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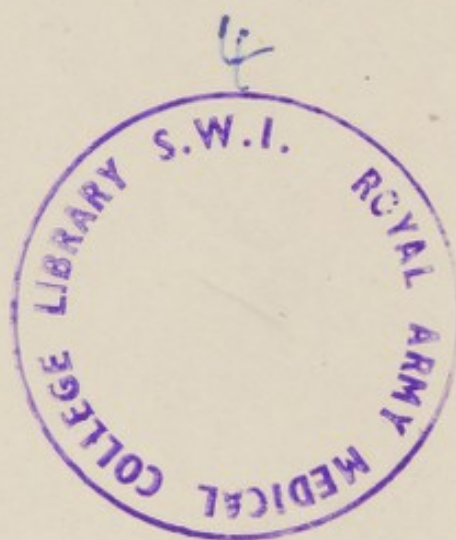
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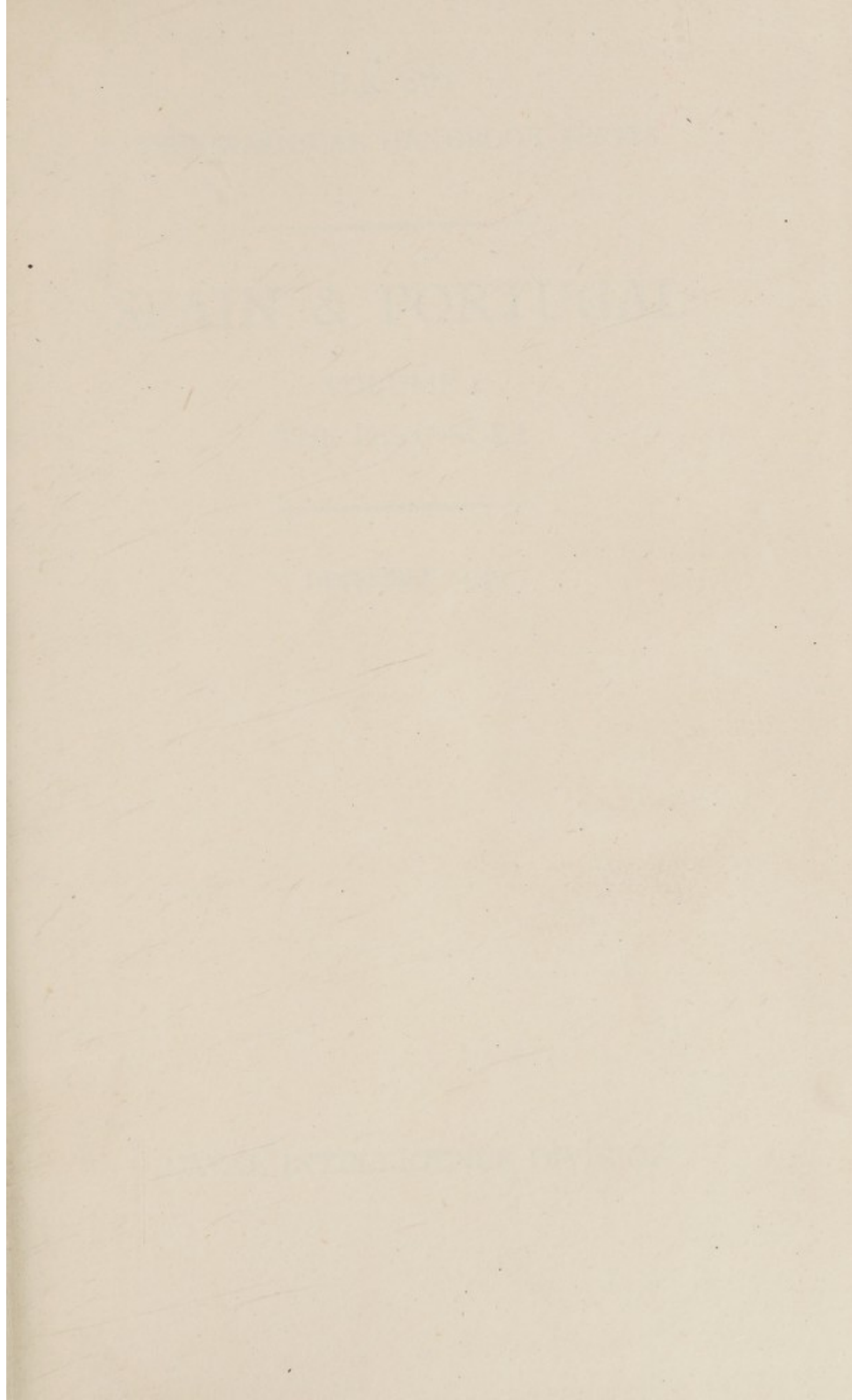
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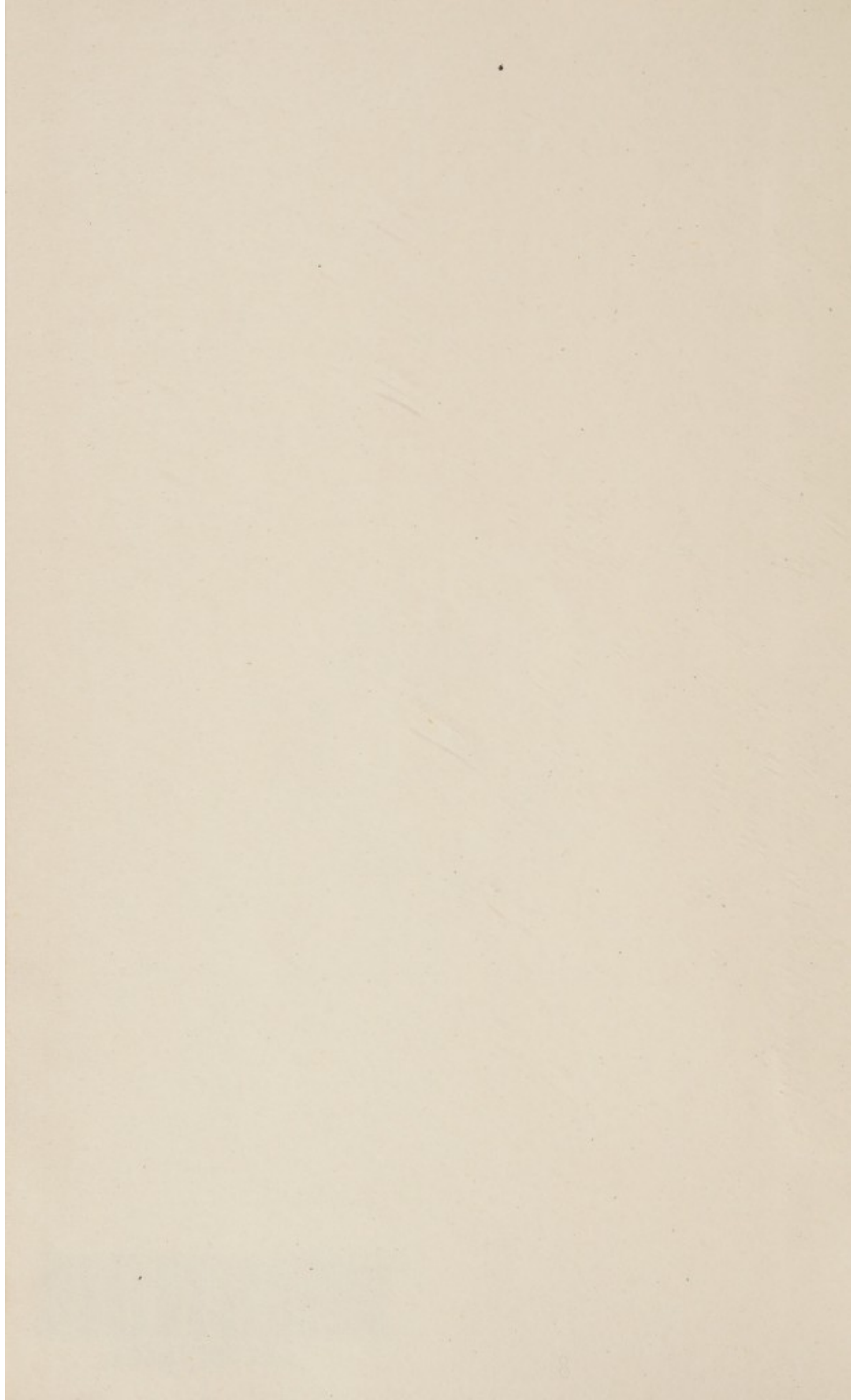
NAVAL INTELLIGENCE DIVISION

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GEOGRAPHICAL HANDBOOK SERIES

SPAIN & PORTUGAL

VOLUME I
THE PENINSULA

DECEMBER 1941

NAVAL INTELLIGENCE DIVISION

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TRO

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IGRE

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 furnished with numerous maps and illustrations. 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 prepared 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. E. W. Gilbert, B.Litt., M.A., of Hertford College, Oxford, and Mr. R. P. Beckinsale, M.A., whose services are gratefully acknowledged.

J. H. GODFREY

Director of Naval Intelligence

OCTOBER 1941

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CHAPTER I

INTRODUCTION

THE Iberian peninsula is the largest in Europe after Scandinavia and is often referred to as *the* Peninsula. It is more of an island than the other two great peninsulas of southern Europe; the isthmus which attaches it to the Continent is narrower than that of either Italy or the Balkans and is sharply defined by the solid barrier of the Pyrenees. It lies farther to the west than is always remembered; the whole of it, except Catalonia, is west of Greenwich, its main mass west of France; all Portugal lies west of Dublin, and Lisbon west of Limerick. This position, stretching out into the Atlantic, together with the massive form of the land and the absence of bays and islands like those of Greece, gives Iberia as a whole something of a continental character, as if it were separate from Europe. It was said long ago that Africa begins at the Pyrenees, and the Peninsula is indeed, in some physical respects, similar to northern Africa. Further, the proximity of Iberia to Africa has given it closer relations with that continent than either Italy or the Balkans have enjoyed.

Iberia divides the Atlantic from the Mediterranean, as it separates Africa from Europe proper, and its strategic position between these two expanses of water on the one hand, and between the two continental masses on the other, has been one cause of its great importance in past centuries, and of the numerous wars which have been fought on its soil.

Area and Population

The Peninsula is divided into two States of very unequal size, which jointly occupy almost the whole surface. Spain, with a total area of over 190,000 square miles, controls nearly five-sixths of the whole, while the remainder (over 34,000 square miles) is Portugal. The only parts which are not under the rule of these two powers are the tiny State of Andorra in the Pyrenees and the British possession of Gibraltar. The former has an area of 191 square miles only, while Gibraltar, which has been British since its capture in 1704, is less than 2 square miles in extent. Islands lying near the coast are few and insignificant, but the Balearic group which lies off the east coast of Spain, gives her nearly 2,000 more square miles of territory, and forms a separate province. The two powers of Spain and Portugal

are also unequal in population, but in this respect Spain's preponderance is not as great as in area. The Peninsula contains a population of over 30 millions, and of these nearly one-quarter, or rather more than 7 millions, inhabit the small State of Portugal, while the remaining 23 millions occupy the much larger area of Spain.

Relief

The high average altitude of the Peninsula is the most striking fact that emerges from a study of its map. Spain has a higher mean altitude than any other European State except Switzerland. The latter country has a mean elevation of 3,600 feet, while the corresponding figure for Spain is 2,000 feet, but it must be remembered that Switzerland rises from a high plateau, while Spain rises straight from the sea. The greater part of the Peninsula is a vast plateau or tableland, known as the Meseta, which is generally 2,000 feet or more above sea-level. This tableland is hemmed in by mountains which rise to considerable heights, the Pyrenees and the Cantabrians on the north and the Andalusian mountains on the south. Further, it is partly separated from each of these mountain systems by a broad and shallow depression, in the north by the Ebro trough, and in the south by the plain of Andalusia. The tableland itself is divided up by mountains which stretch across it roughly in a north-east to south-west direction.

Coasts

The Peninsula rises very steeply from the sea and stands on a narrow oceanic platform, whose edge is only 30 miles distant from the north and west coasts. A narrow coastal plain surrounds the Peninsula except on the north and north-west. The only extensive areas of lowland are to be found in Portugal, south of the Tagus, and in the plain of Andalusia. In spite of the existence of a coastal plain, the coasts are generally difficult of access, as there are few bays and islands do not exist. If we except the larger indentations, such as the *rías* of Galicia,¹ the estuary of the Tagus, the Bay of Setúbal, the Gulf of Cádiz, the Bay of Algeciras, and the harbour of Cartagena, there is no natural accommodation for shipping other than small and badly protected harbours.

