regularly for some years. The recent annual production has been about 111,000 tons of 48 per cent. sulphur and 600 tons of 20 per cent. copper concentrates.

Trondheim. The most important deposits in the Trondheim region are at Foldal, Kvikne, Röros, Killingdal, Kjoli, Reitan, Meråker, Lökken, Ytterøis, Joma, Grong, Skorovas, and Gjersvika. All are being worked (1939) except those at Ytterøis and Meråker. The Foldal mines, which lie to the south-west of Röros, have been producing pyrites, with few interruptions, since 1907. They produce annually about 22,000 tons of pyrites containing 45 per cent. sulphur and 1.8 per cent. copper, and 2,500 tons of concentrate with 18 per cent. copper. The Röstvangen mines, near Kvikne, have been worked during the present century and in 1939 were reported to be re-opening.

The mines near Röros are some of the oldest in the country, having been worked for copper in 1644, and almost continuously up to 1920, when they closed down. Government assistance has, however, in recent years enabled operations to be restarted at several mines, pyrites now being exported as well as copper.

The Reitan mines, to the north of Röros, have recently produced 40,300 tons containing 46 per cent. sulphur and 2 per cent. copper annually. There are mines working nearby at Kjoli and Killingdal. The Kjoli mines are State-aided, and in 1937 produced about 6,000 tons of pyrites; those at Killingdal have produced over 40,000 tons annually in recent years.

The Lökken mines, 30 miles south-west of Trondheim, are worked by Orkla Mines Ltd. (Fig. 29). These, which are amongst the largest in Norway, were started at the beginning of the century. By 1914 the annual production had reached 125,800 tons of pyrites, and it now exceeds 500,000 tons. The mines are connected by an electric railway with Thamshavn, where the Orkla company has a smelting plant. Much of the pyrites from Lökken is treated at this plant, pure sulphur and a rich copper matte being produced. In 1937 323,000 tons of pyrites were smelted, from which 107,400 tons of sulphur and

15,500 tons of copper matte (containing 35 per cent. copper) were produced.

The deposits at Ytterøis, on an island in the Trondheimsfjord, were worked from 1861 to 1911, during which period 500,000 tons of pyrites were exported as well as a smaller quantity of smelting ore.

In Nord Trøndelag the Skorovas deposits are privately owned and operations have been started on a large scale. They are estimated to contain 20 million tons of good quality pyrites. The Joma, Grong, and Gjersvika deposits all belong to The Grong Mines Ltd., a State-owned company which has only recently started working. The largest mine is the Gjersvika, at the north end of Lake Limingen. The estimated output of the Grong company in 1939 was 200,000 tons, but most of it was only useful for extracting sulphur.

West Coast of Southern Norway. There are three mines of commercial importance on the west coast, namely, the Vigsnes and Rødklev mines on the island of Karmøy, Lillebø on the island of Stord (at the mouth of the Hardangerfjord), and the Svanø mine on the Sunnfjord. The Vigsnes mines produce about 70,000 tons of pyrites annually; the Lillebø mines have been worked since 1907 and produced 124,000 tons of pyrites with a low copper content and about 40 per cent. sulphur in 1937; the Svanø mines are now closed.

Central and Southern Norway. The Røstvangen mine at Tinnoset is the only one in central and southern Norway which produces pyrites rather than copper. It yields annually at least 27,000 tons of non-cupriferous pyrites.

Copper

Copper is also found in ores with little or no pyrites. The copper-bearing deposits may be grouped as follows: copper the only, or main, product of economic value; copper in pyritic ore, whose sulphur is also utilized; copper as a by-product from sulphuric nickel-zinc ores. Copper of this last type will be considered under the headings of 'nickel' and 'zinc'.

The copper deposits, like the cupriferous pyrites, are genetically connected with the eruptive rocks of the Caledonian mountain chain. The principal deposits are found in certain metallogenetic provinces in the Telemark, the Raipas, and the Porsanger formations. There are also the Leksdal deposits which occur in conjunction with the

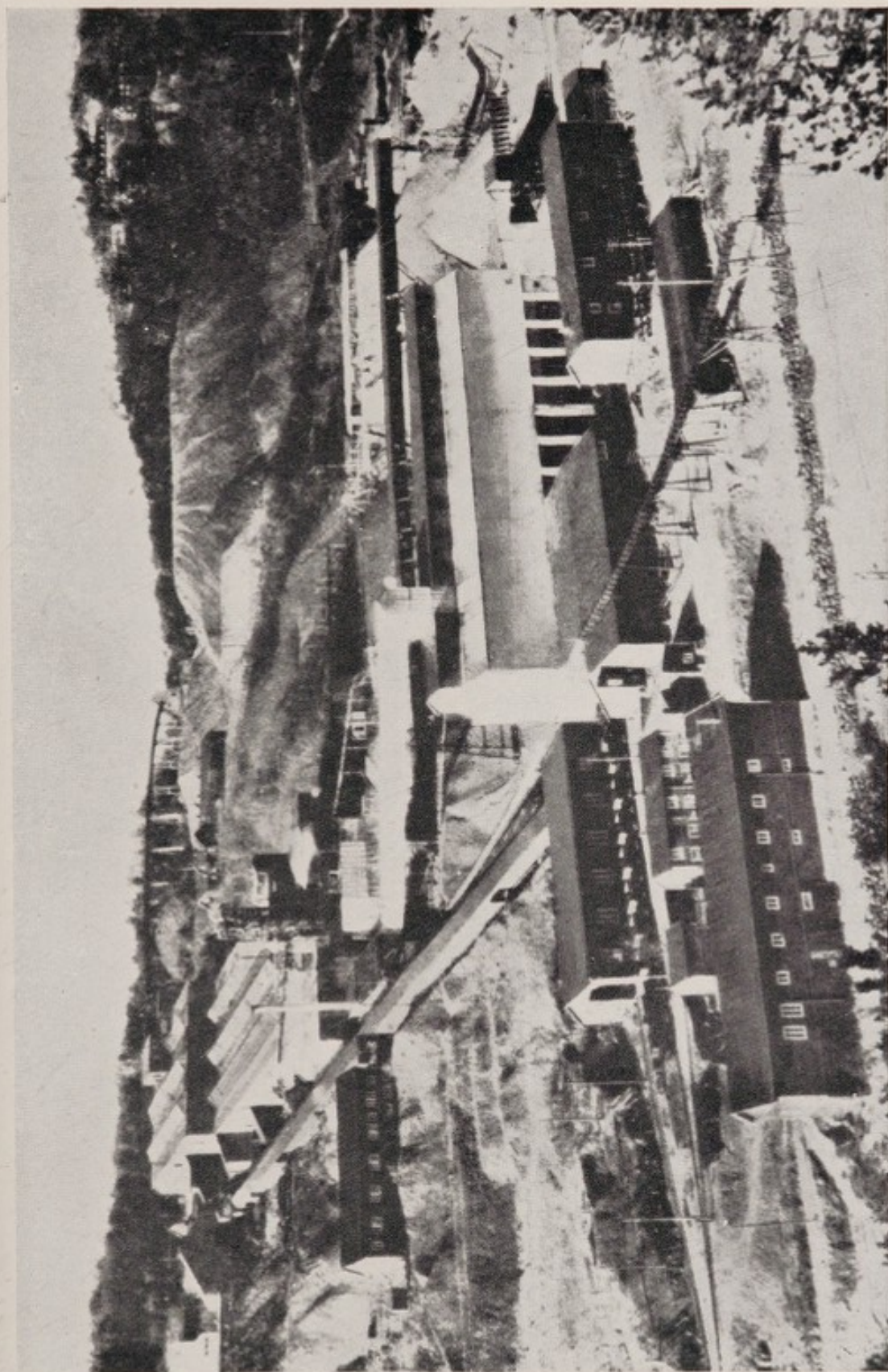


FIG. 29. *The Lökken copper pyrites mines*



metamorphosed greenstones to the south of the Raipas and Porsanger formations.

The numerous deposits of the Telemark formation constitute a well-defined metallogenetic province, with copper as the main metal, but also with deposits of molybdenite, bismuthinite, &c., and locally of silver and gold: there is an almost complete absence of pyrites and pyrrhotite. Most of the deposits, which occur within a broad border zone along the surrounding massif of younger granites, are of quite a different type from those found in the central and northern parts of the country. They generally occur as narrow veins with high-grade copper ores, but usually of little extent and width. The main deposits are at Lårdal, Åmdal, Dalne, Guldnes, and Hovin. The most important mines are at Åmdal, where work began in 1691 and has continued with many interruptions; they have been closed for long periods during this century, but in 1937 a fresh attempt was made by new owners with State assistance. The main vein of copper is over 1,400 metres in length and so far has yielded an average of 60 kgs. of copper per square metre of vein. The 10,000 tons of ore hitherto mined have yielded 8,000 tons of metallic copper. There are estimated to be a further 12,000 tons of ore.

The copper-mines at Lårdal, Dalne in Kviteseid, and Hovin on Tinnsjö have all been working during the present century. Silver and gold have been found with the copper at Dalne.

The ores of the Raipas district, in north Finnmark, are found in veins of metasomatic deposits. The most important of these are at Kvenangen, Kåfjord in Alten, Raipas, Porsa, and Reppefjord. All except the last have been extensively worked, but the mines are now idle. The Porsa, the last to be worked, produced a concentrate with a 22 per cent. copper content. The most northern deposit of this group, at Reppefjord, has never been worked.

The Porsanger deposits (east of the Raipas deposits) are very extensive. Many of them have never been worked and are scattered over an area of about 58 square miles. The copper ores, which are chiefly bornite and chalcocite, are partly impregnated in amphibolite and partly in quartz veins in the amphibolite. The Sjangel copper-mines farther south, most of which are on the Swedish side of the frontier, are of the same type.

The Leksdal deposits, which have a small copper content and are valueless for sulphur production, are found chiefly at Kåfjord in Lyngen, Birtavarre, Moskodalen, and Vaddas. Those at Vaddas, near Nordreisa, and at Birtavarre on the Lyngenfjord alone have been

worked. The Birtavarre mine, which produced annually about 400 tons of copper, closed finally in 1920. There are similar deposits at Hopen, immediately east of Bodö.

In central Norway there are deposits at Årdal and Åsoren, of a different type from the others mentioned and containing metallic copper. Visible gold has also been found in the quartz veins at Årdal. There are also copper-mines at Kvikne which have been worked during the present century.

See Appendix IX,¹ Table 2, for details of production of individual mines, and Table 3 for copper reserves.

Zinc

Zinc is found in the south near Oslo and in the north at Rana. The only Norwegian zinc mine which has been worked recently is at Mofjellet, Rana in Nordland. In 1937 it produced about 6,000 tons of zinc-ore concentrate, 525 tons of lead-ore concentrate, and some barytes.

Zinc deposits have been located at Konnerud near Drammen, Birkeland near Sande on the Sandefjord, Trag, Bamble, Namestad, Nittedal, Grua, and Glomsrudkollen near Modum. All have been worked during the present century, but have yielded little ore. The Grua mine, Lunner, was worked as recently as 1927. The mines at Birkeland produced zinc blend.

Norway imports a considerable amount of roasted zinc ores for treatment. The annual production of zinc amounts to about 45,000 tons, most of which is from imported ores. She also produces some zinc concentrates by the treatment of cupriforous pyrites. The following are the most important of these mines and their average annual production:

A/S Sulitjelma Gruber (at Sulitjelma)	. 6,700 tons	47 % zinc
A/S Foldals Verk (at Foldal) . . . . .	. 1,700 „	48 „
Nord-Norge A/S (at Rana) . . . . .	. 6,250 „	56 „
A/S Björkåsen Gruber (at Ballangen)	. 1,170 „	49 „

Nickel

Magnetic pyrites, containing 2 to 3 per cent. of nickel, is widely distributed throughout Norway, being found between Evje in the south and Senjen near Tromsö in the north. The main deposits worked are at Hosanger to the north of Bergen, Ringerik north-west of Oslo, Faeö

¹ *v.i.* pp. 358-9.

island near Haugesund, and Flåd (or Flåt). They are similar to those found at Sudbury, Canada, but much smaller. The Ringerik and Flåd mines work the oldest Archean rocks, and the other mines unclassified Archean rocks.

The Norwegian nickel-mines were worked in the nineteenth century until the discovery of the larger and richer Sudbury deposits. They were reopened at the beginning of the twentieth because of the greater demand for nickel and of the increased use of hydro-electric power for smelting. In 1910 a large nickel refinery was started at Kristiansand S., which produced about 800 tons of nickel and 500 tons of copper annually. The nickel was obtained largely from the mines at Flåd, Faeö, and Ringerik, about 75,000 tons of nickel ore being smelted each year. After the War of 1914-18 the production of nickel and nickel-ore ceased until 1928, when the Flåd mines and the Evje smelting-works were reopened. In 1929 the nickel refinery at Kristiansand S. was taken over by a Canadian company which extended the plant and increased production. This firm treats Norwegian nickel copper matte as well as imported foreign matte. In 1937 the refinery produced 6,739 tons of nickel and 3,456 tons of copper.

The Flåd mine at Evje has continued working since 1928. Recent annual production has been about 25,000 tons of smelting ore and flotation concentrate, smelted down by the Evje plant, where about 2,000 tons of nickel copper matte have yearly been produced. The same company works the mines at Lilland, Hosanger. In 1936 these mines produced 7,500 tons of flotation concentrate, which was sent to Evje for smelting.

The annual production of nickel is about 8,500 tons of metal, of which over 85 per cent. is from Canadian nickel matte and most of the rest from Norwegian ore.

Arsenical Pyrites

Deposits of arsenical pyrites have been found in several places. A few years ago it was mined at Listolli in Telemark. Deposits of gold-bearing arsenical pyrites found at Bindal, Nordland, originally gave hope of considerable development, which has not so far been realized.

Iron

The iron-mines represent a very considerable part of Norway's mineral wealth and industry and have become increasingly important

in recent years. At the beginning of the nineteenth century there were many Norwegian iron-works which reached the zenith of their output in 1841-50. By 1870, however, most were closed, and in 1900 only the Nes blast furnace was working, though it also soon closed down. Electric smelting was introduced successfully in 1920 and is used to-day for producing both pig-iron and steel. The export of iron-ore and concentrates has recently become more important than the production of iron because of the relatively low phosphorous content of the Norwegian ore. The iron content of the ore varies from 15 per cent. to about 55 per cent., but much of the ore mined has a content as low as 15-35 per cent. This content has, however, been increased recently by concentration methods, which may be said to have revolutionized the production of iron-ore in Norway. Concentration methods vary with the characteristics of the ore treated, but as most of the iron-ore worked is magnetite, the method most frequently employed is that of magnetic separation. This process frees the ores from gangue and produces a concentrate. Cheap hydro-electricity gives Norway advantages over other countries in the production of concentrates, &c. Her output of ore has increased from an annual average of 9,800 tons between 1841 and 1850 to 545,000 tons in 1913 and 1,500,000 tons in 1939.

Iron-ore is found in two main areas, the larger of which extends from Möre to the Finnish border, the smaller being round and near Arendal in the south. Magnetite is the commonest iron-ore, although there are also small quantities of hematite and titaniferous ores.

In the northern region magnetic ores have been located all along the coast. The most important deposits are at Fosdalen (near Malm), Elsfjord, Dunderland, Fagernes, Liland, Bogen, Folstad in the Lofoten islands, Lunkefjord in the Vesterålen islands, on the mainland near Tromsø, Burfjord, and Sydvaranger near Kirkenes. Of these the Elsfjord, Fagernes, Liland, Folstad, Lunkefjord, and Tromsø deposits have either only been worked for a short time or merely prospected.

Those at Fosdalen near Malm in Nord-Trøndelag are still extensive, although sinter has been exported for many years. In 1937 production was 184,000 tons of iron-ore sinter and about 3,800 tons of pyrites.

The Dunderland mine is in the Dunderland valley, about 14 miles north-east of Mo. It is connected with Gullsmedvik quay, at the head of the Nordranafjord, by a private mineral railway.¹ There was

¹ This line is being incorporated into the Nordland Railway.

no regular production until 1937, and in 1938 the output was 155,000 tons of concentrate, which yielded about 68 per cent. iron (hematite and magnetite) and 0.045 per cent. phosphorus. The total body of ore is estimated at 80,000,000 tons.

The Bogen mine, at Evenes on the north shore of the Ofotfjord and near the Liland deposits, was first started on a workers' profit-sharing basis. This scheme was a failure, and in 1936 the deposits were taken over by A/S Sydvaranger. The iron worked here contains 20 per cent. magnetite, a very little hematite, about 0.25 per cent. of phosphorus, and a good deal of sulphur. It is possible to produce annually about 8,000 tons of 68.3 per cent. iron concentrate.

The Burfjord mines, about 6 miles south of Alteidet on Kvenangenfjord, have a small output of ore containing 55-66 per cent. iron.

Most of the iron-ore mined in Norway comes from the extensive deposits at Sydvaranger, in the Pasvik peninsula. They cover about 40 square miles and are estimated to contain 100,000,000 tons of iron-ore. A/S Sydvaranger started production here in 1910. In 1913-15 the annual output reached about 550,000 tons of iron-ore, concentrates, and briquettes. The company, after passing through a difficult period, was reconstructed in 1927, since when production has increased, 732,000 tons of concentrate and briquettes being exported in 1937. Present operations are confined to an area of about 406,650 square yards near Bear lake, to the south of Kirkenes. The ores, which consist of low phosphorous magnetite with an iron content up to 50 per cent., are sent after working to Kirkenes by railway, where they are ground and passed through magnetic separators and so concentrated. The electricity used for these operations is generated by steam and diesel oils. Briquetted ore as well as concentrates containing 66-7 per cent. iron are produced. With a full labour force of 1,700 men there is an annual output of 420,000 tons of briquettes and 400,000 tons of concentrates. If less labour is available fewer tons of concentrates are produced, whereas the production of briquettes remains more or less stable. The labour employed in recent years has varied from 1,700 to 700 hands.

The ore deposits at Elsfjord, on an inlet of the Ranafjord, are small and contain only about 25 per cent. iron, but a concentrate of 70 per cent. iron could be produced. There are several deposits on the shores of the Ofotfjord besides the important Bogen mines. The largest are at Fagernes (on the south-east shore of the fjord) and at Liland (on the north shore of the fjord), besides extensive deposits south of the Horfjeld. The ore at Fagernes is fine-grained with only 20 per cent.

iron and over 1 per cent. phosphorus, while the ore at Liland is rich in manganese. The deposits at Folstad in the Lofoten islands and at Lunkefjord in the Vesterålen islands are magnetic with 50–56 per cent. iron and 0.05 per cent. phosphorus, while those opposite Tromsø contain only 15 per cent. iron as magnetite, 2 per cent. as hematite, with 0.2 per cent. phosphorus.

The iron-ore deposits in southern Norway are less important than those in the north. The largest are at Klodeberg (Oyestad) and Kjenlid, both near Arendal, at Langöy near Kragerö, and in Telemark at Nisserdal, Ulefoss, Holla, and Tinnfoss. None were being worked in 1939. Those at Klodeberg, Kjenlid, and Langöy, where there was some activity at the mines until 1922, contain 43 per cent. iron and about 0.02 per cent. phosphorus.

The deposits at Nisserdal are larger than the three just mentioned. The ore contains 55 per cent. iron and 1.75 per cent. phosphorus. The mines were, until recently, considered to be inaccessible, but there is now a good road from Nisserdal to Arendal and Oslo, and a narrow-gauge railway only $6\frac{3}{4}$ miles away at Treungen. The small deposits at Tinnfoss and Ulefoss were worked until a few years ago.

Besides mines producing magnetite and hematite ore, titaniferous ore deposits have been worked at Sogndal in Dalene and at Rödsand on the Langfjord in Romsdal. The Dalene mine was open in the nineteenth century, but not until the ore began to be used in white paint was any important mining undertaken. A new plant was installed in 1935, and in 1937 about 67,000 tons of ilmenite sinter and 16,900 tons of magnetite sinter were produced. The Rödsand deposits, which have been worked since 1919, produced 43,000 tons of sinter in 1937.

Molybdenite

Molybdenite has been mined for over a hundred years in Norway, but it was only during the War of 1914–18 that its working assumed the proportions of a proper mining industry. Several mines were then opened and the value of production in 1917 exceeded 4 million kr. After the war the price of molybdenite fell and mining for this ore almost ceased for a time. In 1930 more intensive mining was again started, and Norway now produces about 700 tons annually out of a world total of 16,000 tons.

The Knabeheia molybdenite deposits at Fjotland, Vest Agder, are the richest and most extensive. The only mines at present open are the Knabeheia mines, and the Laksådal at Gildeskål in the north.

The Knabeheia mines have been worked for over a hundred years by different companies. In 1930 the Knaben Molybdenite Mines Ltd. was formed, installed a new plant, and made many improvements. Annual production has gradually increased since then to over 700 tons of pure molybdenite ore; it could be increased considerably if the plant were expanded. The Laksådal mine only began operations in 1937.

Besides these two mines now working there are others in southern Norway which have worked for short periods, though none permanently. They are (from west to east) the Gursli molybdenite field, Grimdum in Audnedal, Kobbernuten in Setesdal, and Dalen, Eidsborg, Haugs, and Holmen in Telemark. The most important mines which have been worked in eastern Norway are in the Numedal, and at Lier and Hurum. There are also molybdenite deposits at Flotorp, about 35 miles north-east of Kristiansand S.

Silver

The only silver deposits worked to-day are at the State-owned Kongsberg mines, although private companies at the beginning of the present century mined small deposits at Vinoren and in the Svenningdal in Nordland.

The mines at Kongsberg have been worked since 1623, and from 1623 to 1938 produced 1,260,000 kg. of silver with a total gross value of about 170 million kr. During this century the mines have passed through difficult times, and in spite of improvements in mining and smelting processes, they have not paid. Between 1910 and 1930 production averaged about 10,000 kg. annually. In recent years the veins have not proved so satisfactory, and in 1936 production fell to 6,340 kg., but latterly several good veins have been discovered, so that production is probably assured for some time to come.

Lead

Lead has been found and smelted in Norway, but the quantity produced is too small to be of economic or industrial importance. Galena occurs in the Konnerud or Jarlsberg mines at Skoger near Drammen, but does not seem to be worked at the present time (1939).

Bismuth

Bismuth is obtained (1939) from the Bleka mines, Telemark. Mines were recently worked at Sauherad in Telemark and at Kjenner, near Lier, north of Drammen.

Cobalt

Cobalt was mined at Modum, near Vikesund (on the Dramselv), by a German company from about 1830 until 1898, when the works finally closed down. The mines employed about 1,000 men. There are also other small deposits, but the ore is low-grade and this industry is not likely to be important.

Titanium (Rutile)

Titanium ore is found in the form of rutile (nearly pure titanium dioxide) in southern Norway. The most important mines are at Vegårshei in Aust-Agder, and near Risør and Kragerø. These mines have dressing plants to treat the ore. The mine at Lindvikkollen (Skatøy) near Kragerø has been worked for the last thirty years. The annual production of titanium in Norway in recent years has been about 100 tons. The refined ore is used for the manufacture of dyes and pigments.

Titaniferous iron ores: *see under 'iron'*.

Manganese

Manganese deposits have been worked in the present century not far from Kristiansand S. They have also been reported at Lake Storsjön, the total potential production being estimated at 30,000 tons. Although no manganese was mined in Norway in 1938, about 66,000 tons of various grades were produced annually from imported ores.

Magnesite

Magnesite is mined at Morud and Snarum, north-west of Vikesund. At one time as much as 2,500 tons of crude magnesite were produced annually, but now the Norsk Magnesit Industri only produces about 1,000 tons a year.

Wolfram

Recently wolfram ore has been mined as an experiment at Ösdal in Dalene, not far from Egersund.

Chrome

Chromite has been found in several places in serpentine rocks. The most important deposits are at Feragen near Röros and near Trondheim. They were both worked during the War of 1914-18, 3,000 tons

being produced in 1916 and 1917. After the War activity ceased and little mining was done in 1938. The ores found in these deposits are unsuitable for the production of ferro-chromium. Before the present war, however, chrome was imported and worked at Älvik.

Gold

At Bleka in Svartdal (Telemark) tests were made for gold in 1933. These were successful enough to allow the mining to continue, which it has done to the present day, with partial State aid. Some gold has been extracted as well as bismuth and copper ore. The Eidsvoll deposits have also been worked without success. Attempts have been made in Finnmark to wash for alluvial gold, but with no permanent results.

Thorite

Thorite, containing the rare mineral thorium, has been found in scattered rocks between Langesund and Arendal. It was worked during the nineteenth century, and the total production is reputed to have been worth as much as 1,000,000 kr.

Coal

The only coal found in Norway is on the island of Andøy, one of the Vesterålen islands. The deposits are poor, and form a seam of cannel coal about 3 feet thick. The difficulties of mining, and the high ash content of the coal, make its working impracticable.

QUARRIES

QUARRYING is an ancient industry in Norway, but until the middle of the nineteenth century it was commercially unimportant. The export of granite began in the eighteen-seventies, and 2,000 tons were exported in 1872, 50,000 tons in 1893, and 234,000 tons in 1913. After the War of 1914-18 there was a slump in the stone export trade which did not improve until 1930, since when conditions have grown steadily better. In 1937 588,000 tons of granite blocks and 63,024,000 tons of granite setts were exported. Paving setts and kerb-stones are the main exports. Until recently, the Norwegians rarely used stone for building purposes. About 3,000 persons are employed in the stone industry, which is little aided by machinery, so that most quarrying is by manual labour.

Statistics of the number of quarries, the number of workers

employed in the quarries, and the value of the output of the quarries in 1938 are given in Appendix VIII (*v.i.* p. 357).

Granite. Norwegian granite is easy to quarry owing to its regular lines of jointing and above all to its level 'floors', or horizontal joints. Granite is quarried chiefly in the Östfold county, on either side of the Dramsfjord, and in the districts to the north and east of Oslo. Ninety to ninety-five per cent. of the granite exported comes from Östfold. Drammen granite, which is coarser-grained and redder in colour than the Östfold rock, is much used for bridges throughout Norway. The Oslo granite is mostly used by the building trade in Oslo.

Labradorite. Labradorite, a type of syenite, is quarried near Tönsberg, Sandefjord, and Larvik. This stone, which has a bluish-green opalescence, is expensive to quarry and work, and is mainly used for tombstones and other monuments.

Feldspar. Feldspar, occurring in coarse-grained lodes along with quartz and mica, is worked at numerous places in Norway. In the south it is quarried in the southern districts of Setesdal, in the coast region between Bamble and Arendal, and in the county of Östfold. In the north it is quarried at Drag (Hundholm) and Tysfjord. In 1913 40,842 tons of feldspar were quarried. In 1937 24,221 tons of rock feldspar were quarried and 9,998 tons were pulverized. Some quartz and mica is produced along with the feldspar.

Graphite. There are several graphite works in Norway, the oldest and largest being the Skaland at Berg, Senja island. This company has produced about 3,000 tons annually in recent years. Another company, managed by Minerals Ltd., Holandsfjord in Nordland, has recently produced about 900 tons annually. In 1936 the total amounted to about 3,700 tons and in 1937 to 3,900 tons.

Marble. Marble of various colours is found in Nordland, but is not quarried much at the present time.

Apatite. Apatite was mined during the War of 1914-18 at Ödegården and Bamble, but has not been worked since.

Soapstone and Talc. Soapstone has been much quarried near Trondheim, where it has been used in the construction of the cathedral, and in the Gudbrandsdal. The Östlandske Stensport A/S produces considerable quantities of soapstone from the Bårstad quarries at Lalm (Våga), and also from the neighbouring Fredheim quarry. Talc is worked at different places along the Sognefjord. These stones are used in the construction of certain types of smelting furnaces, and for such purposes are exported throughout the world.

Fluorspar. Fluorspar is quarried at Tveitestå, Bandak in Telemark, where over 1,000 tons are produced annually. It is also quarried at Meheia near Kongsberg.

Slate. Slate outcrops over large areas in Norway, and is quarried for roofing purposes.

Opdal flagstones. These occur in naturally cloven flags and are exported to western European countries.

CHAPTER XII

INDUSTRY

THE timber industry is described in Chapter XIV, whilst the smelting and the treatment of minerals mined in Norway are discussed in Chapter XII. Appendix VIII (*v.i.* p. 357) gives statistics of the numbers of establishments, the number of employees, and the total value of production of the industries described in this chapter. The location of the electro-metallurgical and chemical industries is shown on Map 46.

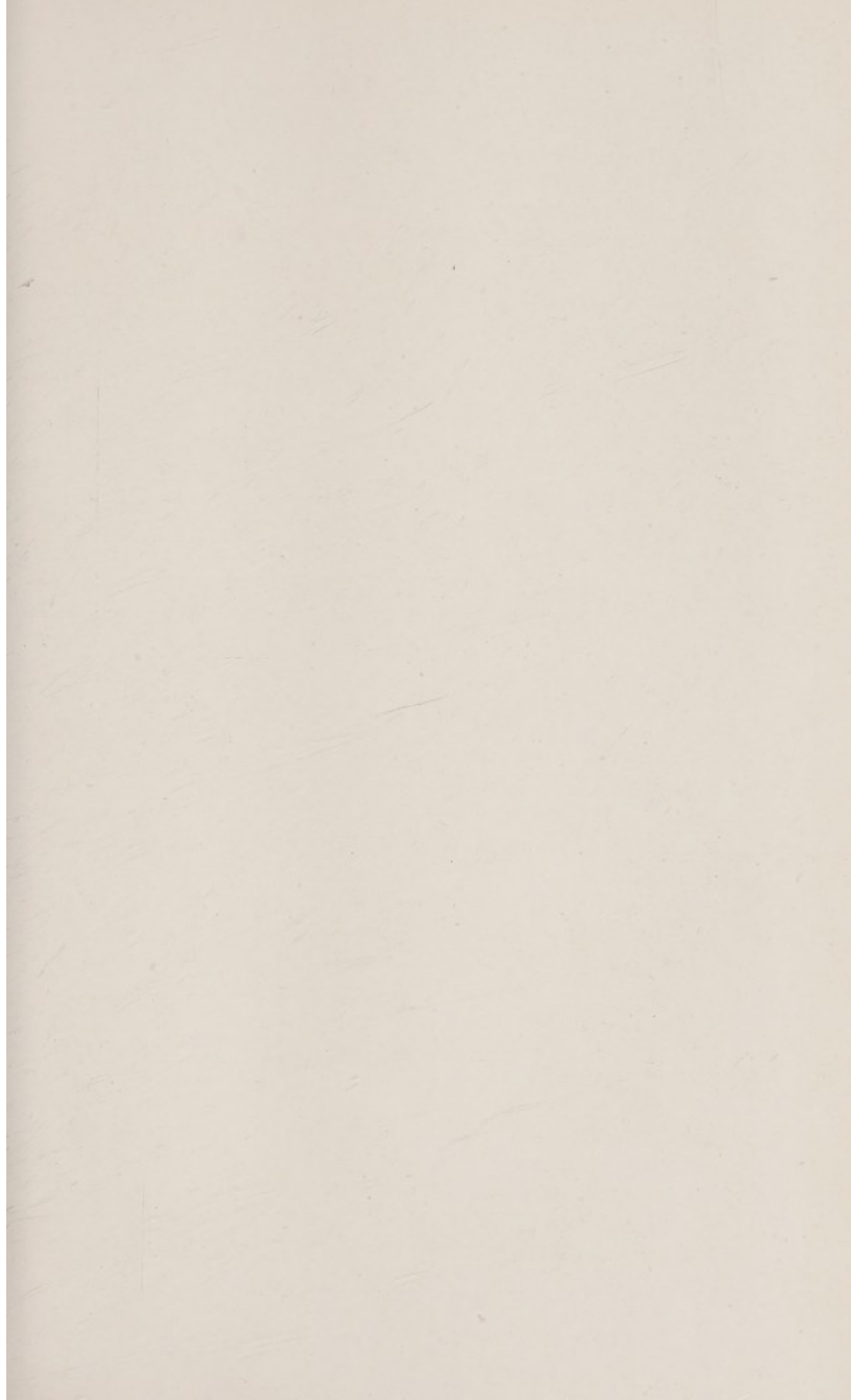
Location of Industry

The greatest industrial activity is found in the counties of Akershus, Östfold, Rogaland, Møre and Romsdal, Buskerud, Vestfold and Sör-Trøndelag, and especially in and near the towns of Oslo, Bergen, Fredrikstad, Sarpsborg, Drammen, Stavanger, and Halden. Other relatively important industrial centres include Skien, Porsgrunn, Trondheim, Kristiansand S., Larvik, Tönsberg, Ålesund, Arendal, and Kristiansund N. Most of the country's industry is therefore carried on near or on the coasts, south of a line extending between Bergen, Oslo, and the Swedish frontier. The districts of Oslo and Bergen have machine and textile industries of great importance, while those of Fredrikstad, Sarpsborg, and Drammen are centres of wood sawing and planing. Drammen and Skien are the principal centres of paper-making as well as being important, together with Hønefoss, for the production of wood-pulp. Stavanger, Haugesund, Bergen, Ålesund, Kristiansund N., Trondheim, Bodö, Harstad, Svolvær, Tromsø, Hammerfest, and Vardö have important fish industries. Stavanger also specializes in the canning of food.

MANUFACTURING INDUSTRIES

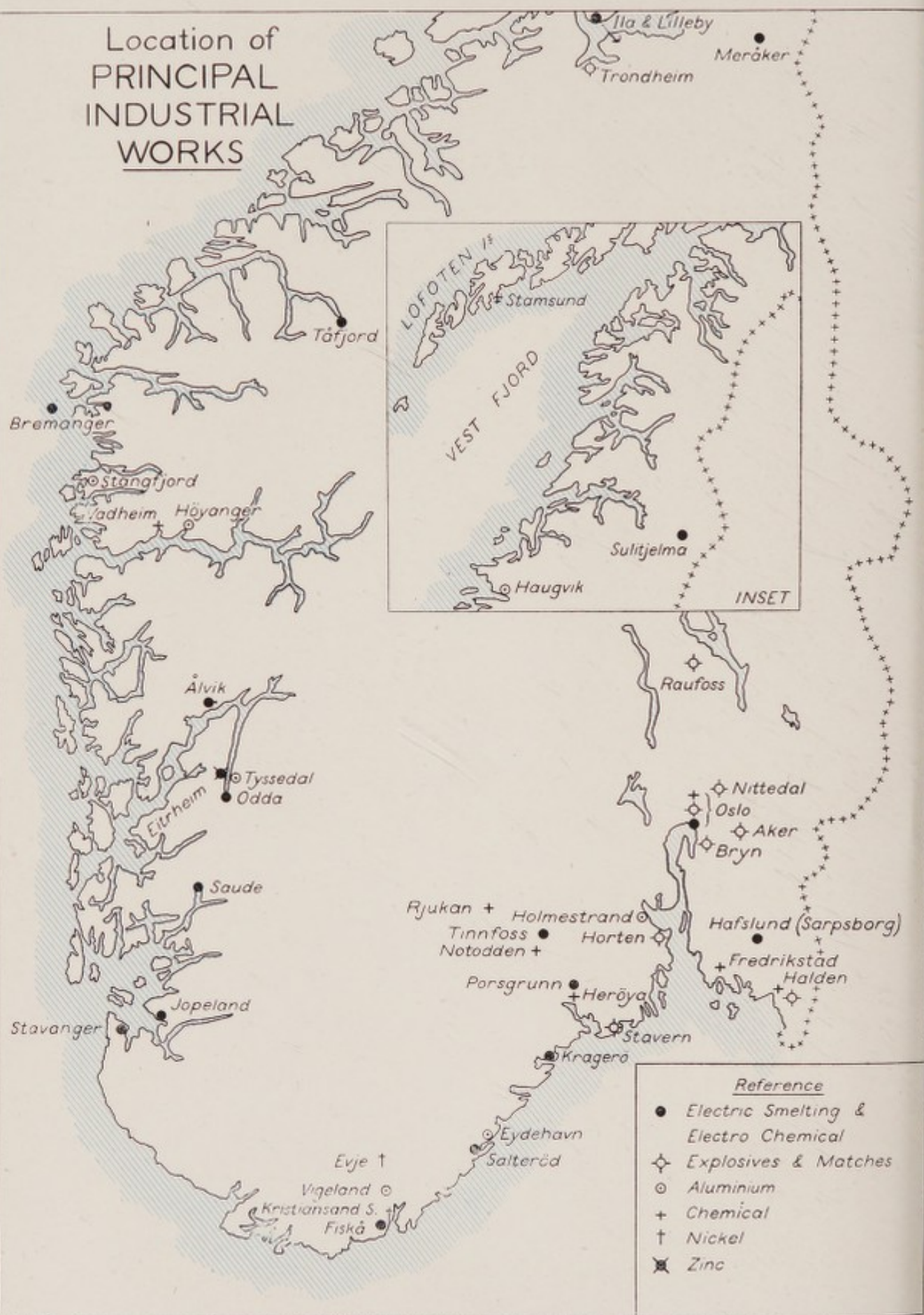
Aluminium Industry

Norway, with production in 1938 of 28,900 tons, was the sixth greatest producer of aluminium in the world. In 1939 she had six plants with an annual capacity of 40,000 tons, although their power resources would permit the trebling of the current output. Norway manufactures aluminium despite the fact that she has to import the necessary raw materials, because the conversion of bauxite and



MAP 46

Location of PRINCIPAL INDUSTRIAL WORKS



alumina into aluminium requires such an excessively large quantity of power that it would be impracticable to use thermal power. The country's abundant supply of hydro-electricity, therefore, is invaluable in the production of aluminium, and it is because of this that the industry has become established in Norway and has attracted foreign capital.

The aluminium plants are at Höyanger, Vigeland, Stangfjord on the Sunnfjord, Eydehavn, Tyssedal, and Haugvik on the Glomfjord, of which the last five are only smelters; that is to say, they transform the intermediate product, aluminium oxide (alumina), into aluminium. The Norsk Aluminium Company at Höyanger on the Sognefjord produces annually 8,000–9,000 tons of aluminium, of which about 1,500 tons are consumed in Norway. This company also has here electrode works and a plant for the production of aluminium oxide which uses the electro-thermic and chemical method enabling aluminium oxide and pig aluminium to be produced at the same works. The Höyanger plant has two power stations aggregating 45,000 h.p., with a reserve of 40,000 h.p., unharnessed.

The plants at Vigeland and on the Sunnfjord are both owned by companies controlled by the British Aluminium Co. Ltd. The Vigeland Brug plant, near Kristiansand S., produces annually 2,400–4,000 tons aluminium, using its own water-power supply of about 15,500 h.p. The works at Stangfjord on the Sunnfjord produce about 500–1,000 tons annually, and have at their disposal about 3,000 h.p. Those at Eydehavn near Arendal, and at Tyssedal are operated by the Norske Nitridakteiselskap, which is partly owned by the British Aluminium Co. and the Aluminium Company of Canada. The Eydehavn works produce annually about 6,000 tons and lease 25,000 h.p., while the Tyssedal works produce 1,000 tons of aluminium and 4,000 tons of alumina, and lease 45,000 h.p. The Haugvik plant, Glomfjord, is worked by A/S Haugvik Smeltverk, which is owned by a British company. These works have an annual production of about 8,000 tons, the power being supplied by the Glomfjord power station near by. (For new factories at Årdal, *see* Vol. ii, p. 192.)

The Norsk Aluminium Company, which is the only company whose activity is not based solely on the export of its output, also produces finished and semi-finished aluminium goods. Norway supplies Sweden and Denmark with finished goods, while her own consumption of finished and semi-finished aluminium exceeded 2,500 tons in 1938.

The Norsk Aluminium Industri, Holmestrand, a subsidiary of the

Norsk Aluminium Company, is the largest producer of finished and semi-finished goods. In 1936-7 this subsidiary consumed about 40 per cent. of the aluminium produced at Höyanger. The company also owns Norway's only aluminium rolling mill, as well as a chromium-plating shop for aluminium and an anodizing and colouring shop. The Norsk Aluminium Industri is the chief producer of kitchen utensils, tanks for breweries and dairies, and various other types of containers. Other firms engaged in the production of semi-finished aluminium goods such as tubes, wires, bars, bolts, mouldings, cables, and such-like, are found at Porsgrunn, Raufoss, Drammen, and Oslo. Vats are made in Oslo, Fredrikstad, and Trondheim, and kitchen utensils at Bergen, Halden, and Moss. Aluminium bus, rail, car, and tramcar chassis are made at Strømmen. There are also aircraft factories at Horten and Strømmen using aluminium.

Zinc Industry

The Norske Zinkkompani's works at Eitrheim, near Tyssedal, is the only important one in Norway which treats zinc ore. This company produces electrolytic zinc with sulphide of zinc as the raw material. The ore is mainly imported, but small quantities of Norwegian ores from Sulitjelma, Foldal, Ballangen, and Mo in Rana are also used. The output is about 45,000 tons of zinc annually. The electro-thermal zinc works at Jösingfjord and at Sundlökken ceased operations over ten years ago.

Nickel Industry

The only important nickel refinery in Norway is at Kristiansand S. This operated in conjunction with the nickel mines and smelting-works at Evje until 1929, when it was bought by a Canadian firm. It now handles nickel matte imported from Canada as well as small quantities of nickel from the Norwegian mines at Hosanger and Evje. The annual capacity of the refinery (1939) is about 8,500 tons of electrolytic nickel and 5,000 tons of electrolytic copper as well as small amounts of silver, gold, platinum, palladium, and platinum by-products. The refinery produces nickel anodes for the plating industry, nickel coin blanks, and rolled strips, while in addition liquid sulphur dioxide is produced from waste gases.

Electric Smelting and Electro-Chemical Industries

There are nineteen major electric smelting-works in Norway besides those already mentioned. Some produce more than one product,

and frequently change from one product to another. It is therefore difficult to state precisely how many are engaged in individual processes, but ferro-silicon is produced by about ten of them, calcium carbide by four, iron and steel by three, ferro-chrome by two, silicon carbide and copper each by one. The aggregate power capacity of these plants is about 250,000 kW., but the output of many of them was below capacity in 1938. The production of ferro-alloys in 1938 amounted to about 150,000 tons, while that of calcium carbide in 1937 amounted to about 70,000 tons. Norway's great quantities of cheap hydro-electricity have encouraged the growth of the electric-smelting industry despite the fact that most of the raw materials have to be imported.

Ferro-Silicon. Ferro-silicon is electrically smelted at Hafslund, Porsgrunn, Tinnfoss, Fiskå, Stavanger, Sauda, Ålvik, Tafjord, Ila and Lilleby, and Meråker. The first three places are all in the Oslo region. The Aktieselskabet Hafslund, near Sarpsborg, produces 25,000 tons of ferro-silicon (45 per cent. silicon) and 40,000 tons of carbide, power being supplied by the station at Sarpsborg. The Porsgrunn Elektro Metalurgiske A/S, at Roligheten near Porsgrunn, produces annually about 12,000 tons of ferro-silicon (45 per cent. silicon) and a small quantity of electric pig-iron, and has a power consumption of 10,000 h.p. The Tinnfoss Jernverk, near Notodden, produces annually about 14,000 tons of ferro-silicon. The factory at Fiskå, near Kristiansand S., produces about 10,000 tons of ferro-silicon.