Climate

In climate the Peninsula presents some startling contrasts. The north and north-west of Spain and the north of Portugal have a

¹ For an explanation of the term *ría*, see p. 11.

climate that is similar in many respects to that of England, with a small range of temperature and a plentiful rainfall. The coastal lands of eastern and southern Spain, on the other hand, enjoy the utterly different climate that is peculiar to Mediterranean lands. The central tableland has a climate of extremes of temperature, experiencing great heat in summer and considerable cold in winter. Moreover, this tableland has but little rain at all seasons and is consequently parched and dry. Probably the most important dividing line in the Peninsula is that between the west and north-west, with its 'rainy' climate, and the remainder which is 'arid'. The former area is generally known as 'pluviose' Spain. The division between these two climates is fundamental in any study of Spain, and is emphasized throughout the following chapters. Nearly three-quarters (71 per cent.) of Spain has been classed as 'arid', with less than 20 inches of rain per annum, while a further 19 per cent. receives a fall of between 20 and 25 inches. In the whole of western Europe the only areas with a rainfall that is below 16 inches are those found in Spain. The aridity of so large a part of Spain is reflected in the barren and treeless nature of the greater part of the tableland. Iberia is not rich in forests and woodlands, and these are only found on any extensive scale in the north and north-west of Spain and in parts of Portugal.

Rivers

The rivers are of no great value for navigation and very few valleys are useful as natural routes for roads and railways. The nature of the ground and of the rivers makes all communications from the coastal lowlands into the interior very difficult. Owing to the fact that most of the Peninsula is a plateau, the rivers which rise on it have cut deep, narrow trenches and reach the coastal lowlands by rapids and gorges. It has been said of Spanish rivers that they possess 'a long name, a narrow channel and very little water', and this remark is generally true of those which flow down the slope of the Peninsula towards the south-west, with the one exception of the Guadalquivir, which occupies the Andalusian depression. It is also true of the short and rapid streams which flow down the eastern face of the plateau. These are all short, with the exception of the Ebro, which drains the trough between the plateau and the Pyrenees. Most of the rivers of the Peninsula are unnavigable or navigable for only short distances from their mouths. For large parts of their courses over the plateau they are roaring torrents at one season of the year and completely dried up at another. When the Spaniards under Blake and Cuesta lost

the battle of Rio Seco, which led to Napoleon's capture of Madrid, the French soldiers, in crossing the dry river-bed in pursuit of the fugitive enemy, are said to have exclaimed, 'Why! Spanish rivers run away too!'

Regionalism

The Peninsula has been cut up by nature into isolated and separate regions, each with its own well-marked individuality and its own mode of agriculture and pastoral life. Until comparatively recently there had been little opportunity for inter-regional commerce. Geography is mainly responsible for the separation of the peoples who inhabit the different parts of the Iberian Peninsula. This 'Regionalism' has been a strong characteristic of Spain. It is noteworthy that the Spanish monarch did not enjoy the title of King of Spain; he was King of *the Spains*. The differences between the peripheral areas of Catalonia, the Basque Provinces, Galicia, and Portugal on the one hand, and Aragon and the Castiles of the tableland on the other, are as great as the differences between any of them. Catalonia looks outwards to the Mediterranean and is related to Provence and to Italy; she once ruled her own empire in the Mediterranean. Portugal has always looked outwards to the Atlantic from Lisbon, her key to the routes to India and to Brazil. Galicia and the Basque lands have looked to the Atlantic and to the Bay of Biscay for their wealth, rather than to the interior.

A constant tendency for the Peninsula has been the possibility that it might split up into a number of independent States. In actual fact, Portugal is the only part which has achieved permanent separation from Spain, its final division from that country being accomplished in 1640. One of the reasons which has made the unity of the whole Peninsula so difficult has been the lack of a natural capital like Paris or London, each of which was the administrative capital of its country from an early date. Spain was for long without the advantage of a fixed capital. Many towns were used for the purpose, and it was not until the late sixteenth century that Philip II made Madrid the capital. This city was an artificial creation and it has never welded Spain into a united country as Paris has done for France.

History

(a) *The Moorish Invasions.* Although Spain may appear on the map to be an inaccessible castle, it has suffered many invasions from different peoples throughout past centuries. Phoenicians, Cartha-

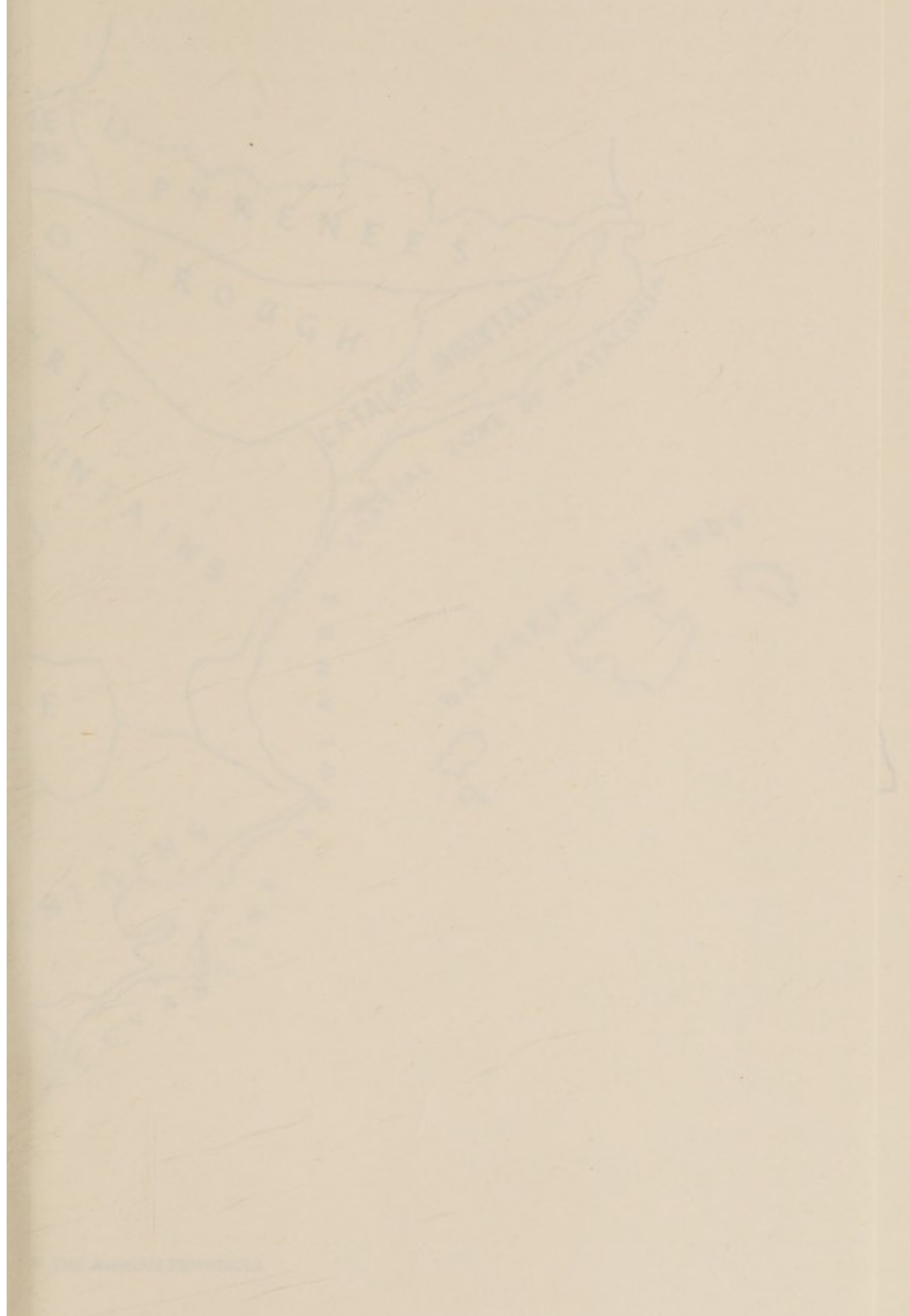




FIG. 1. THE GEOGRAPHICAL REGIONS OF THE IBERIAN PENINSULA

ginians, Romans, northern barbarians such as Vandals and Visigoths, have all poured into Spain. But probably the decisive event in Iberian history was the great Moorish invasion from Africa in the eighth and subsequent centuries. This event not only affected the history of the Peninsula for the next five centuries, but also explains many of the features which differentiate Spain and Portugal from other European States at the present day.

(b) *The opening of the New World.* The second most important fact in the history of Spain and Portugal has been the part played by these two powers in the opening of the New World of the Americas. Both Spain and Portugal were once great imperial powers, and while the Spanish Empire is now but a shadow of its former self, Portugal's overseas possessions are still very extensive. Spain can be described as one of the universal powers, as the existence of the Spanish-speaking world is an important geographical fact of the present day. It has been estimated that about 85 million people in the world speak Spanish, and about 53 millions speak Portuguese. When the fact that the two languages are mutually intelligible is taken into consideration, it can be said that there are no less than 150 million souls in the Hispanic World. This numerical strength is greater than that of either French or Italian, and the Iberian languages therefore come next after English as a universal tongue. In all dealings with Spain it must never be forgotten that she is 'an Empire gone out of business', and that Spaniards still retain a just pride in their great colonial achievements of past centuries, which they claim to be similar to those of Great Britain. The relations between the Iberian Peninsula and Latin America are generally friendly and it has been the object of many persons in Spain to draw the Spanish-speaking world closer together. Spain could generally count on the votes of the Latin American Republics at the League of Nations.

(c) *Civil Wars.* The third important fact of Iberian history has been civil war, fostered by the separatism already described. During the nineteenth century Spain endured many years of civil strife, including the Carlist wars. Still more recently, during the years 1936-9, Spain suffered the tragedy of a disastrous and bitter civil war, fought out with modern weapons of destruction. This, incidentally, makes it difficult to compile economic material about Spain that has any permanent value. The changes caused by the war were substantial and it is difficult, for example, to discover precisely what bridges were destroyed during it, and what bridges have been repaired by any given date. Spanish statistics were never noted

for their reliability, a fact which Richard Ford noticed, a hundred years ago, when he described Spain as 'no paradise for calculators'. But the civil war has made it even more difficult to construct a true and accurate picture of economic conditions there.

Maps

The geographer of Spain and Portugal is not only handicapped by the difficulties already described, but also by a lack of maps. The

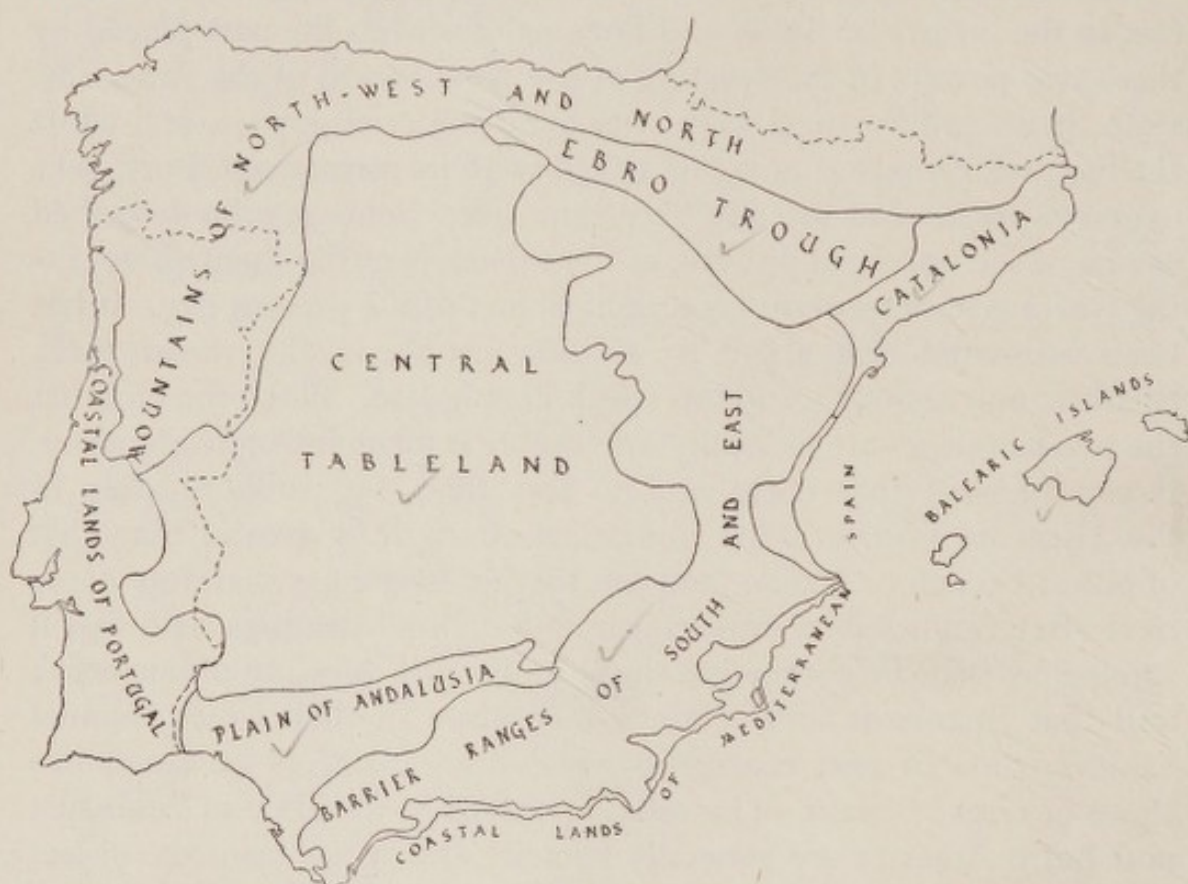


FIG. 2. THE MAJOR GEOGRAPHICAL REGIONS OF THE IBERIAN PENINSULA

Peninsula is one of the worst mapped parts of Europe. The survey of Spain on a scale of 1/50,000, an excellent map, is not nearly complete, and the existing maps on other scales are poor in quality and provide but very limited topographical information. The lack of adequate maps, the unreliability of statistics, and the recent conclusion of a civil war should be constantly borne in mind by the reader of these chapters.