The Sauda, Ålvik, and Tafjord works are all on the south-west coast. Sauda, at the head of a branch of the Boknfjord, manufactures annually 50,000 tons of ferro-silicon and silico-manganese, as well as silico-spiegel, zirconium alloys, calcium-manganese-silicon, calcium-silicon, manganese metal, and manganese copper. The company has its own power station, which also meets the needs of the neighbouring region (Fig. 30). The A/S Bjölvefossen at Indre Ålvik, Hardangerfjord, which is controlled by British and Norwegian interests, has an average annual production of 17,000 tons of ferro-silicon (45 per cent. silicon) and 6,000–7,000 tons of ferro-chrome. Power is supplied by an adjoining hydro-electric station, which has an output of 60,000 h.p. The Tafjord works, near Ålesund, manufacture about 6,000 tons of ferro-silicon annually. The Ila and Lilleby and Meråker works are all in the Trondheim depression. The Ila and Lilleby Smeltverker produce about 6,000 tons of ferro-silicon annually. The Meråker plant, 50 miles due east of Trondheim, is worked by A/S Meråker Smeltverk, which is controlled by Canadian and American interests.

Its average annual production is about 12,000 tons of ferro-chrome, 20,000 tons of calcium carbide, and 5,000 tons of ferro-silicon.

Ferro-chrome. Ferro-chrome is produced at Ålvik and Meråker (see Ferro-silicon above). It is possible that ferro-chrome is also being produced at Odda.

Iron, Steel, and Copper. Electric stainless steel, tool-steel, and tools are manufactured by the Stavanger Elektro-Stålverk electric smelting factory at Jopeland. This company produces annually about 6,000 tons of this type of steel and steel goods. The Kristiana Spiegerverk, Oslo, produces annually about 15,000 tons of high-grade electric pig-iron, having a power capacity of approximately 4,500 kW. The Porsgrunn company produces a small quantity of electric pig-iron (see Ferro-silicon above). The Bremanger Kraftselskap, near the entrance to the Nordfjord, has an annual production of about 25,000–30,000 tons of electric pig-iron from a 6,000 kW. furnace. The Sulitjelma copper-mines also have an electric smelting furnace.

Calcium Carbide. Calcium carbide is manufactured at Hafslund (see Ferro-silicon above), Tinnfoss (Notodden), Odda, Meråker (see Ferro-silicon above), and probably at Salteröd, Kragerö, and Burregård. The Notodden Calcium Carbide Fabrik A/S produces annually 8,000 tons of carbide and 1,000 tons of electrodes. The Odda Smeltverk, Sörfjord, manufactures annually about 60,000 tons of calcium carbide, part of which is converted into cyanamide (Fig. 31). The power for this factory comes from Tyssedal. The Salteröd and Kragerö plants are small. The Burregård factory produces either calcium carbide or ferro-silicon.

Chemical Industry

Norway is an important producer of chemicals largely because of her abundant and cheap supply of water power, and because of her improved processes and new inventions. The largest chemical factories are at Notodden, Rjukan, and Herøya in Fierfjord near Porsgrunn. A wide range of chemicals are manufactured at these factories, all based on the fixation of nitrogen from the atmosphere. The Haber Bosch process which requires pure hydrogen and pure nitrogen is generally used. The principal products from this source are cyanamide, calcium nitrate, nitric acid, nitrate of ammonia, liquid ammonia, nitrate of soda, and sulphate of ammonia. In addition the following chemical products are manufactured as derivatives and in conjunction with the above-mentioned chemicals: pure hydrogen, pure oxygen, calcium carbide, phosphoric acid, deuterium oxide, silicon carbide,



FIG. 30. Sauda. *A fjord-side electro-metallurgical plant with power station*



FIG. 31. Odda. *The electro-chemical works at the head of the Sörfjord*



sulphuric acid, chlorine, sodium carbonate, caustic soda, sodium phosphorous, super-phosphates, dry ice, explosives including calnitro, matches, and wood-tar. Most of the nitrous products are either used as fertilizers or for explosives. The Rjukan factory produces 200,000 tons of calcium nitrate (saltpetre) a year and 100,000 tons of nitrogen as well as smaller quantities of chemicals of the types already mentioned. The Notodden factory produces 20,000 tons of nitrate of ammonia and 50,000 tons of anhydrous ammonia as well as other chemical products, including saltpetre. The Herøya (Porsgrunn) factory manufactures annually 250,000 tons of calcium nitrate (saltpetre), 75,000 tons of sulphate of ammonia, as well as dolnitro and phosphate fertilizers. At Vemork (Rjukan) 100,000 tons of hydrogen, 100,000 tons of oxygen, and 180,000 tons of distilled water are produced annually.

In addition to the heavy products made by electro-chemical and thermal processes the following are also manufactured in Norway: red and white phosphorus, caustic soda, soda crystals, electrolytic sodium, chlorine, oxygen and hydrogen, carbon dioxide, super-phosphate, sulphuric acid, and iodine. Of these, phosphorus is made near Fredrikstad, caustic soda and soda crystals at Halden, metallic sodium at Vadheim, and iodine at Oslo and Stamsund.

Explosives and Match Industries

The Norwegian production of explosives is considerable, mainly because the mining and quarrying industries require large quantities. Statistics of the total production, however, are kept secret.

The general range of explosives manufactured in Norway include the following: T.N.T., blasting gelatine, safety mining explosives, dynamite of all kinds, nitro-propellents, black powder, gun-cotton, pyroxylin, cartridges, detonators, and fuses. The Norsk Sprengstoff-industri A/S, Oslo, is the most important explosive undertaking, with four subsidiaries in and near Oslo and one in Trondheim. At the State-owned factory at Raufoss (SW. of Gjøvik) artillery and S.A.A. is manufactured in sufficient quantity to meet peace-time requirements and to furnish an export surplus of S.A.A. The factory is said to turn out 60 million rounds per annum, and employs about 700 hands. The Norma Projektilfabrik, Oslo, a private company, produces annually 30,000 rounds of S.A.A. and sporting ammunition. The State also owns a shell-filling station and explosives research institute at Horten. There are numerous other explosives factories throughout southern Norway.

Matches are made by Bryn-Halden and Nittedals Taendstikfabrik, Oslo, which operates at Bryn near Oslo, at Halden, Nittedal, Aker on the eastern outskirts of Oslo, and at Stavern to the south of Larvik.

Engineering and Shipbuilding Industries

The Norwegian engineering and metal-working industries are scattered throughout the country, especially along the coast and in the districts around Oslo. They are of national importance since they employ more people and have a larger wages bill than any other industry. The mechanical engineering industry is somewhat limited in scope and is largely dependent on imported rolled steel castings and forgings and other semi-manufactures. It specializes in the machinery required by national industries such as agriculture, paper and wood pulp, and fish canning, but exports 15 per cent. of its production.

Shipbuilding is its most important branch, although the greater part of Norwegian tonnage is constructed in foreign yards. Ships of between 1,000 and 4,000 tons are the most usual type built. These are used for the timber trade, fruit-carrying, general cargo, and passenger ships both for the coastal and North Sea trade. Others are whaling-ships, ferries, fishing-craft and lighters, and at Oslo motor tankers up to 10,000 tons. Most Norwegian shipyards, however, are primarily engaged in repair work.

The chief shipbuilding firms in Norway are:

Ålesund.	Liaaen. A.M., Skibsverft O.G., Mekaniske Verksted.
Arendal.	Pusnes Stöberi & Mekaniske Verksted.
Bergen.	Bergens Mekaniske Verksted A/S. Mjellem & Karlsons Mek. Verksted & Patent-Slipperi A/S.
Brevik.	Trosvik Mekaniske Verksted A/S.
Fredrikstad.	Fredrikstad Mekaniske Verksted A/S. Glommens Mekaniske Verksted A/S.
Greåker.	Sarpsborg Mekaniske Verksted A/S.
Harstad.	Kaarbos Mekaniske Verksted A/S.
Kragerö.	Kragerö Mekaniske Verksted.
Kristiansand S.	Kristiansands Mekaniske Verksted A/S.
Kristiansund N.	A/S Storviks Mekaniske Verksted.
Langesund.	Langesunds Mekaniske Verksted A/S.
Moss.	Moss Mekaniske Verksted. Moss Verft A/S.
Oslo.	Akers Mekaniske Verksted A/S. Nylands Verksted.
Porsgrunn.	Porsgrunns Mekaniske Verksted.

Risör.	Holmens Verft.
Sandefjord.	Framnes Mekaniske Verksted A/S.
Stavanger.	Rosenberg Mekaniske Verksted A/S.
Tönsberg.	Kaldnaes Mekaniske Verksted.
Trondheim.	Orens Mekaniske Verksted.
	Trondheims Mekaniske Verksted.

Small boats are built at Grimstad.

For further particulars *see* under individual ports, Volume II.

Oslo, Bergen, Trondheim, Drammen, Fredrikstad, and Kristiansand S. are the chief centres for the production of machinery, while Stavanger, Ålesund, Arendal, Moss, Porsgrunn, Sandefjord, Skien, Sarpsborg, and Tönsberg are centres of less importance. The following are the principal types of machinery made in Norway: machine tools, internal-combustion engines, steam-engines, locomotives (steam and electric), and hydro-electric turbines; machinery and apparatus for mines, iron-works, electro-chemical factories, rubber plants, saw-mills, paper-mills, wood-pulp factories, the food and drink industries, floating whale-factories, whaling-stations, herring-oil and herring-meal plants, refrigerating plants and agriculture. The turbine industry is important since Norwegian turbines are exported and have a world-wide reputation. Giant turbines of 40,000 h.p. are manufactured, and some are designed for waterheads up to 3,000 feet. This industry is located chiefly at Oslo and Stavanger. The apparatus for whaling-factories is also exported.

The construction of bridges and cranes forms an important branch of the mechanical industry. Cranes are made chiefly at Oslo, Bergen, Arendal, Drammen, Fredrikstad, and Halden.

Iron, steel, and other metal foundries, especially in and near Oslo, are prominent in the mechanical industry. They produce castings for the turbine, motor, shipbuilding, cement, mining, and wood-working industries, as well as special castings for crushing parts, rudder posts and propellers, domestic stoves, general trade castings, and plumbing goods.

The Norwegian electrical industry makes cooking and heating apparatus, wires, cables, transformers, motors, generators, electric locomotives, high- and low-frequency equipment, current limitators, measuring instruments, and incandescent lamps.

There is a large iron and steel rolling works near Oslo which produces iron bars, sheets, rails, and wire nails. Fish-hooks, wire fencing, bolts, nails, screws, axes, spades, and other tools are also manufactured extensively in Norway.

Textile and Clothing Industries

The textile industry, which is comparatively small, employing under 13,000 people, depends on imports for all the raw cotton and over one-third of the raw wool used, and can only satisfy about 35 per cent. of the demand for cotton yarn and 50 per cent. of the cloth required in the country; but the production of woollen yarn and cloth is sufficient to meet 70 per cent. of the demand.

Oslo is by far the most important textile centre, especially for cotton goods, though works of considerable size are in and near Bergen (suburbs of Hillevåg, Espeland, Fana, Ytre Arne, Nesttun, Hop, and Haus), and others are at Drammen, Fredrikstad, Mandal, Moss, Kristiansand S., Trondheim, Tönsberg, and in the Stavanger area chiefly at Sandnes. Wool spinning and weaving is carried on in factories of varying size and as a cottage industry, particularly in Jaeren and Rogaland and in the west coast districts between Haugesund and Trondheim. Halden is one of the most important centres of the cotton industry. Clothing is made principally in and near Bergen and Oslo. The A/S Kunstsilkefabrikken, Notodden, have recently commenced the manufacture of rayon from locally produced cellulose.

There are twenty rubber-goods factories, including one of some importance for waterproof clothing at Moss, others at Askim where 1,200 men are employed, and at Oslo. There are numerous tanneries in Norway along the coast, especially in the far north and in the southwest, but they are dependent on imported hides. There are about 85 boot and shoe factories and small workshops in the country, the largest being at Oslo, Tönsberg, and Halden.

No flax is grown in Norway, and the country's requirements of linen, hemp, and jute goods are mostly imported in a finished state. Hemp- and manilla-rope is manufactured at Bergen and along the coast to the north and south of the town, chiefly at Ålesund, Kristiansand S., and Mandal. This industry is entirely dependent on imported materials.

Brick, Pottery, and Glass Industries

Bricks and tile works have increased in number during the present century with the growing use of bricks instead of wood in buildings. The chief centres of the industry are Fredrikstad, Oslo, Sandnes, Trondheim, Skien, Rakkestad, Holmedal, Sarpsborg, and Solbergelv.

Porcelain is made at Fredrikstad and Porsgrunn, china (faience) and pottery at Egersund, and china at Sandnes. The principal glass-works are in and near Oslo, at Drammen, Moss, Jevnaker near Hønefoss, Magnor and Flesland not far from Bergen.

Foodstuffs

There are over 800 flour-mills, generally small and in rural areas, using both home-grown and imported cereals. Bergen, Oslo, Stavanger, and Sandnes are the principal milling-centres.

Recently the number of dairies, co-operative and otherwise, has increased. They are chiefly in the Oslo region, along the east side of the Oslofjord, along the west coast north and south of Bergen, and in a lesser degree in the Trondheim depression. There are, however, some in Nordland and Troms at the heads of the fjords and in the more sheltered areas. In 1936 a total of 602,904 tons of cows' and goats' milk were delivered to about 600 dairies; 594,722 tons being cows' milk, which is about 44 per cent. of the total production of cows' milk. In 1936 the co-operative dairies produced 11,379 tons of butter, 18,123 tons of cheese of various kinds, and 3,158 tons of casein.¹ Tinned milk of various types is produced and exported, being canned at Moss, Holmestrand, and in the Oslofjord region generally. Margarine is also manufactured in 72 factories in Norway. Butter, however, is mixed with margarine by law. In 1937 6,819 tons of butter were mixed into margarine, representing 12.6 per cent. of the margarine produced in the country.

The canning of foods, especially of fish products, is one of the most important of the food industries in Norway (*v.i.* p. 262).

There are 41 chocolate and sweet factories in the country, mostly near and in the larger towns. Breweries are widely distributed, though there are only 26 of them; Oslo, Bergen, Trondheim, and Drammen are the most important brewing centres.

Various other food products are manufactured, notably in Oslo, Moss, Trondheim, and Kristiansand S.

¹ In 1938 710,217 tons of milk were delivered to 618 dairies and condensed-milk factories, which produced 14,521 tons of butter, 18,640 tons of cheese, and 3,195 tons of casein.

FISHING AND FISH INDUSTRIES

THE Norwegian fishing industry is very important in the economic life of the country, accounting for about 25 per cent. of the total exports. This great development has come about because of the exceptional conditions for fishing in the shallow water of the open sea along the Norwegian coasts (Map 11) and in the numerous fjords, where food for the fish is brought by the currents of the Atlantic and Arctic Oceans.

The industry has remained in the hands of small owners, who used to divide their time between fishing and farming, but since the change-over from sailing- to motor-vessels has extended the fishing-grounds and introduced new methods fishing has tended to become a full-time occupation. Practically the entire fishing-fleet now uses motor-vessels; in 1938 the figures were:

Decked motor-boats	12,209
Open motor-boats	14,524
Steam-vessels	285
Sailing-vessels	127
Open rowing-boats (including 'dories')	60,326

The economic depressions following the War of 1914-18 seriously disturbed the fishing industry. Although catch and export have been great, prices have fluctuated and losses have been unavoidable.

Fishing is mostly coastal, and of the many different kinds the cod and herring fisheries are by far the most important. About 50 per cent. of the annual catch is cod and 25 per cent. herring. The chief season is from the New Year until early spring.

Cod Fisheries

Cod fishing takes place during the first six months of the year. From January to April the fish are caught off the coasts between Ålesund and the Lofoten islands, where they come in from the open sea to spawn; the catch here is about 100,000 tons annually. In April the young or 'spring' cod migrate northward in search of food and are caught off Finnmark. The catch here is about 35,000 tons annually. Several other species of cod are caught, the commonest being coal-fish, haddock, and ling. The 1938 catch was classified as follows:

Cod	129,419 tons
Spring cod	32,382 „
Bank cod	39,901 „
Fjord cod	14,246 „
Coal-fish	36,715 „
Haddock	18,841 „
Ling	5,505 „

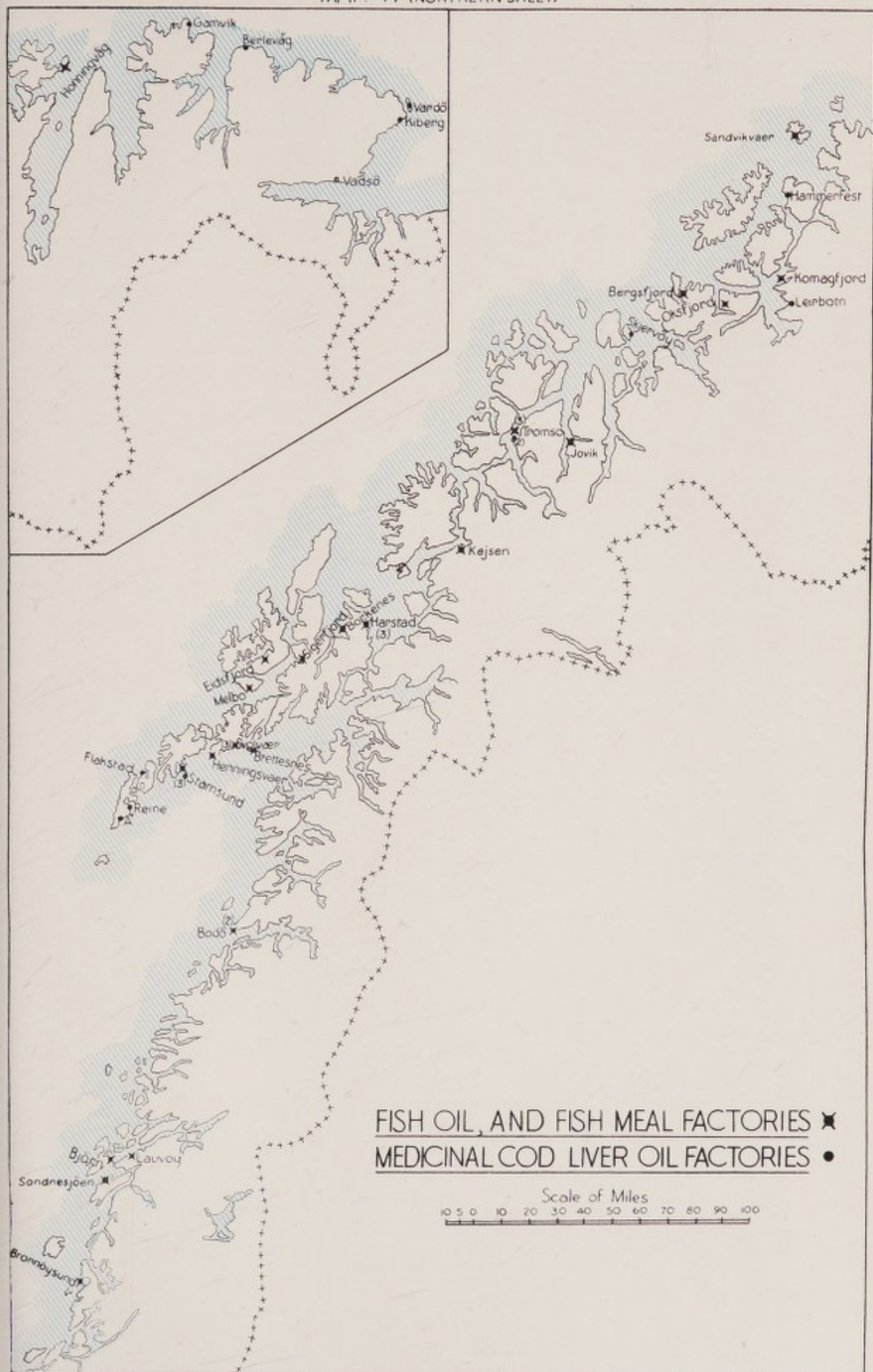


FISH OIL, AND FISH MEAL FACTORIES ✕
MEDICINAL COD LIVER OIL FACTORIES •

Scale of Miles
 10 5 0 10 20 30 40 50 60 70 80 90 100



MAP 47 (NORTHERN SHEET)





The bulk of the catch is prepared for export either as 'stockfish', or salted and dried cod (Fig. 32). Stockfish is prepared by hanging the fish up to dry in the open air after the head has been removed. If only gutted the product is called 'round-fish' (*rund fisk*); if the fish is also split along the back and the upper part of the back-bone removed it is called 'half-split' (*rotskjaer*). The chief markets for stockfish are Italy and West Africa, and other markets are the Netherlands, Belgium, Germany, Sweden, and U.S.A. The preparation of salted and dried cod (*klipfish*) is more complicated. After removal of the head the fish is cleaned, washed, and then split, salted, pressed, and again washed before being finally dried. The chief markets for klipfish are Portugal, Spain, and South America. In order to encourage the production of klipfish a law was passed in 1922 to provide for the compulsory grading of the product.

The sale of cod roes as a foodstuff is rapidly increasing, but export is still mainly to France and Spain, where it is used as a bait in the sardine fisheries; in 1938 5,655 tons of salted roes were exported for this purpose.

The sale of fresh frozen fish is becoming of increasing importance.

The preparation of cod-liver oil is a very important part of the cod-fishing industry. Formerly the oil was obtained by allowing the liver to stand until it decomposed and the oil flowed out. A process has now been introduced by which the liver is subjected to steaming, so that it decomposes and releases the oil in a few minutes. Over 100,000 hectolitres of medicinal cod-liver oil are exported annually. Production and marketing of medicinal cod-liver oil (for human consumption) is subject to government control as regards hygienic and technical conditions in the factories, as well as inspection of the finished product before shipment. The oil is divided into three grades, called Control Standard A, B, and C, indicated by yellow, white, and blue seals respectively. The lower grades may be extracted from coal-fish and haddock. The oil is prepared in small quantities in most fishing ports, but it is exported principally from those indicated on Map 47. The chief exporting centres are Ålesund and Hammerfest.

The preparation of cod meal for feeding live stock is of increasing importance; in Norway it is used principally by the breeders of silver fox, and it is also exported. The meal is obtained from the head and back-bone and is therefore a by-product of stockfish and klipfish. Over 12,000 tons are produced annually.

The chief ports concerned with the catching and preparation of

cod are Ålesund, Kristiansund N., Tromsø, Hammerfest, Vardö, and the ports on the Lofoten and Vesterålen Islands. Bergen and Stavanger deal with only small quantities of cod.

Herring Fisheries

A series of herring fisheries takes place along the coast. From January to April the herrings, known as 'spring-herrings' (*vårnild*), are caught off the west coast between Stavanger and Ålesund, where they come in to spawn. After April the 'small herrings' (*småsnild*) are caught, and later these young herrings ('fat herrings', *fetsnild*) are caught farther north between Ålesund and Hammerfest. From November to January the herrings migrate south again and are caught in the open sea, especially off Møre and Trøndelag, as 'large herrings' (*storsnild*). They are also caught farther out in the North Sea and in Icelandic waters, but Norway has not taken a great part in fishing these waters.

With improved communications both by land and by sea the trade in fresh herrings has considerably increased. A great number of salted herrings are, however, still exported; the chief markets being Germany and the Baltic and Danubian countries. The total export of salted herrings in 1938 was 33,907 tons.

Herring-meal is prepared for feeding to live stock, both at home and abroad; the meal is rich in vitamins and is, therefore, in demand in modern agriculture. Most of it is obtained from the winter fishing (e.g. 'spring' and 'large' herrings), but 'small' herrings are also used in season. Herring-meal is now produced by new technical processes; fresh, or slightly salted, herrings being boiled, pressed, ground, and dried. A modern herring-meal factory can produce up to 1,000 bags (100 kg. each) per day. Over 50,000 tons are produced annually.

Herring oil is a by-product in the preparation of meal, most of it being obtained from 'small' herrings. By the use of modern technical methods herring oil is being increasingly used to prepare a hard, edible fat. Over 150,000 hectolitres are produced annually.

'Spring' herrings are used in the production of canned kippers. The fish is kippered and when the bones, &c., have been removed, it is packed, generally without any addition. About 5,000 tons are exported annually. 'Small' herrings are also canned, being packed either in olive oil or tomato sauce, and marketed as 'Norwegian Sardines-Sild'. About 15,000 tons are exported annually.

Fish-meal and fish-oil factories are scattered along the coast mainly north of Stavanger (Map 47; Fig. 33). The most important centres

are the Lofoten and Vesterålen islands and the Ålesund district. Most of them specialize in herring oil, but since many produce both oil and meal from various species of fish, no distinction is made on the map.

Brisling Fisheries

Brisling, a small species of the herring family, is caught in the fjords of southern Norway chiefly during the summer, when large shoals come to the coasts. Almost the entire catch is canned, and since the quality is better in summer and autumn, it is forbidden by law to pack brisling from 1 January to 1 June. The brisling is slightly smoked, then packed in olive oil or tomato sauce and marketed as 'Norwegian Sardines-Brisling'. In good years the export amounts to over 10,000 tons. In recent years there has been difficulty in obtaining adequate supplies of olive oil, usually imported from Spain and Tunisia, and of tomato pulp, usually imported from Italy.

Salmon Fisheries

This is the most important of the fresh-water fisheries, because of the high value of the fish. The catch amounts to about 1,000 tons annually and fetches about £80,000 (1,600,000 kr.). Most of the catch is exported fresh.

Mackerel Fisheries

Mackerel fishing by means of drift nets takes place during the summer off the south coast of Norway. A considerable part of the catch is canned for the American market, but the bulk is consumed fresh at home.

Lobster Fisheries

Lobsters are caught as far north as Trøndelag. They are exported both alive and tinned. To prevent extermination there are laws which forbid the catching of lobsters smaller than about 8 inches in length and during the spawning season. Over 2 million lobsters are exported annually.

Fresh-fish Export

Since transport problems have been simplified by the construction of special railway refrigerator cars, the fresh-fish trade has increased rapidly. A modern preparation is that of fish-fillets. Besides salmon and lobster the exported fresh fish include herring, halibut, plaice, prawns, cod, haddock, and ling. The chief customers are Great Britain, Germany, and Sweden (*v.i.* pp. 313, 315).

Canning Industry

Herring and brisling form the basis of this industry, which includes the canning of sardines, shrimps, fish-cakes, anchovies, pastes, milk, and a little meat. Most of the canneries are in southern Norway (Appendix X, *v.i.* p. 360); the chief centre is Stavanger and the surrounding district, and there are also many factories at Bergen and on the nearby islands. The industry employs over 19,000 people, for besides those actually engaged in the canneries there are a large number employed in the making of tins, wooden boxes, tin openers, labels, and other packing materials. The U.S.A. take about 50 per cent. of the annual export; Great Britain is the next most important buyer, taking about 25 per cent.

WHALING

WHALES have been hunted from Norway for a long time, but it was not until the last half of the nineteenth century that whaling began to have any commercial importance.

From 1864 to 1904 commercial whaling, which was carried on entirely in northern waters, was seasonal, since the most important species captured, the blue whale, the fin whale, and the humpback, are migratory, only visiting northern waters during the summer months. New methods were adopted whereby the old hand-harpoons gave place to grenade-harpoons and shore-stations were established to which fast whaling-boats towed their capture. In these northern waters the industry reached its peak in 1909, when 1,985 whales, yielding 57,000 barrels of oil, were captured; there was then a serious decline until about 1916.

In 1904, when whales in the northern waters were becoming scarcer, whaling developed in Antarctic waters. The season began here at the beginning of October and lasted till April, when the whales migrated northwards for the remaining months of the year. To overcome the difficulty of distance from home the 'floating factory' was invented. This important invention made possible the rapid development of whaling in Antarctic and other waters, and by 1908 whales were being caught off west and east Africa, west and east Australia, Brazil, Chile, and the Pacific coast of North America. In these waters whaling was, however, only carried on for a few years, whereas Antarctic whaling has remained of primary importance. Between 1906 and 1911 fifteen Antarctic companies were started, of which nine were Norwegian. As the whaling was carried on off the British islands of South Orkney,

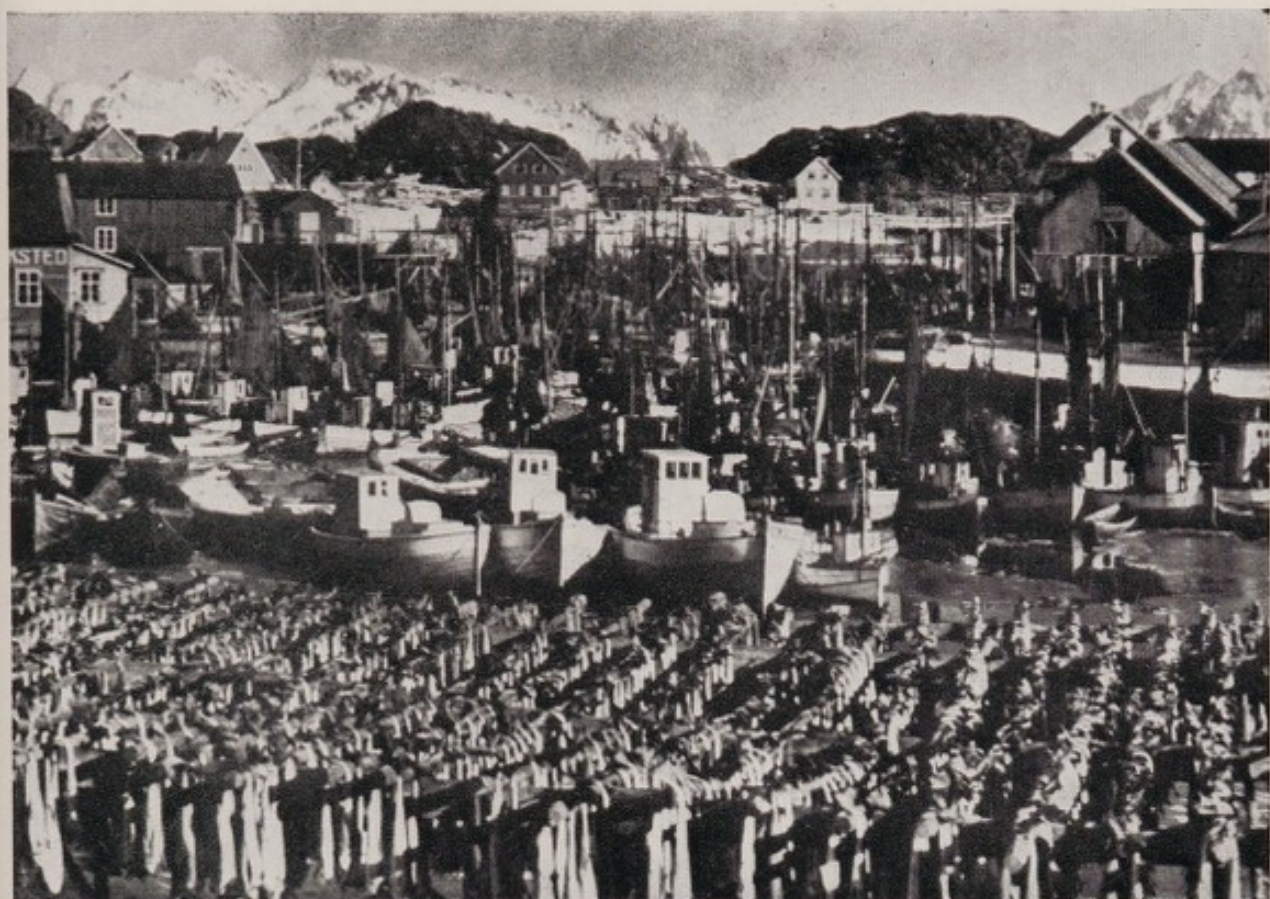


FIG. 32. *Drying cod at Svolvær*

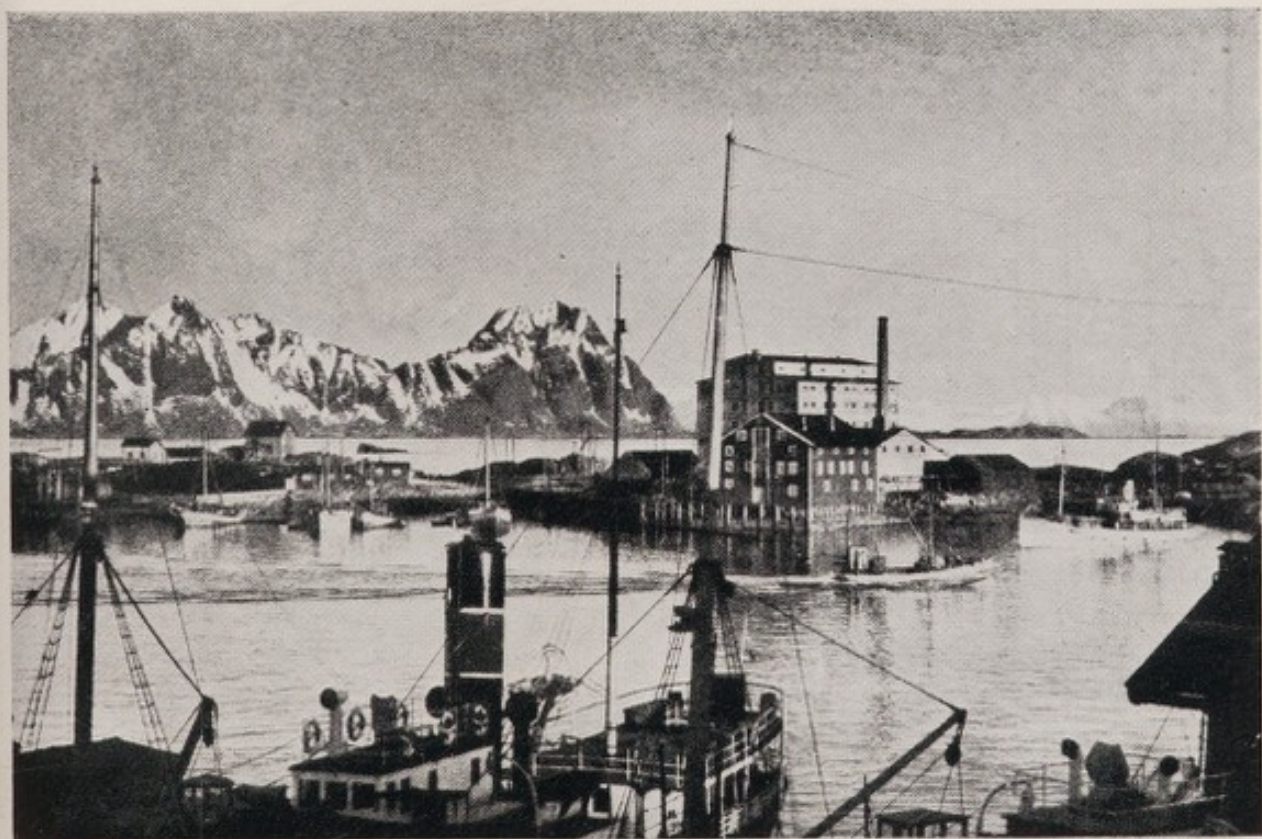


FIG. 33. *A fish-oil factory in the Lofoten Islands*

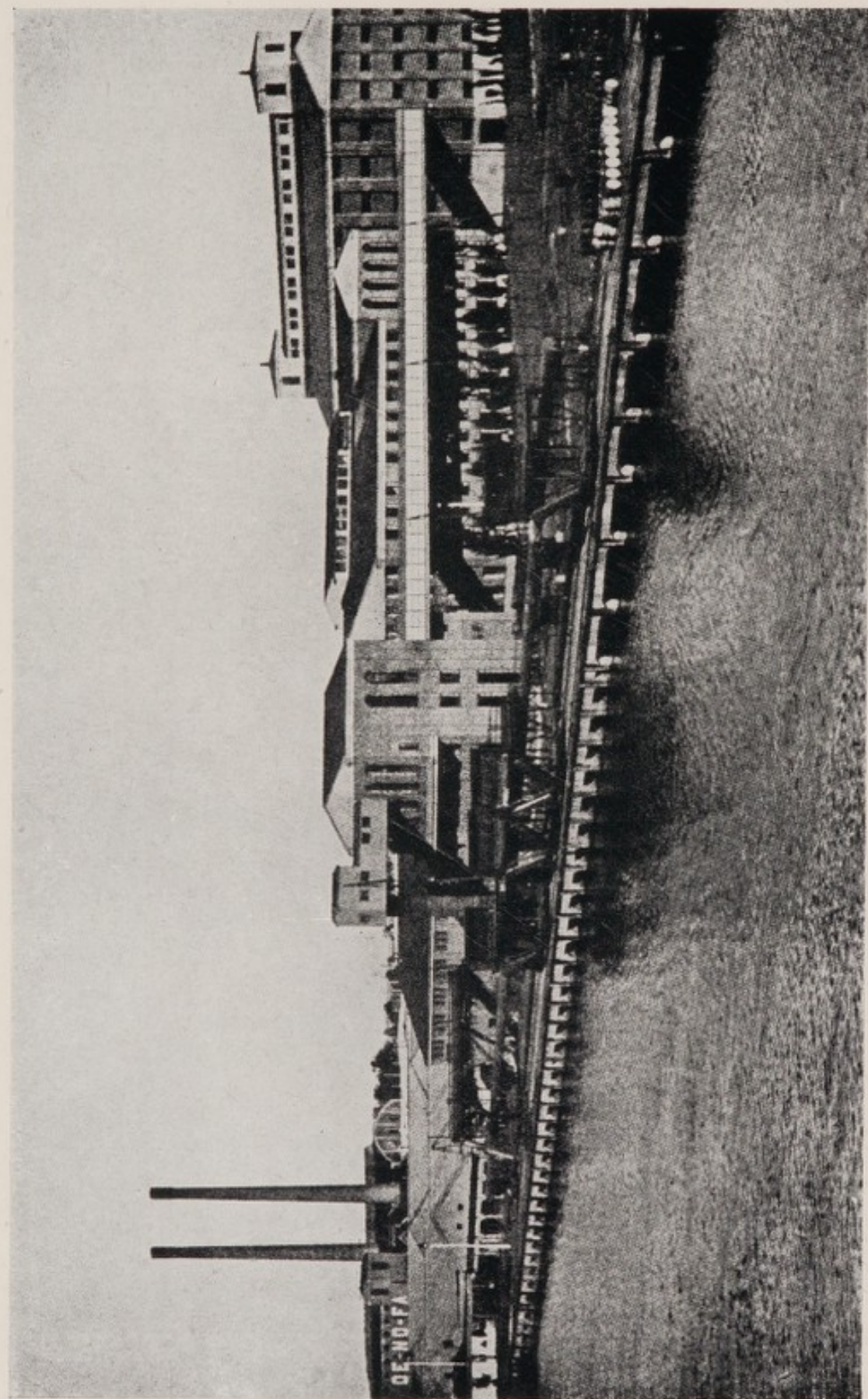


FIG. 34. The De-No-Fa fat-hardening factory at Fredrikstad

South Shetland and South Georgia, and after 1923 in the Ross Sea it was entirely dependent on concessions granted by the British Colonial Office, which restricted the number of such concessions so as to prevent extermination of the whales.

In 1925 whaling in the open sea, so-called 'pelagic whaling', was started and found to be very profitable. In the same year the efficiency of whaling-vessels was increased by the invention of the 'haul-in slip' by which the whale could be hauled on board for flensing. In 1926 ice-edge whaling began along the edge of the south polar ice-cap, and many whales were found. Since there was no limit to the number of whalers fishing in these open waters, over-production took place to such an extent that in 1930-1 the price of whale oil dropped from £25 per ton to £10 per ton and in the following year the fleets were forced to lay up for the season. Whaling began again in 1931-2 with an international agreement limiting the production to 1,932,000 barrels of oil apportioned between the factory ships (Unilever was the only company which remained independent of this agreement). In the 1934-5 season another agreement was reached whereby the Antarctic season was limited to four months, from 1 December to 31 March; this period was further shortened in subsequent years until in 1938-9 it was fixed from 8 December to 7 March, in the hope of preserving the whales and increasing the price of oil; the result was a minimum price of £17 per ton in 1936-7. In 1934 and 1936 the Norwegian companies began to feel the competition of Japanese and then German enterprises; Germany was later persuaded to agree to the international restrictions, but Japan has refused to enter the agreement.

In 1938 the Norwegian whaling industry had a total tonnage of 155,653 gross registered tons of shipping and employed well over 10,000 men. There is a remarkable concentration of the industry in the three towns of Sandefjord, Larvik, and Tönsberg; thus, in 1938, of the total, 80,260 gross tons were registered at Sandefjord, 21,048 at Larvik and 14,313 at Tönsberg. There are 30,248 gross tons registered at Oslo, which is not, of course, primarily a whaling port. Haugesund, Herdla, and Harøy are of secondary importance, and Fredrikstad has large factories using whale oil. In 1938 Norwegian companies together possessed 95 catching boats and 11 floating factories. These factories were, on the average, of over 12,000 gross tons each; they could produce from 1,600 to 2,500 barrels of oil per day and had a total loading capacity of from 80,000 to 120,000 barrels. Whale guano is also produced for use as a fertilizer, but there are no recent figures of production available.

The Antarctic has, during recent years, played an all-important part in whaling; thus in 1938, of the 13,197 whales captured by Norwegian whalers, 12,802 came from the Antarctic and these yielded 977,000 barrels of the total of 988,000 barrels of oil produced by Norwegian firms.

Fat-Hardening Industry

This industry was started in Norway in 1912 with the opening of a factory at Fredrikstad. The industry is concerned with the production of a white, neutral fat from marine oils; whale oil is the most important source, but herring oil is used in small quantities and in recent years experiments have been made with vegetable oils.

The industry received a great stimulus with the introduction of floating factories in the Antarctic whaling industry. The De-No-Fa factory at Fredrikstad now has a tankage capacity of 45,000 tons, and its own quay 547 yards long, at which ships can tie up and pump oil directly into the factory's tank (Fig. 34). In 1914 a second factory was opened at Sandefjord, which now has a 20,000 ton tankage capacity.

The treatment to which the oil is subjected is firstly the removal of the excess fatty acid, water, and dirt; it is then bleached before being hardened by the addition of varying quantities of hydrogen; finally it is deodorized before being used in the margarine, compound lard, and soap industries. Most of the fat is sent to European countries, over 50,000 tons being exported annually.

SHIPPING

SINCE 1850 the Norwegian merchant shipping fleet has developed rapidly with the world expansion of commerce. Her ships have sought and found freight all over the world, not restricting themselves to direct trade with the mother country, but carrying cargoes between foreign nations and taking part in the coastal trade of other countries.

In the days of wooden sailing-ships Norway was well placed to expand her merchant fleet, but when the change over from sail to steam came Norway was handicapped by her lack of raw materials and was therefore very slow in changing, having only 16 per cent. of her tonnage under steam in 1876, as compared with Great Britain's 76 per cent. This delay was perhaps compensated for in the subsequent change over from steam to motor vessels, in which Norway was able to take the lead. The following table shows the development of the merchant navy from 1870 to 1939:

	<i>Steam</i>	<i>Motor</i>	<i>Sail</i>
	net reg. tons		net reg. tons
1870 . .	13,062	..	960,762
1890 . .	203,115	..	1,502,584
	gross reg. tons	gross reg. tons	gross reg. tons
1914 . .	1,511,658	68,610	..
1925 . .	2,260,023	389,232	35,205
1930 . .	2,273,165	1,290,072	5,052
1938 . .	1,876,336	2,547,313	..

During the War of 1914-18 Norway lost 1,237,000 gross registered tons of shipping, so that by 1918 Norway had dropped from fourth to eighth place among maritime nations. At an early period of the war, however, Norwegian owners began to replace their losses by contracting for new ships at yards in various parts of the world, chiefly in the U.S.A. Since 1919 Norway has enormously increased her merchant fleet so that in 1938 she again held fourth place among maritime nations, with a total of 1,949 ships, with a total tonnage of 4,509,221 gross registered tons. About 50 per cent. of this total, or 2,130,000 gross registered tons, represented ships less than ten years old, of which about 19 per cent., or 871,000 gross registered tons, were less than five years old. The average size of vessels also increased from 2,681 gross tons in 1929 to 3,495 gross tons in 1938.

The possession of a large merchant fleet and the maintenance of an extensive and prosperous overseas shipping industry is not merely a matter of national ambition or naval policy; it is, indeed, essential for Norway, whose imports far exceed her exports. The government looks to shipping as one of the chief sources of national revenue. The following table gives figures of the gross value of freights, in kroner, carried by Norwegian ships in foreign trade:

<i>Year</i>	<i>Motor-ships</i> <i>1,000 kroner</i>	<i>Steam-ships</i> <i>1,000 kroner</i>	<i>Total</i> <i>1,000 kroner</i>
1935 . .	234,300	196,100	430,400
1936 . .	284,500	211,700	496,200
1937 . .	468,300	281,700	745,300
1938 . .	..	..	697,600

It is incumbent on the merchant fleet to maintain its strength. To this end, there has been, since 1918, considerable specialization in particular trades and types of vessels. The most conspicuous has been the growth of Norway's fleet of tankers, which in 1938 amounted to 250 ships with a total tonnage of about 1,800,000 gross registered

tons,¹ nearly 45 per cent. of her total merchant tonnage. These tankers operate all over the world, the most usual policy being for a shipowner to enter into a long-term freight contract, for a period of up to ten years, with one of the large oil companies.

Another important development is that of regular liner trade which, in 1937, amounted to 595 ships, with a total tonnage of 1,076,959, nearly 25 per cent. of the total merchant tonnage. The best known of the liner services are Fred. Olsen's Lines, Wilh. Wilhelmsen's Lines, and the Norske Amerikalinje. Fred. Olsen's Lines operate from Norway to the Pacific with ports of call in northern Europe, including England; Wilh. Wilhelmsen's Lines operate from Norway to North and Central America and to the Far East via Africa and India; and the Norske Amerikalinje operates between Oslo and New York.

Special ships are also employed in the fruit trade, which started during last century with the transport of bananas between the West Indies and the U.S.A. This trade has been expanded recently in some parts of the world, especially between Italy and France and their colonies. It, however, received a setback with the closing of the Spanish fruit trade during and after the Civil War of 1936.

A considerable number of Norwegian ships are engaged in coastwise trade in the Far East. This trade has decreased since the beginning of the Sino-Japanese war in 1937, because much of the traffic was Chinese coastwise traffic.

The social conditions in the merchant fleet are very good. Through agreement between owners' and seamen's organizations and intervention by the public authorities, regulations have been brought into force which provide a fixed scale of manning; an eight-hour working day for all ratings when in port, and for certain categories when at sea; holidays with pay for twelve full-working days a year for seamen of subordinate rank; a two-berth cabin system for the men as well as hospital accommodation and special mess-rooms for officers and men. Labour relations are regulated through trade unions. There is compulsory mediation in labour disputes, and strikes are not permitted until mediation has taken place. The seamen are insured against sickness, accidents, and old age, and are paid certain allowances if shipwrecked (*v.s.* p. 214).

The Norwegian shipping lines, with the numbers and types of ships owned on 1 January 1941, and the port of registration, are given in Appendix XI (*v.i.* p. 362).

¹ This figure does not include floating factories in the whaling fleet.

The following table gives the strength of the merchant fleet in 1939 and the gross freights in 1938 by ports:

<i>Port</i>	<i>Total number of ships</i>	<i>Total gross tonnage</i>	<i>Motor- ships, gross tonnage</i>	<i>Steam- ships, gross tonnage</i>	<i>Sailing- ships, gross tonnage</i>	<i>Gross freights in over- seas trade, 1,000 kr.</i>
Oslo . .	643	1,848,512	1,413,607	434,905	..	289,300
Bergen . .	796	820,335	390,273	429,737	325	125,500
Tönsberg . .	137	468,338	346,515	121,823	..	90,500
Haugesund . .	275	359,785	197,588	162,197	..	48,600
Sandefjord . .	105	233,990	122,578	111,412	..	19,900
Stavanger . .	161	164,774	114,396	50,378	..	19,300
Arendal . .	57	144,089	79,100	64,989	..	18,000
Farsund . .	99	119,220	47,754	71,466	..	17,800
Kristiansand S.	54	117,708	73,582	43,549	577	14,600
Larvik . .	34	74,559	52,084	22,475	..	6,200
Drammen . .	68	66,468	24,226	42,242	..	10,200
Trondheim . .	196	65,494	6,549	58,383	562	7,500
Porsgrunn . .	30	46,777	33,214	13,445	118	7,000
Others . .	1,736	316,057	181,528	131,328	3,201	23,200
<i>Total</i> . .	4,391	4,846,106	3,082,994	1,758,329	4,783	697,600

CHAPTER XIII

POWER SUPPLIES

WATER POWER

Natural Resources

NORWAY has taken advantage of her great water power resources and has developed them to a greater extent per head of population than any other country. Even so, only about 14 per cent. of the estimated potential water power resources have been tapped. The total amount of power which can be utilized is estimated at 9.2 million kW. (12.5 million h.p.). By this is meant all-the-year power, i.e. power available during all the hours of the day and throughout the year. This estimate includes only those sources of power which, by reasonable regulation of the watercourse, can yield at least 750 kW. (1,000 h.p.) of all-the-year power and for which the development costs do not exceed 375 kr. per kW., reckoned at prices ruling before 1914. Of the estimated total, slightly under 2 million kW. (2.7 million h.p.) have already been developed.

The topographical and climatic features of the country are well suited to the development of hydro-electric power, since they combine abundant precipitation, torrential rivers, and natural reservoirs. The rivers vary considerably in character in different parts of the country. Along the North Sea and Atlantic coasts the rivers have small catchment basins (Appendix III, *v.i.* p. 331), are short, and descend by many large waterfalls. These falls provide many power sites and are especially suited for development when they have a lake above the fall, as at the Bjölvefoss station, at Ålvik. In the Trondheim area, where the mountains are not so steep, the rivers are longer, and the rock outcrops being softer, many of the falls have been evened out. In the east and south-east the catchment basins are much greater, the rivers longer, and the waterfalls less high, except where there are hanging valleys. It is these exceptions which afford sites for the largest stations, such as Rjukan and Nore. In the north the rivers drain into the Arctic Ocean across a fairly low tableland, so that they have a considerable catchment, but no great waterfalls; remote as well, this region is the least favourable for power sites.

Precipitation in Norway is very unevenly distributed (Map 39). On the highest parts of the fjeld it occurs mainly as snow, so that the flow of water is least during the winter and most during the

spring and early summer, lessening thereafter through the later summer and autumn. In the west precipitation is high near the coast, lasts throughout the year, but is heaviest in winter. It is less along the south coast and diminishes eastwards; and it is low in the rain shadow of the fjeld.

The numerous lakes (Appendix IV, *v.i.* p. 335) of the country are very important for efficient development of power. By using them for regulating the water supply an even supply is obtained all the year round. In the west the lakes on the edge of the fjeld are the most useful for this purpose, for they have a high head of water. In the south-east the important lakes are in the lower part of the valleys, for there is generally a sufficient fall below them (e.g. Lake Öyeren above Mörkfoss-Solbergfoss). Although many lakes are ice-bound in winter (*v.s.* p. 116) the falls do not freeze, and where necessary the water is drawn off by underground flumes.

The easy development of hydro-electric power has been the basis of many industries in Norway, the growth of which has been facilitated by the fact that many of the power sites are at the head of deep, ice-free fjords, which provide easy and cheap transport for raw materials and finished goods.

Development of Resources

Cost. These natural conditions enable power to be developed at a very low cost—most of it between 75 and 150 kr. per kW. and much of the rest below 300 kr. But the best sites have already been used and in future the cost may rise to 450 kr. per kW. Capital cost includes that of driving tunnels and blasting, because of the rocky sites, but the cost of upkeep is low. Depreciation and maintenance charges on machinery are not high because of the exceptional cleanliness of the water, which reduces to a minimum wear and tear on pipe-lines, filter gates, intake machinery, and turbines. The total working expenses should, therefore, not amount to more than 10 per cent. per annum of the development costs.

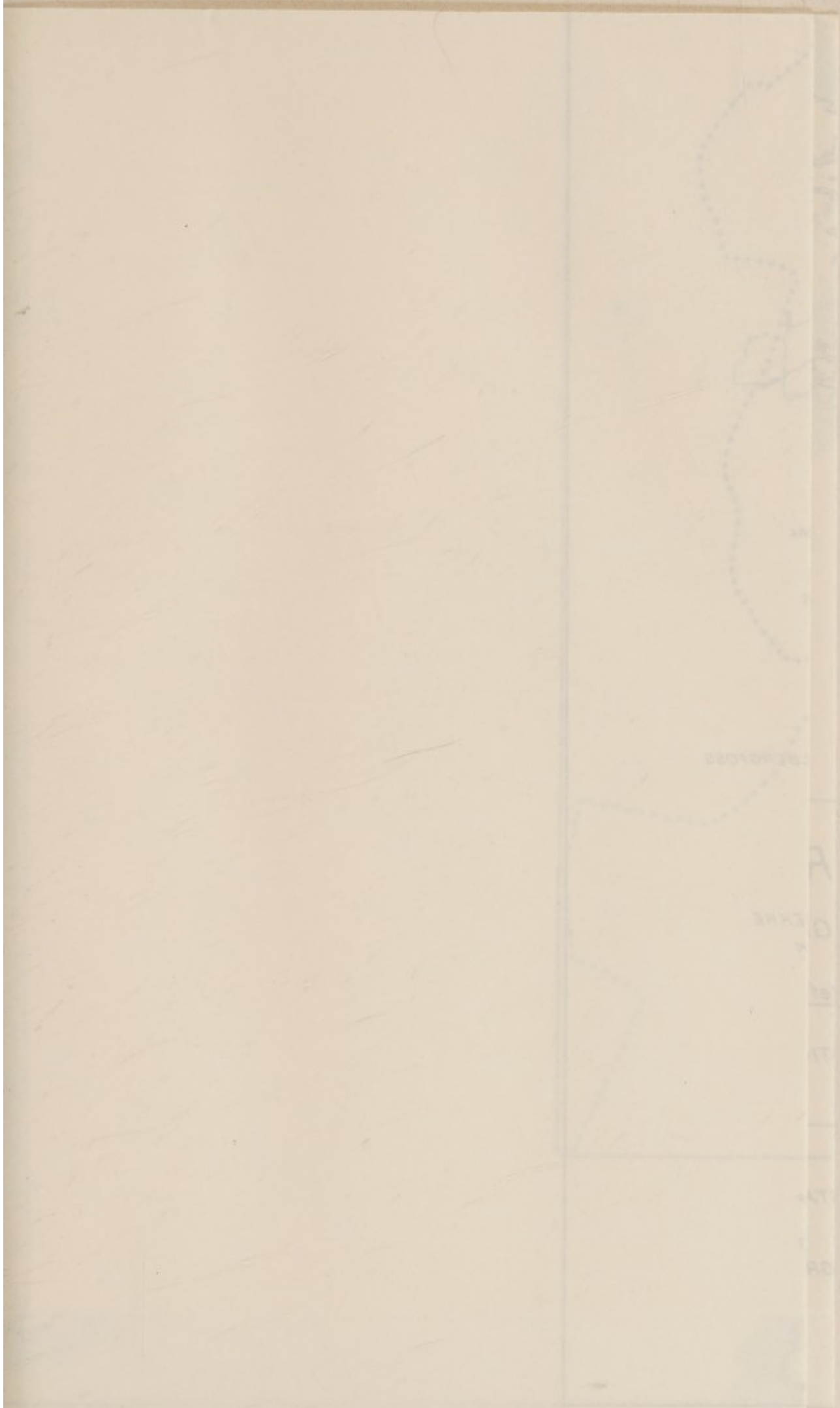
Ownership and Control of Hydro-electric Power. About 10 per cent. of the power is developed at State-owned stations; about 30 per cent. at stations owned by municipalities (the greater part of this being used for domestic purposes); and about 60 per cent. at private stations (principally large-scale electro-chemical and electro-metallurgical industries). The transfer of ownership rights in water-power is subject to the provisions of the Acquirement of Property Acts (Concession Acts), by which only the State and the local authorities have full

liberty to acquire the right of owning and using waterfalls. All others must obtain concession from the Crown to acquire any waterfall which alone, or with other water-power owned by the purchaser, will yield more than 750 kW., or to acquire water power which, when regulated, will, with other falls owned, rented or used in Norway by the purchaser and his family, amount to more than 3,750 kW. Such a concession is for a period of up to fifty years, or, with the consent of the Storting, up to sixty years; whereafter the fall, together with all land, rights, machinery, buildings, and other appurtenances belonging thereto, reverts to the Norwegian State, without payment of any consideration. The State can take possession, at a valuation, of all that does not so revert, or can order it to be removed; and it further has the right to redeem the whole plant when 35 years of the concession period have elapsed. The Acts also contain regulations for a time-limit to begin development, for the delivery of power, the payment of taxes, the preferential right of employment of Norwegian workmen, and for accident relief to be paid. There are also Acts which make it possible for public authorities to secure what power they consider necessary for the community. All apply to developed and undeveloped waterfalls.

The total developed water-power resources are estimated at slightly under 2 million kW. (2.7 million h.p.); of this 92 per cent. is at sites of over 10,000 kW. This power is used for three main purposes:

- (a) For general electricity supply, including domestic use, railways, and miscellaneous small industries. These together consume about 52 per cent. of the total supply. All towns are provided with electric power, and more than half the rural population use electricity. There is a widespread use of household labour-saving devices and many farms have electric machinery for milking, cream separators, &c. The railways have not yet been extensively electrified. Small industries include the manufacture of condensed milk, cheese, rubber goods, textile industries, and many others.
- (b) For large-scale electro-chemical and electro-metallurgical industries. These consume about 40 per cent. of the total supply, most of which is generated at sites owned by the companies concerned.
- (c) For the wood-products industries. These consume 8 per cent. of the total supply and include wood-pulp, paper, artificial silk, and cellulose industries.

Further development may be expected along three principal lines.





Firstly, extension of the supply for domestic purposes; before 1940 this was receiving considerable attention. Secondly, the further development of large-scale industry; this would largely be dependent on foreign capital to develop the power sites, and would be restricted to industries requiring a large power supply in proportion to the amount of raw material needed, and a small labour supply. Thirdly, the development of an export supply of power. This possibility has been considered for some time. Denmark and Germany are both in need of further power for industrial purposes, and it would seem possible to build a line south, through Sweden, into Denmark, making use of the islands off the Danish coast; from Denmark this line could be extended to Germany. There has been a proposal to build a line which would transmit 500,000 kW., but the cost of such an undertaking would be enormous and possibly prohibitive.

REGIONAL DEVELOPMENT OF HYDRO-ELECTRICITY

IN the following regional description the same regions have been used, as far as possible, as in Chapters II and III. This has not, however, been entirely possible. The fjeld region has been omitted because any power stations sufficiently high up to be termed fjeld are connected by grid with the Oslo and Lillehammer areas and are, therefore, best considered with these regions. For this reason, too, the Oslofjord region extends considerably farther than the name would imply. The east has been separated, although many of the stations have grid connexions with Oslo. Only stations with over 2,000 kW. capacity have been included in the statistics. There are a very large number of small stations producing less than 2,000 kW., of which 1,000 have a capacity of 100 kW. or less; the total output of all these small stations is only about 100,000 kW., and almost all the existing power is generated in less than one-third of the plants (Map 48).

1. THE EAST, THE OSLOFJORD, AND TELEMARK

The stations in the east, the Oslofjord and Telemark, are of two types. Stations of the first type are situated on the lower courses of the principal rivers and have a head varying from 45 to 90 feet; they are generally provided with an intake dam built across the river, the power station being situated close to the dam (e.g. Vamma, Fig. 35). Stations of the second type are situated well inland at the foot of the steep hills which form the transition between the fjeld and the

south-east lowlands; these stations have a head varying from 900 to 1,200 feet (e.g. Rjukan, Fig. 36).

1 (a) THE EAST

<i>Name of station</i>	<i>Position</i>	<i>Capacity in kW.</i>	<i>Use, &c.</i>
(a) <i>Halden</i>			
Brekke . .	E. of Halden	7,200	80 ft. head. Halden, general supply.
Saugbruk (Tistedals- foss)	Halden	9,500	4 plants 40/170 ft. head. Halden, general supply and paper industry.
(b) <i>R. Glomma</i>			
Rena . .	At Flatestoen	2,300	120 ft. head. Paper industry.
Elverum .	S. of Elverum	3,300	37 ft. head. Elverum, general supply.
Sör Odal .	Nr. Kongsvinger	2,000	General supply and pulp mill.
Böhnsdalen .	R. Vormå	2,100	56 ft. head.
Rånåsfoss .	Above L. Öyeren	57,600	46 ft. head. Akershus, railways and general supply.
Mörkfoss- Solbergfoss	N. of Askim	64,000	71 ft. head. Oslo, railways and general supply.
Kykkelsrud .	SW. of Askim	36,350	59 ft. head. Oslo and industry at Sarpsborg and Fredrikstad.
Vamma .	S. of Askim	81,600	85 ft. head. Oslo and industry at Sarpsborg and Fredrikstad.
Borregård .	Sarpsborg	18,600	65 ft. head. Paper and electro-metallurgical industry.
Hafslund .	Sarpsborg	23,600	65 ft. head. Carbide and electro-metallurgical industry.
Vinderen .	..	3,500	..
(c) <i>Gudbrandsdal</i>			
Kamsfoss .	47 m. NW. of Lillehammer	6,500	130 ft. head. General supply. On the fjeld.
Lillehammer .	Lillehammer	19,600	860 ft. head. Lillehammer, general supply.
Avella . .	Head of L. Randsfjord	2,700	1,100 ft. head. Lillehammer, general supply.

The stations at Halden are small, but important for industry and have grid connexion with Hafslund to the west.

There is an extensive grid system in the Glomma region. Elverum is connected with the sub-station at Hamar in Gudbrandsdal and thence with Rånåsfoss, which is connected with Oslo.

Mörkfoss-Solbergfoss and Kykkelsrud are also connected with Oslo. Kykkelsrud and the stations below it are connected with Sarpsborg and Frederikstad (sub-station).

From Lillehammer and Avella there is a grid connecting sub-stations on Lake Mjösa, which are also connected with Oslo.

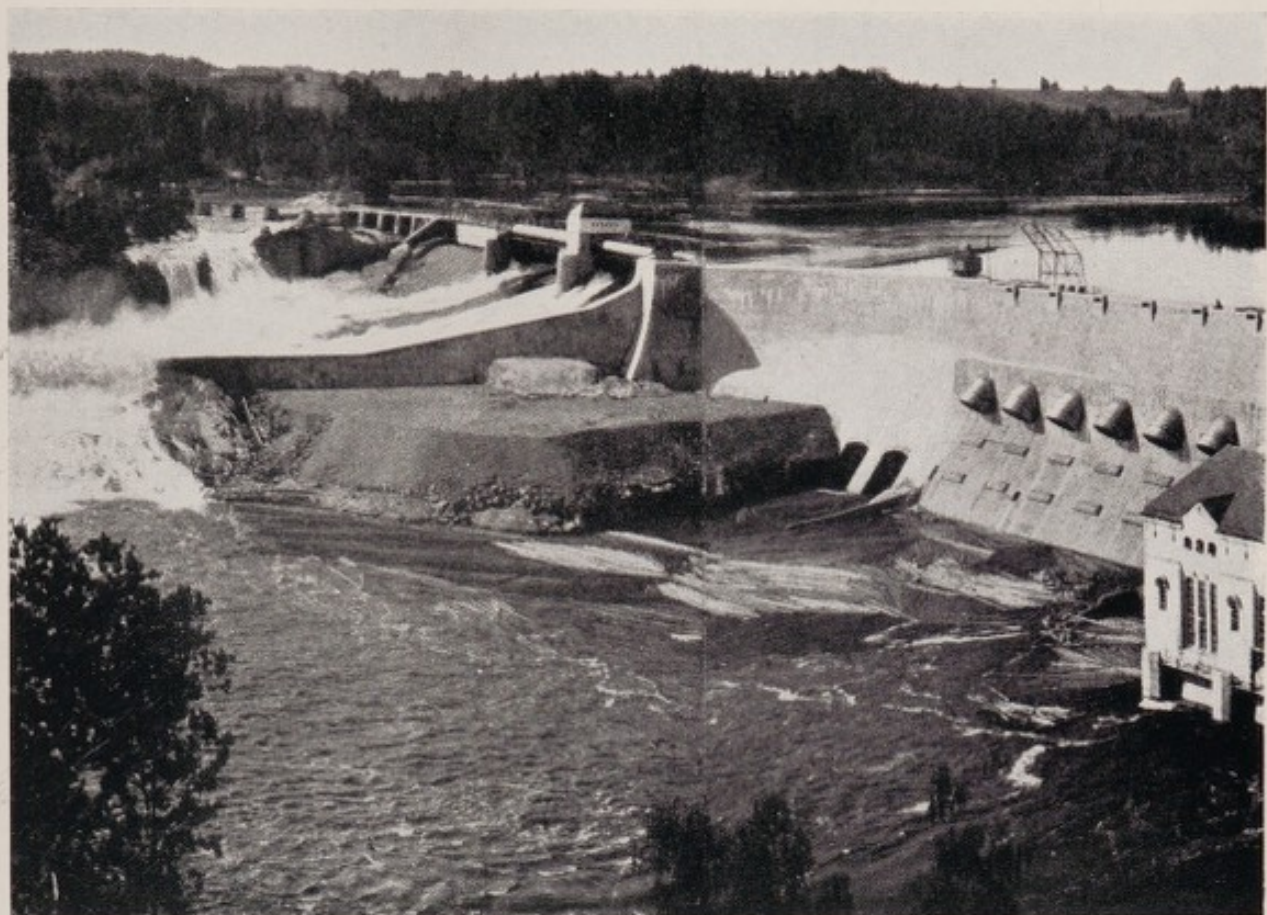


FIG. 35. *Hydro-electric power station (low head) and dam at Vamma*



FIG. 36. *Hydro-electric power station (high head) at Rjukan*



1 (b) THE OSLOFJORD REGION

(a) Oslo

<i>Name of station</i>	<i>Position</i>	<i>Capacity in kW.</i>	<i>Use, &c.</i>
Hammaren . .	N. of Oslo	5,000	350 ft. head. Oslo, general supply.

Hammaren is the chief source of supply for Oslo, but there are four sub-stations near the town which are connected with the out-lying stations in the region.

(b) The Randselv and Dramselv Valleys

<i>Name of station</i>	<i>Position</i>	<i>Capacity in kW.</i>	<i>Use, &c.</i>
Hadeland .	W. shore of Randsfjord	2,800	750 ft. head. General supply.
Kistefoss .	Randselv	2,100	Paper industry.
Askerudfoss	"	3,600	" "
Hensfoss .	R. Begna	2,800	" "
Folefoss .	"	2,900	44 ft. head. Paper industry.
Hönefoss .	Junction of R. Begna and Randselv	6,000	70 ft. head. Paper industry.
Gravfoss .	Dramselv	20,500	60 ft. head. Drammen, general supply.
Geithusfoss .	"	3,200	Paper industry.
Embretsfoss .	"	9,500	47 ft. head. General supply and Vikesund paper industry.

The stations on the Randselv and the river Begna are of only local importance, except for Hönefoss, which is connected with the Flesaker sub-station and thence with many of the larger towns of the region. Gravfoss is connected with Drammen.

(c) The Numedal Valley

<i>Name of station</i>	<i>Position</i>	<i>Capacity in kW.</i>	<i>Use, &c.</i>
Nore . .	In Numedal	145,000	1,180 ft. head. General supply.
Labrofoss . .	S. of Kongsberg	16,000	136 ft. head. Drammen, general supply.
Gravenfoss .	" "	6,200	56 ft. head. Tönsberg and Horten, general supply.

<i>Name of station</i>	<i>Position</i>	<i>Capacity in kW.</i>	<i>Use, &c.</i>
Vittingfoss . .	S. of Kongsberg	8,900	67 ft. head. Tönsberg, general supply.
Fritzo . .	Larvik	2,000	Larvik, general supply.
Kiste . .	NE. of Skien	6,400	130 ft. head. Skien and Larvik, general supply.
Hakavik . .	L. Eikeren. SW. of Drammen	9,800	1,300 ft. head. Railways.
Tokelv . .	N. of Skien	2,900	260 ft. head. Larvik, general supply.
Hogstad . .	„	4,600	420 ft. head. Larvik, general supply.

In the Numedal valley much of the power comes from the 'hanging valleys'. The power is mostly exported for general purposes throughout the Oslofjord region. Nore is by far the most important and is connected by grid with Oslo and Flesaker. Labrofoss and Gravenfoss are also linked with Flesaker. The other important sub-stations on the grid are at Tönsberg and Sandefjord.

1 (c) TELEMAR (THE SKIENS WATERCOURSE)

<i>Name of station</i>	<i>Position</i>	<i>Capacity in kW.</i>	<i>Use, &c.</i>
Frøistul . .	6 m. SW. of Rjukan	24,500	170 ft. head. Nitrate industry at Rjukan; Telemark, general supply.
Vemork (Rjukan I)	R. Måne	145,000	920 ft. head. Hydrogen and nitrate industries.
Saheim (Rjukan II)	„	114,000	815 ft. head. Nitrate industry.
Årlifoss . .	R. Tinne, below Tinnsjö	20,800	56 ft. head. Skien and Larvik, general supply.
Grönvollfoss .	R. Tinne	25,000	74 ft. head. Telemark, general supply.
Svaelfoss (2) .	„	33,600 main; 16,800 reserve	Nitrate works at Notodden and railways. Total capacity may now be 90,000 kW.
Lienfoss . .	„	21,800	55 ft. head. Notodden, nitrate works.
Tinnfoss (I) .	R. Tinne, below Tinnsjö	6,700	60 ft. head. Skien-Porsgrunn, general supply.
Tinnfoss (II) .	„ „	16,800	90 ft. head. Notodden, nitrogen works.
Gjerpen . .	NNW. of Skien	2,200	Paper industry.
Skotfoss . .	NW. of Skien	1,450	130 ft. head. Paper industry.

A high percentage of the very large amount of power developed in the Skiens watercourse comes from tributary streams which join the main stream in falls from 'hanging valleys'. All the stations, except Gjerpen and Skotfoss, are connected by grid. The three near Rjukan supply the local electro-chemical industries, and although they are connected via Flesaker and Drammen sub-stations with Oslo, they very seldom have any surplus for export.

2. SOUTH COAST

<i>Name of station</i>	<i>Position</i>	<i>Capacity in kW.</i>	<i>Use, &c.</i>
Dalsfoss . . .	NW. of Kragerø	4,200	56 ft. head. Carbide works.
Högefoss . . . (Nissedal)	S. of Nisservand	14,000	210 ft. head. General supply.
Flatenfoss . . .	R. Nid, NW. of Arendal	9,000	36 ft. head. Industry.
Böilefoss . . .	" "	25,900	196 ft. head. Arendal, and Eydehavn aluminium works.
Evenstadfoss . . .	" "	9,200	39/50 ft. head. Fröland and Arendal, general supply.
Rygenefoss . . .	R. Nid, SW. of Arendal	5,300	65 ft. head. Grimstad, paper industry.
Nomeland . . .	R. Otra	16,800	67 ft. head. Kristiansand S., general supply and industry.
Kringsja . . .	"	6,500	39 ft. head. Kristiansand S., general supply.
Hunsfoss . . .	"	3,200	40 ft. head. Paper industry.
Vigeland . . .	"	9,100	60 ft. head. Vigeland, alu- minium works.
Skjerka . . .	R. Mandal	24,000	1,110 ft. head. General supply.
Mandal . . . (Tryland)	L. Oidne, NW. of Mandal	3,600	440 ft. head. General supply.
Trelandsfoss . . .	R. Kvina	6,100	85 ft. head.
Hellerfoss . . .	Sogndal, W. of Flekkefjord	2,700	General supply.

A grid connects the stations round Arendal. Böilefoss is by far the most important of these and is connected to the sub-station at Eydehavn. Skjerka, Nomeland, Kringsja, and Mandal all have grid connexion with the sub-stations at Kristiansand S. The power is used for general purposes and for the industries (nickel, ferro-silicon, aluminium, and copper) of the area. Vigeland (aluminium works), Hunsfoss (paper industry), and Hellerfoss (local supply) are not included in the grid connexion. Two small stations at Knaben and Evje supply the molybdenum- and nickel-works at these places.

3. WEST COAST

<i>Name of station</i>	<i>Position</i>	<i>Capacity in kW.</i>	<i>Use, &c.</i>
<i>(a) Stavanger region</i>			
Öygreifoss .	N. of Egersund	2,400	160 ft. head. Egersund, general supply.
Flörli . .	Lysefjord	30,500	2,400 ft. head. Stavanger, general supply.
Oltedal . .	Högsfjord	5,800	230 ft. head. Stavanger, general supply.
Maudalfallene	L. Maudal, E. of Högsfjord	2,900	900 ft. head. Stavanger, general supply.
Tungelandsfoss	Idsefjord	3,500	600 ft. head. Steel-works.
<i>(b) Sauda region</i>			
Sauda I . .	NE. of Sauda	34,400	943 ft. head. Electro-metallurgical industry at Sauda and Haugesund, general supply.
Sauda II . .	„ „	16,800	602 ft. head. Electro-metallurgical industry at Sauda.
Sauda III . .	Sauda	63,000	788 ft. head. Electro-metallurgical industry at Sauda.
Etne . . .	S of Skånevik-fjord	5,600	420 ft. head. Etne and Haugesund, general supply.
<i>(c) Bergen and Hardangerfjord</i>			
Tysse . . .	On Sörfjord, nr. Odda	126,000	1,350 ft. head. Electro-chemical and metallurgical industries at Odda and Eitheim, aluminium works at Tyssedal. Capacity may be greater.
Bjölvefoss .	Ålvik, Hardangerfjord	42,300	2,820 ft. head. Electro-metallurgical industry at Ålvik.
Fröland . .	E. of Bergen	19,200	492 ft. head. Bergen, general supply.
Dale . . .	NE. of Bergen	36,750	1,060 ft. head. Bergen, general supply.
Herlandsfoss .	Nr. Hosanger, Österøy Is.	10,200	460 ft. head. Bergen, general supply.
<i>(d) Isolated stations</i>			
Vang . . .	Nr. Öilo, L. Vangsmjösen	..	..
Höyangfallene	Sognefjord	23,800	2 heads, 1,900 ft., 2,400 ft. Höyanger aluminium works, capacity recently increased.
Stangfjord . .	N. of Sognefjord	2,000	Sunnfjord aluminium works.
Bremanger . . (Svelgen)	Gulenfjord, nr. Nordfjord	10,900	730 ft. head. Bremanger Kraftselskap ironworks and general supply.
Morkevann . .	Nr. Bremanger	4,000	..
Tafjord . . .	Storfjord	18,700	500 ft. head. Electro-metallurgical works.
Skar . . .	Tingvollfjord	3,100	500 ft. head. Kristiansund N., general supply and industry.

The stations on the west coast, south of Trondheim, fall into four groups as above. In the Stavanger region, Flörli, Maudalfallene, and Oltedal all have grid connexion with the sub-station at Stavanger. The three Sauda stations are connected with Etne and the sub-station at Haugesund. Tysse is one of the largest Norwegian stations and serves three very important industrial centres. Bjölvefoss uses a greater head of water than any other station in Norway. In the Bergen area, Froland, Dale, and Herlandsfoss have grid connexion with the sub-stations at Heldal and Haukeland to supply Bergen and the many industries in the surrounding district. Of the isolated stations, Vang is new and there is no information about it. The others all supply local electro-metallurgical works with the exception of Skar, which is connected to Kristiansund N. for general supply and industry.

4. TRONDHEIM

<i>Name of station</i>	<i>Position</i>	<i>Capacity in kW.</i>	<i>Use, &c.</i>
Hyttefoss . . .	R. Nid, S. of Trondheim	8,800	160 ft. head. Trondheim, general supply and industry.
Övre Lerfoss . . .	„ „	7,700	100 ft. head. Trondheim, general supply and industry.
Nedre Lerfoss . . .	„ „	6,600	88 ft. head. Trondheim, general supply and industry.
Skjenaldfoss . . .	Thamshavn (Trondheims- fjord)	2,600	200 ft. head. Thamshavn, copper and paper industry.
Svean . . .	W. of Trondheim	11,200	160 ft. head. General supply.
Selbu . . .	S. of Selbu	2,050	390 ft. head. General supply.
Köpperå I and II.	3 m. E. of Meråker	10,000	Heads, 610 ft., 270 ft. Electro- metallurgical works at Merå- ker. Capacity may now be 21,000 kW.
Follafoss . . .	Beitstadfjord, NW. of Trondheim	23,100	570 ft. head. General supply.

Trondheim itself is supplied by the three linked power stations of Hyttefoss, Övre Lerfoss, Nedre Lerfoss; the power from these stations is transformed at the sub-station in Trondheim and used for general supply and industry. The other stations are not interconnected, but there is an extensive grid from Follafoss to supply the Steinkjer and Namsos districts.

5. NORDLAND AND TROMS

<i>Name of station</i>	<i>Position</i>	<i>Capacity in kW.</i>	<i>Use, &c.</i>
Dunderland . (Reinfoss)	E. of Mo in Rana	3,200	90 ft. head. Iron mines.
Glomfjord .	Glomfjord, S. of Bodö	57,600	1,510 ft. head. Haugvik alu- minium works.
Boden .	NE. of Bodö	5,600	380 ft. head. Bodö, general supply.
Sulitjelma (Fagerli and Gjertrud- dammen)	Nr. Skjerstad- fjord, E. of Bodö	4,700	Heads, 130 ft., 100 ft. Copper mines.
Hakvik .	SW. of Narvik	2,000	Narvik, general supply.
Nygård .	N. of Narvik	24,100	" " "
Vagsfjord .	Hinnöy. Nr. Harstad	2,700	200 ft. head. General supply.
Skar .	Ringvassøy Is., N. of Tromsö	7,300	Tromsö, general supply and in- dustry.

The power stations in the north are isolated units, supplying local domestic needs and local industry. There is no extensive grid system, though short lines connect outlying stations to the towns. Of the stations near Bodö, Glomfjord and Sulitjelma are used by large-scale industry; Glomfjord supplying the Haugvik aluminium works, and having a surplus of power which could be used for further industry, and Sulitjelma supplying the Sulitjelma copper mines. Of the Narvik stations Nygård, which was put out of action in 1940, supplied the iron-ore industry and railway. The Hakvik station is small and used only for general needs. Both stations have grid connexions with Narvik. It is possible that further power could be derived from the Skjoma river.

Skar is the most northerly station and is connected by grid with Tromsö.

6. FINNMARK

No large hydro-electric power stations have yet been developed here, although there are two small ones (1,000 kW.) at Kobholm and Tarnelv, E. of Kirkenes, which are used by the iron mines. It is estimated that the Alta river could yield 80,000 kW., and in the Pasvik river there is also considerable potential water power.

THERMAL ELECTRICITY

THERMAL power is not widely used for the generation of electricity since hydro-electricity in Norway is generally more economical. There are reserve stations at Oslo (43,500 kW.), Drammen (5,600 kW.),

and Trondheim (14,500 kW.). The only large stations which are used for main supply are at the Heröya nitrate works (14,000 kW.), near Porsgrunn, and at the Kirkenes iron works (7,000 kW.).

ELECTRICITY SUPPLY

IN general Norway uses alternating current at 50 cycles. The standard supply is 220/380 volts, i.e. 220 volts single-phase for house lighting and power, and 380 volts single- or three-phase for power in small workshops and factories. Some places in the Fredrikstad, Skien, Mandal, and Stavanger areas have an alternative supply at 120 volts. Direct current is still used in a few districts, e.g. parts of Bergen and Oslo. Trondheim has a supply at 150 volts A.C. Most of the large industrial works have their own plants with no standardized type.

In remote districts even the smallest workshops and factories have their own electric plants, generally using water power.

In the south-east many stations are connected by a grid generally carrying 60 kW., so that shortage of water in any particular district is unlikely to affect production very greatly. In other parts of the country the grid is less extensive and dislocation of any particular plant may cause much interruption to supply.

COAL

THE coal resources of Norway are negligible (*v.s.* p. 245), so that the country depends entirely on imported coal. For particulars of the Norwegian coal imports see Chapter XV.

OIL SUPPLIES AND STORAGE FACILITIES

NORWAY is entirely dependent upon foreign sources for her oil supplies. There are, however, some low-grade shale oil deposits in the country, which have never been worked. In peace-time Norway requires large quantities of fuel oil and diesel oil for her mercantile and fishing fleets, and motor spirit for her road vehicles. There is no local manufacture of tetra-ethyl lead.

The aggregate tankage capacity of the Norwegian oil installations is (October 1940) between 280,000 and 300,000 tons. There is also a considerable amount of tankage for whale oil and herring oil (65,000 tons at Fredrikstad and Sandefjord).

Particulars of Norwegian oil installations are given in Appendix XII (*v.i.* p. 384).

CHAPTER XIV

AGRICULTURE AND FORESTRY

AGRICULTURE

Soils

HUMAN settlement in most of Norway is so restricted by conditions of climate and relief that the mere presence of soil rather than its quality and type encourages agriculture. Norway presents many circumstances adverse to farming; its latitude is high, a large proportion of its area is occupied by plateau and mountains over 2,000 feet above sea-level, while its surface, mainly composed of hard rocks scraped bare during the Great Ice Age, gives scanty and infertile soil. Patches of Quaternary sediments, especially below the height of 600 feet, afford the most suitable soils for cultivation. These soils generally occur at the heads of fjords or river mouths where there are raised beaches and terraces, or with morainic deposits in valleys and plateaux. Such deposits occur throughout Norway; in the north, however, they become more gravelly and less fertile, while in the east they are mixed with clay and, therefore, more fertile. The soils found in the region round the Oslofjord and to the north of it, including the area around Lake Mjösa, and also in the Trondheim depression, are the richest and most fertile in the country because of deposits of marine clay. These clays contain much lime and some phosphorus which are lacking in the soils of most of the rest of Norway. On the whole, however, the clays tend to be cold and slow, and to require much drainage, except where they are mixed with other soils. In the Oslo region, where volcanic deposits and warm sandstones are mixed with the clays, nutritious soils occur. In Jaeren there is another very fertile area where the soils are also of a clayey nature, though of a different type, being intermixed with sands and gravels.

In only a few districts of Norway are there level tracts resembling the plains of other countries. The most important of these are located in the areas of better soils and are found on either side of the Oslofjord, round Lake Mjösa (Fig. 37), in Jaeren (Fig. 18), and in the Trondheim depression.

Extent of Cultivation

Natural conditions affecting agriculture vary considerably from one district to another. This is due especially to the great extent of the

country from north to south and to geological conditions. The climate, which is warm and mild for such northerly latitudes, enables the growth of plants which would not otherwise survive so far north. Most temperate crops can be cultivated in the lowland areas south of the Arctic Circle, and the less hardy types of plants can sometimes be grown successfully in the more sheltered areas. In the far north and in the upland areas the possibilities are more or less limited to growing hay. Barley will ripen as far north as 70° latitude, and potatoes do well in the northernmost parts of the country. Apples, pears, plums, and cherries of good quality are grown in the more sheltered regions of the west coast and Oslofjord; even tobacco is grown in Luster and in other sheltered regions.

Of the total area of the country (124,500 square miles) only 3,400 square miles, or 2·7 per cent., are under cultivation, whilst about 740 square miles consist of natural meadow-land. The available farmland thus totals about 4,140 square miles, or 3·3 per cent. of the total area. In addition about 3,900 square miles of outlying land are either used as hayfields or for grazing. Most forest-land is attached to farming estates which hold rights of property or user over about three-quarters of the area concerned. The farmlands proper, the outlying hayfields, and forests, account for about 28 per cent. of the total area of the country. Large stretches of the remaining land are used as summer pasturage for domestic animals. It is estimated that about 30 per cent. of the total forage required for domestic animals is obtained from summer pasturage, and about two-thirds of this comes from the uplands and mountain grazing-land (cf. Seter System, *v.i.* p. 286).

The most outstanding agricultural districts are those round the Oslofjord, including the counties of Östfold, Akershus, and Vestfold. Although these counties represent only 3·6 per cent. of the total area of Norway, they account for approximately 23 per cent. of the farmland. The proportion of the total area under cultivation in these counties is 20 per cent. as against 2·8 per cent. for the country as a whole, and less than 1 per cent. for the northernmost parts of the country. The unproductive lands (in which outlying grazing-lands and mountain pasture, but not forest, are included) represent about 72 per cent. of the total area of the country. In western Norway and northern Norway the proportion is over 80 per cent., and only in the three counties already mentioned is the percentage less than 20.

Enclosure

The more cultivated areas of Norway, such as the region round

Oslo and the Oslofjord, are enclosed. The farms found in the south-eastern valleys and in the forest regions of the Trondheim depression are enclosed as far as possible in order to keep animals from straying into the forests. The farmland in Jaeren is enclosed by stone walls. Throughout the rest of Norway most agricultural fields lying near individual farms are enclosed usually by unsubstantial wooden fences, while the mountain pastures and seter-lands are generally open. A proportion of the farmland in Norway is the common property of the village or region and is unenclosed.

Distribution of Main Crops

Norwegian agriculture is largely dominated by dairy farming and animal husbandry. Most of the Norwegian farms use rotation systems, by which the land is put down to grass for cattle grazing for certain periods. The most usual and popular of the rotations is somewhat as follows: first year oats or a mixed grain crop, second year root crops or fallow, third year barley or rye, and then meadow grass for three or four years. These meadows, which are largely composed of timothy, clover, and wild grass seeds, may be cut for hay, or the animals may graze them. Two crops of hay are cut annually in the Mjösa region and near the Oslofjord. The hay is dried either on posts or wire fences and is not left to dry on the ground as in England (Fig. 38).