Regional Division

For the sake of uniformity a regional treatment has been adopted and has been used throughout this book. The Peninsula has been divided into eight major geographical regions, some of which are subdivided (Figs. 1 and 2).

THE GEOGRAPHICAL REGIONS OF THE IBERIAN PENINSULA

1. *The Mountains of the North and North-west*
 - (a) Pyrenees.
 - (b) Basque lands.
 - (c) Cantabrian mountains.
 - (d) Galicia.
 - (e) Sil basin.
 - (f) North Douro plateau.
 - (g) South Douro plateau.
 - (h) Portuguese central ridge.
2. *The Basins and Ranges of the Central Tableland (the Meseta)*
 - (a) Northern tableland.
 - (b) Central Sierras.
 - (c) New Castile.
 - (d) Tagus-Guadiana tableland.
 - (e) Sierra Morena.
3. *The Barrier Ranges of the South and East*
 - (a) Iberic mountains.
 - (b) Andalusian mountains.
4. *The Ebro Trough*
5. *The Coastal Lands of Portugal and of Mediterranean Spain*
 - (a) Portuguese coastal lands.
 - (b) Southern coastal strip.
 - (c) Levantine lowlands.
6. *The Plain of Andalusia*
7. *Catalonia*
 - (a) Coastal zone of Catalonia.
 - (b) Catalan mountains.
8. *The Balearic Islands*

Throughout this book the regions are generally discussed in the same order and are given the same name and number. The reader can, therefore, easily extract from the book the descriptions of the part of the Peninsula in which he is most interested. The contrast between Region 1, the mountains of the north and north-west, and the remainder of the Peninsula is given especial emphasis. A regional treatment is more useful in Spain and Portugal than in many other parts of the world, because nature herself has divided the Peninsula into such well-marked compartments.

Arrangement of Book

The handbook on Spain and Portugal will be published in three separate volumes. In this, the first volume, the Peninsula is described as a whole. Portugal and Spain will be treated separately as Vols. II and III respectively. The Balearic Islands are included throughout as a part of Spain, but, while casual reference is made to Gibraltar, no detailed description of the Crown Colony has been included.

The arrangement of this volume is in general accordance with that of the whole series, except in one or two particulars. The chapter on History (chap. VII) precedes the chapter on the People (chap. VIII), thus avoiding repetition. The chapter on History in this volume ends with the year 1815. The separate volumes on Portugal and Spain will each contain a chapter on the modern history of these countries.



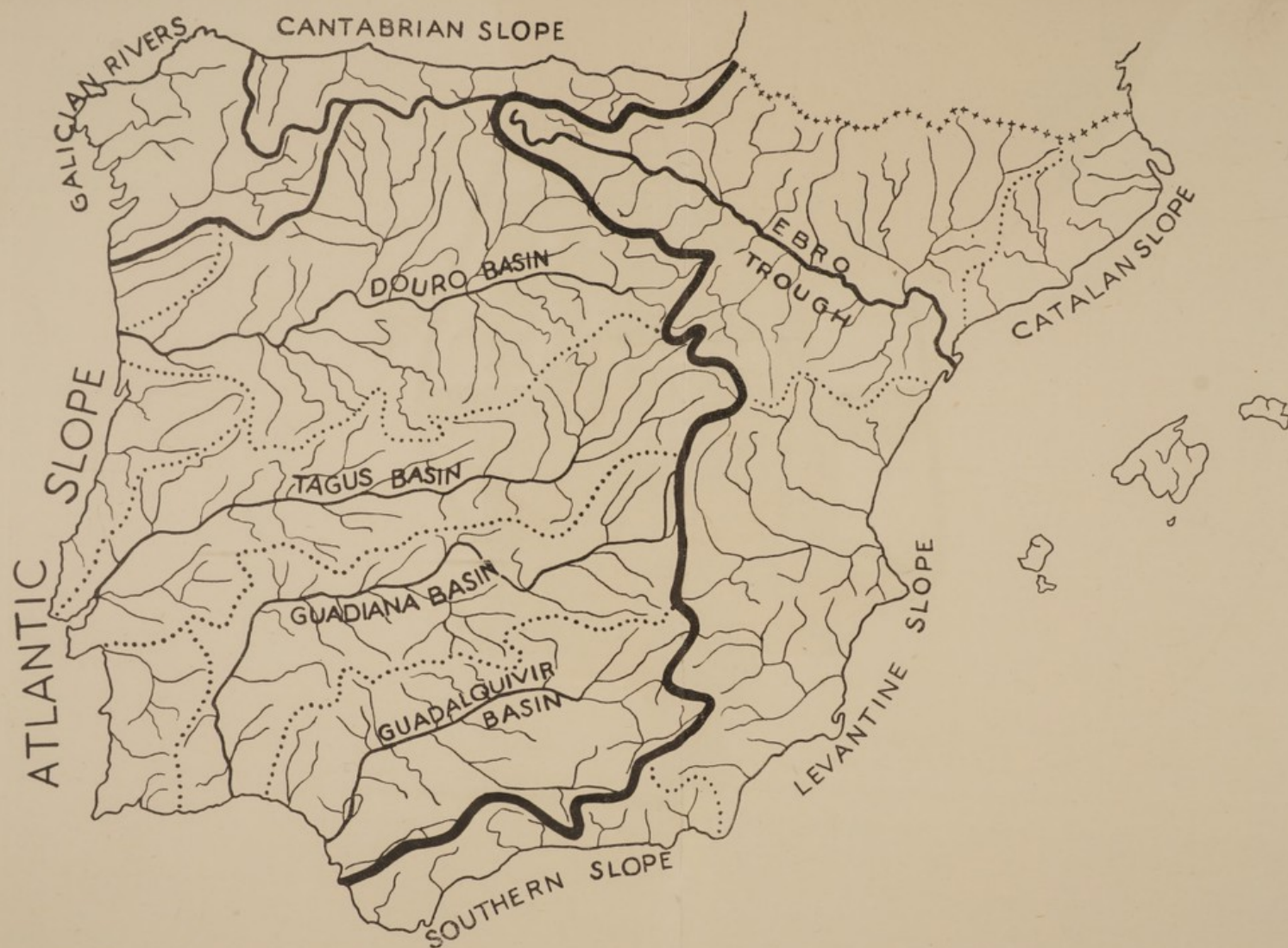


FIG. 3. THE RIVERS AND DRAINAGE-SLOPES OF THE IBERIAN PENINSULA

CHAPTER II

GENERAL PHYSICAL AND GEOLOGICAL DESCRIPTION

I. THE RIVER SYSTEMS AND DRAINAGE OF THE PENINSULA

ARIDITY rivals civil war as the chief curse of Spain, yet the Peninsula contains 1,800 streams. About 90 of these exceed 60 miles in length, and one exceeds 600 miles, but in Iberia the length of a river is no criterion of its volume, nor of its utility for water-supply and irrigation.

The river systems and drainage slopes closely reflect the general relief. The vast central tableland and the interior slopes of its peripheral mountains drain westwards and southwards to the Atlantic, and consequently Portugal enjoys the most useful stretches of the large 'Meseta' rivers. The great plain of Andalusia is drained to the Atlantic by the Guadalquivir, the only considerable lowland river of Spain. Thus, most of the Peninsula drains away from the Mediterranean, and the main watershed is formed by the Iberic mountains. The drainage to the Mediterranean is restricted to the coastal strips, except in the case of the Ebro, which collects the copious waters of the Pyrenean slopes, and cuts a stupendous gorge through the coastal mountains that separate its trough from the seaboard.

The Iberian rivers have certain characteristics that are common to all. They are swift and torrential; their volume, except in the north, is relatively small and highly irregular; their valleys are steep-sided and deeply incised. The rapidity and irregularity of flow discourages navigation, the canyon nature of the valleys militates against irrigation, and, since their narrowness often leaves no room for routes, the valleys may present serious obstacles to communication. The rivers of Spain are in general 'Meseta' rivers, and being the products of a short rainy season and of a rapid run-off are 'Mediterranean' in nature, although most of them drain to the Atlantic. In the drier parts of Spain, where much water is taken for irrigation, the wide, dried-up river-beds frequently serve as sandy roadways in summer, but in winter and spring they may fill with startling rapidity; then, for a few hours, days, or weeks, the long, tall bridges, with ten, twenty, and even sixty arches, justify their apparent uselessness for

the rest of the year. The floods come in late winter and spring and are followed by low water; the Tagus at Aranjuez diminishes from an average flow of 7,400 cubic feet per second in March to 300 cubic feet in August; the Ebro, in spite of the diversity of its sources, is 45 times greater in January than in August. Even the Guadalquivir has great floods, but for suddenness and relative intensity none equals those of the short streams on the Mediterranean seaboard. Here the flood comes as a high wall of turbid waters, rising like a cascade upon itself, and disappearing as rapidly as it came, leaving in its wake a trail of infertile rubble and gravel.

The surface drainage of the Iberian Peninsula falls naturally into eight main slopes or groups of rivers (Fig. 3).

1. *The Cantabrian Slope*

The Cantabrian slope includes a zone averaging 35 miles in width between the Cantabrian watershed and the sea, and stretching from Cabo de Higuer some 250 miles westward to Ribadéo. This district lies mainly in the Basque lands, in the province of Santander, and in the Asturias. Its rivers are short and swift and have a relatively large volume. Their flow is constant throughout the year as, although floods occur in the rainier season, there is no time of marked low-water. The streams abound in salmon, trout, and other freshwater fish. The waterfalls are used for power, and the stream-valleys provide routeways across the Cantabrian mountains. Only a few of the many rivers can be described here. The small Bidassoa forms part of the Franco-Spanish boundary and provides a means of access to its well-populated upper valley. In the province of Vizcaya several small streams converge to form the Nervión, whose steep-sided estuary shelters the port of Bilbao. The chief river of the Asturias is the Nalón (82 miles long), of which a tributary valley is used by the routes that run from Oviedo across the pass of Pajares to Madrid.

2. *Galician Rivers*

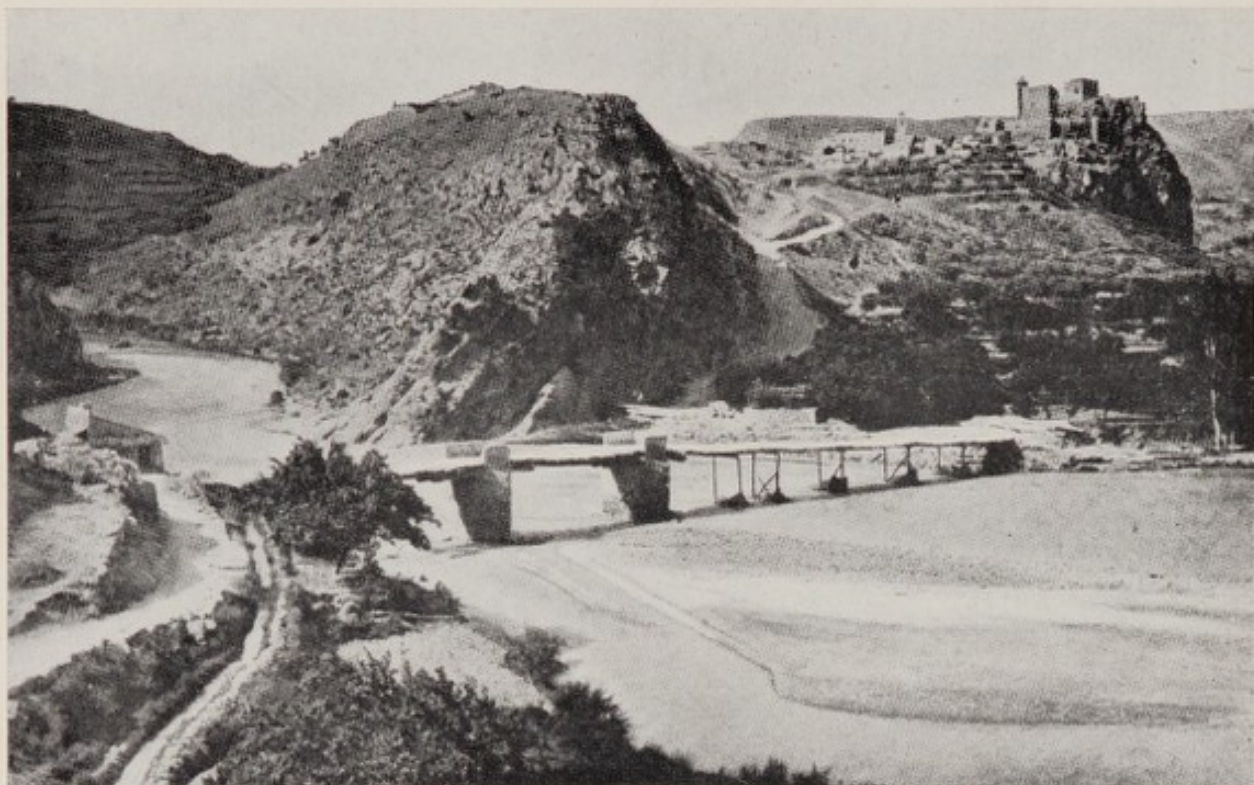
The greatest river of north-western Spain is the Minho or Miño, which rises in Lake Fuenmiña in the province of Lugo, and in a course of nearly 190 miles drains the eastern half of Galicia. Its volume, enriched by many streams, is fairly constant and its main valley usually steep-sided. Of its seventy-four tributaries by far the most important is the Sil (142 miles) that waters the basin of El Bierzo before cutting across the southern end of the Cantabrian mountains in a gorge. This deep furrow is used by the railway from



1. *The river Vinalapó at Elche, during the dry season*



2. *The river Tagus at Toledo*



3. *The confluence of the river Júcar and the river Cabriel at Cofrentes*



4. *A gorge of the Llobregat, showing Montserrat in the background*

Corunna to Madrid. The less spectacular gorge which the lower Minho cuts through the granite block of western Galicia is also used by a railway. The river Minho is tidal to Tuy, 20 miles from the sea, and forms in this section part of the boundary of northern Portugal.