Cereals and potatoes are the most important crops. In 1938, of the area of tilled land, $22\frac{1}{2}$ per cent. was under cereals, $6\frac{1}{3}$ per cent. under potatoes, and the rest, for the most part, under forage crops. It is estimated that 85 per cent. of the total crops produced on the farmland (excluding market-garden produce) is used for animal fodder. In 1938 cereals were grown on about 465,000 acres, of which area 212,500 acres were under oats, 150,000 acres under barley, 87,500 acres under wheat, and about 13,500 acres under rye, while some maslin and peas were also grown. Wheat growing has developed considerably during the last few years, partly at the expense of other cereal crops. The total area under cereals has increased by 15 per cent. since the beginning of the century. Since, however, the yield per area unit has improved considerably as a result of better husbandry and plant selection, the total cereal production has risen during the same period by 50 per cent. During the last few years total production has amounted to about 400,000 tons per annum, while a slightly larger quantity, mainly cereals for bread-making, were imported. The aggregate value of the vegetable produce raised on the farmland in

1937 was estimated at 340 million kr., 50-60 million kr. of which was consumed as food, and the remainder used as fodder for domestic animals. Home production of fodder crops is supplemented by considerable annual imports of cake-meals. It has been estimated that 15-16 per cent. of the total fodder requirements are met by imported cake-meals.

Oats, the most extensively grown of the cereals, are cultivated as far north as Tromsø. The most important oat-growing regions are found in the south-eastern part of the country, although it is the staple crop in the fjord regions, where it is grown instead of barley, since the dampness of the climate makes a longer season necessary. Oats take about 105-115 days from sowing to harvest in the eastern regions, and somewhat longer in the western districts.

Barley is grown extensively throughout the drier regions except in Finnmark, where only a very little is cultivated. Hardier and quicker ripening varieties than those common in Britain have been evolved. The long light and the generally high amount of sunshine make a very short growing-season adequate. Barley requires about 90 days from sowing to harvest in a good season, and about 30 days longer in a bad, whereas in Britain between 120 and 150 days are required. This crop is grown up to a height of about 2,000 feet.

Wheat is rarely cultivated north of the Trondheim depression, except for a little spring wheat in Nordland. It is found more extensively in the regions of better soils round and to the north and south of the Oslofjord. It does not flourish at an altitude higher than 900 feet.

Rye is little grown north of Nordland or in the west coast fjord regions. The greater portion of this crop is found in the county of Östfold. Rye is sown both as a winter and spring crop. The winter rye gives the heaviest yield, but is liable to be damaged by the rapid alternation of frost and thaw.

Peas are cultivated in small quantities in the south-eastern parts of the country and in the Trondheim depression. Two thousand five hundred acres were under peas in 1938.

Potatoes are one of the most important root crops cultivated. They grow easily in almost all the inhabited parts of the country, and form a staple part of the people's diet. About 134,000 acres were under potatoes in 1938.

In recent years market-gardening has developed very rapidly. The annual value of market-garden produce is estimated at 40-45 million kr. In 1938 the number of fruit trees in the country was over

3,000,000, including 1,500,000 apple trees and over 1,000,000 cherry and plum trees. There were also about 4,800,000 cultivated berry bushes. The principal fruit-growing regions are in the south-east, especially round and near Oslo, and in the west coast fjord region, particularly in the Hardangerfjord.

Although Norway lies far to the north, the yield of crops per hectare is considerable. During the five-year period 1933-7 the average yield per hectare was:

	kg.		kg.
Wheat.	1,942	Potatoes	17,998
Rye	1,832	Forage turnips	39,176
Barley	1,940	Hay	3,714
Oats	2,016		

Distribution of Livestock

The climate favours pastoral farming so that the rearing of live-stock has become the most important agricultural occupation. The number of domestic animals in Norway in 1938 was as follows:

Horses	193,000
Cattle	1,399,000
Milch cows (included in previous item)	832,000
Sheep	1,778,000
Goats	308,000
Pigs	429,000
Fully grown poultry	3,526,000

The number of domestic animals, especially poultry and pigs, has increased substantially during recent years, having been almost doubled since the beginning of the century. The feeding and sheltering of the animals has also been greatly improved, and as a result, the yield per animal is much larger.

Cattle. Cattle-raising is the dominant type of farming in the mountainous parts of the country and in the more northern regions. Cattle are principally kept for their milk and milk products. They are usually small, hardy animals which can live in mountainous country and survive the vigorous winter on rather limited fodder. The provision of winter fodder was once a great problem, but recently much has been imported, and use has been made of rotations, as already described, which include fodder crops. The farmer can usually devote much of his land to the growing of winter fodder if he sends his cattle to summer pasture at the seters (*v.i.*, p. 286). The farmers, especially in the far north, when winter fodder is short, mix fish, fish-meal, fish-heads, and seaweed with the fodder crops. The most important breeds of dairy cows in the country are the red-polls,

the Telemark, the grey and black westland, the Döle cattle in Gudbrandsdal and Österdal, the Röros, and the red Trondheim cattle. The Telemark are the most typical and probably the most popular of the mountain cattle. These breeds are indigenous to Norway and have a good milking capacity for their size. The better-class herds give an annual yield of 6,615 lb. of milk per head, with a 3.8 per cent. fat content. The best cows yield up to 11,025 lb. of milk annually. There is no special breed of cattle for beef production, but some herds of imported breeds are fattened, the most important of which are shorthorns.

Horses. There are two main breeds of horses in Norway, the 'fjord horse' of the west and the Gudbrandsdal horse of the east. The former is sturdy and small, being of a fawn or dun colour. It is a very hardy animal and is well suited for hill work, and heavy work on small farms, for which it is used throughout the country. The latter is a medium-sized horse, usually brown in colour, and is well suited for farm, forest, and military work. It is used in the south-east and in Tröndelag.

Sheep are kept throughout the country, especially in the fjord and mountain regions, where they are usually pastured at a higher level than the cows. The sheep reared are usually Cheviots which have been imported from Britain, though there are also some sheep of Norwegian origin.

Goats. The number of goats has recently decreased in forest districts, because so much damage was done by them to the trees. The treeless parts of the country, however, suit them well, and they are numerous in the west coast fjord regions. The breeds of goats, which are almost exclusively of Norwegian origin, are small, but generally good milkers.

Pigs. The most important types of pigs are the Great Yorkshire breed and the Norwegian land swine.

Diseases. Foot and mouth disease does not exist in Norway, and tuberculosis among cattle is rare. Sheep-pox, sheep scab, and foot-rot are also infrequent.

Fur-bearing animals. In recent years, in addition to general stock breeding, Norwegian farmers have extensively bred fur-bearing animals, particularly silver foxes. This branch of agriculture has developed considerably within the last ten or fifteen years. The number of fur-bearing animals bred in captivity in 1929 was 30,000, the majority of which were silver foxes. By 1936 the total had risen to over 400,000 of which 390,000 were silver foxes, 8,600 blue foxes,

and nearly 7,000 mink. In 1937-8 about 330,000 silver fox skins were exported. Norway supplies over one-third of the world's total production of silver fox furs.

The Seter System

Under this system stock is grazed during the summer on natural pastures, which, by reason of quality or position, are neither included in the farmland nor grazed directly from the farms. The stock is attended by a milkmaid, who usually lives in a hut called the 'seter hut', which is generally situated in this summer or 'seter pasture'. As a general rule seter rights belong to each property, and are always sold with the farm to which they belong.

The seter system is not used throughout the whole country, and is less widespread than it was a century ago. The distribution of this system has altered considerably, and is still in process of alteration, owing to developments in modern farming methods, which have changed the relative importance of farmland and natural pastures. Farms are usually situated between sea-level and 2,800 feet and seter pastures usually between 2,000 and 3,000 feet, but the latter may be found at very varied heights. These pastures are generally above permanent settlements, although where land is scarce poor farms may be found alongside the lower seters. This is especially true in the west coast regions, where seters are sometimes as low as 150 feet so that they may escape danger from avalanches, and sometimes as high as 3,000-4,000 feet, because of the scarcity of land.

The seter system is of greatest importance in the highland areas. The principal regions where it is extensively used are: (1) an area extending between the Trondheim depression on the north, Lake Mjösa and the Boknfjord on the south, the Swedish frontier on the east, and the middle reaches of the fjords on the west. Within this region the system is commonest in the plateau regions near the Swedish frontier and at the heads and along the middle reaches of the fjords; and (2) an area to the south-east of the Viddas extending between the Valdres on the north-east and the Byglandsfjord on the south-west. Here the system is most developed in the upper reaches of the valleys. There are few seters in the coastal lowlands round the Trondheimsfjord, in the coastal stretch between Stavanger and the Oslofjord, for some considerable distance inland from the Oslofjord, and to the north of Namsos. Between the two extremes there is usually a fairly wide belt where the seter system is only moderately developed. In general terms the system is rarely practised where forest is grown



FIG. 37. *Östfold. Farm-lands by the Oslofjord*



FIG. 38. *Drying hay on poles near Opdal*



FIG. 39. *Seter huts and pastures*



FIG. 40. *Delivering milk from the seter to the farm in an eastern valley*

commercially, or where agricultural land is good and not broken up by mountains.

The distance of the seters from the farms varies considerably. The seter pastures are generally between a quarter of a mile and 8 miles distant, although a few may be as far as 70 or 80 miles away. More usually the distance from the farm is between $1\frac{1}{2}$ to 4 hours walking, although sometimes the journey may take several days. Some farms have spring, summer, and autumn seters; this practice, however, is not common, and one seter is usual. The length of the seter season may vary from $2\frac{1}{2}$ to 8 months; in the west it is sometimes shorter than in the east, varying from $2\frac{1}{2}$ to 3 months. The season, in most regions, starts at the end of May or the beginning of June, and ends in late September or early October. Climatic conditions and the extent of the farmer's supply of winter fodder influence these dates, but in some parishes a fixed date is given for the beginning and end of the season.

The location of the seter huts is influenced by proximity to water and wood, and shelter from storms, avalanches, and landslides. Cows, stirks, bulls, horses, goats, and sheep are all taken up to the seter and grazed. The cows are given the most attention, and not allowed to wander too far from the seter buildings because they have to be milked daily. The stirks, bulls, and horses are usually separated from the cows and pastured at a higher level. The goats are taken to the roughest pasture and to areas where there are no trees. The sheep, which are sent above the seters to the poorest ground, are not found on all seter pasture throughout Norway, but are largely confined to Rogaland.

The animals are usually looked after by seter maids, who are sometimes the farmer's wives or daughters, or hired servants. The number of these maids varies according to the number of stock kept at the seters. The maids watch the cows, and milk them as well as making butter and cheese. Butter is the most usual seter produce, because it is easier for the seter maid to make. This is because the milk can be kept for several days, and the labour involved is less than that expended on making cheese, which is a very laborious task requiring much timber, not always available, for fuel. The seter cheeses are frequently considered to be of a lower standard than the farm or co-operative dairy cheeses, and do not market so well. The skim milk left over from butter-making is used to feed the calves and pigs. Great quantities of marketable seter-made goat cheese are produced in Sogn and Fjordane. Fresh milk is sometimes sold to dairies, but

this is not always easy, since the roads to the seters are often steep hill-tracks, or at the best, narrow lanes. Recently efforts have been made to improve seter roads, so that lorries can collect the milk, but there have to be a great number of seters to make this profitable and the necessary conditions are generally only found in the east. The seter maids sometimes have to carry the milk or send it down on wire cables to the farm so that it can be collected by lorry or fjord steamer and taken to a factory. Co-operative seter dairies have been set up in some regions, chiefly at places where goat-milk cheeses are made, or where communications are very good. Besides sending their own stock to the seter pastures, farmers frequently fatten those of stock-dealers from the valley regions.

The seter system makes good use of upland pastures in a country where agricultural land is scarce. As a rule the farm is not able to produce enough fodder for cows in summer and winter, and it is profitable to send the cows to other pastures in the summer while fodder crops are being grown for the winter. Recently, however, imported fodder for the winter has been easy to buy, and many farmers prefer to keep their cows in the farms nearer the dairies in the valleys, so as to sell the milk to them. The seter system requires much labour of a type which is becoming more difficult to obtain because the hours are so long and the work so heavy. The system with its seter maids and seter huts may die out, but the seter pasture will always have to be utilized as it forms such a valuable addition to the agricultural resources of Norway.

Irrigation

The rainfall in certain districts of Norway is so slight that irrigation has to be practised during the growing-season of cereal crops. The area of lowest precipitation covers the heads of the Gudbrandsdal and Ottadal valleys in the east, and the Laerdal and Årdal valleys in the west (*v.s.* p. 119). These valleys have a spring and early summer minimum and a late summer and autumn maximum. In Ottadal the rainfall is as low as 2 inches in the growing-season between March and May or June. The rainfall in the Laerdal valley at the head of the Sognefjord is also low, averaging as little as 3.2 inches for the four growing-months. Temperatures in the regions mentioned are high during the period of growth, and therefore what moisture there is in the soil tends to evaporate. The rainfall is too slight to allow a good crop to be grown, and therefore irrigation has to be practised in these

valleys. This irrigation is purely to satisfy the moisture demand of the plants and is in no sense a fertilization process.

Irrigation is less widely practised to-day than it was fifty years ago, largely because corn and fodder crops are easily imported. Nowadays only Gudbrandsdal, Ottadal, some parts of Österdal, Laerdal, and the lower stretches of the Årdal valley are irrigated. Irrigation is generally used only on arable land and that during the growing-season, usually March-June. After these months the plants have a lower demand for moisture, and the rainfall is higher, and so irrigation is unnecessary. In the west, in the Laerdal and Årdal valleys, the irrigation period usually starts in the middle of May and continues for 3 months, while in the east it commences in June and continues for about $2\frac{1}{4}$ months. The number of times the land is irrigated varies from year to year.

It is not always easy to find irrigation water. In the east the heavy falls of dew are utilized, glaciers are tapped, and small streams used. The rivers here are too rapid and incised to permit irrigation, and the farms are so situated as to be unable to use them even if the nature of the river-bed should be suitable. The tributary streams which flow from hanging-valleys are also useless, although some small tarns and minor streams can be used. In the west, in the Laerdal valley, it is possible to use the main river for irrigation as it flows in a series of terrace-like steps. The water, however, in most regions, frequently has to be led over miles of undulating plateau and down steep valley floors. The chief problem in all districts is the adjustment of the gradient of the irrigation channel to the relief. The main channels are $1\frac{1}{2}$ -2 yards wide and 1-2 feet deep, and consist either of the courses of streams which have been regulated or of channels dug out of the soil. Small depressions are frequently crossed by wooden runnels, and the channels, when flowing in open cuttings through porous soil, are sometimes floored with cement in order to prevent erosion.

Irrigation is regulated by dams of sod and stone (in Laerdal they are of wood) at the canal intake. The sub-systems leading to individual fields consist of small open canals or runnels, and pipes when hydrants are used. The runnels in the west are largely earthen, whereas in the east they are wooden, being hand-made from tree-trunks. The runnel is laid centrally in the individual fields and rows of small furrows are made at right angles to it. The irrigation pattern in the fields depends on the slope, the soil, and the crop. As a rule furrows are generally 3-4 yards apart on ploughland and 10-20 yards on meadow-land. The process of distributing the water from these

furrows requires much labour, and much care is needed in regulating the general flow of the water.

Land Tenure, &c.

Norwegian farms are usually small and largely owned by the farmers who work them. Only 5.2 per cent. of the holdings have more than 25 acres of cultivated land, and there are very few estates in the British sense of the term. Norway, therefore, may be considered to be a country of small-holders or peasant farmers. Farms usually have, besides the cultivated land, considerable areas of uncultivated land, outlying fields, and woods and fells with hunting and fishing rights. Therefore a farm which has little cultivated land may frequently be very large in area. The agricultural census of 1929 estimated that there were over 298,000 farms, 90,000 of which had up to 1.25 acres of farmland, 150,000 between 1.25 acres and 12.5 acres, about 53,000 between 12.5 acres and 20 acres, and 5,000 more than 20 acres. Only 32 farms had more than 250 acres. Further details of land tenure are given in Chapters VIII and IX (*v.s.* pp. 175, 211).

Labour Resources

In 1930 about 800,000 persons (30 per cent. of the total population) were engaged in agriculture and forestry, of which about 300,000 persons were directly engaged in tilling the soil. The main occupation only of the breadwinner is mentioned above. Those engaged in agriculture frequently follow a subsidiary occupation as well, while there are about 80,000 persons who carry on agricultural work as a sideline. On the smaller farms most of the work is done by the owner and by members of his family, who are not recorded in the census returns as agricultural workers. The domestic personnel and children who help in the work at home should also be counted, because they take a large share in the agricultural work. It may be said, therefore, that the persons for whom agriculture constitutes the main source of revenue number about 393,000, of which 38 per cent. are independent farmers and 37 per cent. children living at home, whilst the remaining 25 per cent. consist of hired labour. These figures show how agriculture is predominantly a family industry, and this impression would be still further strengthened if it were possible to consider the amount of work connected with agriculture done by the housewife (e.g. under the Seter System). There are few farms which are worked entirely by hired labour, as at one time there was an excessive tax on property owned by farmers possessing more than one holding. Hired labour

is, in consequence, a minor factor, and only in comparatively few districts in which the farms are fairly large does it become a matter of importance. Many of the farm-hands have small holdings of their own. There is little class distinction between the farmers and their labourers, who work together and have similar interests. More than 40 per cent. of the hired agricultural labourers are under 20 years of age.

FORESTRY

FOREST covers about 25 per cent. of the total land area of Norway, the forest area per inhabitant amounting to about 2.1 square miles, which is larger than in most other countries, with the exception of Finland, Sweden, and Canada. The area of productive forest according to the latest forestry statistics available¹ amounts to about 30,105 square miles, of which 21,020 square miles (70 per cent.) is coniferous and 9,085 square miles (30 per cent.) is deciduous. There is also an area of 8,100 square miles of coastland, which has in past years been deforested but is undergoing reafforestation. The total stock of timber in Norway is estimated to be 11,390 million cubic feet, and the annual increase in growth 310 million cubic feet. The depletion of the forest over the last ten years has been about 5 per cent. less than the increase.

Deforestation and Afforestation

Coniferous timber is an important commercial product, while deciduous forest is only used for domestic consumption. There has been little deforestation except in the mountain regions and along the coasts. The deforestation of the mountain regions is largely due to the use of the seter system, which is employed in many of the mountainous areas. This system requires a certain amount of timber for building the seter huts and for domestic uses, while the intensified grazing of cattle in the forest-land prevents the growth of seedlings. The west coast has also suffered much from deforestation, largely because it has been well populated from earliest times and much wood has, accordingly, been used for the building of houses and for other domestic purposes. Large quantities of timber have also been exported throughout historical times because of the ease with which it could be transported by sea. Furthermore the coastal forests were often burnt down, so as to prevent enemies taking cover in them,

¹ The Forestry Commission of 1919-30. The work of this commission was under revision at the beginning of 1940, but no further information is available.

while the enemy in their turn frequently burnt down the forests for similar reasons.

The greater part of Norway which is at present forested should probably remain so since the land is not suitable for cultivation. The Forestry Commission has calculated that only 2.5 per cent. of the present forest area could profitably be cultivated. The forest area itself, however, could be enlarged if the bogs within the tree limit were drained, and if the deforested regions were replanted.

Types of Forest

The coniferous forests of Norway are largely made up of Norway spruce (*Picea excelsa*) and Scots pine (*Pinus sylvestris*).¹ The most common deciduous trees are the birch, aspen, and alder.

The upper limit of coniferous forest is at about 3,300 feet in the eastern regions of Norway, between 2,000 and 2,300 feet in the eastern regions of the Trondheim depression, and at about 1,000 feet in the inland and most sheltered valleys of Finnmark. The upper limit of the conifers in all regions diminishes considerably as the coastal regions are approached. The mountain birch, which is hardy and will grow in poor or shallow soils and in harsh climates, is found up to 500–650 feet above the limit of the conifers, as well as at low elevations near the coast. The other kinds of deciduous trees generally grow in low-lying districts near dwelling-places and at the edges of fields.

The pine is the predominant coniferous tree in most of northern Norway, the west coast fjord region, and in the western regions of the south. It has been ousted from first place in other forest regions by the spruce. The pine is also found sparsely mixed with the spruce forest, as well as on sandy valley floors, rocky hill-sides, and on other poor soils. The pine accounts for 28 per cent. of the total cubic content of Norwegian forests, while the spruce accounts for 54 per cent.

In the southern regions the pine may grow as tall as 110 feet, although its more usual height is between 65 and 82 feet. In the northern regions its average height is not more than 39–43 feet. The average for the whole country is between 52 and 60 feet. The Norwegian pine has a well-formed trunk, which is highly valued for its timber. Under optimum conditions the age of the pine, when felled, is 70–80 years in the more southerly parts of the country,

¹ 'Spruce' and 'pine' throughout the text refer to Norway spruce and Scots pine.

but it is generally older. In the northern parts the age of the tree may vary from 130 to 200 years. The annual increment of pine forest is given in Appendix XIII, Table 3 (*v.i.* p. 392).

The spruce migrated to Norway about 4,000–5,000 years ago, after the pine had become established. The spruce has taken possession of large tracts of forest-land in the eastern valleys and in the Trondheim depression, and is still spreading northwards and southwards from these regions and encroaching farther on the territory of the pine. There is nothing, from a climatic point of view, to prevent the spruce from growing throughout Norway south of the Arctic Circle, and, although small and poor, it is actually found in Finnmark, where it has spread from Finland. Commercially the spruce is more important than the pine since it is more prolific, grows more closely together, and attains maturity more quickly. The average annual increment of the spruce forest is 5.2 million cubic metres and of the pine forest 2.4 million cubic metres. The average height of spruce is 72–85 feet, although trees sometimes reach a height of 135 feet. Under optimum conditions trees may be felled after 40–50 years' growth in the south, and after 100–140 years in the north, but the most usual age for felling is 70–80 years.

The mountain birch is the most important of the deciduous trees, since it is hardy and grows under conditions impossible for other trees. It is frequently employed as protective forest to provide shelter for young coniferous trees. In some regions it is used for fuel and for the making of tools. The trunk of a birch-tree rarely grows higher than 13–16½ feet, while the whole tree is never much taller than 33 feet. Along the south coast there are some small oak forests, which were once important for shipbuilding but are now only cut for fuel. There are also in southern Norway beech forests which cover an area of 1½ square miles and are apparently spreading.

Forest Regions

There are two main coniferous forest zones in Norway; the larger covers the long river valleys of the east, and the smaller the Trondheim depression. In the western part of the country coniferous forest is only found in small patches at the heads of the fjords and in their tributary valleys. The distribution of coniferous forests can be seen most clearly from Map 49 (pp. 299, 300).

The principal forest regions are:

- (1) The eastern region, which is constituted by the counties¹ of

¹ Map 1.

Östfold, Akershus, Hedmark, Opland, Buskerud, Vestfold and Telemark.

- (2) The southern region, which roughly comprises Aust and Vest Agder.
- (3) The west coast fjord region, comprising the counties of Romsdal and Möre, Sogn and Fjordane, Hordaland and Rogaland.
- (4) The Trondheim depression, which may be said roughly to consist of the counties of north and south Trøndelag.
- (5) Northern Norway, comprising the region north of the Trondheim depression, and including the counties of Finnmark, Troms, and Nordland.

The types of trees found in the forest areas of the different regions is given in the following table:

Percentage of Collective Cubic Content of Forest by Types of Tree

	<i>Spruce</i>	<i>Pine</i>	<i>Deciduous</i>
	%	%	%
Eastern Norway	61½	27½	11
Southern Norway	18	54	28
West coast fjord region . . . .	..	64	36
Trondheim depression	67½	15	17½
Northern Norway	22	14	64
The whole country	54	28	18

The forest area of the five regions is given below in percentages of (1) total area of the regions, and (2) total area of the country:

	(1)	(2)
	%	%
Eastern Norway	44	51.9
Southern Norway	30	6.2
West coast fjord region	11	7.9
Trondheim depression	30	14.9
Northern Norway	13	19.1

See Appendix XIII (p. 390), Table 1 for productive forest area (by counties), Table 2 for total collective content of forest (by regions and counties), Table 3 for collective annual increment (by regions and counties), and Table 4 for cubic content of forest per hectare (by counties and regions).

The Eastern Region. This region is largely made up of the long north to south valleys of which the most important are the Gudbrandsdal and Österdal. Most of the southern and eastern areas are

low-lying, while the northern and western areas are hilly and gradually rise to the high fjeld. The soils in the valleys are generally good but other soils vary considerably throughout the region. The total area of the eastern region is divided as follows:

	<i>Hectares</i>	<i>Percentage</i>
Agricultural land . . .	494,900	5.2
Grazing land	248,000	2.6
Bog	630,600	6.7
Unproductive land . . .	606,600	6.4
Lakes and rivers	454,000	4.8
Mountains	3,039,300	32.1
Productive forest	3,992,600	42.2

The forests of this region, which comprise 51.9 per cent. of Norway's total forest area and 66 per cent. of the total coniferous area, are considered to be the most valuable in Norway. The greater part is coniferous, although deciduous forest occurs in the more mountainous districts and is sometimes mixed with coniferous forest in the lowlands near the sea. Two-thirds of the deciduous forest consists of mountain birch, which is found above the limit of the conifers.

Growing conditions are not universally good since much of the forest is on ridges and the flanks of mountains which have a very thin covering of soil. Only 45 per cent. of the trees grow in what is designated as good or medium conditions. On the other hand, the conditions are good for seeding. The spruce seeds every third or fourth year, and the pine every fifth to eighth year. The conditions of natural renewal of the coniferous forest are, on the whole, fairly good when compared with other Norwegian regions.

The conifers here have smaller dimensions than those in the forests of the Trondheim depression, although the trees in the latter region are not so tall or so well shaped. Seventy-one per cent. of the total cubic content of conifers of the whole country is found here, as well as 27 per cent. of the total deciduous cubic content (Appendix XIII, Table 2), 71 per cent. of the country's annual increment of forest, 76 per cent. of the coniferous annual increment, and 48 per cent. of the deciduous annual increment. The average annual increase per hectare of productive forest-land below the upper limit of conifers is 1.85 cubic metres, of which 1.62 cubic metres is conifers. The greater part of the country's timber industry, both for home consumption and for export, is found here, there being hardly any forest

which is so situated that it does not pay to cut. Eighty-two per cent., or about 4.4 million cubic metres, of the timber sold yearly from Norway comes from this region.

Telemark forms a transition area between the eastern and southern regions. The conditions of growth are more variable in this county than in the eastern region, good and bad forest-land being very intermixed. Telemark on the whole, however, has good conditions for a rich timber production despite the large number of rock outcrops in the forest area. The pine is the predominant forest tree, but the percentage of deciduous forest is comparatively high, being very intermixed with coniferous trees. Telemark may, therefore, in many respects be considered to be more characteristic of the southern region than of the eastern.

The Southern Region. Southern Norway is hilly and in the western areas is cut into by long narrow valleys. The land rises gradually from the low-lying coastal area until far inland, in the north of the region, it becomes really high and mountainous. The altitude limit of the conifers is about 2,300 feet in the coastal areas, being higher farther inland.

The pine is the predominant conifer in the western-central parts of the region, the spruce being more widely distributed in the east. Coniferous and deciduous forest are very intermixed in the coastal districts and in the western parts. The birch is the most widespread deciduous tree, although aspen, oak, beech, and hazel are also found in considerable numbers. The total area of the region is divided as follows:

	<i>Hectares</i>	<i>Percentage</i>
Agricultural land . . .	35,605	2.6
Grazing land	23,879	1.6
Bog	88,549	5.8
Unproductive land . . .	241,123	16.0
Lakes and rivers . . .	70,390	4.7
Mountains	576,473	38.2
Productive forest . . .	472,521	31.3

The annual increment is comparatively large, the spruce having an annual increment of 5 per cent. and the pine of 4.1 per cent. (Appendix XIII, Table 3).

This region enjoys a good market for coniferous timber; some is exported directly abroad, the rest being sent either to local factories or to the eastern region to be processed. An average of 420,000 cubic



FIG. 41. *Coniferous forest in the Österdal*



metres of coniferous products is marketed annually: this is equivalent to about 8 per cent. of the total of Norwegian coniferous products.

The West Coast Fjord Region. The coastal area of this region is bare and unproductive, with stretches of heather and poor grazing-ground covering the low-lying districts and the lower slopes of the mountains. Farther inland the mountains rise higher and higher until they finally form large mountain plateaux in the more eastern parts. Extensive areas of loose soil are rare except in the low-lying district of Jaeren, where large stretches of good soil occur. Rich, loose soil is generally found only in small patches along the inner sections of the fjords and at their heads.

The total area of the west coast fjord region is divided as follows (the most recent forestry commission's figures are not available):

	<i>Hectares</i>	<i>Percentage</i>
Agricultural land . . .	202,000	3.5
Grazing land . . .	510,000	9.0
Productive forest . . .	615,000	11.0
Unproductive land . . .	4,284,000	76.5

Deforestation in the west coast fjord region has already been described. The forest which remains is usually found in the inner fjord regions, while the outer coastal region is comparatively bare. This forest consists chiefly of conifers which are frequently mixed with deciduous trees. Pine is the predominant conifer, although spruce occasionally forms forest in a few small areas, the largest of which is at Våss in Hordaland. Birch is the most widely distributed of the deciduous trees, although *Alnus incana* and aspen are widespread. Oak, elm, ash, and lime occur also except in the more northerly part of the region.

The forest conditions are quite good in the inner fjord regions and even farther inland, where the altitude is not too great. The timber has as good dimensions as any in Norway. In the inland and central areas the altitude limit is about 2,000–3,000 feet above sea-level, but in the coastal areas it falls as low as 1,000–1,300 feet. Shelter from sea winds determines the growth of forest in the coastal regions.

The timber produced here is all used locally, and some is also imported from other parts of the country.

During the last 50–60 years there has been much replanting of forest in this region by the State, which has bought considerable areas of land, the largest being about 1,000 hectares near Sandnes, and by private owners, who receive technical and financial assistance

from the county forestry commissions. It is estimated that about 15,000 hectares have been reafforested, and that about 5 million trees are planted annually. In the early stages pine was the only tree used but, as it did not do well, spruce has recently been planted and is thriving in the better situations. Bush pine (*Pinus montana*) and white fir (*Picea alba*) as well as foreign trees such as *Abies-Laux*, *Picea*, and *Pinus* varieties have also been grown quite successfully. The conditions required for successful afforestation are that the plantations should be (1) sheltered from the sea winds, (2) planted on sloping ground since flat ground is liable to become boggy, and (3) well fenced in order to protect them from grazing cattle.

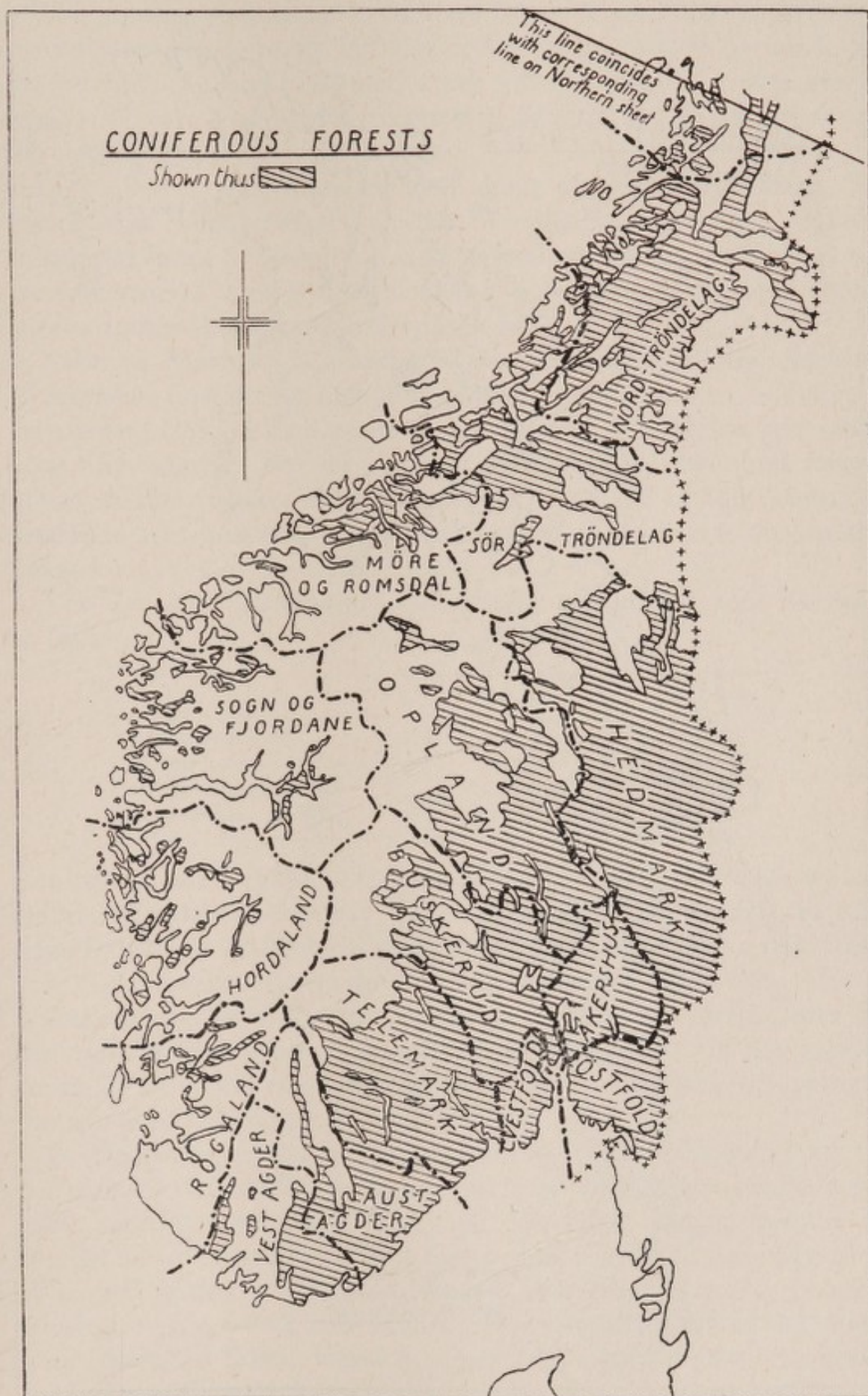
There are large tracts of suitable land besides those already reafforested. Much of this will, however, probably not be replanted, as it is used for cattle grazing all the year round. Cattle raising and dairying are of such economic importance that frequently reafforestation does not pay.

The Trondheim Depression. Coniferous forest is widespread here and stretches far inland towards the mountain plateau on the east. Stunted coniferous forest is also frequently found in the coastal areas where the soil is poor and stony and the climate harsh. The altitude limit of conifers in the southern inland regions of the Trondheim depression varies between 2,300 and 2,600 feet, and in the northern inland regions between 1,600 and 2,300 feet; in the coastal regions the limit varies between 650 and 1,000 feet.

The Forestry Commission divides the area of the Trondheim depression as follows:

	Hectares	Percentage
Agricultural land . . .	134,900	3.3
Grazing land . . .	92,000	2.2
Bog . . .	512,900	12.5
Unproductive land . . .	323,000	7.8
Lakes and rivers . . .	209,000	5.1
Mountains . . .	1,688,900	41.1
Productive forest . . .	1,150,300	28.0

Spruce is the predominant conifer, pine taking a very secondary place, being found largely in the south. The deciduous forest is not mixed with the coniferous to any large extent. Birch is the most widely distributed of the deciduous trees and occurs mainly above the altitude line of the conifers. *Alnus incana*, aspen, rowan, and willows are the only other deciduous trees.



MAP 49 (South Sheet)



MAP 49 (North Sheet)

The seeding conditions of conifers in the Trondheim depression are not very good, partly because of the boggy nature of much of the ground. Spruce trees seed every 4th-7th year, and pine every 6th-12th year. Seeding is frequently spoiled by bad weather in the flowering and ripening season.

In 1938-9 it was estimated that about 934,476 cubic metres of timber was felled annually in the Trondheim depression. Much is used for home consumption, and only about 390,000 cubic metres are sold yearly. This is equivalent to 7.3 per cent. of the total coniferous timber sold from Norwegian forests.

Northern Norway. Northern Norway, broadly speaking, consists of extensive and barren mountain plateaux intersected by numerous valleys and fjords which penetrate far inland. The soil is generally poor and infertile, but 50 per cent. of Norway's deciduous forest grows in this region, which constitutes one-third of the country's total land area. An area of 935 square miles of productive deciduous forest lies north of the Arctic Circle.

The Forestry Commission provisionally divides northern Norway as follows:

	<i>Hectares</i>	<i>Percentage</i>
Agricultural land . . .	84,600	0.8
Grazing land . . .	233,600	2.1
Productive forest-land . .	1,469,700	13.4
Unproductive land . . .	9,175,900	83.7

Coniferous forest is found in inland districts throughout the whole length of northern Norway. The upper limit of conifers in the inland districts of Helgeland is at a height of 1,600-2,000 feet, and in the northernmost part of Finnmark at 650-1,000 feet. There is little coniferous forest in the coastal regions, but birch grows in the more sheltered places as well as in large forests in the inland zones. The coniferous forest is very mixed with birch throughout the whole of the region.

In Helgeland spruce is the predominant tree. It constitutes 95 per cent. of the conifers and grows in large areas which permit very good seeding conditions. The high mountain range, forming a barrier between Helgeland and Salten, has prevented the migration of spruce farther northwards. Pine is, therefore, the only conifer which grows in Salten and Troms. Pine woods flourish in the inner fjord regions of Salten, where the trees are well grown and have good seeding conditions. Large birch forests with comparatively good

seeding conditions also grow in this district. Forest is, generally speaking, less well developed in Troms.

In Finnmark pine forest is more widely spread than in Troms. The soil is poor and sandy and largely covered by a thick carpet of reindeer moss, which makes seeding difficult. Good seeding years for the pine are rare, occurring on an average every 30th year. Birch forest is widespread, although small, and has made this area habitable for a small farming population. *Alnus*, aspen, and rowan are the only other deciduous trees.

The timber from these forests is all used locally. Except for a few saw-mills there are no timber industries in this region. Most of the coniferous forest in Finnmark and Troms is owned by the State.

Forestry Legislation

The Norwegian forestry law has been revised by the Protection of Forests Act, 1932. This Act, together with supplementary Acts, enables the forest owner to deal with his forest and mark trees for felling as he thinks fit, so long as the forestry inspectors consider that he is treating it in accordance with the principles of proper forestry management. In young forests no felling is permitted beyond that which promotes the further development of the stand of timber. Felling in older forests must not be done in such a manner, or the ground treated in such a way, that the natural renewal of growth is prevented or endangered. The forestry inspectors may forbid the felling of trees which have not been previously marked by them; and if, after felling, a sufficient stock of trees has not been left to secure natural aftergrowth, the forest owner may be compelled to take measures for the renewal of growth. A forest owner must notify all felling of timber for sale or for industrial use and pay a cultivation charge amounting to 2 per cent. of the gross value of the felled timber. The forestry commissioners must determine which forests shall be regarded as protective. All felling of protective forest is subject to the trees being previously marked by the inspectors.

The protection of Forests Act is enforced by officials of the Forestry Office and of the Norwegian Forestry Society. This society, which works for the preservation and development of privately owned forests and helps forest owners financially and by advice, is financed partly by private subscriptions and partly by government aid through the Forestry Office. In every county (*fylke*) the society has subsections, which have in their service about

forty qualified officials, called forestry inspectors. These officials, who are paid in part by the State and in part by the county concerned, see to the proper observance of the Protection of Forests Act, afford general guidance to forest owners, and attend to the marking of trees. In addition there is in each rural district (herred) a forest council of three members. These councils appoint the local forest wardens and assist the chief county forestry inspectors.

The Forest Concession Act of 1909 and its subsequent amendments aim at preventing the accumulation of forests in the hands of individual owners, especially those living outside the district, or of joint-stock companies and foreigners. The sale of land and forest properties exceeding a fixed minimum area is subject to concession.

According to the Forestry Act of 1892 all round-timber for export shall, before shipment, be measured by officially sworn measurers who furnish a declaration as to the quantity shipped.

Ownership of Forests

The productive forests of the country are divided into about 121,000 separate properties. Thirty per cent. of the area is divided into small-holdings of up to 250 acres, about 35 per cent. consists of properties of from 250 to 2,500 acres, and 35 per cent. of properties of over 2,500 acres. More than two-thirds of the forest-land is directly or indirectly connected with agriculture; therefore much of it is owned by farmers.

The ownership of forest is distributed as follows:

1·18	per cent.	Forests owned by the State.
3·02	„	Common woodlands owned by the State.
0·95	„	Forest owned by the Education Fund.
2·98	„	Forests owned by the district.
2·37	„	Common woodlands owned by the district.
0·20	„	Forests owned by public institutions.
0·92	„	Forests jointly owned.
8·43	„	Forests owned by private companies.
70·95	„	Forests privately owned.

Lumbering

The lumber industry in Norway is greatly aided by the natural advantages for the transport of timber. The trees, which are felled, barked, and cut into logs up to 33 feet long in the forests, have to be carried to some centre—generally near at hand—either for processing

or for further distribution. This first movement, which takes place in winter, is either by horse-sleigh or by motor-truck and trailer. The latter has the great advantage of carrying 500-700 cubic feet per load but is generally impracticable because of the topography and the depth of snow, whereas the firm, deep snow is admirably suited for sleighs although a horse can haul only 70-100 cubic feet. If the timber has to be transported farther the second movement takes place in spring, and is usually by river and less frequently by road or rail.

The most important rivers for floating timber are indicated by the following table showing the percentage of timber transported by individual river systems:

	<i>Percentage</i>
Glomma river system	32
Drammen „ „	19
Skiens „ „	9
Arendal „ „	2½
Rivers flowing into the Trondheimsfjord	6
Namsen river system	2
All other watercourses	29½

Recently flumes have been constructed in many of the forests and the waterways have been improved for floating timber.

TIMBER INDUSTRY

MOST of the productive forest of Norway is owned by farmers, and over 70 per cent. of forest-land is directly or indirectly connected with agriculture. Forestry, therefore, tends to be mainly an auxiliary occupation for the farmer, who is able to employ profitably labour otherwise idle during the winter months. This development has, on the whole, impeded the wholesale exploitation of the forests and large-scale afforestation. At the same time it has imparted a somewhat peculiar character to the Norwegian timber industry.

The type of tree felled has always depended on the uses to which the timber is to be put. As long as the market was limited to beams, masts, and sawn timber, the larger trees were felled and the smaller ones left either to rot or to be used for domestic consumption. In the middle of the last century, when wood-pulping and the manufacture of paper from wood-pulp were introduced, the utilization of the forests was revolutionized. Small trees are now felled as well as the large in order to make pulp, cellulose, and paper. In 1938 Norway had about 100 large industrial concerns (Map 50) producing pulp, paper, cellulose, &c., mostly for export, and over 800 saw-mills and planing-

mills of varying size, the majority of which produce only for home requirements. The saw-mills and planing-mills annually prepare about 70,000,000 cubic feet of timber, about a quarter of which is exported. The pulp-, cellulose-, and paper-mills use annually about 140,000,000 cubic feet of wood, the products of which are mostly exported. Round-timber, telegraph poles, railway sleepers, and specially prepared timber of different kinds are both used at home and exported. About 90,000,000 cubic feet of wood are also used in the country for fuel. The average value of all timber and timber products exported each year is about 200 million kr. (being about 192 million kr. in 1938). The forestry and wood-product industries normally employ about 90,000 people.