The minor streams draining to the Galician seaboard resemble in character those of the Cantabrian slope. They terminate, however, in large estuaries called *rías*.¹ On the rolling, granite uplands of Galicia the streams flow slowly in narrow beds incised within wide valleys, but near the sea the valleys contract and waterfalls commonly occur.

3. *Rivers of the Atlantic Slope*

The central tableland of Spain is drained to the Atlantic by three great rivers, the Douro, Tagus, and Guadiana, each of which suffers from an irregular régime and a relatively small volume. Each river also forms for a part of its course the boundary between Portugal and Spain.

The Douro (582 miles) drains the northern tableland and the greater part of northern Portugal, having in all a drainage basin of 30,500 square miles. From its source on the flanks of the Picos de Urbión in the northern Iberic mountains the river traverses the bleak uplands of Soria and, turning abruptly westwards, collects the drainage of the northern tableland. At Zamora the river has already dropped 1,575 feet below its source, but is still 2,000 feet above sea-level. Near Miranda, where the river forms the international boundary, the valley contracts into a deep gorge, flanked by precipices, and continues steep-sided to within a few miles of Oporto. In the frontier stretch the current is fast and occasionally quickens into rapids and waterfalls so that navigation is only possible from the mouth to Barca de Vilbestre, a distance of 142 miles. The Douro has 333 tributaries, and the greatest of these rise on the southern slopes of the Cantabrian mountains. Among them are the Pisuerga and the Arlanzón, whose valleys are followed in part by the railways northward from Valladolid.

The southern tableland is drained by the Tagus and Guadiana, which are separated in their middle courses by the line of sierras

¹ *Ría* is a Spanish word that is applied to the estuaries of the rivers of northern and north-western Spain. They are mouths of river valleys which have been submerged. These estuaries are regarded as the most typical examples of drowned river valleys, and the word *ría* is now in general use to define similar valleys in other parts of the world, for example, those in the south-west of England (Plymouth and Falmouth).

stretching from the Montes de Toledo to the S. Mamede mountains in Portugal.

The Tagus rises at 5,250 feet in the Sierra de Albarracín and enters the sea near Lisbon after a course of 626 miles. Although the longest river in Iberia, its drainage basin is exceeded by that of the Ebro, Douro, and Guadalquivir (Fig. 3). In Spain, the Tagus crosses some of the most arid and unhealthy districts of the provinces of Madrid, Toledo, and Cáceres and does little to increase their attractiveness. The banks are generally steep and barren; after rains the river becomes a raging flood and in the hot season diminishes into gentle backwaters which are not difficult to ford. The tributaries are comparatively few (fifty-nine), and those entering the left bank almost dwindle away in summer. Some of the right-bank tributaries, such as the Alagón and Tiétar, are fed by the melting of snows on the Central Sierra, but the Manzanares at Madrid varies from a sandy *rambla* (dry river-bed) to a raging torrent. The Tagus in Portugal is navigable to Abrantes, 120 miles from its mouth, and during high water small boats can almost reach the Spanish boundary near Alcántara.

The Guadiana, the *Anus* of the Romans and *Uadi-Ana* of the Arabs, is the least important of the larger rivers of the Atlantic slope. Some headstreams of the river arise in the lagoons of Ruidera in the south-west of La Mancha, but the shallow river soon disappears by infiltration into the thirsty plains. Longer headstreams start near the town of Cuenca, but these also seep into the flat lagoon-dotted surface. North-east of the town of Ciudad-Real numerous springs, the Ojos de Guadiana, gush forth in a marshy district and combine to form the stream that takes a tortuous course westwards. Near Mérida the river is sluggish, and the shallow bed, in which the drought of summer reveals vast stretches of sandbanks, is so wide that one bridge has sixty-four arches. At Badajoz the valley turns abruptly southwards and at the same time narrows and deepens where it forms the political boundary. In spite of sandbars at its mouth, the Guadiana is navigable for some 30 miles upstream.

The Atlantic slope is also drained by several smaller streams that flow entirely in Portuguese territory. The chief of these are the Mondego, whose basin occupies about 13,100 square miles, the Vouga in north Portugal, and the Sado in south Portugal.

4. *The Plain of Andalusia*

The plain of Andalusia and the adjacent mountain slopes are

drained to the Atlantic by the Guadalquivir, a river 423 miles long which is, in many respects, the most useful waterway in Spain. Rising at about 4,593 feet the river descends rapidly between high, precipitous banks to Baeza (932 ft.). Thence the valley widens, revealing in parts the remnants of flat riverine terraces, and falls slowly to Córdoba (328 ft.), where it enters the coastal plain. Below Seville (33 ft.) the river is tidal and flows out to sea across the extensive marsh-lands about its estuary. The Guadalquivir receives 806 affluents, of which several exceed 100 miles in length; the chief is the Genil (222 miles), which derives a copious supply of water from its source in the Corral del Veleta, the only considerable icefield of the Sierra Nevada. From its confluence with the Genil, the Guadalquivir does not fall below 880 cubic feet per second in volume even at low water, and the flow is normally 1,240 cubic feet to 1,400. The 'great river', as the Arabs called it, is the only Spanish river with a large coastal plain, and Seville is the only large river-port in the whole of Spain.

Several smaller rivers flow independently from the plain of Andalusia to the Gulf of Cádiz. The Guadalete enters Cádiz bay, while the Odiel and Tinto enter a joint estuary near Huelva. These last two rivers, which rise on the southern slopes of the Sierra Morena, are badly contaminated with mineral deposits derived from the water pumped from various mines; the Odiel contains no fish.

5. *The Southern Slopes of the Andalusian Mountains*

From Tarifa to Cabo de Gata, a distance of 225 miles, high mountains come close to the littoral and numerous short streams rush seawards, cutting deep canyons in their upper courses and building low, alluvial deltas at their mouths. The longest of these, the Guadalhorce (104 miles), has a remarkable defile at Gaytanes that is used by the railway leading to the interior from Málaga, but the deep canyon at Ronda, on a tributary of the Guadiaro, is equally impressive. The streams are precipitous, the Guadalfeo, for example, dropping 8,000 feet in 40 miles, and their volume is highly irregular, although some which rise in the Sierra Nevada derive much water from melting snows.

The Mediterranean coastlands between Cabo de Gata and Cabo de Creus (some 497 miles) fall into three hydrographic groups, the Levantine, the Ebro, and the Catalan.

6. *The Levantine Drainage Slope*

The whole economy of the Levantine lowlands is based on irrigation, and many of the smaller rivers have been deprived of their water before they reach the Gulf of Valencia. The larger rivers rise far inland; thus the Segura (213 miles), with its tributary the Sangonera, irrigates the great *huerta* of Murcia with water derived from the Andalusian mountains, while the Júcar (311 miles) rises on the flanks of the Sierra de Albarracín not far from the source of the Tagus. The Júcar traverses wild gorges; many rapids occur in its upper course and, like its neighbours, it is liable to disastrous floods. The Turia (152 miles) also rises in the Sierra de Albarracín and falls swiftly to the Valencian lowlands, where it is almost exhausted for irrigation purposes. The many smaller streams of this Mediterranean littoral become quite dry or diminish to mere trickles in time of drought, and all, when flowing, are heavily laden with debris. The gorge-like nature of their upper valleys often makes them useless as routeways.

7. *The Ebro Basin*

The Ebro collects the drainage of about one-sixth of Spain, an area greater than that of any other river basin in the Peninsula. The river rises in springs at the foot of Peña Labra some 3 miles west of Reinosa and flows thence in a general south-easterly direction to its delta in the province of Tarragona. The upper valley as far as Haro is steep-sided and relatively narrow, but by the time Tudela is reached, the valley, although still steep-sided, is considerably wider and contains a powerful flow (1,600 cub. ft. per second). Towards Saragossa wide, flat river terraces occur above the banks of the present stream. Eventually, at Mequinenza, the Ebro enters a deep gorge across the Catalan mountains and winds its way in great defiles before debouching on to an extensive delta. The Ebro is outstanding among Spanish rivers for its volume, due mainly to the abundant supply of water brought by tributaries from the high Pyrenees. Hence the Spanish saying:

Arga, Ega y Aragón
Hacen al Ebro varón—

‘the Arga, Ega, and Aragón make the noble full-grown Ebro’. Many of these fast Pyrenean tributaries exceed 100 miles in length, and the chief, the Segre, is 160 miles long. On the other hand, the tributaries that enter the right bank from the Iberic mountains are short, except

the Jalón (145 miles) whose valley is followed by routes leading from Saragossa to Madrid. All told, the main river during a course of 576 miles collects the water of 222 tributaries, many of which are vital to agriculture. The river is navigable by barge to Tudela in the rainy season, but in time of low water, navigation stops at Mequinenza. Small boats, however, can only ascend to Tortosa, a mere 15 miles from the mouth. The Ebro is also of some strategic value as a second line of defence in the rear of the Pyrenean barrier.

8. *The Catalan Drainage Slope*

A ridge of sierras, usually of moderate height, forms the watershed between the Ebro trough and the coastal lands of Catalonia. From this watershed, short streams rush seawards, the most important being the Llobregat (99 miles) whose upper course lies in a deep gorge and whose mouth, as is usual with Mediterranean rivers, terminates in a flat, deltaic plain. The longest river is the Ter, which in a journey of 130 miles falls 7,500 feet from the Pyrenees to the Mediterranean littoral. The courses of these impetuous Catalan rivers are frequently broken by rapids and waterfalls, which, in spite of violent floods, are utilized for power. Their valleys which cut across the coastal ridge are of considerable assistance to routes leading inland, especially those of the Llobregat and the Ter.

II. GENERAL DESCRIPTION

The greater part of the Iberian Peninsula is occupied by a vast tableland, known as the Meseta, which slopes gradually west and south towards the coastal lands of Portugal. During a complicated geological history, in which the tableland formed the local nucleus of the mountain-building movements that affected the Peninsula, this resistant block suffered much warping and fracturing at its edges. A great ridge of buckled and tilted blocks was also raised across the Meseta from north-east to south-west and tended to divide it into a northern and southern tableland. The north-eastern edge of the plateau is formed by the Iberic mountains, the northern edge by the Cantabrian mountains, and the southern edge by the Sierra Morena, all of which can to some extent be regarded as the upturned rims of the tableland. Several depressions or troughs lie around the Meseta. Beyond the Iberic mountains is the great trough drained by the river Ebro, and to the south-east, beyond the Sierra Morena, is the great lowland drained by the Guadalquivir. Beyond these valleys rise the

greatest mountain ranges of Spain, the Pyrenees to the north of the Ebro trough, and the Andalusian mountains south-east of the Guadalquivir valley (Fig. 1).

The block-like structure of the Iberian Peninsula is further emphasized by the general absence of coastal lowlands, and only in the neighbourhoods of the lower Tagus and the Guadalquivir does the relief favour movement inland. Natural lines of communication are, however, not entirely absent, as the hardness of most of the rocks of Iberia caused them to fracture into blocks, between which are depressions that are useful as routeways.

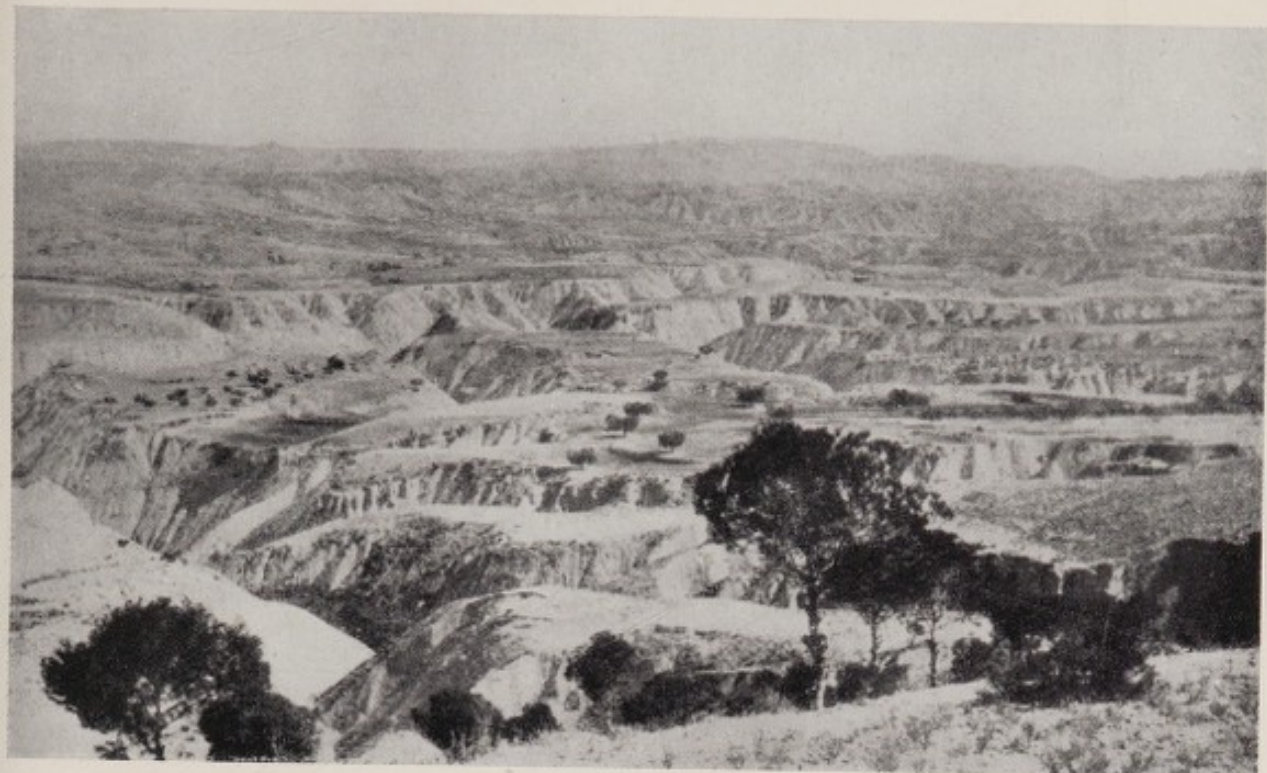
It is almost impossible to generalize the complex geological layout of the Iberian Peninsula, but, roughly speaking, north-western Spain, the plateau lands of northern Portugal, the Central Sierra, and parts of the Toledo mountains are floored mainly with granites. Abutting on to this granitic core is a great mass of ancient slates, sandstones, and crystalline rocks which cover large areas in the Asturias, in western León, southern Portugal, Spanish Extremadura, and in the eastern mountain ranges.

Sedimentary rocks of Secondary age occur mainly in the north-east, in the Basque lands, in west-central Portugal, and in the coastal strip of southern Algarve.

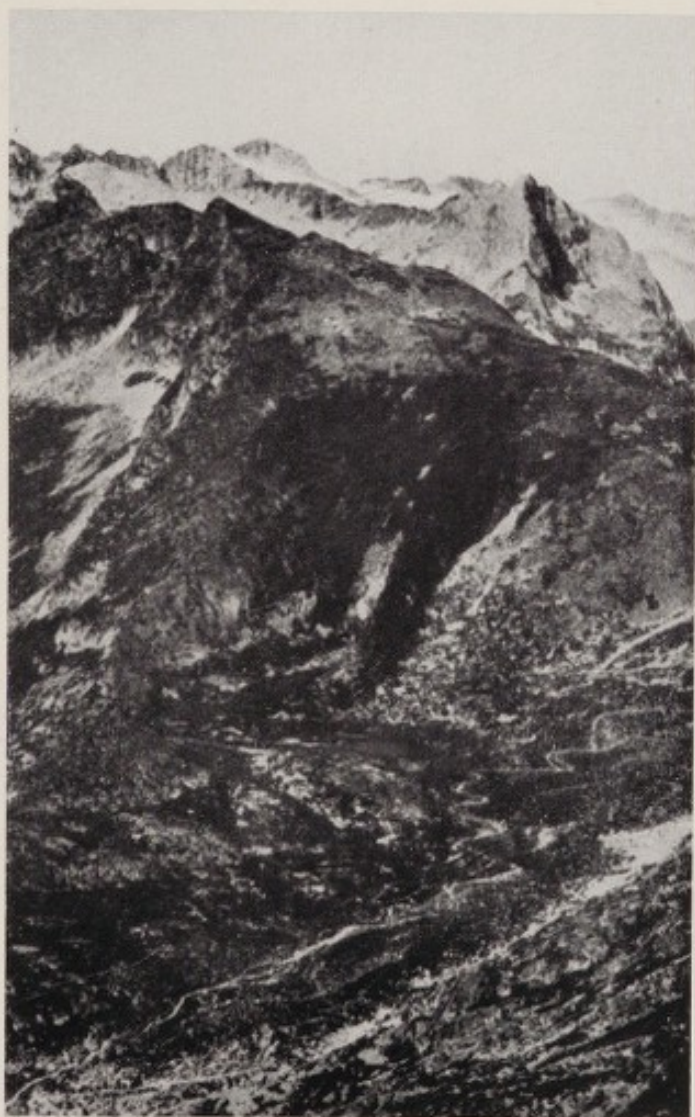
Tertiary deposits, which cover rather more than one-third of the Peninsula, overlie this girder framework of old rocks. The vast basins of Old and New Castile, the Ebro trough, and the upper parts of the Andalusian plain are usually floored with tertiary clays and sandstones. The plains about the mouths of the Tagus and Guadalquivir show considerable stretches of marine deposits of Tertiary age.

More recent deposits cover one-tenth of Spain. The largest tract lies south of the Cantabrian mountains, but both flanks of the Central Sierra have patches of these young deposits. The trough between the Central Sierra and the Toledo mountains was a great collecting-ground for this Quaternary debris which is now deeply trenched by the valley of the middle Tagus.

As a result of the geological structure outlined above, Iberia may be roughly divided into two areas of surface rocks. The western half of the Peninsula is floored mainly by siliceous rocks, such as granites, schists, and quartzites, which weather into rolling uplands or peneplanes. The eastern half consists mostly of young sedimentary rocks, mainly of a calcareous nature; here the typical landform is the flat, limestone tableland (*páramo*) which rises abruptly through a steep



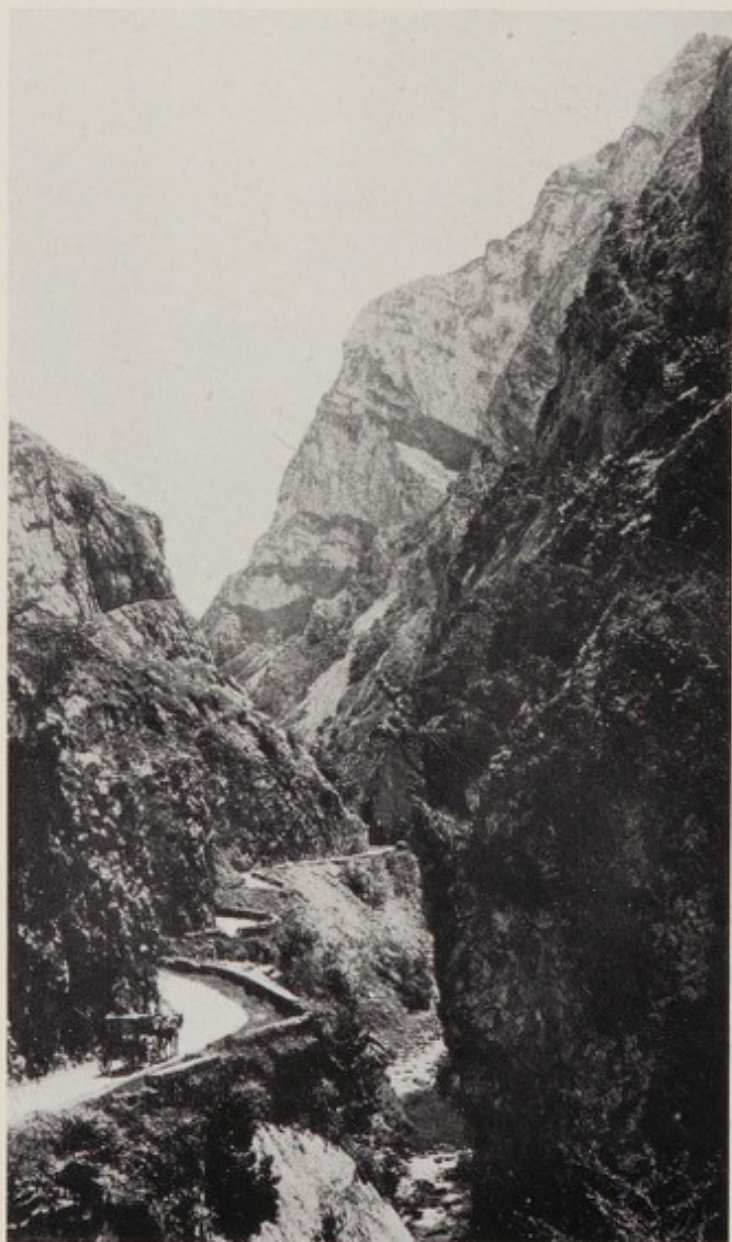
5. *The dissected tableland (páramo) at Alhama in the Province of Murcia*



6. *La Maladetta in the Central Pyrenees near the Gap (puerto) of Viella in the Province of Lérida*



7. *The Cantabrians seen from the south near Reinosa*



8. *The gorge of the Sella*

scarp (*cuesta*) of marl from flat plains (*campos*) of sand or clay. In some districts the high tablelands or *páramos* are gashed with ravines which dissect the upland into many small, steep-sided blocks whose surface in their turn may become pitted with hollows and roughened by furrows. As erosion advances, these small tablelands diminish into isolated hillocks which then dominate an extensive stretch of plain.

The topography of each geographical region of the Peninsula is described in the following pages; an account of the water-supply and the natural routeways is also included.

III. REGIONAL DESCRIPTIONS

I. THE NORTH AND NORTH-WEST

The Pyrenees

Region 1 (*a*)

The Pyrenees stretch from Cabo de Creus in the east to Cabo de Higuer in the west, a distance of about 260 miles, and reach a maximum width of nearly 80 miles. The Spanish part of the range covers some 15,000 square miles.

Generally speaking, the interior zone is composed of crystalline rocks such as granite, gneiss, and schist, which protrude above an outer zone of sedimentaries, mainly limestones of Secondary and Tertiary age. The highest summits usually lie on the northern side of the ridge, so that the mountains drop abruptly on the French slopes, and descend more gradually in terraces to the Ebro trough. The height of the summits (maximum 11,169 ft., in Pic d'Aneto) is less remarkable than the unbroken nature of the range, the central part of which never falls below 5,000 feet.

To-day the ice-fields of the Pyrenees are small and occur mainly in France, but cirques (armchair-shaped hollows) and U-shaped valleys are well developed, as the area was glaciated in the Ice Age.

The Pyrenees may be divided into three sections, eastern, central, and western. The eastern section stretches about 60 miles from Cabo de Creus to the Col de la Perche. This ridge tends to be separated from the main Pyrenean range by the deep, wide valley of the upper Segre river, although the great mountain blocks of Puigmal (9,544 ft.) and Canigou (9,137 ft.) are typical of the central Pyrenees. Near the Mediterranean coast the range rapidly decreases in width, and in the Alberes mountains is only 6 miles wide. Here it separates the broad,

flat basin of Ampurdán from the plain of Roussillon in France. The narrow coastal plain affords a route for the main railway line, while a pass, the Col de Perthus, across the Alberes ridge is used by a main road.

The central Pyrenees, which stretch for about 170 miles from the Col de la Perche westwards to Pic d'Orhy, have been formed about a core of schists and granites that give rise to an Alpine scenery of precipitous ridges, steep-sided mountain blocks, and occasionally towering crags. This high backbone is flanked on the Spanish side by Secondary rocks, mainly calcareous, and by a wide belt of still younger (Tertiary) sands, clays, and limestones.

South of this wide terrace the Secondary rocks outcrop again, forming in parts a line of sierras that overlook the Ebro valley. Consequently, over large areas of the southern flanks of the central Pyrenees three zones can be distinguished, the high crystalline mountains, the wide valley or depression on the sands, clays, and limestones, and the broken ridge of rather narrow sierras rising above the Ebro trough. The true mountain zone lies mainly between 8,000 and 9,000 feet, with its summits at over 10,000 feet and its passes at over 7,000 feet. The depression on the young rocks is especially well seen near Jaca, where the soft strata have been gullied by the infrequent but heavy showers into a maze of steep-sided gorges. The zone of smaller sierras, south of this depression, has summits at 4,000 to 6,000 feet. The chief of these sub-Pyrenean ridges are Montsech in the east and the sierras which rise to about 4,500 feet between the Noguera and Cinca rivers. The ridge is continued westwards through the Sierras de Guara (6,700 ft.), de Grata (5,100 ft.), de Santo Domingo (4,940 ft.), and de la Peña.