Wood-pulp, Paper-making, and Artificial Silk Industries

Processes. Wood pulp is manufactured from coniferous wood by mechanical or chemical processes. There are two main types of chemical process, the sulphate and the sulphite or acid. The sulphate is the older method and permits the use of wood waste from saw-mills as well as that of spruce and pine. Both chemical processes produce better pulp for paper-making than the mechanical method, owing to the greater length of the fibre released, while the paper made from it fades less quickly. There are only six sulphate-pulp mills in Norway, which produce annually 53,000 tons, having a value of about kr. 8,905,000. About 15,000 tons of this is exported, while the rest is made into paper in Norway. The sulphite factories, of which there are 19, produced in 1938 about 471,000 tons of pulp, worth about 104 million kr.

There has been a recent tendency to increase the bleaching capacity of the sulphite mills, and the larger part of their output now consists of bleached sulphite. At the same time the quantities of pulp suitable for producing rayon have been steadily increased. The consumption of timber in the sulphate and sulphite pulp industry in 1936 was about 2,750,000 cubic metres, which was worth about 40 million kr.

In the production of chemical wood pulp the yield of cellulose fibre is only 40–50 per cent. of the wood used, about 50 per cent. of the dry substance of the wood being lost. Waste sulphite liquor is sometimes made into skiwax, tannin extract, and ink, besides being used to spray the roads. By-products of the sulphate industry are turpentine and resin oil.

There are about 52 mechanical pulp mills which produced in 1938 about 875,000 tons, valued at 45 million kr.

The pulp produced for use in Norway is generally made into paper or box-boards, and more rarely into artificial silk. The two largest paper-producing companies are the Borregård mills at the Sarpfoss Falls owned by A/S Borregård, and the Drammen river paper-mills owned by A/S Union Sliperi and Papir Fabriker, both of which produce their own pulp. The former company owns mills at Hurum, Bamble, and Lilleström, as well as properties and mills in Sweden, Germany, and the U.S.A., and produces annually at its Norwegian mills about 150,000 tons of pulp, largely bleached, and about 30,000 tons of paper which is used for writing and printing. The Union Company, which also owns other mills, produces annually about 200,000 tons of mechanical pulp, about 55,000 tons of chemical pulp, and 145,000 tons of paper which is largely used for newsprint. The total Norwegian production of paper in 1938 was about 516,000 tons, valued at about 152 million kr. The paper-mills employ more than 6,500 workmen. Bleached pulp is used for the production of artificial silk at Notodden by the Kunstsilkefabrikken where the viscose process is used. In 1936 the world production of bleached pulp for artificial silk was about 700,000, of which 120,000 tons (17 per cent.) was produced in Norway. Cellophane is also made from this silk pulp.

Location. The chemical wood-pulp industries are located principally near Drammen, Sarpsborg, Skien and its neighbourhood. The most important are found at Drammen.

The greater part of the mechanical wood-pulp industry is located near Skien, Drammen, and along the coast between Lillesand and Kragerö. There are, however, numerous scattered factories throughout south-eastern Norway, as well as near Namsos.

The most important centres for paper-mills using wood pulp are at Skien, Drammen, Skotfoss, Gulslogen, Hønefoss, Oslo, Sarpsborg, and Fredrikstad.

Plywood is manufactured by several factories, the largest of which is at Odderness near Kristiansand S. This factory produces annually 19,000 cubic metres of plywood made from Norwegian pine and imported gaboon mahogany. Much of this plywood is exported.

CHAPTER XV

COMMERCE, CURRENCY, AND BANKING

COMMERCE

NORWAY has a considerable foreign trade in proportion to her population. Since she is neither rich in industrial raw materials nor self-sufficient in foodstuffs, the value of her imports exceeds that of her exports. In 1938 the excess amounted to as much as kr. 406,121,000. This adverse balance is mainly made up by receipts from shipping, tourist traffic, and the sale of whale oil, which does not appear in Norwegian statistics since export takes place direct from the whaling-stations (*v.s.* p. 262).

Between the years 1929 and 1933 inclusive the value of Norwegian imports and exports decreased steadily, but since 1934 there has been a steady increase so that in 1937 the value of imports amounted to kr. 1,292,717,000 and of exports to kr. 823,258,000. In 1938 the corresponding figures were kr. 1,192,650,000 and kr. 786,529,000.

Imports

The main features of the Norwegian import trade are summarized in the following tables:

Imports (by weight), 1938

	Tons	Country of origin
FOOD, DRINK, AND TOBACCO		
<i>Fish products</i>	5,316	Denmark 33% ; Sweden 30%.
<i>Cereals</i>		
Wheat	166,865	Canada 56% ; U.S.S.R. 20%.
Rye	133,094	U.S.S.R. 63% ; U.S.A. 29%.
Maize	150,197	Argentina 48% ; U.S.A. 26%.
Barley	12,602	Denmark 86%.
Rice—husked	3,272	British India 56% ; Thailand 24%.
<i>Cereal products</i>		
Flour (wheat)	41,510	Canada 65% ; U.S.A. 14%.
<i>Fruit, vegetables, &c.</i>		
Oranges and lemons . .	27,955	Palestine 42% ; U.S.A. 35% ; British Asia 8% ; Italy 8%.
Bananas	8,593	Jamaica 36% ; B. Honduras 18% ; Colombia 14%.
Apples and pears . . .	5,428	U.S.A. 74% ; Australia 20%.

Imports (by weight), 1938 (cont.)

	<i>Tons</i>	<i>Country of origin</i>
Coffee	19,630	Salvador 31% ; Brazil 18%.
Tea	168	Ceylon 52% ; Netherlands E. Indies 20%.
Sugar	96,657	Great Britain 58% ; Czechoslovakia 17%.
Soya beans	24,495	Manchukuo 98%.
Tobacco	2,908	U.S.A. 76%.
CLOTHING AND TEXTILES		
<i>Textile raw materials and fibres</i>		
Wool	758	Great Britain 54% ; Australia 19%.
Wool waste	138	Great Britain 86%.
Raw cotton	324	U.S.A. 91%.
Cotton waste	982	Belgium and Lux. 41% ; France 28%.
Hemp	3,225	Philippines 47% ; Netherlands E. Indies 19%.
Jute	1,136	British India 97%.
<i>Textiles, semi-manufactured</i>		
Woollen yarn	1,372	Great Britain 32% ; Czechoslovakia 20% ; Belgium and Lux. 19%.
Cotton yarn	3,656	Great Britain 44% ; Sweden 20%.
Linen and hemp yarn	1,057	Belgium and Lux. 38% ; Italy 17% ; Germany and Austria 19%.
Artificial silk yarn	356	Netherlands 54% ; Germany and Austria 19%.
<i>Textiles, manufactured</i>		
Pure silk cloth	167	Japan 28% ; France 28%.
Cotton piece-goods	4,788	Great Britain 34% ; Japan 16% ; Sweden 11%.
Woollen piece-goods	1,962	Germany 33% ; Great Britain 24%.
PETROLEUM AND OIL PRODUCTS		
Petroleum (unrefined)	37,059	Colombia 52% ; Peru 48%.
Petroleum (refined)	179,015	Netherlands W. Indies 52% ; U.S.A. 22% ; Iran 17%.
MINERALS (metallic and non-metallic)		
Coal	2,299,046	Great Britain 62% ; Poland 19%.
Coke	354,121	Great Britain 96%.
Manganese ore	125,973	British W. Africa 86% ; U.S.S.R. 10%.
Zinc ore	112,577	France 34% ; Belgium and Lux. 31% ; Spain 27%.
Chrome ore	50,672	Rhodesia 57%.
Alumina	44,292	Germany and Austria 32% ; U.S.A. 25%.
Sulphur	6,736	U.S.A. 91%.
Pig-iron	12,227	Sweden 24% ; Belgium and Lux. 21% ; Germany and Austria 22%.

Imports (by weight), 1938 (cont.)

	<i>Tons</i>	<i>Country of Origin</i>
Nickel-copper matte	13,158	Canada 100%.
Crude aluminium	877	Canada 98%.
Lead ore and bars, &c.	3,867	Mexico 65%.
Tin ore and bars, &c.	531	Great Britain 88%.
<i>Manufactured mineral products</i>		
Sheet-iron	68,591	Germany 27% ; Belgium and Lux. 27% ; U.S.A. 14%.
Steel	35,152	France 48% ; Belgium and Lux. 38%.
Chemicals and fertilizers	109,409	Germany 52% ; Netherlands 40%.
<i>ENGINEERING AND MACHINERY</i>		
Ships new and used (No. of ships 108)	<i>Regt. tons</i> 376,710	<i>Percentage of tonnage</i> Sweden 34% ; Germany 26% ; Great Britain 17%.
New private cars	<i>Number</i> 7,267	<i>Value</i> Germany 35% ; U.S.A. 29%.
Machinery . . . . .	..	Germany 34% (approx.) ; Sweden 22% (approx.) ; Great Britain 10% (approx.).
<i>MISCELLANEOUS</i>		
Cement	<i>Tons</i> 25,082	Belgium and Lux. 49% ; Poland 27%.
Rubber	5,096	U.S.A. 46% ; Netherlands E. Indies 19%.
Rubber goods	1,590	U.S.A. 33% ; Great Britain 23%.
Cork	1,357	Portugal 64% ; Algeria 15%.
Paper of various kinds	6,318	Sweden 38% ; Germany 9%.

Imports (by value), 1938

	<i>Value in 1,000 kr.</i>
<i>FOOD, DRINK, AND TOBACCO</i>	
Meat products	3,981
Milk products, eggs, honey	590
Fish products for foodstuff	2,957
Wheat	25,989
Rye	16,366
Maize	18,927
Barley	1,903
Husked rice	677
Other cereals	2,661
Food products derived from cereals, including flour	10,472
Fruit and nuts	29,923
Vegetables and vegetable products	5,519
Coffee	15,664
Tea	619
Sugar and confectionery	20,681

Imports (by value), 1938 (cont.)

	<i>Value in 1,000 kr.</i>
Cocoa beans	2,216
Spices and cocoa products	1,077
Tobacco	7,839
Drinks and vinegar	13,573
Feeding stuffs for animals	26,509
FISH AND VEGETABLE OILS	
Oil seeds	23,039
Olive oil	4,117
Glycerine	828
Fish and whale oil	16,283
Other animal and vegetable fats	7,793
CLOTHING AND TEXTILES	
Wool raw or semi-manufactured	3,260
Cotton raw or semi-manufactured	3,070
Yarn	27,645
Other textiles	4,796
Fabrics	65,427
Clothes	27,343
Specialized textile articles	8,781
Clothes (leather or fur)	1,319
Footwear	4,896
Other textile goods (linoleum, &c.)	3,745
PETROLEUM AND OIL PRODUCTS	
Petroleum (unrefined)	2,341
Petrol (refined)	18,334
Paraffin oil	2,726
Combustible oil	17,662
Mineral oil	4,744
Other petrol and oil products	8,437
Oils and perfumes	3,178
MINERALS (metallic and non-metallic)	
Coal	54,301
Coke and cinders	23,636
Manganese ore	8,937
Zinc ore	9,735
Chrome ore	4,764
Bauxite	680
Alumina	14,968
Other ores and dross	94
Iron and steel	61,248
Copper and bronze, raw and treated	6,159
Brass, semi-finished	1,456
Lead, raw and semi-finished	1,524
Zinc, raw and semi-finished	1,276
Tin, raw and semi-finished	1,984
Copper matte	19,391
Other non-ferrous metals	4,349

Imports (by value), 1938 (cont.)

	<i>Value in 1,000 kr.</i>
Non-metallic minerals, raw and semi-finished	13,855
Products of non-metallic minerals	2,344
Precious metals, stones, and pearls	2,509
Fertilizers, especially phosphates	12,258
ARTICLES WHOLLY OR MAINLY MANUFACTURED	
China	8,091
Glass and glassware	6,088
Metal goods (tools and cables)	44,392
Machines and equipment (non-electrical)	59,549
Electrical machines and equipment	41,142
Cars	18,841
Aeroplanes	62
Steamships	11,968
Motor-ships	40,275
Other vehicles and transport materials	9,220
Unclassified manufactured articles	8,101
MISCELLANEOUS	
Hides and skins	13,824
Tanning and dyeing products	11,660
Furs semi-finished	2,604
Rubber (and rubber products)	8,367
Wood, cork, and their products	17,624
Wood, paper, cartons, &c.	12,311
Miscellaneous raw and semi-finished products	25,239
TOTAL	1,192,650

The chief imports are now machinery and raw materials for industry rather than consumption goods, which were so important fifty to sixty years ago. The former accounts for over 78 per cent. of the total value of imports and the latter for 22 per cent., while in 1880 consumption goods made up 74 per cent. of the imports.

The largest proportion of the goods imported are purchased in European countries, 80 per cent. coming from Europe in 1929, 82 per cent. in 1937, and 71·5 per cent. in 1938. In 1938 16 per cent. of Norway's total imports were from North America, while purchases from Africa, Asia, South America, and Australia direct were relatively unimportant, being about 1 per cent. for Africa, 7 per cent. for Asia, 3 per cent. for South America, and 1·5 per cent. for Australia. The transit trade, including goods produced by one European country but purchased from another, generally amounts to 10-12 per cent. of the total imports.

Up to 1937 Great Britain and Northern Ireland supplied the

largest share of the Norwegian imports, shipping 24·7 per cent. of the total for 1937. In 1938, however, Great Britain supplied only 16 per cent., compared with Germany's (including Austria) 18 per cent. Germany manufactures the larger part of her exports to Norway which consist especially of drapery goods, various chemical products, steel-, iron-, and metal-wares, as well as machinery. In contrast, a high proportion of the British exports are in transit, consisting of fodder and oil, while the principal commodities produced in Britain include sugar, coal, textiles, metals, ships, vehicles, and machinery.

In 1929 about 15 per cent. of the total imports were derived from the other Scandinavian countries, but in the years 1930-7 the proportion increased to 18-19 per cent. before dropping again in 1938 to 15 per cent. Sweden alone provided over 11 per cent. in 1938. Of the Scandinavian countries Denmark has the largest transit trade with Norway. Among other European countries there is a considerable import trade from Belgium, France, the Netherlands, Italy, Poland, Czechoslovakia, and Spain. Among non-European countries imports from the U.S.A. are the largest, amounting almost to 10 per cent. of the total. These mainly consist of motor-cars, machinery, heavy and volatile oils, cereals, and groceries.

Exports

The main features of the Norwegian export trade are summarized in the following tables:

Exports (by weight), 1938

	<i>Tons</i>	<i>Destination</i>
FOOD AND DRINK		
Fresh herrings . . .	94,587	Germany 67% ; Great Britain 20%.
Cod, fresh and filleted . . .	2,508	Sweden 26% ; Great Britain 23% ; Belgium and Lux. 22%.
Other fresh fish . . .	20,883	Great Britain 51% ; Sweden 15%.
Dried fish . . .	25,590	Italy 42% ; British West Africa 32%.
Klipfisk . . .	40,744	Portugal 60% ; Spain 18%.
Salted herring . . .	33,907	Sweden 29% ; Poland 18% ; Ger- many and Austria 17%.
Canned fish and meat . . .	25,996	U.S.A. 42% ; Great Britain 28%.
Canned milk . . .	4,026	British W. Indies 23% ; Gibraltar and Malta 18% ; Netherlands E. Indies 16% ; Thailand 16%.
Wild berries . . .	347	Great Britain 97%.

Exports (by weight), 1938 (cont.)

	<i>Tons</i>	<i>Destination</i>
Medicinal cod-liver oil . . . . .	..	U.S.A. 25% ; Italy 8% ; Poland 7%.
Fish oil . . . . .	..	U.S.A. 34% ; Germany and Austria 25% ; Belgium and Lux. 5%.
TIMBER AND WOOD PRODUCTS		
Timber . . . . .	..	Great Britain 67%.
Wood pulp (mechanical)	498,536	Great Britain 80% ; France 13%.
Wood pulp (chemical)	264,870	Great Britain 33% ; U.S.A. 24% ; France 8%.
Paper	235,670	Great Britain 26% ; Argentine 14% ; British India 10% ; Denmark 6%.
Cardboard	14,906	Great Britain 70%.
MINERALS (metallic and non-metallic)		
Iron ore (concentrated and briquettes)	1,334,480	Germany 77% ; Great Britain 14%.
Pyrites	717,153	Germany 42% ; Sweden 27%.
Copper ore	5,793	Germany 85%.
Zinc ore	14,429	Belgium and Lux. 56% ; Germany 29%.
Molybdenite	783	Germany 52% ; Sweden 47%.
Pig-iron	26,894	France 26% ; Great Britain 22% ; Germany 14%.
Tool steel	2,834	Great Britain 39% ; Japan 19%.
Copper	7,594	France 37% ; Belgium and Lux. 28%.
Zinc	43,651	Germany 39% ; France 19% ; Sweden 14%.
Nickel	7,317	Italy 32% ; Great Britain 23% ; Germany 12%.
Aluminium	23,173	Great Britain 19% ; Japan 18% ; Germany 12% ; U.S.S.R. 11%.
Ferro-silicon	32,310	Great Britain 43% ; Germany 38%.
CHEMICALS		
Saltpetre	398,036	Denmark 29% ; U.S.A. 25% ; Egypt 20% ; Sweden 15%.
Cyanamide	39,345	Netherlands 32% ; Belgium and Lux. 22% ; Sweden 13%.
Calcium carbide	44,126	Great Britain 95%.
Nitrate of soda	12,362	France 81%.
Ammonium nitrate	1,988	France 35% ; U.S.A. 23% ; Japan 18%.
MISCELLANEOUS		
Ships	33	Japan 29% ; France 24%.
Fox furs	361,099	Great Britain 57%.

Exports (by value), 1938

	<i>Value in 1,000 kr.</i>
FOOD AND DRINK	
Meat and meat products	1,141
Milk product (including tinned milk)	9,720
Fish products	115,344
Fodder for animals (largely fish flour)	17,504
FISH AND VEGETABLE OILS	
Medicinal cod-liver oil	7,004
Herring oil	2,866
Other fish oil, excluding whale oil	8,889
Hardened fat	15,973
Other animal and vegetable oils and fats	11,437
TIMBER AND WOOD PRODUCTS	
Timber	15,523
Wood pulp, paper, cellulose, &c.	171,276
CLOTHING AND TEXTILES	
Textile raw materials and semi-finished goods	2,562
Cloth	1,022
Specialized textile goods (fish-nets and ropes)	1,249
Clothing	1,422
PETROLEUM PRODUCTS	1,895
MINERALS (metallic and non-metallic)	
Non-metallic minerals, including feldspar, labrador, and other stones as well as cement	12,275
Products of non-metallic minerals	2,778
Metallic minerals	49,160
Ferro-alloys and steel	43,062
Non-ferrous metals	97,015
CHEMICALS, ETC.	
Chemicals and fertilizers	71,367
ENGINEERING AND MACHINERY	
Metal goods, machines, and non-electrical equipment	8,981
Electrical machines and equipment	2,420
Transport vehicles, and steam- and motor-ships	40,143
MISCELLANEOUS	
Tanning and dyeing products	1,380
Hides and skins	9,385
Furs (undressed)	40,423
Rubber and rubber products (including electric cables and goloshes)	2,313
Miscellaneous unclassified	21,798
TOTAL	786,520

Semi-manufactured and finished goods make up an increasing share of the total value of the exports. Shipments of timber, wood products, fish and fish products have relatively declined over the last 50 or 60 years, whereas paper and pulp and other industrial products have risen considerably. In spite of this change, timber and timber products (paper and pulp included) and fish products still constitute the largest group.

Exports of timber and timber goods, together with paper and pulp, had a total value of 221 million kr. in 1937 (27 per cent. of the total exports) and 187 million kr. in 1938 (24 per cent.); the quantities of the more important products being:

	1936	1937*	1938
Timber in m. ³	267,917	291,022	234,488
Wood pulp in tons	550,775	599,667	498,536
Cellulose (chemical wood pulp) in tons	331,194	373,097	264,870
Cardboard in tons	19,837	22,808	14,906
Paper in tons	289,872	321,898	235,670

* The timber export trade reached its peak in 1937.

The greatest proportion (67 per cent.) of the timber including hewn, rounded and planed wood, box-boards, and plywood was exported in 1938 to Great Britain, with the Netherlands taking the second greatest proportion of hewn and rounded wood. Australia took the second greatest proportion of planed wood, the Union of South Africa of box-boards, and Belgium of plywood.

The products of fishing and hunting constitute another important group, the total value of which in 1938 amounted to 142,955,000 kr. In addition to the items already mentioned in the Table of Exports (by weight) the following exports of fish oils were also important:

	1937	1938
Herring and fish meal in tons	43,023	79,012
Medicinal cod-liver oil in hectolitres	113,443	94,592
Other fish oils in hectolitres	288,334	247,551
Hardened whale oil in tons	59,325	..

In recent years some products of the Norwegian engineering industry have been exported. So far most articles in this group have been small-sized steel goods, wood-refining and electrical machinery, and electrical apparatus, as well as explosives, cartridges, and matches.

The exports show a wider geographical distribution than the

imports, but here again European countries take the lead, absorbing about 80 per cent. of the total exports. This figure shows an increase of $5\frac{1}{2}$ per cent. on that of 1929. It has been calculated that about 4.5 per cent. of the goods exported by Norway are re-exported by other countries, while 10-12 per cent. of the imports are derived from countries not producing the goods. Next to Europe in importance as export markets come North and South America with 16 per cent. in 1929 and 11.3 per cent. in 1938, Asia with 4.9 per cent. in 1929 and 4.3 per cent. in 1938, Africa with 2.8 per cent. in 1929 and 3 per cent. in 1938, and finally Australia with 1.7 per cent. in 1929 and 0.9 per cent. in 1938.

Great Britain is by far the most important market for Norwegian goods, taking 27 per cent. of the total exports in 1929, and 24 per cent. in 1938. The figures for 1929, however, are not strictly comparable with later figures, as they are calculated by countries of sale rather than of consumption. Great Britain is the most important buyer of Norwegian fish and fish products, timber, pulp, and paper, as well as importing quantities of furs and hides, crude metals, and ferro-alloys.

Germany is the second greatest market, in 1938 importing 15 per cent. of the total Norwegian exports. These consist primarily of fish and fish products, furs, hides, cod-liver oil, crude metals, and ferro-alloys. The third largest consumer of Norwegian goods is the U.S.A., which took 8 per cent. in 1938, consisting mainly of canned goods, cod-liver oil, crude metals, and nitrate of calcium. The Scandinavian countries, Belgium, France, Italy, Netherlands, Spain, Japan, the Argentine, and Egypt are amongst other valuable markets for Norwegian goods.

CURRENCY

THE present monetary system was introduced in 1875 and was based on gold, with the krone, divided into 100 öre, as the monetary unit. The legal value of the krone corresponded to a weight of $\frac{25}{62}$, or 0.40323 of a gramme of fine gold (cf. gold value of the £ at par, 7.32238 grammes). Gold coins formerly consisted of 90 parts weight fine gold and 10 parts weight copper, but they are no longer in circulation. Coins in circulation are 1 krone, 50 öre, 25 öre, 10 öre, 5 öre, 2 öre and 1 öre; the three smallest are bronze, the others are nickel, the latest issue being perforated in the centre. Bank of Norway notes are issued for 5, 10, 50, 100, 500, and 1,000 kroner; notes of 1 krone and 2 kroner ceased to be legal tender after 1 July 1926. Bank of Norway notes are the only ones issued; normally the Bank is obliged to

redeem its notes at their face value in gold coin, but this obligation was suspended on 27 September 1931 and has not been resumed. Since 1933 the exchange rate has been fixed at 19.90 kroner to the £ sterling and the value of the kroner has fluctuated with that of the £. In January 1940 its value was 50 per cent. below par. The currency in circulation was kr. 26,668,000 in coins (December 1938) and kr. 560,091,000 in Bank notes (February 1940).

BANKING

NORWAY did not possess an independent banking system until 1816, when the Bank of Norway was founded; previously Copenhagen had been the centre of Norway's monetary and banking system. Banking since 1816 has developed a markedly decentralized character; this is because the country is divided up into very distinct districts having different industries and conditions of livelihood. As a result in 1938 there were 105 independent joint-stock banks and 606 savings banks scattered throughout the country, besides various specialized banks. Although banking is thus very decentralized there is considerable co-ordination through the Bank of Norway and the State Inspectorate of Banks. Also the joint-stock banks have a Bankers' Association, and the savings banks a Central Association, which effect considerable co-operation.

The Bank of Norway

The Bank of Norway was established by Royal Charter in 1816. It is a joint-stock company, with a share capital of 35 million kr.; it has the right to function as a bank for loans, transfers, deposits, and note issue. It has the sole right of note issue, which it may exercise for an amount not to exceed 325 million kr. and, in addition, for an amount up to the value of gold bullion in the Bank. In exceptional circumstances, such as war, or a serious financial crisis, the Crown may, with the consent of the Storting, authorize the Bank to increase the fiduciary issue. If the total fiduciary issue should exceed the above-mentioned maximum the Bank must at once inform, and explain the cause to, the Government and pay to the Treasury a tax on the excess issue.

The Bank is supervised by a council of 15 members elected by the Storting, and a managing board of directors of 5 members, the chairman and vice-chairman being appointed by the Crown, the others being elected by the Storting for a period of 6 years. There are 21 branch offices, each of which is administered by a managing director

and a board of management, composed of 3 members elected by the Storting.

The Bank has, within certain limits, the right of using its resources for purposes of profit in most kinds of ordinary banking activity. Deposits at call, or for transfer or retention, are received, though no interest is allowed. The Bank has the special obligation of accepting and administering government and other public funds, capital and income, as well as making payments in respect thereof, without, however, advancing money.

The following are some of the principal items from the accounts:

	1936 <i>mill. kr.</i>	1937 <i>mill. kr.</i>	1938 <i>mill. kr.</i>
LIABILITIES			
Share capital	35.0	35.0	35.0
Reserve fund	14.7	14.7	14.7
Other reserves	3.8	4.1	4.4
Deposits at call	105.7	102.5	130.6
Notes in circulation	428.6	448.9	477.4
ASSETS			
Gold in vaults	118.9	135.3	152.8
Interest-bearing securities	53.6	106.8	136.3
Balances abroad	192.4	192.8	191.1
Loans	221.5	123.1	117.3

In 1937-8 the shares of the Bank were quoted at about 70 per cent. premium. The surplus available for distribution is divided proportionately between the State and the shareholders, the latter receiving, in recent years, a dividend of 8 per cent.

Joint-stock Banks

The first of the joint-stock banks, Kristiania Bank og Kreditkasse, was founded in 1848; Bergens Privatbank followed in 1855, and Den Norske Kreditbank in Oslo in 1857; these are still the three largest joint-stock banks in Norway. Since 1857 minor banks have increased as indicated by the following figures:

<i>Year</i>	<i>No. of banks</i>	<i>Share capital mill. kr.</i>
1913	116	70.9
1920	195	509.1
1936	105	174.8
1938	105	176.5

The increase after 1913 was due to inflationary prosperity caused by shipping and exports during the War of 1914-18, while the subsequent decrease was due to depression in ensuing years.

More than half of the joint-stock banks have a capital of less than 1 million kr. each. Five have a capital of over 10 million kr., and these command more than half of the total resources of the joint-stock banks. Most of the banks operate without branches; a few have branches, but none more than seven or eight outside the municipality of the head office.

The total amount of capital and funds possessed by the banks in 1938 was 253.3 million kr. Deposits amounted to 1,010.9 million kr., of which 142.5 million kr. were deposits on demand and 868.4 million kr. deposits on time.

The banks generally conduct an all-round banking business. Advances are mainly in the form of cash, book, or bond credits; deposits are partly on three-monthly, partly on six-monthly terms. Deposits at call are also accepted, the rate of interest thereon being about 0.5 per cent. The interest rate on long-term deposits is usually fixed in relation to the discount rate of the Bank of Norway.

Savings Banks

The first savings bank was started in Oslo in 1822; since then many have been established to meet the needs of the widely scattered population. In 1938 there were 606 savings banks in operation with deposits totalling 1,971.1 million kr., the number of deposits being 2,257,377.

Every savings bank is managed by a board of directors elected by the depositors; there may also be regulations whereby members of municipal councils are to have seats on the board. Strict public control is exercised by the Savings Bank Inspectorate. Savings banks may be founded by private persons or municipalities; but the founder must provide a minimum capital of 5,000 kr. which bears interest, and he must obtain a concession to found such a bank.

The purpose of the banks is to receive deposits (from unspecified depositors) and use such funds for earning profits, but they do not pay dividends, the portion of the profits which is not used for interest or put to reserve funds being given to social and philanthropic purposes. To a certain extent the savings banks grant credit to farmers, fishers, handicrafts, and minor industries, usually on the security of mortgages on real property. Funds are also invested.

In 1938 the total funds of the savings banks amounted to 275.8

million kr. and the total deposits to 1,971.1 million kr., of which 24.6 million kr. were on demand and 1,946.5 million kr. on time.

Other Credit Institutions

Special banks are not very numerous in Norway, but there are a few important ones.

Agricultural and rural property interests are looked after by:

- (1) The Mortgage Bank of the Kingdom of Norway (Kongeriket Norges Hypotekbank), founded in 1851 to advance sums against mortgages on property. In 1938 the capital was 67 million kr. and the bank had issued bearer-bonds, representing 476.8 million kr., which were floated both at home and abroad; loans on mortgage totalled 453.5 million kr.
- (2) The Norwegian State Smallholdings and Building Bank (Den Norske Stats Småbruk og Boligbank), established in 1915, mainly to serve small-holders. It has a capital of 275 million kr. Loans are granted on small properties, mainly with municipal guarantee; they totalled 213.2 million kr. in December 1938. A series of bonds totalling 114.1 million kr. has also been issued.
- (3) The Norwegian Credit Association for Agriculture and Forestry (Norges Kreditfor. for Land- og Skogbruk), which, at the end of 1936, had about 40 million kr. on loan.
- (4) Central Credit Association for Farmers (Centralkassen for Bøndernes Driftskredit), which has about 6 million kr. on loan to farmers.
- (5) Loan Bank for Farmers (Lånekassen for Jordbrukere), which has about 18.3 million kr. on loan to farmers.

There are also various district credit societies for advancing loans on property.

There are several special banks for *shipping*:

- (1) Ship Mortgage Bank of Norway (Den Vesten og Nordenfj. Skipshypotekfor.). At the end of 1936 about 25 million kr. had been loaned from funds raised by capital and bearer-bonds.
- (2) Norwegian Ship Mortgage Bank of Oslo (Norsk Skipshypotekbank i Oslo). At the end of 1936 about 3.9 million kr. were on loan from funds raised by shares and bearer-bonds.
- (3) Credit facilities for shipping are available through other societies; the most important of them being the Shipowners' Ship Credit Society, Kristiansand (Redernes Skipskreditfor.), founded 1929, which advances loans against a first mortgage

up to 50 per cent. of the value of a vessel; it has on advance about 6 million kr. from funds provided by bearer-bonds.

The Norwegian Shipowners' Association (Redernes Skipskreditfor.) has put aside about 4.5 million kr. for investment in second mortgage on ships.

Fishing interests are looked after by the Norwegian State Fisheries Bank (Den Norske Stats Fiskesibank), established by the Government in 1919. Loans are advanced on fishing-vessels and implements 8.9 million kr. being on loan. The bank has a capital of 6 million kr.; capital has also been obtained by the issue of State-guaranteed bearer-bonds to the amount of 11.9 million kr.

Industrial interests are looked after by:

- (1) The Industrial Bank of Norway (Den Norske Industribank), which was established in 1936. It has a share capital of 10.7 million kr., half of which is provided by the State, the remainder of the shares being offered to certain institutions, particularly to banks and insurance companies. The bank has also borrowed another 10 million kr. The purpose of this bank is to grant long-term loans to industry against first mortgages on land or plant. Against mortgages in real property the loans may amount to 60 per cent. of the assessment value, against mortgages in machinery up to 40 per cent. of the assessment value. At the end of 1936 the bank had 15.2 million kr. on loan.
- (2) Norwegian Mortgage Society for Commerce and Industry (Norges Hypotekfor. for Næringslivet). This society grants loans to industry up to 50 per cent. of the assessment value of the security. Funds have been raised by bearer-bonds to the amount of 9 million kr.

Municipal credit is also served by a special bank, the Municipal Bank of Norway (Kommunolbanken). This bank has a capital of 34 million kr. and a reserve fund of 3.3 million kr. granted by the State. Funds are also raised both at home and abroad by bearer-bonds, which are State-guaranteed.

APPENDIX I

TOPOGRAPHICAL EVOLUTION

Skjaergård and Strandflat

THE close connexion between the skjaergård and the strandflat has already been indicated, but the views concerning the origin of these features have varied greatly. Fridtjof Nansen outlined the various theories which had appeared before 1921. These theories variously attributed their formation to marine erosion, alone or with glacial denudation; to sub-aerial denudation, aided by marine denudation, alone or with drift ice; to glacial denudation, alone or with other forces of sub-aerial denudation, and even aided by tectonic disturbance. Nansen, however, wrote particularly and critically of the strandflat as a feature of the skjaergård. He recognized the importance of profound sub-aerial denudation in preparing the pre-glacial peneplain of low, rounded hills which form the present islands, and maintained that waves and currents could not well remove sufficient waste to make the strandflat unless (a) the land should stand at the same level for an incredibly long time, or (b) the land be dissected, i.e. as islands among channels, sounds, and embayments, but not necessarily by streams or by the work of ice. He stressed the lack of evidence suggesting that ice, on land as level as the coastal zone, could accomplish the required degree of dissection, or that river denudation on an adequate scale had ever been operative. He does, however, consider that during glacial and post-glacial oscillations of sea-level, temperatures were suitable to effect the required cutting by frost-weathering and freezing aided by shore ice. As the rock is cracked loose by freezing spray and other water in crevices of the rock, waves and currents remove it; thus the whole strandflat may well have been formed in interglacial and post-glacial times. Sufficient shiftings of level during these times have occurred to produce strandflats at the several known levels, and at other levels now below the sea. Each must have been produced by a relatively long, quiet stand of the sea at a constant level.

This explanation, adequate for the strandflat, does not, however, take into full consideration the nature and importance of the pre-glacial peneplain. This, as already described, would look very much like the upland plateaux to-day where free from ice, and would even have the same appearance of thorough glaciation. Rock slopes, above and below water, rarely drop more than 200 to 300 feet in a mile, and many are far gentler. Such slopes could persist only if the land remained near sea-level, or effectively covered by ice or sea. Should the area be uplifted so that the floors of the valleys be raised, for example, to 500 feet above the sea, streams would quickly entrench themselves, carving youthful valleys, just as they have later cut through the rock sills between the basins in the valleys above the

water-level of the fjords. It would seem, therefore, that the island zone has never stood much above sea-level since streams reduced it to old age.

Moreover, it hardly seems possible, as Nansen contends, that these land-forms could have undergone serious differential glacial erosion. The region was undoubtedly glaciated, but in such a way as to remove the mantle of soil, and to smooth, polish, and striate the living rock. This could not have been a zone of deep valleys, for the ice would have carved them as it did the fjords. There must have been a thick mantle of disintegrated rock, for in the time necessary to carve such old forms as these, weathering must have been deep and thorough. If the pre-glacial surface was not dissected by valleys (and there is no reason to suppose that it was), then it must have been essentially a peneplain; and as mature topography has a thick mantle of disintegrated rock, the surface must have looked much as it does to-day, except that it was heavily covered with soil and rock waste, with an elevation slightly higher, although not high enough to be dissected by streams and not so low as to be drowned as at present.

The date of the formation of this peneplain cannot be determined from the examination of the island area alone; it is necessary also to consider the fjord and gorge sections. As already stressed, neither streams nor ice have succeeded in seriously dissecting the coast zone since the pre-glacial period of peneplanation. The dissection or fragmentation necessary to produce the multitudes of islands from the high parts of the plain and the water areas from the mature valleys must, accordingly, have come about by simple depression of the peneplaned surface. Thus the strandflat must have been formed at sea-level, after the ice had scoured off residual soil and after glacial depression had fragmented or separated the land into islands, by flooding all the lower parts of the peneplain. This interpretation avoids the difficulty which Nansen and others have experienced in accounting for the necessary dissection of the coast zone with neither sufficient ice nor stream erosion to act as the agent.

The Fjords

There are several theories which attempt to explain the formation of the fjords. The first maintains that as all Norway has been glaciated it is entirely reasonable to ascribe their formation to ice erosion. But this theory does not explain why practically all the fjords are in a zone lying between two bordering zones of complete glaciation, one, the upland plateau, to the landward side, the other, the skjaergård, to the seaward, which have no fjords. Some other explanation accordingly seems essential.

The second school of thought considers that streams have been the major agent in carving the fjords. This school is prepared to attribute but moderate powers of erosion to ice and so considers that it was responsible only for the finishing touches on a stream topography, much like the present, which had already developed. When, however, it is remembered

that (1) the superficial rock waste has been everywhere thoroughly removed, (2) the tributary valleys generally hang at a considerable height, and (3) the fjord troughs sometimes attain a depth of as much as 3,000 feet below the mouths of the valleys, more imagination seems to be required to explain the fjords as mainly the product of stream erosion than to grant great powers to glaciers.

A third school of thought in an attempt to substantiate the second considers that, as the floors of the fjords are far below the level of possible stream erosion, the fjords originated primarily as large submerged river valleys greatly modified by ice. It is true that in the gorges and waterfalls of Norway there is considerable evidence of the force of stream erosion, but none to suggest the possibilities of erosion to depths of about 5,000 feet or more which this theory implies.

A fourth school of thought has been greatly influenced by the widespread development of fracturing and faulting in the fjord region. For some considerable time at least seventeen major tectonic directions have been recognized, and Gregory in particular maintains that these have been widened by stream erosion and touched up by glaciers before submergence.¹ Whilst admitting that many of the fjords do coincide with tectonic lines, it is, however, easy to show that many do not lie along such lines. The Sognefjord, for example, seems to lie across both faults and rock-contacts and to possess the outline of a normal river system.

Objections can be raised, as already suggested, against each of the normally accepted theories explaining the formation of fjords. But whereas each theory cannot be accepted in its entirety, each has certain valid contributions to offer. As so frequently happens, the most satisfactory explanation is obtained from a combination of the cogent parts of each theory, whilst remembering that individual fjords cannot all be ascribed to the same causes operating in the same order and intensity.

It can be accepted that if stream erosion were ever of paramount importance in the evolution of fjords it must have been before the ice did its work. Stream erosion must have operated primarily in the fjord zone and not in the upland plateau areas of undissected peneplain, nor, as already discussed, in the skjaergård zone. If streams carved the valleys now occupied by the fjords, the waste removed must have been carried seaward by well-loaded streams. Such streams would have had considerable powers of denudation in the island zone unless the land there was sufficiently low to prevent it. This consideration demands that the fjord zone was sufficiently elevated for streams to carve deep valleys across the varied rocks of differing resistance which composed it, while the coastal zone was at a sufficiently low elevation not only to retard denudation but to accelerate deposition. That such a state of affairs existed is to be seen from an examination of the upland plateau.

¹ Vide *The Nature and Origin of Fjords*, by J. W. Gregory, London, 1913.

This plateau, as already described, slopes continuously down from the watershed to the west coast. Whether this slope is the product of one or more cycles of denudation is immaterial to the immediate problem, but it must have been completed before the oncoming of the Great Ice Age. On the other hand, the present altitude of the peneplain in the watershed areas offers no measure nor suggestion of the height it had when formed. It could not have been formed with its present altitude, either at the seaward margin, where it is generally somewhat below sea-level, or near the watershed, where its elevation is 6,000 to 6,500 feet with rounded summits rising up to 2,000 feet above its surface as 'monadnocks'. This relief is, however, not really so astounding as it appears at first sight. The distance to the west coast from the higher parts (e.g. the Jotunheim) is about 130 miles. A descent of 6,500 feet in 130 miles is about 50 feet in one mile. This slope is far too steep for a newly made peneplain, but not so steep that it could not be produced by slight differential uplift of a peneplain. This problem of slope becomes less acute farther north, where the altitudes of the plateau do not rise above 3,000 feet, and the distance to the west coast is about 100 miles, thus giving rise to a descent of only 30 feet in one mile. Even so, plains as mature as this peneplain appears to be, would probably have slopes seaward of 10 to 20 feet per mile. Assuming the lesser figure, one finds that the higher parts of the plateau were warped upward possibly as much as one mile to produce the present slopes. This altitude was attained as a result of uplift, it is generally agreed, at the close of Tertiary or at the opening of Quaternary times, and has been reattained after the withdrawal of the ice of the Great Ice Age on account of the resilience of the rocks and their response to the unloading. In contrast it has already been stressed that the peneplain has been little disturbed in the coast zone, either by stream or by ice erosion, indicating that its altitude has never been sufficient to promote erosion.

The altitudes which the land attained in the course of its warping were thus undoubtedly sufficient to stimulate the streams to carve the gorges which subsequently became fjords. At the same time the altitudes postulated would also undoubtedly induce considerable precipitation; and if the conditions, climatic and otherwise, were suitable for its conservation and conversion into névé (or glacier) ice, it seems reasonable to think of the streams as starting their intensive carving when warping uplifted the land surface. The altitude attained localized the ice-caps at first on the lofty upland surface. Next the ice spread outward and eventually reached the receding falls and rapids which the streams were pushing headward in their valleys. Apparently little or no stream erosion takes place when the land is covered by slow-moving or stationary ice, so that the growing ice-cap would check the force of stream erosion when it spread far enough to meet the falls and rapids at the head of the great gorges. But, at this stage, tongues and lobes of the ice-sheet were able to push down the gorges or youthful river valleys and to deepen, straighten, widen, and polish them.

The ice-caps, with the intensification of the Ice Age, expanded and gradually fused into a large ice-sheet overspreading more and more of the upland surface and engulfing the lobes, which had advanced down the valleys, before finally spreading out as a vast ice-sheet beyond the present shoreline. In the fjord zone this ice-sheet carved valleys and converted the gorges into typical U-shaped, steep-sided, over-deepened fjords. In the skjaergård zone it eroded more like a sheet of ice, removing any weathered products and the deltaic deposits of the streams which had been eroding the gorges. Loose material thus picked up from the skjaergård zone and denuded from the fjord valleys could not have been deposited by the ice until near its margin of melting. This obviously was well to seaward of the skjaergård zone, because no material comparable in quantity to that which must have been removed during the formation of the stream gorges and ice-eroded fjords is known in close proximity to the islands. These combined processes of erosion and transportation continued to operate until the conditions which made glaciation feasible were replaced by those which made it impossible. When this stage came about the ice began to melt and to disappear. More than one glacial stage in combination with intervening inter-glacial conditions would permit the resumption of the formation of gorges, and would continue the glaciation of such inter-glacial stream-made gorges when the ice advanced again.