It is usual for rivers flowing southwards from the high Pyrenees to flow in wide valleys in the Tertiary depression, and then to cut deep, narrow ravines across the sub-Pyrenean sierras. This is well illustrated by the course of the upper Aragón and the headstreams of the rivers Gállego and Cinca.

The western section of the Pyrenees stretches from the Pic d'Orhy for 40 miles to Cabo de Higuer. As the backbone of this range consists mainly of sandstones, the scenery is more rounded and more subdued than in the central Pyrenees. The range seldom exceeds 4,000 feet west of the Col de Roncesvalles, where it is crossed by a road at 3,468 feet. The greater part of this section of the Pyrenees lies in Spanish territory. Here the main international routes traverse the coastlands between Hendaye and San Sebastián.

The Basque Lands

Region 1 (b)

Between the western Pyrenees and the eastern termination of the Cantabrian mountains there stretches a hilly country formed of a complicated arrangement of small mountain blocks and narrow river valleys. This area, the nucleus of the Basque homeland, extends for some 100 miles from east to west and for about half that distance from north to south. It includes the hinterland of the coast between San Sebastián and Santander and lies in the provinces of Vizcaya, Guipúzcoa, Alava, and Santander.

The region is floored mainly by cretaceous rocks (Secondary) of immense thickness which have been eroded by rivers into a series of mountain ranges that are steepest on their northern slopes. There is, however, a small outcrop of Jurassic strata near Bilbao which is very important because of its richness in iron ore.

Although few heights exceed 4,000 feet, the topography of the Basque lands is distinctly mountainous and the average altitude is probably over 2,000 feet. In the extreme east the foothill sierras of the Pyrenees (*see* p. 18) are continued eastwards in the Sierras de Aralar and Andía which border the valley followed by the main railway from Pamplona to Vitoria. In the extreme west the mountain range about Monte Valnera (5,600 ft.) marks the beginning of the Cantabrian system. It is the intermediate sector, or the region inland from the coast between San Sebastián and Bilbao, that forms the true 'Basque Depression'.

The topography of this 'depression' consists of four main mountain ridges which run in a general east to west direction more or less parallel to each other (Fig. 4).

The first main ridge rises majestically above the coast of the Bay of Biscay. It is marked, from east to west, by the peaks of Uzturre (2,418 ft.), Hernio (3,488 ft.), Itzarraitz (3,588 ft.), Urco (2,615 ft.), Oiz (3,411 ft.), Vizcargui, Achispe, and Axpe. From the backbone of this ridge high spurs project seawards as bold, rocky headlands. The chief of these projecting hill-ranges are Montes Mendoegui (3,445 ft.), Andaza (1,857 ft.), Pagoeta (2,359 ft.), Anduz (2,001 ft.), Arno (2,037 ft.), and Sollube (2,244 ft.), each of which is partly separated from its neighbour by the green, well-wooded valley of a north-flowing stream.

The second main ridge, which commences in the east at Monte Aritz (3,494 ft.) and the Sierra de Aralar (3,682 ft.), is the greatest

relief feature of the Basque lands, being higher and more continuous than the three other ridges. It forms the main watershed, and from it swift streams flow north to the Atlantic and, less directly, south to the Ebro. West of the Sierra de Aralar, the ridge increases in height to 5,082 feet in the Pico de Aitzgorri, the summit of a mountain

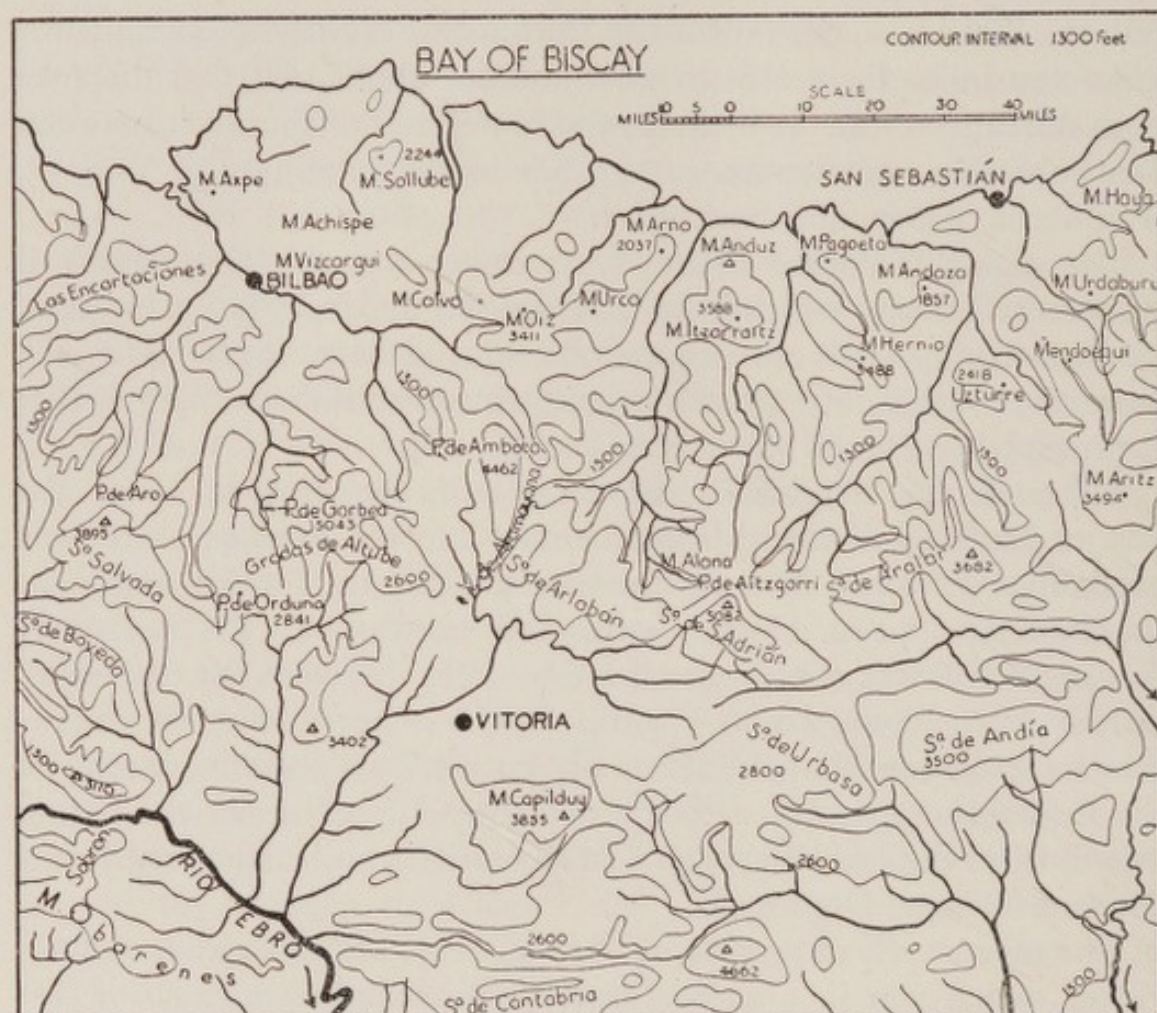


FIG. 4. THE RELIEF OF THE BASQUE LANDS (after Aranegui)

group that extends north-west to Monte Aloña (4,259 ft.) and west into the Sierras de S. Adrián and Arlabán. The Valle de Aramayona separates these sierras from the mountains to the west about the peaks of Amboto (4,462 ft.) and Gorbea (5,043 ft.). The Pico de Gorbea merges westwards through the hilly country known as the Gradass de Altube into the Sierra Salvada, which culminates in the prominent Pico de Aro (3,895 ft.). The highlands of Altube and Salvada are partly separated by the valley of the upper Nervión, which forms an important routeway from Bilbao to Vitoria. The col at the head of this valley is dominated by the Pico de Orduña (2,841 ft.), which, consequently, is of considerable strategic importance.

The topography at the western end of this second main ridge becomes more confused and the hill blocks have a distinct north-west to south-east trend. The northern flanks of the Sierra Salvada drop abruptly to the Valle de Mena, beyond which the land rises more gradually to the Monte de Ordunte. Still farther north, stretching west from Bilbao, is the territory of Las Encartaciones, that consists of a series of hill-ranges directed from north-west to south-east and separated by small green valleys. As the summits of Las Encartaciones rise to between 3,000 and 5,000 feet, the range is a serious obstacle to communications.

The third main ridge of the Basque lands is separated from that described above by a well-marked east to west valley, which is utilized by the important routes between Vitoria and Alsasua. The ridge begins in the east with the Sierras de Andía and Urbasa with summits of 3,500 feet and 2,800 feet respectively. The range is continued in the Montes Capilduy (3,855 ft.) and the Montes de Vitoria, which overlook, from the south, the town of that name. The rivers Zailora and Bayas then breach the ridge, their valleys forming an important routeway. West of this gap the mountain range reappears as the Sierras de Basquiñuelas and Badaya (3,402 ft.).

The fourth, or most southerly ridge, includes the Sierras de Codes (4,662 ft.) and Cantabria which divide the Basque lands from the district known as 'La Rioja', the upper valley of the river Ebro. These sierras are prolonged westwards by the Montes Obarenes which, in the east, are crossed by the Ebro at the gorge near Haro. The western heights of the Obarene mountains project north into the mighty buttress of the Montes de Sobrón and the Sierra de Aracena (3,110 ft.), which lie entirely in the drainage basin of the Ebro.

The importance of the Basque depression as a natural routeway becomes apparent when the heights of its mountain ridges are compared with those of the Pyrenees or Cantabrians. Even the summits of the Basque lands are lower than the passes across the central Pyrenees and are little higher than the few cols across the Cantabrian mountains. The main watershed is only about 28 miles from the coast, and the narrow cols between the rivers flowing down its northern and southern flanks greatly facilitate the building of roads and railways. Hence the Basque lands, although mountainous, form the only easy natural routeway into northern Spain.

The Cantabrian Mountains

Region 1 (c)

The high ridge of the Cantabrian mountains extends for 150 miles from east to west, forming the mountainous country that stretches inland from the coast between Torrelavega in the province of Santander and Foz near the border of Galicia.

The eastern portion of the Cantabrians consists mainly of Secondary limestones, the central section of Primary slates and limestones, and the western of slates and quartzites. Thus, on the whole, the rocks become progressively older to the west. This scheme, however, is interrupted on the northern flanks of the range by a large fault valley which runs in an east to west direction. This valley is floored by young Secondary and Tertiary rocks which give it great importance for both farming and mining.

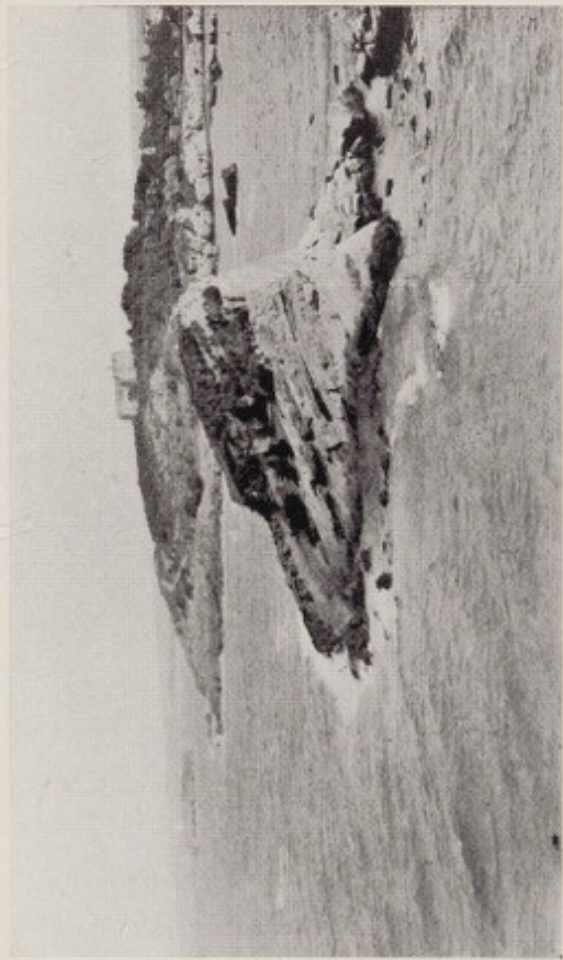
The relief of the Cantabrians is as complicated as its geology. The eastern foothills south of Santander rise abruptly into the gigantic mountain blocks of the Picos de Europa (8,794 ft.) and Peña Labra. Thence the main ridge continues west for about 60 miles, keeping mainly between 5,000 and 7,000 feet and culminating in summits at 7,000 to 8,000 feet. The range is usually less than 50 miles wide, but is relatively unbroken and seldom falls below 4,500 feet. West of the latitude of Oviedo the range assumes a more southerly direction and in the Sierra de Ranadoiro runs almost from north to south. The main ridge, after turning south, splits into two high ranges (6,000 to 7,000 ft.) which enclose the basin of the river Sil.

The fault valley on the northern flanks is especially well developed between Onís and Oviedo. Rivers and important routes follow the valley, and here are the chief coal-field of Spain and great iron-ore deposits. Throughout most of its length this depression is separated from the coast by a belt of hilly country.

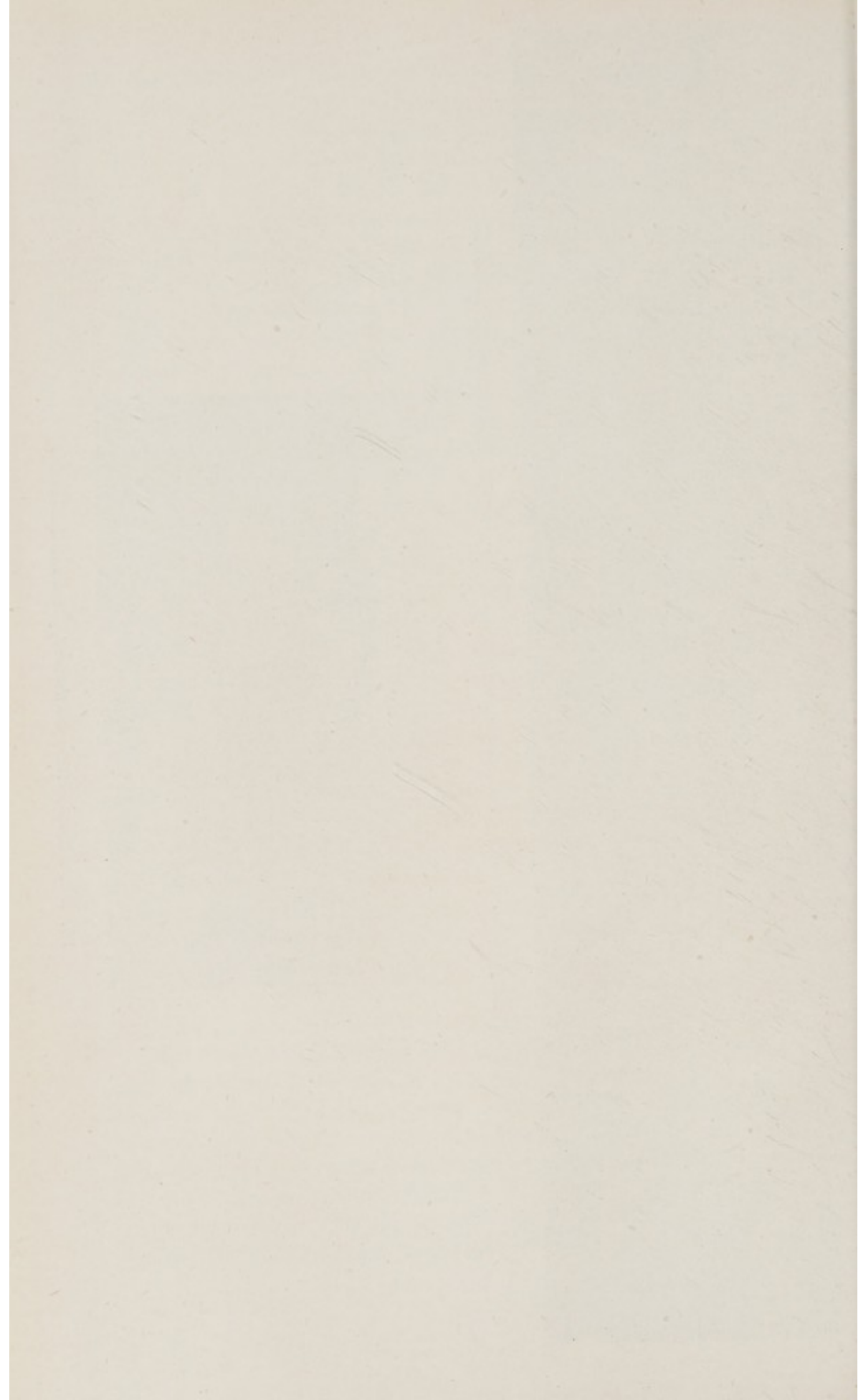
The characteristic landforms of the high Cantabrian ridge are the isolated mountain blocks (*parameras*), whose desolate, plateau-like summits are surrounded by steep or almost vertical cliffs. Locally, as near the pass of Pajares, the sedimentary strata may be weathered into wild, serrated ridges and craggy pinnacles. The southern or interior slopes fall gradually to the tableland of central Spain, but the northern slopes descend steeply towards the sea. The rivers often flow directly northwards in their higher courses but may, on approach-



9. *The Picos de Europa, from the Viorna, about two miles SW. of Potes in the Province of Santander*



10. *The Palacio Real, Santander, from the Sardinero*



ing the coast, flow in an east to west direction, when they enter the fault depression described above.

The main feature of the coast is the very distinct coastal platform or raised sea-beach that forms a terrace some 130 to 430 feet above sea-level. In a few districts, as near Ribadesella, the mountains almost reach the sea, but generally the coastal platform is remarkably persistent and its level surface stretches inland for a width of several hundred yards and at Cabo de Peñas widens to a few miles. Streams have eroded the flat surface of this beach into rounded hills, but it remains a most distinctive feature of the coastline of the Asturias.

The Cantabrian ridge is a great barrier to routes, being in many ways even more difficult to cross than the Pyrenees. Only two main routes cross it: that from Oviedo to León, and that from Santander to Valladolid. The former route uses the Puerto de Pajares, which the road crosses at 4,475 feet and the railway at 4,210 feet. The summit-crossing on this railway is one of the most difficult in Europe; Busdongo is only 7 miles as the crow flies from Puente de los Fierros, but the line joining them is 27 miles long and makes use in this distance of sixty tunnels and nine viaducts. The Santander-Palencia route rises only to 3,230 feet, but in the 21 miles between Bárcena and Reinosa there are twenty-two tunnels on the railway.

Galicia

Region 1 (*d*)

Galicia is the north-western and most oceanic portion of the Iberian Peninsula. Although stretching on an average for 100 miles from east to west and some 120 miles from north to south, it possesses a very distinctive geographical uniformity.

The province is floored almost entirely by slates, schists, and granites, but a few eruptive rocks are present and the wide valley about Monforte de Lemos is covered by young sandy-clayey deposits.

Because of warping and fracturing, the main structural lines run either in a north-east to south-west, or in a north to south direction. The former trend is seen in the direction of the rivers Ulla, Lérez, and Minho and in the orientation of the large estuaries of the Galician rivers. The north to south fracturing is seen in the great valley that stretches from Padrón to Tuy and southwards into Portugal. During a recent stage in its history the tableland has been tilted gently north-west so that the existing relief slopes in that direction.

The greater portion of this peneplane, or low tableland, lies below

1,500 feet, and consists of an undulating land of rounded hills, gently curving granite domes and wide, flat upland valleys. The country slopes gradually seawards from 3,500 feet in the south-east to the broad plateau surfaces at 1,250 feet, that are characteristic of the landscape of Corunna, Pontevedra, and western Lugo. Only in Orense does the tableland exceed 4,000 feet (max. 5,800 ft.). These

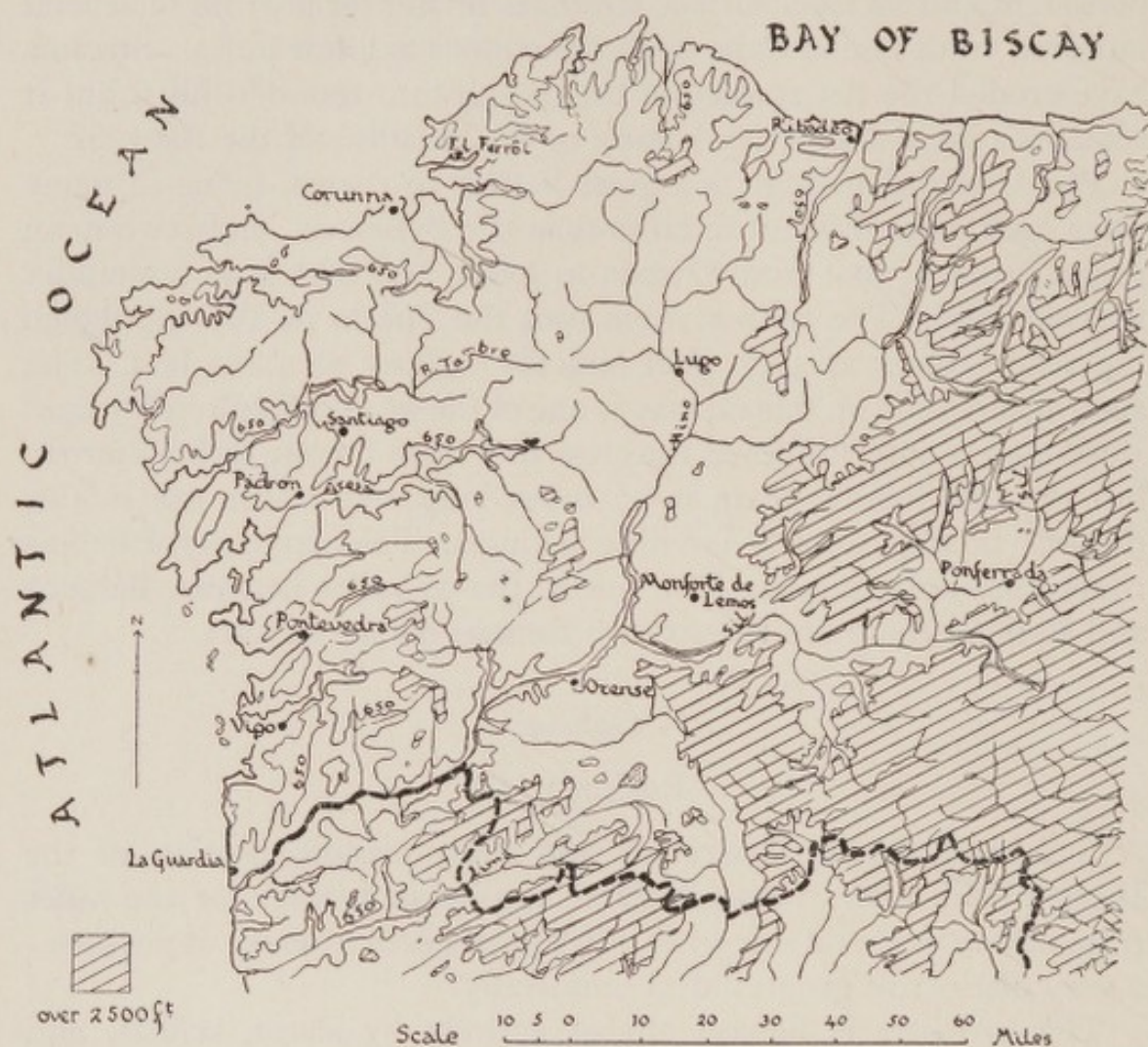


FIG. 5. GALICIA

rolling uplands terminate seawards in a cliffed, rocky, and deeply indented coast along which the patches of lowland are small and isolated. The deep estuaries of the rivers which widen rapidly towards the ocean, known as *rías*,¹ are an important feature of the coast and are described in chap. iii.

The rivers of Galicia drain mainly south-westwards. On the rolling plateau and open moorland the streams flow in wide, and often marshy, valleys, but the stream bed itself is often incised in the

¹ See footnote on p. 11.



FIG. 6. THE PHYSICAL DIVISIONS OF PORTUGAL

This diagrammatic map should be used with the folded map at the end of the volume

damp soils. The Sil and the lower Minho have cut deep, precipitous gorges in which the current becomes at times almost a rapid. Rapids are also common on the smaller streams near the point where they enter the rías.

The lines of fracturing of the old, hard rocks are often the site of springs which occasionally, when deep-seated, are warm and rich in mineral content, as happens near Orense and Ribadavia. It is noticeable that the largest area of river deposits, that in the Minho valley in the province of Lugo, is ill drained. Shallow bogs and marshes are common in this district.

The Sil Basin

Region 1 (e)

The Sil basin marks the transition between the Cantabrian mountains and the granitic tableland of north-western Iberia. The basin, which has been formed by fracturing, seldom exceeds 30 miles in width, but being floored by fairly recent alluvial deposits it forms a rich farming land known as 'El Bierzo'.

The mountain rim consists chiefly of slates that are flanked on the north-east by a wide outcrop of coal-bearing strata, and that are replaced in the south-west by granite highlands. This rim is narrow but high and rises in places to between 6,000 and 7,000 feet. The floor of the basin is 1,500 feet above sea-level, and in order to cross the surrounding mountains, passes over 3,600 feet must be used. In the south-west, however, the river Sil has cut a deep gorge through the highlands and this is followed by the main railway from Salamanca to Corunna. The Sil basin itself is gently undulating, but the surrounding mountains are steep and rugged.