There is accordingly a very close relationship between the formation of the gorges and the fjords. The gorges as they now appear at the ends or sides of fjords and glaciated valleys lead back towards the watersheds. Their origin would seem to date from the period when, during the final stages of glaciation, the ice-sheet had receded sufficiently for the drainage from its face to fall over the end or side of the fjord and there and then to commence the process of gorge-cutting. The gorges do not usually cut back into the plateau as far as the edge of the existing ice-sheets or lobes, so that the process of gorge formation, including the headward retreat of waterfalls, has not proceeded as rapidly as the melting of the ice. Even so, the rate of headward recession has been rapid, because in most cases the water flows from the ice-front well laden with agents of destruction. These have not invariably cut waterfalls—some rivers, indeed, have never even flowed over rapids or cascades; the existence or otherwise of such phenomena depends primarily on the relative resistance of the rocks over which the streams flow.

The foregoing hypothesis¹ not only accounts satisfactorily for the formation of the fjords, but shows the close relationship between the skjaergård, the fjord zone, the gorges, and the upland plateaux and many of the features of glaciation. It has not, however, attempted to explain directly the factors which have governed the directions of the fjords, or,

¹ *Vide* 'Unity of Physiographic History of Norway', by G. D. Hubbard, *Bulletin of the Geological Society of America*, vol. xlv (1934), pp. 637-54.

to state the problem in different words, what factors determined along what lines the streams were to carve the valleys which later became fjords. The answer to this problem has, in actual fact, been partly anticipated, for it was shown in the account of the geological history how the main lines of the Norwegian drainage pattern were developed upon the post-Caledonian peneplain, and how this pattern was transferred to the peneplain which was formed after the Tertiary mountain-building period. This is not to suggest that the two drainage patterns were identical, for the Tertiary warping, the extent of which has been indicated in discussing the formation of the fjords, must also have introduced new elements of its own. The rivers of both of these drainage systems were, of course, likely to become trapped along different tectonic lines in the course of grading their valleys. As a result both superimposed and structural (or tectonic) systems of drainage developed in Norway. In the same way both superimposed and structural fjord patterns developed. Examples of fjords following structural lines are parts of the Trondheimsfjord, parts of the Nordfjord, and much of the Storfjord and Oslofjord; the Hardangerfjord is notable for the way in which it divides the ancient crystalline rocks from the younger sedimentary rocks. The Sognefjord is the outstanding example of the superimposed type.

APPENDIX II

PRINCIPAL GLACIERS

<i>Name</i>	<i>Approximate area in sq. miles</i>	<i>Maximum height in ft.</i>
Hardangervidda		
Breifonn	20	3,937
Storefonn	30	5,702
Folgefonn	108	5,423
Hardangerjøkel	50	5,934
Storskavlen	20	5,610
Hellevasfonn (Hallingskarvet)	20	6,161
Steganase	8	5,500
Fresvikbreen	15	5,246
Storboteggen	15	..
Jotunheim		
Kalvabreen	15	6,965
Steensflybreen	10	..
Memurubreen	40	7,690
Veobreen	35	7,660
Glitretind	40	6,670
Tverbreen	45	7,866
Smortstabbreen	60	6,866
Horungtinderne	10	6,787
Jostedalsbreen		
Hartbarsbreen	70	6,637
Spørtegbreen	60	5,708
Hestbrepiggene	40	6,869
Grjotabreen	30	6,201
Holabreen	20	..
Sikkelbreen	70	6,252
Skridulaupbreen	70	6,995
Jostedalsbreen	580	6,500
Snenipa	50	5,890
Ålfotbreen	90	5,200
Nordland		
Okstindbreen	30	6,273
Ortfjeld	10	4,730
Hogtundbreen	20	4,235
Steinfjeld	10	4,357
Svartisen	230	5,246
Sulitjelma	30	6,283
Blåmannsisen	60	5,154
Hurrejiekna	10	4,183
Bjørntopp	8	4,987
Frostisen	60	5,721
Blåisen	10	4,708

<i>Name</i>	<i>Approximate area in sq. miles</i>	<i>Maximum height in ft.</i>
Troms		
Rivtind	8	4,783
Noevertind	8	4,667
Isdalsfjeld	10	4,500
Njalavarre	30	5,019
Jaggevarre	30	6,283
Jagervandstind	35	5,544
Maccevarre	30	4,510
Langfjordjökel	40	3,422
Oksfjordjökel	50	3,825
Seiland	46	3,218
Normandsfjordjökel	30	3,527

APPENDIX III

PRINCIPAL RIVERS

THE following table gives statistics for the chief Norwegian rivers. They are arranged in order around the coast from south-east to west, continuing northwards along the west coast.

The hydrographic office of the Watercourse and Electricity Service records observations at about 450 water-gauges, from which a selection has been made to cover the most important rivers. Between the different years the run-off commonly varies from 70 to 130 per cent. of the normal amount. The low-water run-off can fall in any year as low as about 1 per cent. of the average run-off, while the flood run-off can reach as much as 2,000 per cent. of the average run-off.

River	Approx. length in miles	Water-gauge	Drainage area km. ²	Normal run-off		Average water-level m.	Max. spring flood water-level m.	Average date of culmination of spring floods
				m. ³ p. sec.	mill.m. ³ p.a.			
Glomma . . .	400	Aursunden Elverum	830 15,356	19.2 241.0	606 7,606	1.90 2.68	2.23 4.30	1/6 25/5
Lågen . . .	106	Langnes	40,013	664.0	20,950	7.86	10.32	2/6
Otta . . .	74	Losna	10,988	242.0	7,638	4.25	5.37	11/6
Randselv . . .	12	Lalm	3,979	105.0	3,314	4.85	6.23	11/5
Dramselv . . .	25	Kistefoss	3,663	58.6	1,850	2.20	2.76	30/5
Begna . . .	105	Geithus	9,860	168.0	5,303	3.58	4.40	2/6
Hallingdalselv . . .	124	Slidrefjord	788	17.8	562	2.02	2.43	10/6
Numedalslågen . . .	190	Fjöhölen	1,840	37.6	1,187	..	..	..
Måne . . .	75	Bergheim	4,237	95.8	3,024	8.19	8.80	9/6
Tinne . . .	31	Kröderen	5,094	115.0	3,630	5.09	6.43	4/6
Vingeelv . . .	43	Kongsberg	4,219	90.3	2,850	3.10	4.10	30/5
Toke . . .	37	Brommestad Bro	5,513	123.0	3,881	21.51	23.00	18/5
Nidelv . . .	105	Mösvand	1,498	51.0	1,610	..	..	..
Topdalselv . . .	80	Kirkevoll Bro	3,643	104.0	3,282	1.75	3.46	1/6
Otra . . .	150	Vingevand	927	39.3	1,241	2.91	4.60	10/6
Mandalselv . . .	62	Farsjö	1,148	33.2	1,046	2.49	3.85	23/5
Lygna . . .	37	Lundemölle	3,841	130.0	4,085	3.87	4.80	17/5
Kvina . . .	44	Flaksvand	1,700	65.1	2,054	3.47	4.46	1/5
Sira . . .	75	Byglandsfjord	2,772	119.0	3,755	3.44	4.00	9/6
Bjerkreimselv . . .	31	Røyknes	3,531	147.0	4,639	3.68	4.41	11/6
Årdalselv . . .	24	Orvassoset	1,006	52.8	1,666	..	..	..
Ulla . . .	25	Kjøleimo	1,746	87.1	2,750	5.49	7.40	11/5
		Tingvand	263	16.4	518	..	..	..
		Røynestad	1,080	67.0	2,115	2.77	3.30	29/5
		Lindeland	965	59.0	1,862	..	..	..
		Flikeid	1,920	114.5	3,625	6.05	7.82	28/5
		Bjerkreim Bro	641	50.8	1,603	2.13	3.17	9/5
		Tveid	502	39.7	1,253	2.30	2.87	1/6
		Haugebro	383	35.4	1,117	1.55	1.90	6/6

River	Approx. length in miles	Water-gauge	Drainage area km. ²	Normal run-off		Average water-level m.	Max. spring flood water-level m.	Average date of culmination of spring floods
				m. ³ p. sec.	mill. m. ³ p. a.			
Suldalslågen	43	Suldalset	1,215	94.8	2,992	3.49	4.30 1917	17/6
Saudeelv	18	Storlivand	282	25.4	802	..	..	..
Etnelvv	18	Stordalsvand	125	12.9	407	2.12	2.47 1913	1/6
Eidfjordelv	25	Eidfjordvatn	1,116	50.2	1,585	..	..	..
Vosselv	44	Bulken	1,030	65.7	2,073	4.41	5.63 1913	9/6
Eksingdalselv	24	Nese	340	28.4	897	3.97	4.43 1929	6/6
Flåmselv	18	Brekke Bro	113	7.3	230	1.89	2.80 1921	28/6
Aurlandselv	26	Vassbygdvand	728	36.8	1,162	2.90	3.80 1914	1/7
Laerdalselv	31	Lo Bro	542	19.4	612	3.85	4.80 1920	15/6
Årdalselv	25	Årdalsvand	1,000	46.2	1,459	3.14	3.91 1914	23/6
Gaula	38	Viksvand	491	41.0	1,294	2.52	3.38 1913	14/6
Jølstra	30	Jølstervand	367	30.0	947	2.08	2.39 1910	12/6
Breimselv	25	Breimsvand	552	40.0	1,262	2.32	3.17 1914	23/6
Eidselv	24	Hornindalsvand	375	24.3	767	1.39	1.94 1903	8/6
Stadheimselv	5	Øie	113	7.8	246	1.52	2.25 1928	16/6
Tafjordelv	6	Onilsavand	295	14.3	451	1.99	2.51 1914	21/6
Rauma	40	Horgheim	1,098	35.9	1,134	3.08	3.85 1923	17/6
Aura	46	Eikisdalsvand	1,080	38.1	1,203	3.42	4.95 1923	19/6
Driva	76	Kongsvoll	277	5.1	159	..	..	..
Todalselv	19	Elverhoi	2,437	63.1	1,991	2.27	3.30 1923	15/6
Svorka	15	Rodal	240	11.7	369	1.25	2.30 1918	15/6
Søa	21	Gravvold	118	6.6	209	1.27	1.60 1922	9/6
Skjenaldelv	12	Rovatn	237	11.0	347	..	..	..
Orkla	93	Skjenaldfoss	147	4.8	151	..	..	..
Gaula	77	Naeverdalen	726	14.8	467	3.08	3.55 1929	6/6
Nidelv	68	Bjørset	2,285	48.9	1,543	4.28	6.00 1918	1/6
Stjørdalselv	44	Haga Bro	3,055	77.3	2,440	3.64	4.70 1924	31/5
Vaerdalselv	25	Løkaunet	3,020	97.3	3,070	108.3	109.3 1917	3/6
		Floren	979	35.2	1,111	2.6	3.3 1922	16/4
		Grundfoss	876	34.7	1,095	2.27	3.10 1922	25/5

River	Approx. length in miles	Water-gauge	Drainage area km. ²	Normal run-off		Average water-level m.	Max. spring flood water-level m.	Average date of culmination of spring floods
				m. ³ p. sec.	mill.m. ³ p.a.			
Agårdselv	21	Öyungen	235	11.0	347	2.95	3.35	27/5
Namsen	118	Namsvand	695	35.6	1,124	3.32	4.25	20/6
		Fiskemfoss	3,285	152.0	4,800	2.65	3.10	6/6
Åbjöra	32	Åbjörvand	384	27.1	855	1.98	2.68	17/6
Vefsna	90	Hatfjellidal	1,920	54.2	1,711	4.42	5.20	16/6
		Laksfoss	3,647	148.0	4,675	4.82	6.00	29/5
Rösa	22	Tustervand	1,500	65.2	2,060	..	..	..
Bjerka	12	L. Målvand	266	15.1	477	2.78	3.35	26/6
Rana	55	Reinfosshoi	3,113	177.0	5,588	3.73	4.68	29/6
Fykanaga	16	Fykanvand	288	28.2	890	..	..	..
Beiarelv	30	Selfoss	790	39.9	1,260	2.20	2.88	19/6
Saltdalselv	40	Russånes	1,151	38.3	1,209	4.32	5.45	28/6
Lakså	15	Lakshål	220	13.5	426	2.01	2.61	4/6
Sagelv	16	Rotvand	233	12.3	388	3.23	4.30	9/6
Elvegårdselv	28	Garnes	804	28.9	912	3.80	4.80	29/5
Håkvikelv	6	Höibakfoss	74	3.1	97	..	..	..
Nygårdselv	10	Nygård	148	6.1	191	1.60	1.72	8/6
Salangselv	32	Vassås	580	21.5	679	3.20	4.03	19/6
Målselv	70	Malangfoss	3,140	85.8	2,708	3.24	4.02	21/6
Barduelv	68	Bardufoss	2,258	74.7	2,358	2.95	4.04	25/6
Reisaelv	65	Moskudal	2,080	54.1	1,708	2.30	2.80	18/6
Altaelv	112	Stengelsen	6,432	83.6	2,638	3.58	4.30	3/6
Stabursneselv	43	Staburse	1,100	18.0	568	..	..	..
Lakselv	30	Skoganvarre	918	14.9	470	..	..	..
Tana	120	Polmak	14,005	175.0	5,522	4.44	6.87	28/5
Neiden	63	Neset	2,351	31.5	994	2.42	3.36	31/5
Pasvik	80	Bjørnvand	18,022	180.0	5,681	..	..	..

APPENDIX IV

PRINCIPAL LAKES

LAKES in Norway cover about 4 per cent. of the area of the country. Most of the largest lakes lie in the valleys of the great south-east-flowing rivers. There are also a very large number of small lakes in the fjeld and at the heads of the fjords on the west coast. The most important function of the lakes is to act as reservoirs for the surplus water derived from the spring melting of the snows. Without the lakes serious flooding would undoubtedly occur during the spring and early summer.

The chief lakes in Norway are given in the following table. There are (or used to be) motor- or steam-boat services on some of those appearing in the table and also on Lakes Gjende, Sikkilsdalsvand, Espedalsvand, Årdalsvand, Loenvand, Oldenvand, Uppstrynsvand, and Eikesdalsvand. Nedrevand and Örevand are used by barges carrying ore from the Sulitjelma railway to the head of the Skjerstadfjord at Finneid.

<i>Lake</i>	<i>Watercourse</i>	<i>Approx. area sq. miles</i>	<i>Height in feet</i>	<i>Greatest depth in feet</i>	<i>Remarks</i>
Byglandsfjord	Otra	9	666	..	Motor-boat service
Fyresdalsvand	Nidelv	21	885	..	Steamer service
Vråvand	Nidelv	7	844	..	Steamer service
Nisservand	Nidelv	28	796	..	Steamer service
Tokevand	Toke	8	147	..	Canal
Totakvand	Totak	15	2,234	..	
Bandakvand	Ulefosselv	24	236	725	Steamer service
Kvitescid	Ulefosselv	7	236	..	Steamer service
Flå (Röir)	Ulefosselv	7	236	..	Steamer service
Mösvand	Manelv	17	2,780	..	Motor-boat service
Tinnsjö	Tinne	17½	605	1,436	Train-ferry and steamer service
Hitterdalsvand	Tinne	8	52	..	Steamer service
Norsjö	Tinne	23	49	540	Steamer service
Eikeren	..	9	45	..	
Kröderen	Hallingdalselv	16	393	100	Steamer service
Strondefjord	Begna	10	1,194	..	Motor-boat service
Sperillen	Begna	15	534	..	Steamer service
Randsfjord	..	52	439	355	Steamer service
Tyrifjord	..	51	209	920	
Mjösa	Lågen	140	406	1,482	Steamer service
Vannsjö	..	12	..	..
Aursund	Glomma	16	2,263	..	
Öyeren	Glomma	36	337	..	Steamer service
Storsjö	Rena	17	823	..	
Ossjö	Osen	14	1,469	..	
Femund	Trysillev	79	2,171	427	Steamer service
Sirdalsvand	Sira	8	167	..	Steamer service
Lundevand	Sira	8	134	..	Motor-boat service

Lake	Watercourse	Approx. area sq. miles	Height in feet	Greatest depth in feet	Remarks
Suldalsvand .	..	10	232	..	Steamer and motor-boat service
Tyin .	..	13½	3,618	325	Steamer service
Bygdn .	..	17½	3,618	705	Steamer service
Veitestrandfjord.	..	10	..	..	Motor-boat service
Jölstervand .	..	17	672	..	..
Hornindalsvand	..	20	170	1,594	Steamer service
Gjevilvand .	Driva	12	2,175	..	..
Selbu .	Nea	23	525	443	Steamer service
Snäsavand.	..	49	78	443	..
Tunnsjö .	Namsen	36	1,264	..	..
Limingen .	Namsen	36	1,382	..	..
Rösvand .	Rösa	73	1,227	820	..
Altevand .	Barduelv	33	1,663	..	..

APPENDIX V

CLIMATIC STATISTICS

TABLE 1. *Percentage Frequency of Wind Direction*

VARDÖ. 1867-1925

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm
January .	7	6	3	6	16	33	13	11	5
February .	8	8	3	5	13	35	13	11	4
March .	9	8	5	6	14	27	14	12	5
April .	10	9	7	11	14	17	12	14	6
May .	14	10	9	14	12	9	8	17	7
June .	20	10	10	16	10	4	6	19	5
July .	23	11	10	17	11	3	2	17	6
August .	17	10	12	16	13	5	3	16	8
September .	12	8	6	10	17	14	10	17	6
October .	9	8	4	7	15	24	14	15	4
November .	10	8	5	7	14	26	12	13	5
December .	6	9	4	6	15	33	10	11	6

SKOMVAER. 1891-1925

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm
January .	7	6	8	8	17	24	15	11	4
February .	8	9	12	8	15	23	11	11	3
March .	6	9	13	10	17	21	11	9	4
April .	7	11	14	9	16	18	10	9	6
May .	11	17	13	5	11	17	9	9	8
June .	16	18	7	3	7	19	9	9	12
July .	12	23	7	2	6	17	9	6	18
August .	11	19	12	5	9	16	8	7	13
September .	9	10	10	6	11	23	13	11	7
October .	8	11	10	7	13	23	11	11	6
November .	9	9	10	8	13	24	13	10	4
December .	6	8	10	11	20	23	11	8	3

NORDÖYAN. 1891-1925

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm
January .	8	4	11	28	8	19	14	8	0
February .	8	4	11	29	8	19	13	8	0
March .	8	5	13	30	8	17	11	8	0
April .	11	9	10	24	6	19	10	9	2
May .	19	14	9	13	4	21	10	8	2
June .	27	18	7	5	2	18	11	10	2
July .	23	18	8	6	1	19	12	10	3
August .	17	15	10	14	3	19	11	8	3
September .	13	8	8	16	5	25	14	10	1
October .	10	7	12	26	7	18	11	9	0
November .	9	5	11	27	8	18	13	9	0
December .	6	4	12	35	10	16	11	6	0

TRONDHEIM. 1885-1925

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm
January .	1	3	7	23	34	19	7	6	0
February .	3	5	7	22	31	16	8	7	1
March .	5	7	8	22	28	14	7	8	1
April .	10	7	6	17	23	12	10	15	0
May .	17	10	4	9	13	8	14	25	0
June .	20	8	3	5	7	5	16	35	1
July .	20	10	3	5	10	6	15	31	0
August .	14	9	5	8	16	9	13	25	1
September .	11	6	5	14	23	13	12	15	1
October .	5	7	7	19	31	13	8	9	1
November .	2	4	6	21	36	17	7	7	0
December .	2	5	5	26	36	16	5	5	0

BERGEN. 1841-1920

January .	7	2	4	16	40	7	3	6	15
February .	11	4	3	15	35	6	4	6	16
March .	15	4	4	14	33	6	4	7	13
April .	22	3	4	10	27	6	5	11	12
May .	24	3	3	6	24	7	7	16	10
June .	25	2	2	5	21	8	9	19	9
July .	22	2	1	5	22	9	10	19	10
August .	20	1	2	8	26	9	8	15	11
September .	16	3	2	11	31	8	5	11	13
October .	12	3	4	14	34	7	4	7	15
November .	10	4	5	17	33	6	3	5	17
December .	8	3	5	16	36	7	3	5	17

SKUDENES. 1861-1925

January .	7	5	13	23	18	8	10	8	8
February .	9	5	13	21	18	7	9	9	9
March .	10	6	13	18	18	6	8	12	9
April .	14	5	13	14	15	6	8	18	7
May .	15	3	9	10	17	8	10	22	6
June .	17	2	6	7	14	8	12	29	5
July .	16	2	4	9	16	7	13	26	7
August .	15	3	6	10	16	8	12	24	6
September .	13	4	8	12	18	9	11	16	9
October .	12	5	11	19	18	7	8	11	9
November .	11	6	13	20	16	7	9	10	8
December .	8	5	13	22	18	8	9	9	8

LISTER. 1863-77, 1920-9

January .	4	11	24	15	9	11	12	10	4
February .	5	11	28	13	5	7	13	14	4
March .	7	12	22	15	6	6	9	17	6
April .	4	7	19	16	8	5	12	22	7
May .	4	4	12	14	10	8	17	24	7
June .	2	2	9	10	7	7	24	33	6
July .	2	2	9	12	9	8	22	31	5
August .	3	3	11	11	8	10	21	28	5
September .	3	5	14	13	9	11	16	25	4
October .	6	9	18	12	9	10	11	20	5
November .	8	15	22	10	6	8	11	15	5
December .	7	16	21	10	8	9	12	14	3

OKSÖY. 1870-1929

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm
January	17	17	8	6	8	17	17	8	2
February	14	21	12	5	8	16	14	8	2
March	11	22	14	5	8	16	13	8	3
April	9	23	17	4	7	17	12	8	3
May	5	16	18	5	9	25	12	7	3
June	4	12	14	4	9	32	15	7	3
July	4	9	12	5	10	33	18	6	3
August	7	10	11	6	9	26	22	7	2
September	10	11	10	6	8	22	22	9	2
October	14	16	11	8	8	16	17	8	2
November	17	16	9	8	7	14	17	10	2
December	20	17	7	7	8	14	15	10	2

OSLO. 64 years

January	8	23	12	5	12	5	3	4	28
February	9	21	11	5	14	6	3	4	27
March	9	21	11	5	16	8	4	3	23
April	10	18	12	7	18	11	4	4	16
May	10	14	8	8	27	15	4	4	10
June	9	12	8	7	30	19	4	3	8
July	7	11	10	8	30	17	4	3	10
August	8	12	10	8	26	14	4	3	15
September	9	15	8	6	21	12	4	3	22
October	11	19	10	6	15	7	4	3	25
November	10	21	11	5	11	6	3	4	29
December	10	27	13	5	11	4	2	3	25

TABLE 2. *Number of Days with Maximum Temperature below Freezing*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Alta	17.5	24.0	23.9	5.6	—	—	—	—	—	4.6	17.9	23.9	117.4
Trondheim	12.2	10.6	5.5	0.4	—	—	—	—	—	0.7	6.0	10.5	45.9
Laerdal	9.8	10.2	5.5	—	—	—	—	—	—	0.7	7.4	10.7	44.3
Bergen	4.3	3.6	1.2	—	—	—	—	—	—	—	1.1	3.6	13.8
Oslo	17.7	14.1	5.1	0.1	—	—	—	—	—	0.2	7.3	14.9	59.4
Röros	24.5	25.3	20.8	6.3	0.5	—	—	—	—	5.3	19.6	26.2	128.5

TABLE 3. *Duration of the Seasons*

	First date on which average				Duration (days)			
	temp. exceeds: 32°	50°	temp. falls below: 50°	32°	Winter	Spring	Summer	Autumn
1. WEST COAST								
<i>(a) Outer</i>								
Ona	—	June 16	Sept. 23	—	—	108	99	158
Florø	—	May 28	Sept. 22	—	—	104	117	144
Bergen	—	May 20	Sept. 25	—	—	99	128	138
Skudenes	—	May 26	Oct. 6	—	—	101	133	131
<i>(b) Inner Fjords</i>								
Laerdal	Mar. 1	May 13	Sept. 18	Dec. 8	83	73	128	81
Ullensvang	Feb. 16	May 18	Sept. 20	Jan. 15	32	91	125	117
2. EASTERN INTERIOR								
Rena	Apr. 8	May 31	Sept. 5	Oct. 28	162	53	97	53
3. FJELD								
<i>(a) West</i>								
Finse	May 12	—	—	Oct. 10	214	75	—	76
<i>(b) East</i>								
Veggli	Apr. 3	May 31	Sept. 6	Nov. 1	153	58	98	56
Granheim	Apr. 7	May 28	Sept. 2	Oct. 28	161	51	97	56
Dovre	Apr. 15	June 13	Aug. 20	Oct. 21	176	59	68	62
Röros	Apr. 24	June 28	Aug. 14	Oct. 16	190	65	47	63
4. SOUTH COAST								
Lister	—	May 23	Oct. 4	—	—	110	134	121
Oksøy	—	May 23	Oct. 2	—	—	102	132	131
Dalen	Mar. 24	May 20	Sept. 17	Nov. 14	130	57	120	58
5. OSLO FJORD								
Oslo	Mar. 21	May 13	Sept. 25	Nov. 19	122	53	135	55
6. TRONDHEIM DEPRESSION AND TRÖNDELAG								
Nordöyan	—	June 17	Sept. 14	—	—	120	89	156
Trondheim	Mar. 22	June 2	Sept. 12	Nov. 20	122	72	102	69
7. NORDLAND								
Svolvær	Apr. 2	June 18	Sept. 4	Dec. 3	120	77	78	90
Skomvær	—	July 13	Aug. 26	—	—	135	44	186
Bodø	Apr. 2	June 18	Sept. 3	Nov. 25	128	77	77	83
Hattfjelldal	Apr. 16	June 10	Aug. 27	Oct. 23	175	55	78	57
Brønnøy	Mar. 16	June 13	Sept. 12	Dec. 14	92	89	91	93
8. TROMS AND FINNMARK								
Gjesvær	Apr. 22	July 17	Aug. 16	Nov. 2	171	86	30	78
Vardø	May 3	—	—	Oct. 29	186	88	—	91
Kirkenes	May 1	June 28	Aug. 23	Oct. 17	196	58	56	55
Alta	Apr. 26	June 22	Aug. 26	Oct. 20	188	57	65	55
Karasjok	May 4	June 18	Aug. 21	Oct. 7	209	45	64	47
Tromsø	Apr. 16	July 2	Aug. 20	Nov. 7	160	77	49	79
Andenes	Apr. 7	July 14	Aug. 24	Nov. 22	136	98	41	90

TABLE 4. *Number of Days with Frost*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1. WEST COAST													
(a) Outer													
Bergen . . .	15.5	16.8	13.8	4.4	0.2	—	—	—	—	1.7	9.1	11.9	72.9
(b) Inner Fjords													
Laerdal . . .	22.4	23.2	18.4	7.1	0.2	—	—	—	0.3	7.3	15.4	20.3	114.0
3. FJELD													
(b) East													
Röros . . .	30.3	30.3	30.0	27.8	15.5	4.2	0.6	1.8	10.5	23.1	29.1	30.3	232.6
5. OSLO FJORD													
Oslo . . .	28.0	27.4	24.8	10.6	0.7	—	—	—	0.2	6.4	19.9	24.5	141.2
6. TRONDHEIM DEPRESSION AND TRÖNDELAG													
Trondheim . .	25.5	25.9	23.6	13.4	2.7	0.1	—	—	0.4	8.3	20.0	24.7	143.4
8. TROMS AND FINNMARK													
Alta . . .	29.4	30.1	29.1	25.6	13.0	0.3	—	0.3	3.6	19.7	27.6	29.5	207.1

TABLE 5. *Temperature: Monthly Means (° F.)*

1861-1920

	Alt. ft.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1. WEST COAST														
<i>(a) Outer</i>														
Ona	39	36.9	36.1	36.5	40.3	44.4	49.8	53.6	54.3	51.6	46.4	41.2	38.1	44.1
Florø	23	35.2	34.7	35.6	41.0	47.1	53.8	56.8	55.9	51.8	45.5	39.7	36.3	44.4
Bergen	72	34.2	34.3	36.0	42.3	48.9	55.2	57.9	56.7	52.0	45.3	39.2	35.6	44.8
Skudenes	23	36.0	35.4	36.3	41.5	47.8	53.8	57.0	57.2	53.8	47.5	41.5	37.8	45.5
Kristiansund N. 49 (years not known)	49	34.9	33.6	34.9	39.9	46.0	52.2	55.6	55.8	51.5	44.6	38.1	35.4	43.5
<i>(b) Inner Fjords</i>														
Laerdal	10	29.5	30.0	33.6	42.3	50.5	58.1	61.0	58.3	50.5	42.3	35.2	30.6	43.5
Ullensvang	98	32.0	32.0	34.2	41.7	49.5	56.7	59.4	57.4	51.1	43.7	37.0	33.3	44.1
2. EASTERN INTERIOR														
Rena	738	12.4	15.8	23.4	34.7	45.3	55.8	58.5	54.7	46.6	36.1	24.6	15.1	35.2
3. FJELD														
<i>(a) West</i>														
Finse	4,022	16.5	16.2	18.0	25.0	33.1	41.5	46.0	44.6	38.8	30.2	22.3	17.2	29.1
<i>(b) East</i>														
Veggli	666	18.3	21.2	26.8	35.8	45.1	54.3	57.4	54.3	47.5	37.4	26.8	19.2	37.0
Granheim	1,283	14.5	17.2	23.0	34.3	44.4	54.0	56.8	54.0	46.6	36.3	26.6	16.2	35.2
Dovre	2,113	16.7	18.3	22.6	32.0	41.4	50.7	54.0	51.1	43.9	33.6	23.9	17.4	33.8
Røros	2,067	12.6	14.0	18.7	29.1	39.0	48.6	52.2	49.6	42.4	32.4	21.9	14.4	31.3
4. SOUTH COAST														
Lister	39	33.6	33.6	34.9	41.4	48.4	54.5	58.6	58.5	54.5	46.9	40.6	36.1	45.1
Oksøy	36	32.9	32.4	33.6	39.9	48.2	56.1	60.1	59.0	54.1	46.8	39.9	35.1	45.0
Dalen	338	25.0	25.5	29.8	39.0	48.7	57.7	60.6	57.6	50.5	40.5	31.6	25.9	41.0
5. OSLO FJORD														
Oslo	82	24.4	25.5	30.6	40.5	50.9	60.1	63.1	59.9	52.3	42.3	32.9	26.4	42.4
6. TRONDHEIM DEPRESSION AND TRØNDELAG														
Nordøyen	102	33.1	32.2	32.9	38.1	43.2	49.6	54.0	54.0	49.8	43.2	37.6	33.4	41.7
Trondheim	131	27.3	27.9	30.6	38.3	45.9	53.6	57.2	55.4	48.9	40.5	33.1	27.7	40.5
7. NORDLAND														
Svolvær	13	30.0	28.6	29.7	34.7	41.5	49.5	54.9	54.1	47.1	39.9	34.0	30.7	39.6
Skomvær	52	34.0	32.5	32.9	36.1	40.5	46.0	50.4	51.1	47.3	42.3	37.8	35.1	40.5
Bodø	72	29.1	27.7	29.1	35.6	42.4	49.6	54.5	53.8	47.7	39.9	33.6	29.3	39.4
Hattfjelldal	728	15.8	16.2	21.2	31.6	40.3	51.1	55.6	52.3	44.8	34.2	23.5	16.0	33.6
Brønnøy	20	31.5	30.6	31.8	38.1	44.2	50.5	54.9	54.5	49.5	42.3	36.0	31.8	41.4
8. TROMS AND FINNMARK														
Vardø	33	22.1	21.4	23.5	29.5	35.1	42.3	47.7	47.8	43.2	34.9	28.2	24.1	33.3
Kirkenes	26	12.2	11.1	17.6	27.7	36.7	46.6	53.1	51.3	43.7	32.4	21.0	14.0	30.6
Karasjok	420	3.7	4.6	12.4	25.3	36.7	49.3	55.0	51.1	41.7	28.4	13.6	5.2	27.3
Gjesvær	20	25.3	24.3	26.1	31.1	36.7	44.6	49.8	50.0	43.7	35.8	29.7	26.2	35.2
Alta	33	17.6	16.7	21.0	29.7	38.3	48.2	54.0	52.2	44.4	33.3	23.7	18.1	33.1
Tromsø	148	26.2	24.8	26.4	32.0	38.8	47.1	51.8	50.7	44.2	36.1	30.4	26.6	36.3
Andenes	23	29.7	27.9	28.8	33.4	39.4	46.0	50.2	50.9	45.7	38.5	33.3	29.8	37.8

TABLE 6. *Temperature: Mean Annual Extremes (° F.)*

1861-1920

	Max.	Min.
1. WEST COAST		
(a) Outer		
Ona	66.9	21.0
Florö	74.7	17.6
Bergen	77.5	14.2
Skudenes	73.4	17.6
(b) Inner Fjords		
Laerdal	77.0	4.6
Ullensvang	76.8	12.2
2. EASTERN INTERIOR		
Rena	82.6	-30.1
3. FJELD		
(a) West		
Finse	63.3	-19.5
(b) East		
Veggli	81.0	-18.0
Granheim	77.7	-22.5
Dovre	75.2	-13.7
Röros	74.5	-35.3
4. SOUTH COAST		
Lister	72.9	12.6
Oksøy	72.7	13.1
Dalen	82.6	-1.7
5. OSLO FJORD		
Oslo	87.4	-2.2
6. TRONDHEIM DEPRESSION AND TRÖNDELAG		
Nordöyan	67.8	13.3
Trondheim	81.9	0.0
7. NORDLAND		
Svolvær	73.8	11.3
Skomvær	62.1	18.0
Bodö	75.4	5.4
Hattfjelldal	78.8	-34.1
Brønnøy	77.4	11.1
8. TROMS AND FINNMARK		
Vardö	64.9	2.3
Kirkenes	78.3	-24.9
Karasjok	80.8	-43.6
Gjesvær	77.2	6.1
Alta	78.4	-14.8
Tromsø	73.2	5.9
Andenes	66.9	10.0

TABLE 7. *Precipitation (inches)*
1876-1925

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1. WEST COAST													
<i>(a) Outer</i>													
Ona	4.9	3.7	3.0	2.5	2.8	1.6	2.9	3.0	5.0	4.9	6.2	4.1	44.6
Florø	9.0	7.1	6.0	4.4	4.4	3.5	5.2	7.3	9.5	9.2	9.0	8.5	83.3
Bergen	8.8	7.1	6.1	4.4	4.6	4.2	5.6	7.7	9.3	9.2	8.7	8.7	84.4
Skudenes	4.4	3.9	3.3	2.5	2.3	2.2	3.2	4.8	4.8	5.6	4.9	4.8	46.9
Kristiansund N.	5.1	3.6	3.2	2.4	2.5	2.1	3.1	4.2	5.4	5.7	4.8	4.4	46.5
<i>(b) Inner Fjords</i>													
Laerdal	2.0	1.5	1.1	0.5	0.9	1.2	1.7	1.9	2.2	1.7	1.8	1.6	18.1
Ullensvang	8.1	6.3	4.9	2.6	2.8	2.7	3.3	4.8	6.5	6.5	7.3	7.4	63.2
2. EASTERN INTERIOR													
Rena	1.5	1.3	1.6	1.7	2.2	2.3	3.3	4.0	2.6	2.8	1.9	2.3	27.6
3. FJELD													
<i>(a) West</i>													
Finse	3.2	2.8	2.7	1.5	1.9	2.0	2.7	3.9	3.5	3.7	3.3	3.5	34.9
<i>(b) East</i>													
Veggli	1.2	1.1	1.5	1.8	1.9	2.4	3.2	3.9	2.4	3.0	2.0	2.3	26.9
Granheim	1.1	1.0	1.1	1.0	1.6	2.1	3.1	3.4	2.2	2.0	1.5	1.5	21.8
Dovre	1.4	1.1	0.8	0.5	1.0	1.3	2.2	2.3	1.3	1.1	1.1	1.1	15.3
Røros	1.3	1.1	1.0	0.8	1.2	2.0	2.6	2.6	1.9	1.4	1.1	1.0	18.0
4. SOUTH COAST													
Lister	3.9	3.0	2.7	2.4	2.4	1.8	3.2	4.6	3.9	5.0	4.8	4.7	42.3
Oksøy	2.5	2.2	2.6	1.9	2.0	1.7	2.6	3.9	3.0	3.9	3.7	3.8	34.0
Dalen	2.5	2.0	2.2	1.9	2.3	2.3	3.2	4.6	2.9	3.8	2.9	3.2	34.1
5. OSLO FJORD													
Oslo	1.6	1.5	1.5	1.6	1.7	2.1	3.0	3.5	2.4	2.6	2.0	1.9	25.4
6. TRONDHEIM DEPRESSION AND TRØNDELAG													
Nordøyen	4.9	4.6	3.6	2.7	2.8	2.7	2.9	3.7	5.4	5.0	5.2	4.5	48.1
Trondheim	3.4	2.9	2.2	1.8	1.5	1.7	2.2	3.0	3.3	3.4	3.1	2.6	31.1
7. NORDLAND													
Svolvær	6.2	7.6	4.5	2.9	3.7	3.1	3.2	3.2	7.0	7.2	7.6	5.4	61.5
Skomvær	2.1	1.9	1.4	1.1	1.1	1.2	1.5	1.9	2.6	2.6	2.7	2.0	22.1
Bodø	2.8	2.9	2.4	1.7	2.7	2.7	2.4	2.0	4.1	4.4	3.8	2.4	34.1
Hattfjellidal	4.0	3.3	2.1	1.4	1.4	1.9	2.4	3.1	4.1	3.2	4.1	3.1	34.1
Brønnøy	3.5	3.0	2.5	2.2	2.5	2.5	3.0	3.3	5.1	4.6	4.7	3.2	40.1
8. TROMS AND FINNMARK													
Vardø	2.6	2.8	2.1	1.7	1.4	1.6	1.7	2.0	2.4	2.5	2.5	2.6	25.8
Kirkenes	0.7	0.8	0.6	0.6	0.8	1.5	2.4	1.9	1.9	1.5	1.2	0.9	14.7
Karasjok	0.7	0.7	0.5	0.6	0.9	1.7	2.4	2.1	1.9	1.2	1.0	0.7	14.3
Gjesvær	2.6	3.1	2.8	2.2	2.1	2.2	2.8	2.6	3.8	3.5	3.4	2.9	34.1
Alta	0.9	0.9	0.6	0.5	0.6	1.1	1.8	1.7	1.4	1.1	1.1	0.6	12.1
Tromsø	4.3	4.4	3.1	2.3	1.9	2.2	2.2	2.8	4.8	4.6	4.4	3.8	40.7
Andenes	3.0	2.7	2.2	1.7	1.6	1.5	1.7	2.1	3.7	3.5	3.7	2.8	30.2

TABLE 8. *Precipitation-Days**
1876-1915

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1. WEST COAST													
(a) Outer													
Florø	19	15	15	12	12	9	13	15	16	17	18	18	179
Bergen	17	15	15	12	13	10	14	16	16	17	17	17	179
Skudenes	14	14	14	9	10	8	10	14	14	16	16	16	155
Kristiansund N. (1896-1915)	17	15	13	13	12	10	13	15	16	16	16	15	171
(b) Inner Fjords													
Laerdal (1881- 1915)	9	6	5	4	6	6	9	11	10	9	8	7	90
Ullensvang	13	10	9	7	9	9	12	14	13	12	12	12	132
2. EASTERN INTERIOR													
Rena (1891- 1915)	9	8	10	7	9	9	11	13	8	11	8	11	114
3. FJELD													
(b) East													
Veggli (1896- 1915)	6	6	9	7	7	8	10	12	7	10	7	10	99
Granheim	7	6	7	5	7	9	11	12	9	9	7	9	98
Dovre	7	6	6	4	5	7	10	10	7	7	7	7	83
Röros	7	6	6	4	6	8	11	11	9	8	7	7	90
4. SOUTH COAST													
Oksøy	11	9	10	7	8	7	9	11	9	12	12	13	118
Dalen (1889- 1915)	11	7	10	8	8	8	11	13	8	12	11	11	118
5. OSLO FJORD													
Oslo	7	6	7	6	7	7	10	11	7	9	8	9	94
6. TRONDHEIM DEPRESSION AND TRØNDELAG													
Nordøyen (1891-1915)	15	14	13	11	9	8	9	12	17	16	16	15	155
Trondheim (1885-1915)	13	11	10	10	9	9	11	12	15	12	12	11	135
7. NORDLAND													
Svolvær (1886- 1915)	17	15	14	12	10	9	11	12	17	18	18	16	169
Skomvær (1890-1915)	13	11	11	9	8	7	7	10	15	16	15	14	136
Bodø	13	11	10	9	10	9	11	11	15	14	15	12	140
Hattfjellidal (1884-1915)	15	11	10	8	9	9	12	15	15	13	14	12	143
Brønnøy	14	11	9	10	9	11	12	15	15	15	15	13	144
8. TROMS AND FINNMARK													
Vardø (1894- 1915)	14	15	12	9	9	7	9	9	13	14	15	14	140
Kirkenes	5	5	5	4	6	7	9	8	9	7	7	5	77
Karasjok	7	5	5	5	6	7	10	9	9	7	7	5	82
Gjesvær (1884- 1915)	12	13	12	11	11	9	10	9	14	14	13	11	139
Alta	6	5	4	4	4	5	8	8	7	6	6	4	67
Tromsø	15	13	12	11	10	9	11	11	16	15	15	13	151
Andenes (1910- 15)	16	12	12	13	13	10	9	10	18	17	13	12	155

* Precipitation (snow and rain) exceeding 1 mm. (0.04 inch).

TABLE 9. *Number of Days with Snow**

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1. WEST COAST													
(a) Outer													
Florø	9.2	9.4	8.1	4.8	0.8	—	—	—	—	0.9	4.3	6.3	43.3
Bergen	9.0	9.5	8.3	4.2	0.6	—	—	—	—	0.7	4.5	5.8	42.3
Skudenes	5.8	7.3	5.6	2.4	0.2	—	—	—	0.1	0.4	2.6	3.6	27.8
(b) Inner Fjords													
Laerdal	5.8	5.0	3.3	1.4	0.2	—	—	—	—	0.3	2.3	4.3	22.6
Ullensvang	7.7	6.9	4.9	2.3	0.8	—	—	—	0.0	0.6	2.9	5.1	31.1
3. FJELD													
(b) East													
Granheim	11.3	11.1	10.8	6.9	2.0	0.1	—	—	0.4	4.3	9.0	13.1	68.6
Dovre	11.5	11.5	10.0	6.6	3.0	0.5	0.0	—	1.4	5.4	10.9	11.3	71.8
4. SOUTH COAST													
Oksøy	6.3	6.5	6.4	2.1	0.2	—	—	—	—	0.5	2.1	4.6	28.6
5. OSLO FJORD													
Oslo	9.9	9.6	10.1	3.9	0.6	0.1	—	—	0.1	1.2	5.4	10.5	51.1
6. TRONDHEIM DEPRESSION AND TRØNDELAG													
Trondheim	13.6	13.8	10.9	7.9	3.3	0.3	0.0	0.0	0.5	3.5	9.9	10.5	73.7
7. NORDLAND													
Svolvær	14.3	15.0	11.7	8.1	3.9	0.5	—	—	1.0	5.7	10.7	10.2	80.6
Hattfjelldal	16.9	15.6	12.9	8.2	3.7	0.9	0.2	—	1.2	6.3	13.3	14.4	93.1
Brønnøy	11.4	11.7	10.1	6.1	2.6	0.3	—	—	0.3	3.0	7.7	8.7	61.7
8. TROMS AND FINNMARK													
Vardø	13.8	15.9	12.0	9.3	6.9	4.8	1.0	0.3	2.4	8.6	13.8	14.6	99.1
Alta	8.6	9.5	7.5	7.0	4.0	0.8	0.1	0.0	1.3	6.5	9.1	6.7	60.8
Tromsø	12.3	13.6	10.2	8.4	5.8	1.1	—	—	1.4	7.1	11.1	9.9	80.5

* The symbol — means that during the years covered by observation, no snow at all has been observed during the month in question. 0.0, on the other hand, indicates that while snow has been occasionally observed the average number of days works out at an insignificant figure.

TABLE 10. *Number of Days with Snow-Cover**

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
WEST COAST													
<i>(a) Outer</i>													
Ålesund . . .	12	14	13	8	1	—	—	—	—	1	7	13	69
Gjerde . . .	10	10	10	1	—	—	—	—	—	0	4	5	40
Bergen . . .	9	12	9	1	0	—	—	—	—	0	4	9	44
Utsire . . .	5	7	4	1	0	—	—	—	—	0	2	3	22
<i>(b) Inner Fjords</i>													
Årdalstangen .	13	10	5	1	—	—	—	—	—	0	5	11	45
Ullensvang .	15	16	12	3	0	—	—	—	—	—	3	8	56
2. EASTERN INTERIOR													
Ytre Rendal .	31	28	31	15	0	—	—	—	0	3	15	26	149
3. FJELD													
<i>(a) West</i>													
Griptruste .	31	28	31	30	31	20	2	0	1	12	25	31	242
<i>(b) East</i>													
Veggli . . .	31	27	31	26	5	—	—	—	0	6	20	30	176
Granheim . .	29	26	31	20	1	—	—	—	0	4	19	28	158
Lesje . . .	26	27	26	11	1	0	—	—	1	4	21	26	143
Os . . .	31	28	31	30	23	1	0	0	3	14	28	31	220
4. SOUTH COAST													
Bryne . . .	8	8	4	1	—	—	—	—	—	—	1	6	28
Kristiansand S.	23	18	18	6	—	—	—	—	—	—	3	10	78
Seljord . . .	29	26	30	9	0	—	—	—	—	0	9	25	128
5. OSLO FJORD													
Oslo . . .	27	26	22	2	0	—	—	—	—	1	7	17	102
6. TRONDHEIM DEPRESSION AND TRØNDELAG													
Namsos . . .	22	23	25	9	0	—	—	—	—	3	16	23	121
Trondheim . .	26	24	27	10	1	0	—	—	0	1	14	24	127
7. NORDLAND													
Svolvær . . .	26	27	29	22	3	—	—	—	0	4	15	22	148
Skomvær . . .	8	9	8	5	1	—	—	—	0	0	5	7	43
Rosenvold . .	30	27	28	19	5	—	—	—	1	6	19	20	155
Rødøy . . .	14	18	20	10	2	—	—	—	—	2	9	14	89
Hattfjelldal .	31	28	31	30	17	0	0	—	0	6	23	31	197
8. TROMS AND FINNMARK													
Vardö . . .	31	28	31	28	16	1	2	—	1	11	24	30	209
Karasjok . . .	31	28	31	29	12	0	—	—	1	12	28	30	202
Kirkenes . . .	31	28	31	30	21	3	—	—	0	9	26	31	210
Tranøy . . .	27	28	30	21	9	0	—	—	1	7	16	24	163
Barkestad . .	22	24	25	19	5	0	—	—	0	5	14	20	134

* The symbol — means that during the years covered by observation, no snow at all has been observed during the month in question. 0.0, on the other hand, indicates that while snow has been occasionally observed, the average number of days works out at an insignificant figure.

TABLE II. *Mean Depth of Snow (inches)**

	Alt.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1. WEST COAST													
<i>(a) Outer</i>													
Ålesund . . .	335	2.0	2.0	2.4	0.8	0.0	—	—	—	—	0.0	0.8	2.4
Gjerde . . .	30	1.6	2.0	2.0	0.0	—	—	—	—	—	0.0	0.4	0.8
Bergen . . .	141	0.6	0.4	0.6	0.0	0.0	—	—	—	—	0.0	0.0	0.6
Utsire . . .	30	0.4	0.4	0.0	0.0	0.0	—	—	—	—	0.0	0.0	0.0
<i>(b) Inner Fjords</i>													
Årdalstangen . .	7	1.2	0.8	0.4	0.0	—	—	—	—	—	0.0	0.4	0.8
Ullensvang . .	92	2.8	3.9	2.8	0.0	0.0	—	—	—	—	0.0	0.4	1.6
2. EASTERN INTERIOR													
Ytre Rendal . .	915	9.8	11.4	14.2	5.1	0.0	—	—	—	0.0	0.4	2.0	7.1
3. FJELD													
<i>(a) West</i>													
Grjotruste . .	4,265	45.3	62.2	72.4	75.6	49.6	17.7	3.2	0.8	0.0	2.4	13.8	31.9
<i>(b) East</i>													
Veggli . . .	666	16.5	15.7	18.1	9.4	0.4	—	—	—	0.0	0.4	3.9	13.4
Granheim . .	1,276	11.4	12.2	13.8	7.1	0.0	—	—	—	0.0	0.4	2.8	10.2
Lesje . . .	1,667	5.5	6.7	6.3	1.6	0.0	0.0	—	—	0.0	0.4	2.4	4.7
Os . . .	367	29.1	39.4	42.5	39.0	16.1	0.4	0.0	0.0	0.0	2.8	9.0	20.9
4. SOUTH COAST													
Bryne . . .	36	1.2	0.8	0.4	0.0	—	—	—	—	—	—	0.0	0.4
Kristiansand S.	72	5.9	7.5	6.3	1.6	—	—	—	—	—	—	0.4	3.1
Seljord . . .	400	9.8	11.0	11.8	3.1	0.0	—	—	—	0.0	0.0	1.2	5.6
5. OSLO FJORD													
Oslo . . .	75	5.1	6.7	5.5	0.4	0.0	—	—	—	—	0.0	0.4	2.8
6. TRONDHEIM DEPRESSION AND TRØNDELAG													
Namsos . . .	39	5.1	7.9	5.1	2.0	0.0	—	—	—	—	0.4	2.8	9.1
Trondheim . .	116	5.9	9.8	8.7	2.8	0.0	—	—	—	0.0	0.0	1.6	3.9
7. NORDLAND													
Svolvær . . .	3	8.7	13.0	16.1	3.5	0.8	—	—	—	0.0	0.4	3.5	8.7
Rosenvold . .	164	5.9	9.1	7.9	3.1	0.4	—	—	—	0.0	0.8	2.0	2.4
Rødøy . . .	33	1.6	3.5	2.4	2.0	0.4	—	—	—	—	0.0	1.6	2.8
Hattfjeldal . .	728	22.0	34.3	38.6	31.1	6.3	0.0	0.0	—	0.0	0.0	3.5	11.4
8. TROMS AND FINNMARK													
Vardø . . .	20	20.9	29.1	34.3	30.3	13.8	1.2	—	—	0.0	1.6	5.1	15.0
Karasjok . .	420	12.2	14.6	16.1	12.6	1.6	0.0	—	—	0.0	0.8	6.3	10.6
Tranøy . . .	13	9.8	15.4	17.7	16.1	2.0	0.0	—	—	0.0	0.8	4.3	7.9
Barkestad . .	23	7.5	12.6	15.4	13.0	2.4	0.0	—	—	0.0	0.8	4.3	7.5

* The symbol — means that during the years covered by observation, no snow at all has been observed during the month in question. 0.0, on the other hand, indicates that while snow has been occasionally observed, the average depth works out at an insignificant figure.

TABLE 12. *Daylight, 1941*(a) *Length of daylight, excluding twilight (hours and minutes)*

N. Latitude	Dec. 21	Feb. 1	Apr. 1	June 21	Aug. 1	Nov. 1
58	6:28	8:18	13:10	18:11	16:28	9:01
60	5:52	7:57	13:15	18:43	16:53	8:45
62	5:10	7:35	13:22	19:45	17:22	8:26
64	4:12	7:07	13:29	21:01	17:58	8:04
66	2:46	6:33	13:38	—	18:42	7:38
68	—	5:51	13:48	—	19:44	7:08
69	—	5:24	13:54	—	20:25	6:50
70	—	4:54	14:00	—	21:21	6:28
71	—	4:16	14:07	—	23:29	6:05

(b) *Length of daylight, including twilight (hours and minutes)*

58	8:11	9:46	14:29	20:43	18:14	10:24
60	7:47	9:33	14:40	22:25	18:54	10:14
62	7:28	9:17	14:54	—	19:44	10:04
64	6:48	9:00	15:08	—	20:56	9:52
66	6:08	8:38	15:24	—	—	9:36
68	5:18	8:14	15:46	—	—	9:18
69	4:46	8:00	15:58	—	—	9:09
70	4:06	7:34	16:10	—	—	8:57
71	3:16	7:27	16:26	—	—	8:45

(c) *Number of days when the sun does not rise*

N. Latitude	No.	From	To
68	25	Dec. 10	Jan. 3
69	41	Dec. 2	Jan. 11
70	52	Nov. 26	Jan. 16
71	62	Nov. 21	Jan. 21
72	70	Nov. 17	Jan. 25

(d) *Number of days when the sun does not set*

66	18	June 12	June 29
68	53	May 26	July 17
69	63	May 21	July 22
70	72	May 16	July 26
71	81	May 12	July 31
72	88	May 8	Aug. 3

(e) *Number of days with twilight all night*

62	43	May 31	July 12
64	65	May 21	July 24
66	82	May 12	Aug. 1
68	97	May 5	Aug. 9
69	104	May 1	Aug. 12
70	110	Apr. 28	Aug. 15
71	117	Apr. 24	Aug. 18
72	128	Apr. 16	Aug. 21

TABLE 13. *Number of Days with Fog**
(1929-38)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1. WEST COAST													
<i>(a) Outer</i>													
Ona . . .	—	0.1	0.8	1.4	3.1	1.8	3.1	1.1	0.6	—	—	—	12.0
Bergen . . .	1.8	1.4	3.9	1.6	1.7	0.7	1.0	1.5	1.7	1.8	1.3	1.2	19.6
Skudenes . . .	1.0	0.9	3.3	2.0	3.1	1.5	0.8	0.7	0.3	0.2	0.3	1.4	15.3
<i>(b) Inner fjords</i>													
Laerdal . . .	0.2	0.3	0.2	0.1	0.6	0.1	0.1	0.1	0.2	0.1	0.6	0.5	3.1
Ullensvang . . .	—	0.9	0.6	0.1	—	—	0.3	—	0.3	—	—	—	2.2
2. EASTERN INTERIOR													
Rena . . .	5.2	3.4	4.0	4.2	2.0	0.6	1.8	5.2	9.5	8.0	10.5	6.6	61.0
3. FJELD													
<i>(a) West</i>													
Slirå (Finse) . . .	4.1	4.2	5.2	5.7	7.8	8.2	8.8	5.9	7.2	7.6	5.7	6.5	76.9
<i>(b) East</i>													
Granheim . . .	1.9	0.1	1.2	1.2	0.5	0.1	0.7	1.6	4.8	3.1	3.5	3.9	22.9
Dovre . . .	0.3	0.3	0.3	0.7	0.3	1.0	1.0	1.4	1.8	2.4	3.7	0.9	13.9
Röros . . .	3.1	3.7	2.2	2.4	0.9	0.6	1.0	6.1	6.7	3.3	6.1	4.2	40.3
4. SOUTH COAST													
Lister . . .	2.4	2.2	5.8	3.6	5.0	2.4	1.3	1.0	1.0	0.8	0.4	1.9	27.8
Oksøy . . .	7.9	4.2	7.2	6.0	6.1	4.1	2.7	2.5	2.8	3.6	3.5	5.1	55.7
Dalen . . .	0.8	0.3	0.5	1.5	1.1	0.5	1.2	0.6	1.0	1.5	1.8	1.0	11.8
5. OSLOFJORD													
Oslo . . .	6.1	3.4	4.9	0.5	0.4	0.3	0.1	0.7	1.8	2.2	5.4	7.3	33.1
6. TRONDHEIM DEPRESSION AND TRØNDELAG													
Nordøyen . . .	—	0.4	0.8	0.8	2.4	2.5	5.4	1.6	0.7	0.4	0.2	—	15.2
Trondheim . . .	1.0	0.6	1.7	0.5	1.4	0.9	2.2	2.8	3.1	2.1	2.1	2.7	21.1
7. NORDLAND													
Svolvær-Skrova . . .	0.1	0.3	0.4	0.2	1.8	2.5	2.2	1.3	0.8	0.1	0.5	0.4	8.0
Skomvær . . .	0.7	0.2	0.9	1.2	3.8	6.2	7.5	4.7	1.3	0.5	0.2	0.1	27.3
Bodø . . .	—	0.4	—	0.2	0.6	1.0	2.3	1.5	0.3	—	—	—	6.5
Hattfjelldal . . .	1.1	0.7	0.4	0.5	1.2	1.2	3.6	3.5	3.8	2.3	2.5	1.7	22.5
Brønnøy . . .	0.1	0.1	1.0	1.1	2.2	1.9	3.3	1.8	0.1	0.1	—	0.3	12.0
8. TROMS AND FINNMARK													
Vardø . . .	0.5	—	—	0.2	0.7	3.9	7.0	4.6	0.5	—	—	—	16.4
Kirkenes . . .	1.1	1.0	0.1	0.1	0.4	0.6	0.9	2.0	1.2	1.3	1.0	0.7	11.6
Karasjok . . .	2.7	3.1	2.0	1.2	0.6	0.8	1.2	5.6	3.6	3.1	1.9	2.4	28.2
Alta . . .	—	—	—	0.3	1.0	0.6	1.3	1.7	1.2	0.5	0.1	0.1	6.8
Tromsø . . .	—	0.1	—	0.2	0.5	0.1	1.1	1.3	0.6	—	0.1	0.5	4.5
Andenes . . .	0.1	—	—	0.2	1.1	2.1	3.6	1.4	0.3	0.1	—	—	8.9

* A day with fog = one on which fog is at any time observed.

Fog, 1929-36 = 'slight fog' or more.

Fog, 1937-8 = visibility less than 1 kilometre.

TABLE 14. *Number of Days with Thunder*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1. WEST COAST													
(a) Outer													
Ona	0.4	0.3	0.1	0.0	0.1	0.1	0.3	0.2	0.2	0.1	0.2	0.3	2.4
Ringereide	0.2	0.1	—	0.2	0.1	0.5	1.2	0.8	0.6	0.1	0.8	0.7	5.3
Bergen	0.6	0.4	0.2	0.1	0.3	0.5	0.7	1.2	0.7	0.7	0.7	0.6	6.7
Skudenes	0.2	0.0	0.1	0.1	0.3	0.5	0.8	1.2	0.8	0.6	0.3	0.1	5.2
(b) Inner Fjords													
Ullensvang	0.1	0.2	0.0	—	0.1	0.3	1.0	0.7	0.2	0.2	0.3	0.1	3.3
2. (See 3 (b))													
3. FJELD													
(b) East													
Granheim	—	—	—	—	0.2	1.4	2.2	0.8	0.0	0.0	—	0.2	4.6
Dovre	0.1	0.0	—	—	0.1	0.6	1.2	0.5	0.1	0.1	0.1	—	2.7
4. SOUTH COAST													
Mandal	0.1	0.1	0.0	0.4	1.3	2.5	2.6	3.7	1.3	1.2	0.3	0.5	14.2
5. OSLO FJORD													
Oslo	—	—	—	0.1	0.8	2.2	3.7	2.9	0.6	0.1	0.1	—	10.7
6. TRONDHEIM DEPRESSION AND TRÖNDELAG													
Trondheim	0.3	0.2	0.1	0.0	0.3	0.8	1.9	1.3	0.2	0.1	0.1	0.1	5.5
7. NORDLAND													
Brønnøy	0.1	0.2	0.0	0.0	0.0	0.1	0.6	0.2	0.1	0.1	0.2	0.2	1.9
Umbogten	—	—	—	—	—	0.5	1.7	0.5	0.2	—	—	—	2.9
Skomvaer	0.1	0.0	—	0.0	0.1	0.2	0.4	0.1	0.1	0.0	0.0	0.2	1.2
8. TROMS AND FINNMARK													
Malangen	—	0.1	—	—	—	0.5	0.7	0.1	—	0.2	—	0.1	1.6
Alta	—	—	—	—	0.0	0.2	0.4	0.2	—	—	—	—	0.8
Bugöynes	—	—	—	—	0.2	1.0	1.6	0.5	0.1	—	—	—	3.4
Karasjok	—	—	—	—	0.6	1.0	3.7	1.8	—	—	—	—	7.2

TABLE 15. Night-frost

Station	Height, feet	Latitude		Longitude		Date when average temperature rises above 32° F.	Date of last night-frost	Date of first night-frost	Date when average temperature falls below 32° F.
		°	'	°	'				
Gjesvaer	20	71	6	25	22	April 22	..	..	November 2
Alta	31	69	58	23	15	April 26	May 25	September 12	October 20
Tromsø	146	69	39	18	58	April 16	..	..	November 7
Bodø	72	67	17	14	24	April 2	May 10	October 10	November 25
Trondheim	116	63	26	10	25	March 22	May 11	October 8	November 20
Bergen	141	60	23	5	21	..	April 19	November 4	..
Oslo	75	59	55	10	43	March 21	April 27	October 11	November 19

APPENDIX VI

MEDICAL STATISTICS

TABLE 1. *The Commoner and Certain Other Causes of Death, 1938.*
Rates per 100,000 Living

	Norway	England and Wales
Cancer and malignant disease	130.5	166.5
Old age	108.3	37.2
Diseases of the heart	100.9	306.6
Other diseases of the circulatory system	72.8	72.5
Cerebral haemorrhage	98.4	64.9
Other diseases of the nervous system	21.7	29.1
Pneumonia (all types)	95.6	63.0
Bronchitis	9.2	32.2
Other diseases of the respiratory system	9.6	10.0
Tuberculosis of the respiratory system	73.0	53.2
Other forms of tuberculosis	15.2	10.3
Violence	42.3	55.3
Nephritis	25.4	32.8
Other diseases of the genito-urinary system	18.6	19.8
Diarrhoea and enteritis	4.9	11.6
Septic ulcer	7.0	11.1
Appendicitis	6.1	6.8
Other diseases of the digestive system	23.0	29.5
Typhoid and paratyphoid fevers	0.3	0.4
Diphtheria	0.5	7.1
Influenza	1.8	11.8
Diabetes mellitus	9.0	17.3
Syphilis	1.8	3.1
Alcoholism	0.5	0.2
Suicide	6.5	12.9
Total mortality rate	1003.0	1160.0

TABLE 2. *Case Rates of certain Infectious Diseases in 1938 per 1,000
Population*

	Norway	England and Wales
Scarlet fever	1.23	2.41
Diphtheria	0.06	1.58
Enteric fever	0.01	0.03
Puerperal fever	0.05	0.23
Erysipelas	1.00	0.40
Cerebro-spinal fever	0.01	0.03
Poliomyelitis	0.03	0.04

APPENDIX VII—FINANCE

TABLE 1. *State Revenue and Expenditure*

Years, ending 30 June	Revenues			Expenditures			Working surplus + deficit —	Total surplus + deficit —
	Working	Capital	Total	Working	Capital	Total		
	Mill. kr.	Mill. kr.	Mill. kr.	Mill. kr.	Mill. kr.	Mill. kr.	Mill. kr.	Mill. kr.
1914	102.2	10.2	112.4	98.0	25.4	123.4	+4.2	-11.0
1917	242.7	20.7	263.4	198.3	35.4	233.7	+44.4	+29.7
1918	442.6	25.4	468.0	456.8	45.3	502.1	-14.2	-34.1
1921	448.5	64.5	513.0	653.4	92.3	745.7	-204.9	-232.7
1927	362.5	36.8	399.3	338.7	56.3	395.0	+23.8	+4.3
1929	350.8	38.6	389.4	341.9	45.4	387.3	+8.9	+2.1
1936	399.0	59.8	458.8	344.8	85.8	430.6	+54.2	+28.2
1937	460.2	64.8	525.0	367.2	99.3	466.5	+93.0	+58.5
1938	461.1	40.4	501.6	417.0	84.6	501.6	+44.2	..

TABLE 2. *State Expenditure*

	1913/14	1936/7	1937/8	1938/9
	1,000 kr.	1,000 kr.	1,000 kr.	1,000 kr.
A. Current Expenditure				
I. State political organs	2,428	4,714	4,704	4,800
II. Foreign Office	1,276	4,995	4,936	5,330
III. Defence	27,490	45,775	52,664	67,306
IV. Justice	4,705	16,656	18,552	19,328
V. Administration of the counties, municipal office of the Depart- ment of Justice	314	895	940	946
VI. Church	1,166	3,768	4,357	4,418
VII. Education	14,683	54,048	60,460	68,694
VIII. Social purposes (including relief work)	3,702	28,962	65,757	76,602
IX. Public hygiene (medical officers, hospitals, &c.)	4,268	12,809	19,282	20,828
X. State constructions (roads, har- bours, water-courses)	4,238	40,898	43,705	51,212
XI. Agriculture (excluding schools)	2,029	37,238	35,240	35,208
XII. Commerce, shipping, industry, and fishery	5,707	27,267	25,688	31,852
XIII. Assessment, taxation	3,879	14,281	16,946	18,149
XIV. Interest on debt and pensions:				
a. Interest on national debt	12,411	7,746	4,344	622
b. Pensions	2,642	9,685	11,115	12,561
XV. Miscellaneous	7,123	13,048	11,029	11,089
XVI. Deficit on State's trading enter- prises, properties, &c. . . . .	..	44,436	55,061	56,843
A. Total current expenditure	98,061	367,221	434,780	485,788
B. Capital Expenditure				
I. State trading enterprises and funds:				
a. Railways, telegraphs, telephones, power stations	14,751	41,697	44,593	49,563
b. Funds set apart	5,181	6,428	5,442	48,793
c. Others	567	13,026	5,421	6,036
II. Repayments on National Debt	4,879	38,179	36,387	33,351
B. Total capital expenditure	25,369	99,330	91,843	137,743
TOTAL EXPENDITURE	123,430	466,551	526,623	623,531

TABLE 3. *State Revenue*

	1913/14	1936/7	1937/8	1938/9
	1,000 kr.	1,000 kr.	1,000 kr.	1,000 kr.
A. Current Income				
I. Taxes and duties:				
a. Income and capital taxes . . .	12,759	90,935	136,386	174,725
b. Customs receipts	52,424	140,380	145,382	154,278
c. Other consumption taxes . . .	12,801	170,371	187,989	200,910
d. Other taxes and duties	10,212	29,081	29,068	29,660
II. Capital and income receipts:				
a. Interest	9,394	17,751	18,711	18,437
b. Dividends of shares, Bank of Norway	714	336	336	336
c. Surplus on State's trading enterprises, properties, &c. . . .	1,989	..	..	..
III. Other receipts	1,949	11,313	11,498	11,929
A. Total current income	102,242	460,167	529,370	590,275
B. Capital Income				
I. Income from State capital:				
a. Funds	1,008	2,298	2,083	3,676
b. Others	154	3,729	3,406	3,661
II. State loans	9,041	58,819	37,276	77,871
B. Total capital income	10,203	64,846	42,765	85,208
TOTAL INCOME.	112,045	525,013	572,135	675,483

TABLE 4. *National Debt*

Years, ending 30 June	Consolidated		Non- consolidated	Total
	External*	Internal		
	1,000 kr.	1,000 kr.	1,000 kr.	1,000 kr.
1914	336,473	15,922	5,000	357,395
1921	398,404	445,825	346,331	1,190,560
1925	716,391	708,100	307,135	1,731,626
1929	793,828	769,482	15,588	1,578,898
1932	742,731	739,547	43,772	1,526,050
1933	726,207	742,903	26,917	1,496,027
1937	692,118	758,077	43,102	1,493,297
1938	653,639	741,327	33,778	1,428,744

* Re-calculated in Norwegian kr. at par value.

APPENDIX VIII

INDUSTRY, 1938

	Number of establish- ments	Number of workers	Value of production in 1,000 kr.
I. <i>Mining</i>	62	13,506	111,790
II. <i>Quarrying and Stone Industries</i> .	417	7,867	38,796
Cement factories	3	696	8,217
III. <i>Engineering</i>	885	43,309	238,001
IV. <i>Chemical and Electro-Chemical Indus- tries</i>	107	5,159	76,672
Including electro-chemical	6	2,653	50,500
V. <i>Fats and Oil</i>	217	3,514	29,535
Including herring-oil, flour, and fish- flour	89	1,327	6,556
Fat and oil refineries	10	1,206	12,796
Soap factories	49	866	9,884
VI. <i>Timber Industries</i>	880	13,832	49,340
Including saw-mills and planing-mills	383	6,467	19,971
Furniture and other wooden goods .	386	5,978	23,360
VII. <i>Paper Industry</i>	194	16,462	95,317
Including mechanical pulp	52	15,090	14,960
Chemical pulp	25		36,844
Paper and cardboard	54		35,721
VIII. <i>Leather and Rubber Industry</i> . .	88	3,588	21,324
Including tanneries	38	755	4,909
Rubber goods	20	1,801	10,918
IX. <i>Textile Industry</i>	218	14,000	55,191
Including woollen fabric	67	4,652	17,952
Cotton fabric	20	3,209	12,159
Knitted goods	53	3,219	12,467
X. <i>Clothing Industry</i>	372	15,232	54,891
Including shoes	85	4,538	17,707
Ready-made clothes	190	7,120	23,267
XI. <i>Foodstuffs, &c.</i>	760	18,902	225,187
Including margarine	72	1,449	19,884
Preserves	198	7,267	19,120
Breweries	26	2,001	43,108
Chocolates and confectionery . . .	41	2,235	22,552
Tobacco factories	40	2,061	46,344
Mills	231	2,060	15,487
XII. <i>Printing and Book-binding</i> . . .	290	6,584	41,447
TOTAL (of all groups of industries) .	4,490	161,959	1,037,491

APPENDIX IX —MINERAL STATISTICS

TABLE 1. *Production of Ore, in tons*

	<i>Silver ore</i>	<i>Copper ore</i>	<i>Pyrites</i>	<i>Nickel ore</i>	<i>Iron ore</i>	<i>Other ores</i>
1912 . . .	3,950	59,069	456,989	30,211	401,644	2,466
1915 . . .	8,297	55,210	505,224	75,801	703,621	4,662
1920 . . .	7,891	6,701	328,749	12,284	77,956	3,519
1925 . . .	19,615	4,228	614,509	..	418,702	16,158
1930 . . .	14,383	24,649	719,401	28,624	760,216	13,209
1931 . . .	14,568	14,373	354,263	15,001	565,801	18,600
1932 . . .	15,673	18,085	715,533	22,993	381,267	18,139
1933 . . .	14,421	21,743	850,915	23,240	489,222	19,273
1934 . . .	13,824	23,004	945,715	28,751	584,339	13,552
1935 . . .	14,556	25,312	879,395	30,974	790,446	11,756
1936 . . .	15,772	26,798	1,015,522	32,784	899,561	16,860
1937 . . .	14,581	30,142	1,031,736	21,797	1,058,564	18,714
1938 . . .	14,671	34,550	1,011,537	33,679	1,451,181	16,252

TABLE 2. *The Total Production of Norwegian Copper Mines up to the end of 1932*

	<i>Cupriferous pyrites</i>	<i>Copper</i>		<i>Total</i>
		<i>In cupriferous pyrites</i>	<i>From copper ores and concentrates</i>	
	<i>tons*</i>	<i>tons*</i>	<i>tons*</i>	<i>tons*</i>
Sulitjelma . . .	3,130,000	92,400	37,400	129,800
Lökken . . .	4,435,000	111,000	14,400	125,400
Röros . . .	534,000	13,800	87,800	101,600
Vigsnes . . .	791,000	23,700	3,400	27,100
Foldal . . .	1,037,000	19,500	3,500	23,000
Killingdal . . .	693,000	12,000	..	12,000
Meråker . . .	72,000	1,000	7,300	8,400
Åmdal . . .	..	..	8,000	8,000
Kåfjord in Alten . . .	..	..	7,800	7,800
Kvikne . . .	..	..	7,000	7,000
Röstvangen . . .	205,000	5,400	..	5,400
Rödklev . . .	208,000	4,800	..	4,800
Kjoli . . .	228,000	4,350	250	4,600
Birtavarre . . .	..	..	3,500	3,500
Small pyrites mines . . .	157,000	3,000	..	3,000
Small copper mines . . .	..	..	11,600	11,600
Nickel mines . . .	..	..	..	7,000
TOTAL . . .	11,490,000	291,000	192,000	490,000

* Gross copper content.

TABLE 3. *Reserves of Copper in the Developed Deposits (in metric tons)*
1932

	Ore in sight		Probable ore	
	Total	Copper content	Total	Copper content
Cupriferous pyrites:				
Lökken	14,000,000	350,000	(?)	(?)
Grong { Joma	6,300,000	140,000	2,800,000	60,000
{ Gjersvik	1,400,000	30,000	..	..
Sulitjelma	3,100,000	56,000	3,000,000	54,000
Foldal	300,000	4,900	300,000	4,900
Killingdal	150,000	2,600	100,000	1,700
Kjoli	100,000	1,900	150,000	2,900
Rödklev	50,000	1,300	..	..
Copper ores:				
Vaddas	1,500,000	25,300	..	..
Röros	700,000*	7,000	..	5,000?
Amdal . . . . .	..	7,000	..	5,000
Nickel ores	1,500,000	13,000	..	..
		639,000		134,000

* Waste dumps.

APPENDIX X

CANNING FACTORIES

1. OSLO FJORD REGION

Oslo (11)
 Botnekilen
 Bryn
 Engelsvik
 Fredrikstad (11)
 Gjøvik (2)
 Holmestrand
 Holmsbu (2)
 Horten
 Hvasser
 Hönefoss
 Moss (3)
 Onsøy
 Råde
 Ringebu
 Sandefjord
 Skjaerhollen
 Son
 Sponvik
 Tönsberg

Farsund
 Foresvik
 Haraldsøyvåg
 Haugesund (4)
 Heröysund
 Hillevåg
 Höle i Högsfjord
 Kirkehamn
 Kopervik
 Korshamn
 Rekefjord (2)
 Sandnes (5)
 Skånevik
 Skudeneshavn
 Stavanger (80)
 Steinnesvåg
 Sunde i Sunnhordland
 Tasta (2)
 Tau
 Toftevåg
 Uskedal
 Vikevåg

2. SOUTH-EAST COAST

Arendal (2)
 Flekkerøy
 Grimstad
 Helgeråen
 Kragerö (2)
 Kristiansand S. (2)
 Langesund (3)
 Lillesand
 Nevlunghavn
 Porsgrunn
 Skien
 Stavern (3)

3. WEST COAST: *Lindesnes to Hardangerfjord*
 Egersund

4. BERGEN REGION

Bergen (22)
 Alverstraumen
 Björøyham
 Bövagen
 Davanger
 Eikelandsosen
 Fjell
 Florvåg
 Foldrøyham
 Follese
 Hellesøy
 Hauglandshella
 Hetlevik
 Kalandssjöen
 Krokeide

Manger
 Meling
 Mongstad
 Os
 Rubbestadneset
 Stord
 Strandvik
 Strusshamn
 Saebövik

Sognefjord to Trondheim

Trondheim (11)
 Ålesund (2)
 Askvoll
 Atløy
 Brattvåg
 Bremanger
 Bryknesøy
 Fjaerland
 Florø
 Fosnavåg
 Gjaesingen
 Hermannsverk
 Kristiansund N. (6)
 Kumle
 Lesund
 Lurvik
 Maløy (3)
 Melandsjö
 Monsøy
 Molde
 Moldtustranda
 Nordvikja
 Orkanger
 Rosvoll

Sandshamn
 Sistranda
 Stordal
 Stranda
 Titran
 Vik i Sogn

Nordland

Abelvaer
 Bessaker
 Bodö (2)
 Grytöya
 Engavågen (2)
 Melbu
 Nesna
 Namsos
 Sandnessjøen

*Lofoten, Vesterålen, Troms, and
 Finnmark*

Bjarkøy (Lofoten)
 Bugöyfjord
 Hakkstabben
 Hammerfest
 Harstad (4)
 Honningsvåg (2)
 Kabelvåg (Lofoten) (3)
 Kasfjord (Lofoten, Bergen Com-
 pany)
 Sortland (Vesterålen)
 Tromsö (5)
 Vadsö
 Vardö
 Örnesvika

APPENDIX XI NORWEGIAN SHIPPING, January 1941

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
ÅLESUND								
Årseth, Elling	1 S	..	..	1
Den Norske Stat (see also Kristiansund N. and Molde)		{ 1 M/S 1 S	2
Norske Shell (see also Oslo and Svolvær)	1 M/T	1
There are also 75 S and 19 M/S under 500 tons be- longing to independent small owners		{ 75 S 19 M/S	94
ARENDALE								
Arendals Dampskibsk A/S	5 S	1 S	6
Boc, Olaf & Co.	1 M/T	..	..	..	..	1
Gjeruldsen, G. A.	1 S	..	..	1
Hansen, Johs	1 M/T	..	..	..	2 S	3
Hauge	3 S	..	3
Jacobsen, B.	1 S	..	..	1
Jensen, J. P.	{ 4 S/T 1 M/T	..	..	..	..	5
Mørland, A. J.	2 M/T	1 M/S	..	..	..	3
Olsen, C.	1 S/T	..	..	..	..	1
Smith, A.	1 S	..	1
Sørensen, C. H. & S.	1 M/T	{ 1 M/S 1 S	..	..	..	3
Sørensen, O. B. & Co.	1 M/T	..	1 S	..	..	2

NORWEGIAN SHIPPING, January 1941 (*cont.*)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
ÅRENDAL (<i>contd.</i>)								
Sorensen, S. H. Smith	.	..	2 M/T	..	..	..	1 M/S	3
Thommesena	.	..	..	..	..	2 S	..	2
There are also 4 S and 1 M/S under 500 tons be- longing to independent small owners		..	..	..	..	..	{ 4 S 1 M/S	5
ÅSKERÖY								
Marcussen, J. & B..	.	..	..	..	2 S	..	..	2
Marcussen, E.	.	..	..	..	..	..	1 S	1
BERGEN								
Bergenske Dampskibsk A/S Det.	.	..	{ 3 M/S 1 S	{ 1 M/S 1 S	20 S	4 M/S 7 S	..	37
Bergh and Helland.	.	..	1 S	..	1 S	..	..	2
Christensen, J.	.	..	1 S	..	..	..	..	1
Den Norske Amerikalinje A/S (<i>see also under Oslo and Stavanger</i>)	.	1 S	..	..	..	..	..	1
Eide, L.	.	..	..	..	..	1 S	..	1
Elinssen, J.	.	..	..	..	2 S	..	..	2
Erichsen, L.	.	..	..	..	{ 2 S 1 M/S	..	..	3
Fylkesbatane I Sogn og Fjordane	.	..	..	..	..	6 S	{ 5 S 5 M/S	16
Gjerding, P.	.	..	1 M/T	..	..	..	..	1
Gjesdal, Th.	.	..	..	..	1 S	..	..	1
Gran, J.	.	..	1 S	..	..	..	..	1

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
BERGEN (cont.)								
Halvorsen, T.	.	..	..	..	7 S	..	..	7
Hansen, K. W. (Songa D/S, A/S)	.	..	1 S	..	..	..	..	1
Hansen, W.	.	..	..	..	6 S	..	..	6
Hardanger Sunnhordlandske Dampskipsk.	.	..	..	..	..	3 S	{ 9 S 4 M/S	16
Harloff, A.	.	..	..	..	1 S	..	..	1
Hvide, J.	.	..	..	1 S	..	..	..	1
Jansen	.	..	..	..	..	1 S	..	1
Jebsen, Kr.	.	..	..	..	3 S	..	..	3
Jebsen, P.	.	..	..	..	..	1 S	..	1
Jebsen, W. (Seljan Air)	.	..	3 M/T	..	..	..	..	3
Johannessen, J.	.	..	..	..	2 S	..	..	2
Johnsen	.	..	..	..	1 S	..	..	1
Kjerland	.	..	..	..	4 S	1 S	..	5
Kjode, G.	.	..	..	..	1 S	..	..	1
Kjode, J.	.	..	{ 1 S 1 M/S	{ 5 S 1 M/S	{ 5 S 1 M/T	..	2 S	16
Kubom, W.	.	..	1 S	..	..	..	..	1
Kuhnle, H.	.	..	1 M/T	1 M/S	..	..	..	2
Kuhnle, S. M.	.	..	..	1 M/S	..	..	..	1
Larsen, J.	.	..	..	..	3 S	..	..	3
Lund, E.	.	..	..	..	4 S	..	..	4
Martens, H. G. (Storfjeld-Dampsk)	.	..	..	..	1 S	..	..	1
Meidell, A.	.	..	..	2 S	..	..	..	2
Mowinckels Rederi A/S	.	2 M/T	{ 3 M/S 3 M/T	{ 4 S 5 M/S	..	..	..	17

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company	Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
BERGEN (cont.)							
Müller, S.	1 S	..	..	1
Müllers Rederi A/S	1 S	..	..	1
Nordgreen, P. B.	1 S	..	..	1
Norsk Bjerningskompagni A/S	1 S	6 S	7
Odfjell A/S Rederict	1 S	{ 4 M/S 1 S	..	..	..	6
Olsen, O. G. & L.	1 S	..	..	..	1
Olsen, R. F.	2 S	3 S	..	5
Reksten, H.	1 M/S	5 S	..	..	6
Schanche, S.	1 S	..	..	1
Schelderup, A. (Ringhorn D/S, A/S)	2 S	..	..	2
Stamer, C.	1 M/S	..	..	..	1
Storas, H.	1 S	1 S	2
Torkildsen, V.	2 S	..	..	2
Vestlandske Petroleumskompagni A/S	1 S/T	..	..	{ 2 M/T 1 M/S	4
Wallen & Co. A/S.	{ 1 S 1 M/S	8 S	5 S	..	..	15
Westfal-Larsen & Co. A/S	{ 2 S 5 M/S 10 M/T	{ 5 S 5 M/S	1 S	..	..	28
Wik, A.	1 S	1 S	..	..	2
Østervold, H.	1 S	1 S	..	..	2
Årstad, S.	1 S	..	1

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company	Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
BERGEN (cont.)							
There are also 35 S, 27 M/S, 1 M/T, and 1 M/lecter under 500 tons belonging to independent small owners	64
Storfield Dampsk A/S (see under H. G. Martens)							
BODÖ							
Nordlandske Dampskelsk A/S	1 S	..	1
Sannes, E.	1 S	..	3 S	4
There are also 7 S and 2 M/S under 500 tons belonging to independent small owners	9	9
BRÖNNÖYSUND							
1 ship under 500 tons	1	1
DRAMMEN							
Bruusgård A/S	2 S	..	..	2
Bruusgård, K.	3 S	..	..	3
Bruusgård. Kiøsterud & Co.	..	2 S 1 M/T 1 M/S	2 M/S	10 S 1 M/S	..	..	17
Bruusgård, S.	..	1 S	..	..	..	..	1
Kiaer. H. & Co. A/S	1 S	..	..	1
Pehrson & Wessel	1 S	1 S	..	..	2
There are also 4 S under 500 tons belonging to independent owners	4	4

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
FARSUND								
Brovik, Th.	.	1 M/T	{ 2 M/T 1 S/T	1 M/S	8 S	..	..	13
Gabrielsen, G.	.	..	..	..	1 S	..	..	1
Johannesen, J. M.	.	..	..	..	2 S	..	..	2
Lundegård & Sønner	.	..	{ 2 S 1 M/S	..	2 S	..	..	5
Mosvold, M.	.	..	{ 3 S/T 1 M/T	3 M/S	..	..	..	7
Salvesen, J.	.	..	..	..	2 S	..	..	2
Samuelsen, J.	.	..	..	1 S	..	..	..	1
Samuelsen, V.	.	..	..	1 S	..	..	..	1
Stray, G. & S.	.	..	..	1 S	..	..	..	1
There is also 1 S under 500 tons belonging to an independent owner	.	..	..	..	..	..	1 S	1
FLEKKEFJORD								
Hassen, B. & Co.	.	..	2 M/T	..	..	..	..	2
FLORÖ								
There are 1 S and 1 M/S under 500 tons belonging to independent owners	.	..	..	..	..	..	{ 1 S 1 M/S	2
FREDRIKSTAD								
Andersen, K. & Co. A/S	.	..	..	..	2 S	..	..	2
Olsen, O. M.	.	..	..	..	..	2 S	..	2
Wilhelms, I.	.	..	..	..	1 S	1 S	..	2

NORWEGIAN SHIPPING, January 1941 (*cont.*)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
FREDRIKSTAD (<i>cont.</i>)								
Wilkins, H. Th. & Co. A/S	.	..	..	..	1 S	..	..	1
There are also 6 S and 1 M/T under 500 tons belonging to independent owners		..	..	..	..	..	{ 6 S 1 M/T	7
GRIMSTAD								
Tønnevold, O. T. & Co. A/S	.	1 M/T	2 M/T 1 M/T	..	..	..	..	3
Ugland, J. M.	.	..	..	..	..	..	..	1
HALDEN								
Hannestad, M.	.	..	..	..	1 S	..	..	1
Wiel & Amundsen A/S	.	..	..	1 S	..	..	..	1
There are also 2 S under 500 tons belonging to independent owners		..	..	..	..	..	2 S	2
HARSTAD								
Nordlandslingen A/S	.	..	..	..	..	1 S	1 S	2
There are also 5 S and 2 M/S under 500 tons belonging to independent owners		..	..	..	..	..	{ 5 S 2 M/S	7
HAUGESUND								
Amlie, R. & S.	.	..	..	..	3 S	..	..	3
Amundsen, J. & S.	.	..	..	..	..	1 S	..	1
Bakkevig, E.	.	..	..	..	..	1 S	..	1
Brummenaes & Torgersen	.	..	..	3 S	..	1 S	..	4
Clausen, M.	.	..	..	..	..	..	3 S	4
Evers, T.	.	..	..	..	1 S	1 S	..	1
Fostenes, L. & A. Knutsen	.	..	..	1 M/S	..	..	..	1

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
HAUGESUND (cont.)								
Hårland, C.	.	..	$\begin{cases} 1 S \\ 1 S/T \\ 2 M/T \end{cases}$	1 M/S	..	..	..	5
Hårland, J. K. & Co. A/S	.	..	..	1 S	1 S	..	..	2
Hårland, J.	.	..	..	..	1 S	1 S	..	2
Høgh-Hervig, K.	.	..	..	1 S	..	..	..	1
Jansen, R.	.	..	..	..	1 S	..	..	1
Knutsen, Knut, O.A.S.	.	1 M/T	$\begin{cases} 5 M/S \\ 5 M/T \\ 1 S \end{cases}$	$\begin{cases} 6 M/S \\ 1 S \\ 1 S/T \end{cases}$	2 S	1 S	$\begin{cases} 5 S \\ 1 M/S \end{cases}$	29
Kongshavn, M. H. & Son, A/S	.	..	..	..	1 S	1 S	..	2
Krogh, E.	.	..	..	..	..	1 S	..	1
Kvilhaug, O.	.	..	..	..	..	1 S	..	1
Kyvig, J. & S. Fresvig	.	..	..	..	..	1 S	..	1
Larsen, H.	.	..	..	..	..	1 S	..	1
Lindo, A.	.	..	..	..	..	1 S	..	1
Lindoe, P. & Co. A/S	.	..	..	..	1 S	..	..	1
Lothe, A.	.	..	..	..	1 S	..	..	1
Lynholm, S.	.	..	..	..	..	1 S	1 S	2
Matland, T.	.	..	..	..	..	1 S	..	1
Nordbø, F. N.	.	..	..	..	..	1 S	1 M/S	2
Nordbø, T. H.	.	..	..	..	1 S	1 S	..	2
Naesheim, E. A/S	.	..	..	..	1 S	..	..	1
Odland, J. S.	.	..	..	1 M/S	7 S	..	..	1
Pedersen, B. & Son	.	..	..	..	1 S	1 S	..	8
Risanger, S.	.	..	..	..	1 S	2 S	2 S	2
	.	..	..	..	..	..	..	4

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company	Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
HAUGESUND (cont.)							
Rögenaes, F.	1 S	..	..	1
Rögenaes, N.	3 S	..	..	..	3
Skogland, T.	2 S	..	..	2
Skogland, V. A/S	4 S	1 S	..	..	5
Stolt-Nielsen, B. & Son, A/S	2 S	..	..	2
Thuestad, K. M.	1 M/S 2 M/T 1 S	..	..	1 S	..	1
Wrangell, H. M. & Co. A/S	6 S 1 M/S	..	..	..	11
There are also 17 S and 7 M/S under 500 tons belonging to independent owners	17 S 7 M/S	24
HOLMESTRAND							
There are 2 S and 1 M/S under 500 tons owned by one company	2 S 1 M/S	3
HORTEN							
Hannevig, H. A/S.	1 M/T	1 S 1 M/T	..	..	3
KIRKENES							
There is 1 S under 500 tons owned by one company	1 S	1
KOPERVIK							
There are 5 S and 3 M/S under 500 tons owned by independent owners	5 S 3 M/S	8

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company	Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
KRAGERÖ							
Salvesen, A.	1 S	..	1
Sandas, K.	1 S	..	..	1
KRISTIANSAND S.							
Andersen, H.	2 M/T	1 S	..	..	1
Bang, J.	2
Björneboe, I.	1 S	..	..	1
Gerrard, J.	1 S	..	..	..	..	1
Hansen, E.	1 S/T	..	..	1 S	..	2
Hansen, M.	2 S	..	..	2
Hansen-Tangen, H. E.	3 M/T	..	..	..	..	3
Issaksen, T.	1 S	..	..	1
Kile, E.	1 S	..	..	..	1
Knudsen, K.	{ 2 M/S 1 M/T }	1 S	..	..	..	4
Knudsen, O. S.	1 S	..	..	1
Kristiansands Dampskibsk A/S.	1 M/S	1 S	..	2
Langfelot, A. I. & Co.	1 S/T	2 S	1 S	1 S	..	5
Olsen, R. K.	1 M/T	..	..	..	..	1
Rasmussen, E.	2 M/T	..	..	..	..	2
Stray, M. C.	1 M/S	1 S	..	..	2
There are 2 S under 500 tons belonging to independent owners	2 S	2
KRISTIANSUND N.							
There are 5 S and 5 M/S under 500 tons belonging to independent owners	{ 5 S 5 M/S }	10

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company	Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
LARVIK							
Bugge, I. . . . .	..	3 M/T	..	..	..	..	3
Larvik-Fredrikshaunferjen A/S . . . . .	..	..	..	1 M/S	..	..	1
Melsom & Melsom	1 M/T	3 S	..	..	..	15 S	19
Nielsen, C. & Co. A/S . . . . .	..	1 M/T	..	..	..	..	1
LILLESAND							
Bendixen, T. S. . . . .	..	..	..	1 S	..	..	1
MANDAL							
Bugg, F. . . . .	..	..	..	1 S	..	..	1
Sanum, E. . . . .	..	..	..	1 S	..	..	1
Sanum, O. N. . . . .	..	..	..	..	1 S	..	1
MOLDE							
Møre Fylkes Ruteselskap (see under Kristiansand S. & Ålesund)	..	..	..	..	1 S	{ 17 S 1 M/S	19
There are also 3 S and 2 M/S under 500 tons belonging to independent owners	..	..	..	..	..	{ 3 S 2 M/S	5
MOSS							
Herlofson, S. & Co. A/S (see also under Oslo)	1 M/T	2 M/T	..	..	..	..	3
Ronneberg, G. & J. F. G. . . . .	..	1 M/T	..	..	..	..	1
There are also 3 S and 2 M/S under 500 tons belonging to another company	..	..	..	..	..	{ 3 S 2 M/S	5
MALØY							
There is 1 S under 500 tons belonging to one owner . . . . .	..	..	..	..	..	1 S	1

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
NAMSOS								
There are 8 S under 500 tons belonging to independent owners		..	..	..	..	..	8 S	8
NARVIK								
There are also 4 S and 1 M/S under 500 tons belonging to independent owners		..	..	..	..	..	4 S 1 M/S	5
OSLO								
Åbys Rederi A/S	.	..	{ 2 M/S 1 M/T	{ 1 S 1 M/S	1 S	3 S	..	9
Andersen, A. O. Shipping	.	..	2 M/T	..	1 S	..	..	2
Andvig, J.	.	..	..	..	1 S	..	..	1
Bech, N.	.	..	..	..	..	1 S	..	1
Bendixen, F. B.	.	..	..	..	1 S	..	..	1
Berg, O.	.	1 M/T	2 M/T	..	1 S	..	..	4
Biörnstad, Biörn & Co.	.	..	2 M/T	1 M/S	..	..	..	3
Biörnstad, A. F.	.	..	..	..	..	1 S	2 S	3
Blich, P.	.	..	..	..	1 S	..	..	1
Boe & Pedersen	.	..	..	2 M/S	..	..	1 M/T	3
Borthen, H. & Co.	.	..	2 M/T	..	..	..	..	2
Brathen, L.	.	1 M/T	{ 4 M/T 1 M/S	..	..	..	..	6
Bruusgård & Bodtger	.	..	..	..	1 S	..	..	1
Bruusgård, K. (Norsk Transatlantic Rederi A/S)	.	..	1 M/T	..	..	..	..	1
Dahl A/S (see also under Sandefjord)	.	..	1 S	..	..	..	..	1
Dann, C.	.	..	..	1 M/S	..	1 S	..	2

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
Oslo (cont.)								
Dannevig, T. & Co.	.	..	2 M/T	..	..	..	..	2
Den Norske Amerikalinje (see also under Bergen and Stavanger)	.	..	5 S	{ 4 S 1 M/S	1 S	..	1 M/S	12
Den Norske Syd. Amerikalinje	8 M/S unspeci- fied ton- nage
Ditlev-Simonsen, Halfdan & B. Co.	.	..	6 M/T	..	..	..	..	6
Ditlev-Simonsen, O.	.	..	1 M/S	2 M/S	..	..	..	3
Ditlev-Simonsen, S. & Co.	.	..	1 M/S	1 M/S	..	..	..	2
Einersen, K. T.	2 S	2 S	..	..	4
Ekerholt, B.	2
Evensen, E.	.	..	2 M/T	..	..	..	..	2
Evensen, N.	.	..	3 M/T	..	..	..	..	3
Farsjö, J. T. & Co.	4 S	..	..	4
Fearnley & Astrup	.	..	1 M/T	..	..	..	..	1
Fearnley & Eger (Garonne Dampstintsk &c.)	.	..	{ 2 M/S 2 M/T	8 M/S	6 S	..	..	18
Fischer, H.	1 S	1 S	2
Fredriksen	1 S	..	1
Fruit Express Line A/S	4 M/S unspeci- fied ton- nage
Gill-Johannessen, L.	.	..	1 M/T	..	1 S	1 M/T	..	3
Gjerpen, H.	3 S	..	..	3
Godager, B. & Co.	1 S	..	..	1

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker; Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
Oslo (cont.)								
Godager, O.	.	..	1 S	1 M/S	..	..	..	2
Gogstad, C. T. & Co.	.	..	..	1 S	{ 4 S 1 M/S	..	..	6
Gram, H. F.	.	..	..	1 S	..	..	1 S	2
Gundersen, C. & Co.	.	..	..	..	3 M/S	..	..	3
Görrissen & Co. (Karaibien, Skibs A/S)	.	..	..	..	6 S	..	..	6
Halle & Pederson (Baltimore Dampsk A/S)	.	..	{ 2 S/T 1 M/T	..	..	..	..	3
Hamre, I.	.	..	..	1 S	..	..	..	1
Hansen, G.	.	..	1 S	2 S	4 S	..	..	7
Hansen, T.	.	..	..	2 M/S	..	..	..	2
Harboe, J. L. & C.	.	..	..	..	{ 2 S 1 M/S	..	..	3
Heitmann, H. & Co.	.	..	..	..	..	3 S	..	3
Henriksen, D.	.	..	..	..	2 S	..	..	2
Herlofson, S. & Co. A/S (see also under Moss)	.	..	1 M/S	4 M/S	..	..	..	5
Holm, P.	.	..	1 M/T	1 M/S	..	..	..	2
Holter-Sörensen, S.	.	..	2 M/T	9 M/S	..	..	..	11
Holter-Sörensen & Co.	.	..	..	..	..	1 S	1 S	2
Höegh, L. & Co. A/S	.	1 M/T	{ 7 M/T 4 M/S	1 M/S	..	..	..	13
Jacobsen, R.	.	..	..	..	..	1 M/S	..	1
Jacobsen & Salvesen	.	..	..	1 M/S	..	..	..	1
Jakhelln, A. (La Plata, Skibs A/S)	.	..	{ 1 M/T 1 M/S	..	..	..	..	2
Jenssens Rederi A/S	.	..	1 S/T	..	..	..	..	1

NORWEGIAN SHIPPING, January 1941 (*cont.*)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
OSLO (<i>cont.</i>)								
Johannesen and F. Pedersen	1 S	..	..	1
Klaveness, A. F. & Co. (International Dampsk A/S)	.	..	{ 2 M/S 6 M/T	9 M/S	1 S	..	..	18
Kleppe, P.	2 S	..	..	..	2
Kloster, L.	5 M/S	..	..	..	5
Konow, M. & Co.	.	..	1 M/T	..	..	..	..	1
Kristiansen, F.	1 S	..	..	1
Lange, E.	2 S	..	1 S	3
Larsen, S. A. & E. Thorvildsen	1 S	..	..	1
Lodding, T.	.	..	{ 2 M/T 1 S/T	..	..	..	..	3
Lorentzen, L.	3 S	1 S	..	4
Lorentzen, Ö.	2 M/S	1 S	..	..	3
Lorentzen's Rederi Co.	.	..	2 M/T	..	..	..	..	2
Lokke, Ö.	1 S	..	..	..	1
Marcussen, S.	.	..	1 M/T	..	..	..	..	1
Matheson, E.	.	..	2 M/T	..	..	..	..	2
Mathiesen, A.	.	..	{ 3 M/T 1 S/T	..	..	..	..	4
Meyer, P.	.	..	3 M/T	..	2 S	..	..	5
Mithassel, R.	1 S	1 S	..	..	2
Mohn, A.	.	..	1 M/S	..	..	..	..	1
Moltzau & Christensen	.	..	3 M/T	1 M/S	..	..	..	4
Molvig, A.	1 S	..	..	1
Mortensen, A.	1 S	..	1 S	2
Mortensen, E.	1 S	2 S	..	..	3

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
OSLO (cont.)								
Nilson, R. & A. Nyquist	1 S	1 S	..	2
Norske Shell A/S (see also under Ålesund)	2 M/T	2
Nyegård	1 S	..	..	1
Olsen, C. A.	1 S	..	..	1
Olsen, Fred & Co.	.	..	7 M/S	{ 1 S 8 M/S 1 M/T	{ 18 S 13 M/S	{ 5 S 1 M/S	{ 1 M/S 1 S	56
Olsen & Ugelstad	.	..	4 M/T	..	10 S	..	..	14
Onstad Shipping A/S (Canada Tank, Skibs A/S)	.	..	2 M/T	..	..	..	..	2
Öppen, W. & O. Sørensen	.	..	1 M/T	..	..	..	..	1
Otter, R.	1 S	..	1
Owren	1 S/T	..	2 S/T	3
Pedersen, J. & Sm. (Ocean A/S)	.	..	2 M/T	2 M/S	..	..	..	4
Ringdal, O. (Gdynia Skibs A/S)	.	..	{ 2 M/S 1 S	2 M/S	..	..	..	5
Rudd-Pedersen	1 S	..	..	..	1
Salvesen, A.	1 S	1 S	..	2
Samuelsen, E. H.	.	..	{ 2 M/T 1 M/S	1 M/S	..	..	..	4
Schage, V. L.	1 S	..	..	1
Simonsen & Astrup	1 M/T	..	1
Skaugen, I. M.	.	..	{ 3 M/T 1 M/S 1 M/S	..	..	..	..	4
Smith, C.	3 M/S	..	..	..	4
Stang, J. B.	4 S	1 S	..	5

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
Oslo (cont.)								
Staubo, H. & Co.	.	..	{ 1 M/T 1 M/S	..	2 S	..	..	4
Stenersen, J.	.	..	2 M/T	..	..	..	..	2
Stephansen & Torgersen	.	..	1 M/T	..	..	..	..	1
Sveen, A.	.	..	..	..	3 S	..	..	3
Sondenfields Norske Dampskibsk	.	..	..	..	3 S	3 S	..	6
Teilefesen, E.	.	..	..	..	..	1 S	..	1
Texas Co. (Norway) A/S	.	2 M/T	7 M/T	1 M/T	..	..	..	10
Thoresen, T. A/S	.	..	..	..	4 S	..	..	4
Thorvik, M.	.	..	..	..	3 S	..	..	3
Torgersen, T. R. (Orient Skibs A/S)	.	..	2 S	..	1 S	..	..	3
Tschudi & Eitzen	.	1 M/T	{ 2 M/S 3 M/T	1 M/S	..	..	..	7
Ugelstad, R.	.	..	..	..	1 S	..	..	1
Ugelstad, S.	.	..	2 M/T	..	3 S	..	..	5
Ursin Smith, R.	.	..	..	..	1 S	..	..	1
Wåge, H.	.	..	2 M/T	..	..	..	..	2
Wahl & Co.	.	..	..	..	1 S	..	..	1
Wahlström, E.	.	..	..	..	2 S	..	..	2
Wilhelmsen, A.	.	..	..	1 M/S	..	..	..	1
Wilson, J. & Son	.	..	..	..	1 S	..	..	1
Östberg, C.	.	..	..	..	1 M/S	..	..	1
Östlandske Petroleumskompagni A/S (see also under Vestlandske Petroleumskompagni Bergen)	.	..	1 M/T	..	..	..	1 M/T	2
There are also 48 S, 10 M/S and 6 M/T under 500 tons belonging to independent owners		..	..	..	..	..	{ 48 S 10 M/S 6 M/T }	64

NORWEGIAN SHIPPING, January 1941 (*cont.*)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
PORSGRUNN								
Borgestad A/S	.	..	..	7 M/S	..	..	..	7
Holta, T.	.	..	1 S	1 M/S	1 S	..	..	3
Reim, C. J.	.	..	..	..	3 S	..	..	3
Tangvald-Pedersen, H.	.	..	..	..	1 S	..	..	1
There are also 3 M/S under 500 tons belonging to independent owners		..	..	..	..	..	3 M/S	3
RISÖR								
Henriksen, J.	.	..	..	..	1 S	..	..	1
Prebensen & Blakstad	.	..	{ 2 M/T 1 S/T }	..	..	..	..	3
SANDEFJORD								
Blåhval A/S	.	1 S	..	..	..	..	..	1
Bulls Tank Rederi A/S	.	..	1 M/T	..	..	..	..	1
Dahl A/S Ther. (<i>see also under Oslo</i>)	.	{ 3 S 1 M/T }	5 M/T	{ 3 M/S 1 S/T }	..	..	30 S	43
Jahre, A.	.	{ 2 S 1 M/T }	2 M/T	1 M/S	..	..	22 S	28
Rasmussen, J. & Co.	.	..	1 M/T	..	..	..	..	1
Rasmussen, J. & M. Konow	.	1 M/S	..	..	..	..	9 S	10
Rasmussen, K. K.	.	..	..	1 S	..	..	..	1
Virik, H.	.	..	2 M/T	..	..	..	..	2
There are also 2 S and 2 M/S under 500 tons belonging to independent owners		..	..	..	..	..	{ 2 S 2 M/S }	4

NORWEGIAN SHIPPING, January 1941 (*cont.*)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company	Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
SANDNES							
Sandnes Dampsk A/S	1 S	1 S	2
SANDNESSJÖEN							
Det Helgelandskedampsklsk	1 S	5 S	6
SARPSBORG							
Borregård A/S	1 S	..	..	1
Mörch, O. L. & Holter, O.	1 S	1 S	..	2
There are also 4 S under 500 tons belonging to independent owners	4 S	4
SIGERFJORD							
There are 3 S under 500 tons belonging to independent owners	3 S	3
SKIEN							
Holta, O. & J. A/S	2 S	1 S	..	3
Isaksen, I. W.	1 M/S	..	1
Rjukanbanens Driftsbestryer	1 S	2 S	3
There are also 8 S and 3 M/S under 500 tons belonging to independent owners	(8 S 3 M/S)	11
SKUDENESHAVN							
Gjessens, Eftg., O.G.	2 S	..	2
There is 1 S under 500 tons belonging to an independent owner	1 S	1

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
SORTLAND								
There is 1 S under 500 tons belonging to an independent owner		..	..	..	..	..	1 S	1
STAVANGER								
Anda, B. . . . .		..	..	..	..	1 S	{ 2 S 1 M/S	4
Bergesen, S.		1 M/T	6 M/T	..	..	..	..	7
Bergesen, Sig. & Co. . . . .		..	3 M/T	..	..	..	..	3
Den Norske Amerikaline A/S (see also under Oslo and Bergen)		1 S	..	..	..	..	..	1
Monsen, S. . . . .		..	..	..	..	1 S	..	1
Olsen, A. G. . . . .		..	1 M/T	..	2 S	1 S	..	4
Olsen, K. . . . .		..	1 M/T	..	..	3 S	..	4
Smedvig, P. . . . .		..	1 M/T	2 S	..	1 S	..	4
Stavangerske Dampskibsk A/S . . . . .		..	..	..	2 S	10 S	{ 8 S 4 M/S	24
There are also 13 S, 9 M/S, and 1 M/T under 500 tons belonging to independent owners		..	..	..	..	..	{ 13 S 9 M/S 1 M/T	23
STEINKJER								
Indherreds Aktie-Dampskibsk . . . . .		..	..	..	..	2 S	3 S	5
STOKMARKNES								
Vesterålen's Dampskibsk A/S . . . . .		..	..	..	2 S	{ 5 S 5 M/S	{ 5 S 1 M/S	18

NORWEGIAN SHIPPING, January 1941 (cont.)

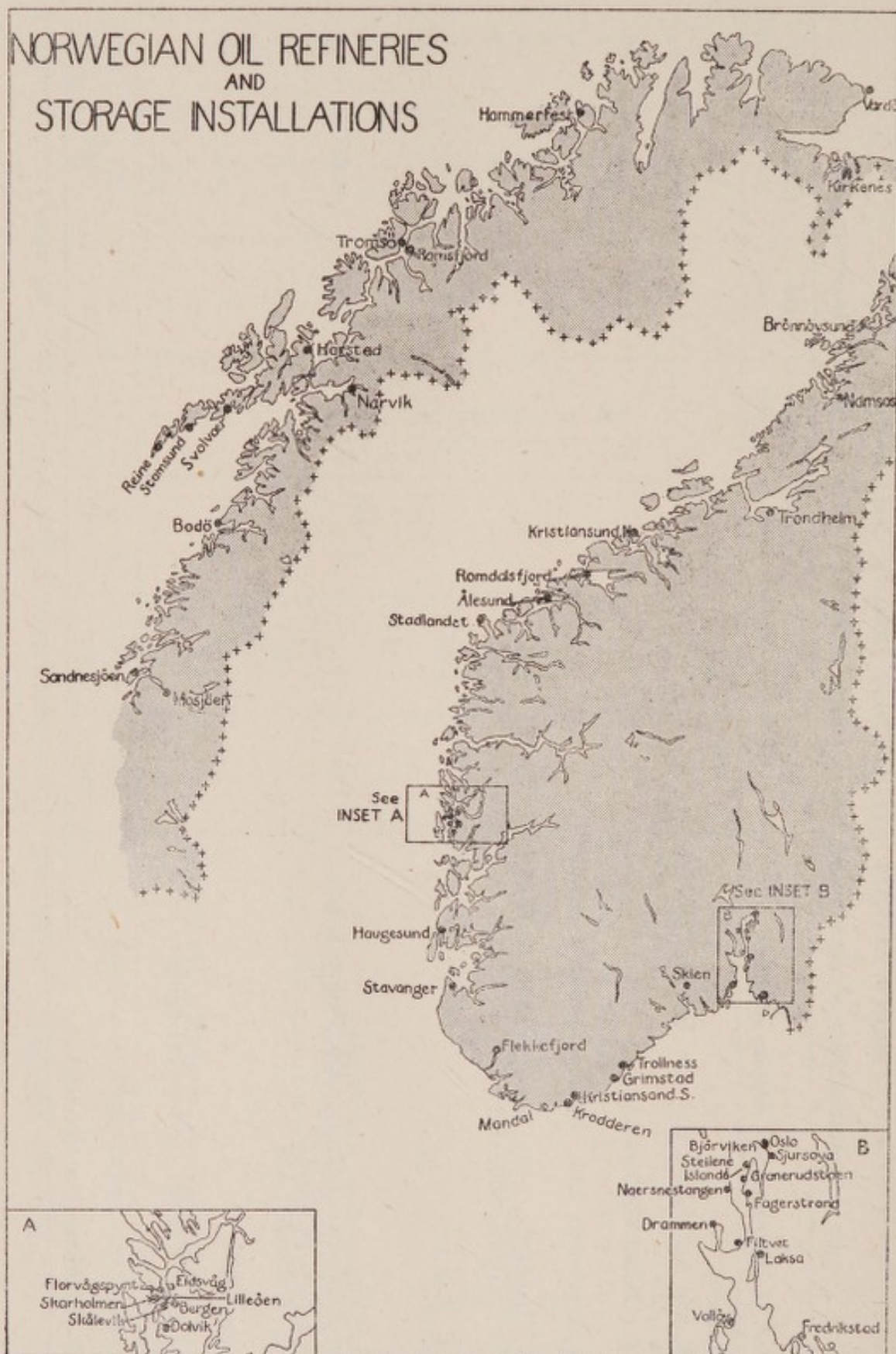
(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company		Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
SVOLVAER								
There are 2 S under 500 tons belonging to independent owners	2 S	2
TROMSÖ								
There are 9 S and 9 M/S under 500 tons belonging to independent owners including Troms Fylkes Dampskibsselskab A/S, which own 7 S and 1 M/S		{ 9 S 9 M/S	18
TRONDHEIM								
Bachke & Co.	5 S	1 S	..	6
Grundtvig, O.	1 S	..	..	1
Lykke, Per. T.	1 S	..	..	1
Nordenfjeldske Dampskibsselskab A/S, Det.	14 S	4 S	2 S	20
Tetlie, B.	1 S	..	..	1
Torkildsen, K.	2 S	..	..	2
There are also 15 S and 6 M/S under 500 tons belonging to independent owners		{ 15 S 6 M/S	21
TVEDESTRAND								
Bech, A.	1 M/T	..	..	..	..	1
Jorkjend, B.	1 S	..	..	1
TÖNSBERG								
Berg, T.	{ 2 M/T 2 S/T	..	..	..	..	4
Borge, H.	2 S	1 S	..	..	3

NORWEGIAN SHIPPING, January 1941 (cont.)

(S = steamship; M/S = motor vessel; S/T = steam tanker; M/T = motor tanker. Gross tonnage.)

Port of registration and shipping company	Over 10,000	5,000- 10,000	2,500- 5,000	1,000- 2,500	500- 1,000	Under 500	Total
TÖNSBERG (cont.)							
Bruun & von der Lippe (see also Falkland Ship- owners Ltd.)	1 S	..	..	..	..	10 S	11
Bugge, N. (United Whalers Ltd.)	2 S	..	..	..	..	17 S	19
Bull, N.	..	..	..	1 S	..	..	1
Falkland Shipowners Ltd. London (Bruun & von der Lippe)	..	1 S	..	..	..	4 S	5
Flakland Whaling Co. Ltd. Jersey (Fadum & Wang)	..	1 S	..	..	..	3 S	4
Finnhvalas Hvalfangstselskapet	1 S	..	..	..	..	4 S	5
Kröger, J.	..	..	..	1 S	..	..	1
Lyngas, L. S. & J.	..	5 M/T	..	..	2 S	..	7
Rød, L.	..	1 M/T	1 M/S	..	..	..	1
Rød, R.	..	1 M/T	2 M/S	..	..	..	1
Rød, H. & Co.	..	..	..	..	..	..	2
St. Helier Shipowners Ltd. London (Fadum & Wang)	1 S	..	..	..	..	2 S	3
Torgersen, H. H. & Co. A/S	..	1 M/T	..	..	..	..	1
Tönsbergs Hvalfangeri A/S	..	1 S/T	..	..	..	7 S	8
	..	{ 32 M/S 1 S/T 5 S	8 M/S	..	..	..	46
Wilhelmsen, Wilh.	..	..	..	..	..	..	..
There are also 3 S under 500 tons belonging to inde- pendent owners	..	..	..	..	..	3 S	3
VARDÖ							
Finnmark Fylkesrederi og Ruteselskap	..	..	..	..	..	1 S	1



MAP 51

APPENDIX XII

OIL INSTALLATIONS (October 1940)

Position	Company	Capacity (tons)		Remarks
		White products	Black products	
OSLO AREA				
Björviken	..	?	?	Not known whether the oil is stored in tanks or drums
Oil wharf Oslo				Small benzene depot, one mile south of the entrance to Björviken.
Sjursöya	Texas Co.	900	..	
Steilene Islands	S.O.C.*	22,125	9,075	About 7 miles SW. of Oslo. The tanks are on the two islands of Landsteilene (8 tanks, mainly white products) and Storsteilene (12 tanks, partly black products and partly white). Wharf at E. end of Storsteilene.
				White products storage includes:
				Benzene 17,120 tons
				Kerosene 5,005 "
Granerudstøen	Norsk Engelsk A/S†	12,480	9,620	On E. side of the fjord, 2½ miles S. of Steilene. 24 tanks, 3 large and one medium size. Most of the tanks are close to the shore. Two underground tanks (capacity 1,000 cubic metres) were under construction for the Norwegian Government and may be completed (October 1940).
Naersnestangen	Gulf Oil Co.	4,250	500	At entrance to a small bay on the W. side of Oslofjord, 5 miles SW. of Steilene.
Fagerstrand	Norsk Braendselolje†	24,330	19,120	On E. shore of Oslofjord. Concrete bunkering quay immediately N. of village.
				White products storage includes:
				Benzene 21,960 tons
				Kerosene 2,370 "
Filtvet	..	9,200	1,700	On W. shore of Oslofjord, immediately SW. of Horn.
Laksa (near Son)	Norsk Engelsk	11,540	85	Immediately E. of Laksa, midway between Sonstangen Point and the head of the small inlet. Stocks are almost entirely of motor spirit.
Drammen	S.O.C.	..	1,050	Believed to be near Solum.

* Standard Oil Company.

† Shell.

‡ Anglo-Iranian.

Position	Company	Capacity (tons)		Remarks
		White products	Black products	
Valløy (near Tönsberg)	S.O.C.	10,000	15,000	The refinery is on Valløy peninsula. It has a throughput capacity of 51,000 tons a year. Three large crude oil tanks and several smaller tanks for motor spirit, fuel oil, lubricating oil, and other products.
Krakerøy (near Frederikstad)	S.O.C.	150	150	Four small tanks.
FROM OSLOFJORD TO KRISTIANSANDSFJORD				
Skien	S.O.C.	150	150	One mile south of town, on E. bank of river.
"	Norsk Braendselolje	150	150	1½ miles S. of town, on W. bank of river.
Arendal	S.O.C.	150	150	On mainland near Salterød (58° 29' N.; 8° 50' E.).
"	S.O.C.	..	570	Trollenes, 4 small fuel tanks.
"	Norsk Engelsk	500	180	Krogenes. On mainland (58° 28' N.; 8° 50' E.).
"	Norsk Braendselolje	420	160	Lille Skodholmen. On an island in middle of Galtesund (58° 27' N.; 8° 47' E.).
KRISTIANSAND S. TO STAVANGER AREA				
Kristiansand S.	Norsk Braendselolje	2,000	4,250	Kolsdal.
"	S.O.C.	..	965	Four small tanks at Kanevigen and one small tank on NE. side of Langmandsholmen.
Krodderen	?	..	100	Two tanks near Krodderen on E. side of Indre Flekkerøy, 4½ miles SSW. of Kristiansand.
Mandal	S.O.C.	..	100	..
Flekkefjord	S.O.C.	..	350	..
STAVANGER TO BERGEN AREA				
Stavanger	S.O.C.	..	1,800	Hillevåg, 3 small and one very small tank. Small jetty. Near railway on W.
"	Norsk Braendselolje	1,550	1,700	On a small island between Buøy and Steinsøy, N. of town.
"	Norsk Engelsk	4,800	100	On E. side of Langøy Island, 4 miles north by east of Stavanger. Two tanks, 3 filling houses, and jetty.
Haugesund	S.O.C.	..	1,220	Three tanks at Asalviken at N. end of the town, 2 at Skagen.
BERGEN AREA				
Dolvik (Bergen)	Norsk Engelsk	..	3,200	Two tanks and jetty on Fjosanger, ¾ mile NNW. of village of Dolvik, and 4½ miles SW. of Bergen.

Position	Company	Capacity (tons)		Remarks
		White products	Black products	
Skålevik . . .	S.O.C.	10,000	6,000	Reported completely destroyed August 1940. Original capacity 6,400 tons. Ten tanks on small promontory. Six for white products, still intact. Two of the black products tanks burnt out by R.A.F.
Skarholmen . .	R.O.P.*	5,000	5,000	Four tanks on small island of Skarholmen, S. of Askøy.
Lilleøen . . .	Norsk Braendselolje	8,000	7,000	On E. and S. of the small rocky island of Lilleøen, SW. of Florvågspynt. Some tank sites blasted out of rock. Jetty for 7,000 ton tankers. Damaged April 1940.
Florvågspynt .	?	? 250	? 250	Opposite Lilleøen. Damaged April 1940.
Eidsvåg . . .	Sporvienes Bensindepot	1,000	3,000	Believed damaged July 1940.

BERGEN TO TRONDHEIM AREA

Stadland . . .	?	..	50	One small tank on the shore, 40 miles SW. of Ålesund.
Ålesund . . .	S.O.C.	..	950	One tank at Nörve.
Kjeholmen . .	Norsk Braendselolje	1,050	850	On the small island of Kjeholmen, N. of Ålesund.
Bjornøy . . .	Norsk Engelsk	1,950	3,600	On the SE. of Bjornøy, an island NNE. of Ålesund. Almost entirely destroyed April 1940.
Romsdalsfjord .	..	..	6,500	Two large and one small tank, on the point of an island. Name of island unknown.
Kristiansund N.	Norsk Braendselolje	..	2,700	Medium-sized tank E. of the S. end of the Nordsund bridge.
„ . . .	S.O.C.	..	980	Three tanks.

TRONDHEIMFJORD AREA

Beian Harbour .	?	?	120	Two small fuel oil tanks west of the harbour entrance.
Trondheim (NW. of main part of town).	Norsk Braendselolje	3,350	2,550	N. of former site of now dis-used foundry. Jetty.
Trondheim (NW. of main part of town).	Norsk Engelsk	..	780	250 yards N. of Norsk Braendselolje. Three small and 2 very small tanks.
Hovringen (NW. of Trondheim)	Nordenfelseske	1,300	..	Four tanks. Mostly benzene.
Hovringen (NW. of Trondheim)	S.O.C.	6,740	3,400	Eight tanks on west side of harbour. Jetty.

* Russiske olje producer.

Position	Company	Capacity (tons)		Remarks
		White products	Black products	
NORTHERN NORWAY				
Namsos . . .	S.O.C.	200*		Probably destroyed in 1940 operations.
Brønnøysund . .	S.O.C.	..	100	..
Mosjøen . . .	S.O.C.	50	75	..
Sandnessjøen . .	S.O.C.	..	2,600	Three tanks.
Bodø . . .	?	300*		Probably destroyed in 1940 operations. Tank for aviation fuel reported on Kyalvika peninsula (1940).
Reine (on Lofoten Islands)	S.O.C.	..	100	..
Stamsund . . .	..	1,000	6,000	..
Svolvær . . .	S.O.C.	..	500	Three small tanks on Kløtterholmen.
„ . . .	Norsk Engelsk	6,300	4,500	On Storøy island. Almost entirely burnt out in 1940 operations.
„ . . .	Norsk Braendselolje	1,950	3,600	Severely damaged by fire in 1940 operations.
Harstad . . .	Vestlandske Petroleum A/S (S.O.C.)	3,000	6,200	Five tanks at Sama, just N. of the town; probably destroyed.
„ . . .	Norsk Braendselolje	..	800	Almost entirely destroyed.
Narvik . . .	?	?	?	Gas and diesel oil is stored in 2 tanks at ore quay, capacity 2,000 tons; 3 tanks at Fagernes, joint capacity 100 tons. All tanks reported destroyed.
Ramfjord (near Tromsø)	Naval oil depot	?	15,000	Three tanks (5,000 tons each) in a line parallel with the fjord at Nyrud, on the mainland on N. side of Ramfjord, 8 miles SSE. of Tromsø. Fuel oil and diesel oil tanks.
Tromsø . . .	Norsk Engelsk	..	3,200	Three tanks SW. of the town.
„ . . .	Nordolje	..	3,000	Three tanks one mile N. of bunkering depot. Mainly diesel oil, some solar.
„ . . .	S.O.C.	..	350	Two small tanks on mainland due S. of main quays.
Lervik (Hammerfest)	Norsk Engelsk	325	3,120	Four tanks, one large for solar oil, 2 small for benzene and one small for kerosene.
Hammerfest . .	S.O.C.	..	2,150	Three tanks at Rypkubbeidet.
Vardø . . .	S.O.C. and Others	..	1,500	Storage tanks just S. of the pier.
Vadsø . . .	Vestlandske Petroleum Co.	?	?	Tank reported.

* Type unknown.

Position	Company	Capacity (tons)		Remarks
		White products	Black products	
WHALE OIL AND HERRING OIL				
		Storage capacity in tons		
Fredrikstad	De Nordiske Fabrikker A/S (De-No-Fa)	45,000		Whale oil and herring oil factory. Large quay.
Sandefjord	Sanda Fabrikker A/S and Vera Fabrikker A/S	20,000		S. of town on E. side of fjord. Six large and 6 small tanks.

APPENDIX XIII

FORESTRY STATISTICS

TABLE 1. *Productive Forest Area (in Hectares)*

County	Coniferous forest	Deciduous forest		Collective forest area	
		Total	Above conifer line	Total	Percentage of total area
Östfold . . .	242,124	2,089	..	244,214	58.4
Akershus . . .	316,123	3,855	..	319,978	60.0
Hedmark . . .	1,335,663	188,403	126,794	1,524,067	55.3
Opland . . .	562,367	116,511	72,163	678,877	26.9
Buskerud . . .	510,144	58,825	33,951	568,970	38.4
Vestfold . . .	113,903	11,725	..	125,628	53.8
Telemark . . .	475,222	55,667	21,316	530,889	35.0
Aust-Agder . . .	253,504	55,845	3,492	309,349	33.1
Vest-Agder . . .	99,274	71,101	444	170,375	23.5
Rogaland . . .	32,595	38,925	..	71,520	7.8
Hordaland . . .	87,839	73,553	..	161,392	10.4
Sogn and Fjordane .	77,190	141,367	..	218,557	11.8
Møre . . .	75,456	87,852	..	163,308	10.9
Sør-Trøndelag . . .	300,788	149,766	82,465	450,554	24.1
Nord-Trøndelag . . .	608,118	91,629	59,724	699,748	31.2
Nordland . . .	168,748	415,331	123,490	584,078	15.3
Troms . . .	34,596	420,204	..	454,800	16.9
Finnmark . . .	87,843	343,018	..	430,860	8.9
TOTAL . . .	5,381,497	2,325,666	..	7,707,164	..

TABLE 2. *Collective Cubic Content in 1,000 m.³ of Conifers of 0 cm. at Breast Height, and for Deciduous Trees of 5 cm. or over at Breast Height*

County	Norway spruce	Scots pine	Spruce and pine	Deci- duous	Total	
Östfold . . .	6,020	4,588	10,608	1,521	12,129	Eastern region 207,314
Akershus . . .	16,347	4,468	20,815	1,833	22,648	
Hedmark . . .	37,744	22,730	60,474	6,243	66,717	
Opland . . .	26,596	6,519	33,115	3,454	36,569	
Buskerud . . .	20,381	8,779	29,160	3,815	32,975	
Vestfold . . .	5,593	866	6,459	1,766	8,225	South 19,413
Telemark . . .	14,177	9,492	23,669	4,382	28,051	
Aust-Agder . . .	3,405	6,665	10,070	2,916	12,986	
Vest-Agder . . .	150	3,842	3,992	2,435	6,427	
Rogaland . . .	..	9,110	9,110	5,126	14,236	
Hordaland . . .					West coast fjord region	
Sogn and Fjordane					14,236	
Møre . . .						
Sör-Trøndelag . . .	9,840	4,563	14,403	3,523	17,926	Trondheim depression 51,558
Nord-Trøndelag . . .	24,847	3,389	28,236	5,396	33,632	
Nordland . . .	5,683	1,031	6,714	9,800	16,514	Northern Norway 27,089
Troms . . .	..	683	683	5,358	6,041	
Finnmark . . .	..	1,961	1,961	2,573	4,534	
TOTAL . . .	170,783	88,686	259,469	60,141	319,610	

TABLE 3. *Collective Annual Increment in 1,000 m.³ of Conifers of 0 cm. in diameter and over at Breast Height, and for Deciduous Trees with 5 cm. diameter and over at Breast Height*

County	Norway spruce	Scots pine	Spruce and pine	Deciduous	Total	
Östfold . . .	271	139	410	47	457	Eastern region 6,942,000
Akershus . . .	670	138	808	62	871	
Hedmark . . .	1,339	619	1,958	177	2,135	
Opland . . .	880	174	1,055	92	1,147	
Buskerud . . .	680	246	927	106	1,033	
Vestfold . . .	245	29	275	57	332	South 729,000
Telemark . . .	532	302	834	132	967	
Aust-Agder . . .	162	252	415	87	502	
Vest-Agder . . .	5	140	146	81	227	
Rogaland	187	187	111	298	West coast fjord region 298
Hordaland . . .						
Sogn and Fjordane						
Møre	19	157	197	355	Trondheim depression 1,265
Sör-Trøndelag . . .						
Nord-Trøndelag . . .						
Nordland . . .	138	19	157	197	355	Northern Norway 529
Troms . . .	..	13	13	107	120
Finnmark . . .	..	15	15	38	54

TABLE 4. *Cubic Content of Norwegian Spruce and Scots Pine, and of Deciduous Forest in m.³ per hectare*

County	Class of site			Deciduous forest above coniferous tree line	Average for productive forest below coniferous tree line
	High	Medium	Low		
Östfold . .	72.9	51.0	28.0	..	47.8
Akershus . .	100.6	63.4	36.1	..	68.0
Hedmark . .	78.4	48.2	23.5	8.8	45.9
Opland . .	109.1	69.4	39.3	12.0	56.1
Buskerud . .	102.8	74.8	38.5	13.1	62.1
Vestfold . .	88.5	63.0	41.5	..	52.0
Telemark . .	95.8	69.3	32.5	12.4	40.0
Aust-Agder . .	73.1	53.7	26.9	..	36.3
Vest-Agder . .	50.9		28.5	..	40.0
Sör-Trøndelag . .	101.6	60.9	27.9	11.6	36.3
Nord-Trøndelag . .	99.3	66.6	31.9	13.6	49.9
Nordland . .	..	..	..	..	29.3

Eastern region 55.8

South 38.2

Trondheim depression 43.1

APPENDIX XIV

BIBLIOGRAPHY AND LIST OF MAPS

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- (1) *Topografisk Kart over Norge*; 1/100,000. First edition, 1870- ; revisions up to 1936. Large parts of the country are covered by these maps.
- (2) *Amtskarter (Fylkeskarter)*; 1/200,000. First edition, 1826- ; revisions up to 1937. All fylker are mapped in this series except Finnmark, for which there is a special map (1/400,000), and Nordland, which is covered by *Land Generalkarter* (1/250,000).

There are G.S.G.S. reproductions of both the 1/100,000 and the 1/200,000 series of maps. The legibility of the Norwegian maps depends greatly on the date of their original publication, and particularly of revision. The most recent 1/100,000 revisions are excellent coloured maps showing a wealth of detail.

Amongst other notable maps are:

- (1) The *Omegns-(Omlands-) Karter* (scales 1/25,000 or 1/50,000) of the principal towns; published 1921-38.
- (2) The *Turistkarter* (mostly 1/50,000), a series of 14 maps covering the principal tourist, and particularly mountain, areas.
- (3) Large-scale geological maps (1/100,000 and 1/250,000) cover only limited areas of the country.

The Kongelig Norsk Automobilklub publishes (a) a Year Book (the *Rutebok og Årbok*) describing the principal main roads of the country, and (b) a useful series of road-maps.

The *Okonomisk-Geografisk Atlas over Norge* (1921) is the best atlas of the country.

INDEXES

I. PLACE-NAMES

-breen, -fonn = glacier; -elv, -jokka, R. = river; -fjeld, -tind, M. = mountain or highland; -ö, -öy, I. = island; -sjö, -vand, L. = lake. There are additional names of (1) glaciers in Appendix II, (2) rivers in Appendix III, (3) lakes in Appendix IV, (4) canning factories in Appendix X, (5) oil installations in Appendix XII, (6) fish-oil, &c., factories on Map 47, and (7) paper and pulp mills on Map 50.

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