The North and South Douro Plateaux

Region 1 (f-g)

The mountainous region traversed by the lower Douro in northern Portugal and the western parts of the Spanish provinces of Zamora and Salamanca are composed mainly of extensive masses of granites and schists with considerable outcrops of gneiss and crystalline slates. Granites predominate in the west and east, while in the centre is a large area of quartzites and slates that floors the major part of Trás-os-Montes. Siliceous slates are exposed in the Douro valley between Villarino, on the boundary, and Lamego in Portugal. The whole region forms a mountainous zone some 100 to 120 miles wide between the Atlantic coast and the northern tableland. The Douro plateaux are

structurally related to the Meseta, but on the west a great fault-line separates the region from the younger and softer rocks of the coastal strip.

The heavier rainfall of the plateaux has caused them to be dissected by rivers into a series of deep valleys between which rise mountain ranges. The relief lines run mainly from north-north-east to south-south-west, with the exception of the Douro that has cut a deep furrow across the region. The larger rivers, especially the Douro, Sabor, and Tua, have, in their lower courses, worn their valley-bottoms to below 700 feet in altitude, and the Douro lowland extends as far back as the Spanish frontier. The Douro valley is narrow, but several of its right bank tributaries flow in wide north-east to south-west valleys that lie mainly below 1,200 feet. Between these rivers is a series of mountain ranges that usually rise above 3,000 feet but rarely over 5,500 feet. The Serra de Bornes and Serra de Nogueira (max. 4,380 ft.) between the deep valleys of the rivers Sabor and Tua well illustrate the typical landform of the Douro plateaux. The rounded granite summits of the mountains are often surmounted by outcrops of bare rock that weather into shapes suggestive of a ruin.

The mountainous relief decreases from the interior towards the sea and terminates, north of the Douro, in a lower plateau some 20 to 30 miles wide generally below 1,300 feet. This lower, hilly region is strongly developed between Braga and the Douro, where it grades westward into a coastal plain 10 to 15 miles wide. South of Oporto the coastal plain widens out, until in places it occupies one-fifth of the total width of Portugal.

The dissected Douro plateaux seriously hinder communications inland, and the only main railway line that crosses the region from west to east follows the deep and difficult gorge of the Douro. Another main line across north Portugal, from Coimbra into Spain, takes a circuitous route between the plateaux and the high central ridge to the south, but the two lines have no connexions in Portugal except along the coastal plain.

The Portuguese Central Ridge

Region 1 (*h*)

The mountain ridge of central Portugal traverses the country from north-east to south-west for a distance of 160 miles from Guarda to Cintra. It is divided into two widely differing landscapes by a north to south fracture which roughly follows a line from Abrantes on the Tagus to Coimbra. To the east the old rocks, mainly of slates and



11. *The plateau of Galicia near Taboadela in the Province of Orense*



12. *The country near Verín in Galicia*



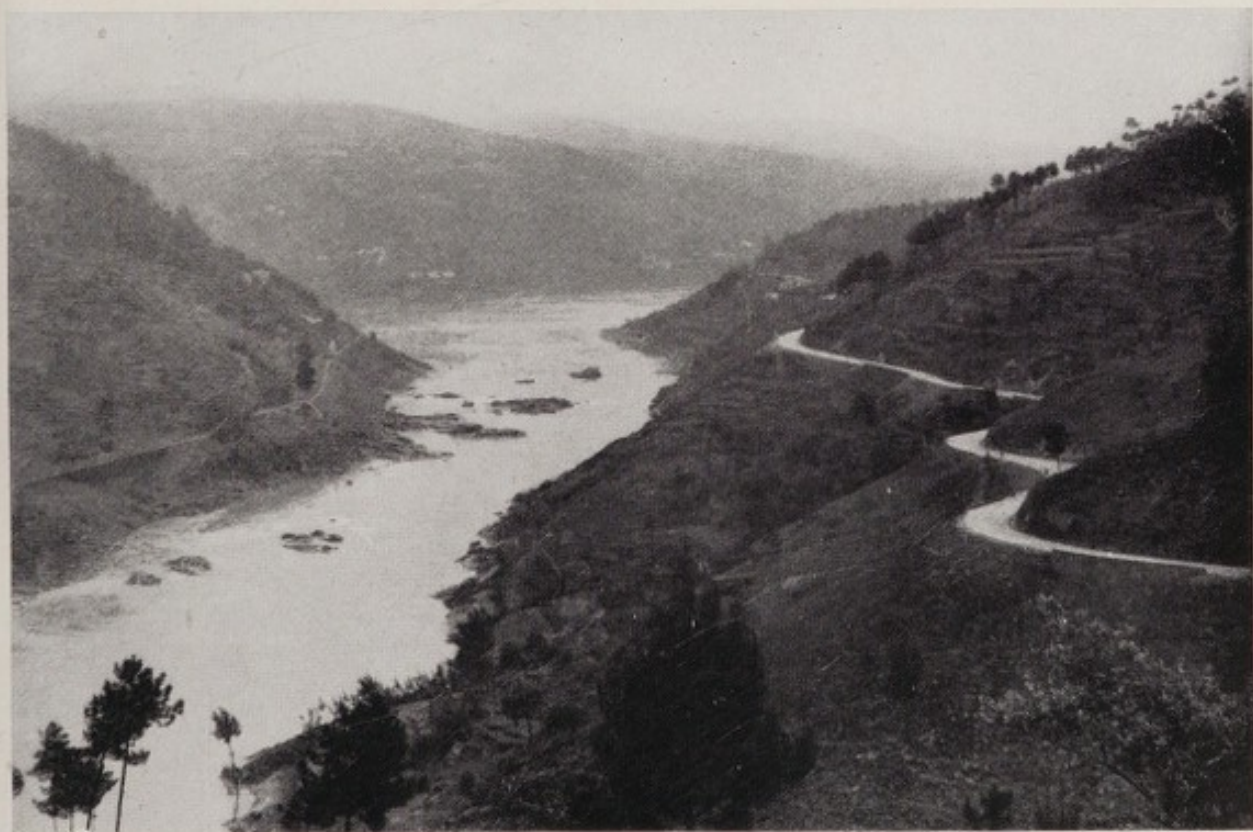
13. *The Mondego, upstream from Coimbra*



14. *The upper Douro valley near the mouth of the Rio Yeltes. In the background is the high plateau of Léon*



15. *The Serra Marão SE. of Amarante in the east of the District of Oporto*



16. *The Douro below Aregos on the eastern border of the District of Oporto*



17. *Montalegre with Larouco (5,000 ft.) in the background*



18. *Trás-os-Montes; typical vegetation with the Serra de Bornes in the background*

granites, have been buckled and broken into high ridges that are merely a continuation of the Central Sierra of Spain; to the west the rocks are of Secondary age, mainly limestones folded and fractured into low tablelands belonging structurally to the coastal plain. The mountain blocks of the high serra are alined from north-east to south-west, and this alinement is continued southwards in the lower hill-country where, however, some of the hills have a north to south trend (Fig. 6).

The eastern granite area has two main ridges: the northern is formed by the Serra da Estrêla (6,500 ft.) and the Serra da Louzã (3,942 ft.); the southern, which culminates in the Serra Guardunha (4,000 ft.), falls steeply south to the Tagus valley. The higher parts of these serras are littered with enormous granite boulders that weather into picturesque, rectangular shapes.

On the younger rocks of the west, the country is hilly and lies mainly below 750 feet. The limestones and shales form small tablelands at 750 feet to 1,500 feet above sea-level, and only where patches of granite or basalt occur, as at Cintra and Monte Junto respectively, do the hills rise to 2,000 feet. The fairly steep scarps of the limestone tablelands overlook north to south trending valleys that occasionally almost breach the hill range. The characteristic feature of the scenery is the irregularity of the limestone surfaces that have been dissolved by the action of water into a maze of deep furrows and tall pinnacles; on these uplands the drainage is mainly underground, the whole district being honeycombed with subterranean river channels.

Lines of communication across the high serras are very restricted, and the railway leading northwards to Guarda circumvents the main ridges. On the lower hill-country to the west the valleys from north to south are used by several roads, and by two railways that lead to Lisbon.

2. THE CENTRAL TABLELAND

The Northern Tableland

Region 2 (a)

The northern tableland is mainly a vast, flat basin, surrounded by higher and more rugged country. This elevated plain extends for some 140 miles from north to south and about 110 miles from east to west, and forms the greater part of the historical provinces of León and Old Castile.

The whole region shows considerable geological and topographical uniformity. Its central and western areas are floored mainly by

Tertiary deposits, covered in the north and south, at the foot of the mountains, by vast expanses of more recent debris. Extensive stretches in the river valleys are also covered by fine alluvium.

These rocks, mainly soft clays, marls, limestones, and sandstones, vary in their resistance to erosion and give rise to certain topographical features that repeat themselves with monotonous regularity. The more resistant limestone and chalky marls are dissected by the streams into tablelands, whose cold, sterile surfaces are called *páramos*. The more clayey and softer soils are eroded into wide basins (the *campiña* or cereal land) that are usually separated from the *páramos* by a fairly steep step of sandy marls, known as the *cuesta* or escarpment (Photo. 5). Hence it happens that while the relief may be subject to local variations, large parts of the region are flat and monotonous.

The average elevation of the plateau is about 2,500 feet, the height ranging from 3,500 feet in the east to 2,000 feet in the valley of the Douro in the extreme west. The higher northern and eastern districts near the mountain rim are wide, flat-topped *páramos*, but in the provinces of Palencia and Valladolid river action has eroded these uplands and formed a lower plain, the Tierra de Campos, above which a few elevations, such as the Torozos hills near Valladolid, tell of the former level. This rolling, rather desolate plain grades in the west and south into the equally flat uplands about the towns of Zamora and Salamanca.

The river valleys are deeply incised in the plains, but four terraces are usually distinguishable along them, the highest being about 350 feet to 400 feet above the present river-level.

The waters of the tableland drain to the Douro, which eventually cuts across the high plateau of north Portugal in a stupendous gorge that is avoided by railways. The other natural exit of the basin lies in the Tertiary depression north-east of Burgos, and is an important routeway. It is noticeable too that the prolongation of Tertiary deposits up the Douro valley to the valley of the eastward-flowing Jalón is followed by the main railway line from Valladolid to Saragossa.

The Central Sierras

Region 2 (b)

The central tableland of Spain is divided into a northern and southern plateau by the Central Sierras, a range of high mountain blocks, arranged *en échelon* from west-south-west to east-north-east, that forms the backbone of Iberia. The sierras continue into Portugal,

but by far the highest and longest section is in Spain. The blocks are mainly of granite and crystalline schists, and this structure, together with the effects of faulting, gives a heavy, rounded landscape and somewhat tabular summits. Where granite outcrops, the surface of the higher areas is usually broken with rectangular masses of rock and with large boulders.

The gradual slopes of the rounded summits of the range are often interrupted by wide hollows (*navas*) shaped like an upturned boat, the result of stream erosion on the flatter granite areas. These valleys afford shelter for tree-growth and crops, and are in marked contrast to the desolate boulder-strewn country where the bare granite is exposed at the surface.

The general slope of the sierras shows considerable differences, and between each main block is a lower plateau surface of difficult, hilly country. These gaps or cols are, however, of great importance as routeways. The high ridge begins in the north-east with the Sierras de Ayllón and Somosierra (6,700 ft.), which are divided from the Sierra de Guadarrama by the Somosierra pass (4,650 ft.), the easiest crossing between the two Castiles. The granite mass forming the Sierra de Guadarrama (7,888 ft.) slopes abruptly northwards towards Old Castile, and more gently southwards towards Madrid. In the west the deep Lozoya valley splits the range into two main ridges and increases the barrier. The Guadarrama mountains slope westwards into a wide, hilly plateau, a land of high *parameras*, that is crossed with difficulty by two main railways leading northwards from Madrid. This irregular country rises into the Sierra de Gredos, which falls abruptly to the south but grades more gently northwards into the plateau about Salamanca. Here the Plaza del Almanzor attains 8,727 feet, the highest point in the Central Sierras. This ridge is separated from the next highland block by the wide col about Béjar, that is drained by the river Alagón, and is utilized by the main railway from Badajoz northwards to Salamanca. The highlands are then continued in the Sierra de Peña de Francia and the Sierra de Gata, forming, especially in the district known as Las Hurdes, an extremely hilly and barren landscape.

The Southern Tableland

Region 2 (c-e)

The southern tableland of the Meseta extends for more than 150 miles from north to south, and some 300 miles from east to west.

Over so vast an area (almost as large as England) considerable differences in relief are to be expected, although the scenery is generally tabular or plateau-like in appearance. The tableland has an average elevation of 1,750 to 2,000 feet and slopes gently westwards into the undulating plateau of Spanish Extremadura and southern Portugal. The relief and scenic variations are largely based on differences in geological structure, the eastern half being floored almost entirely by Tertiary deposits, whereas the western half consists mainly of slates, granites, and crystalline rocks.

The north-eastern districts, where New Castile grades into the foothills of the Iberic mountains, are hilly and deeply furrowed by narrow valleys. The steep sides of these gorges outline numerous small plateaux (*páramos*), whose flat, limestone surfaces are usually almost barren and waterless. The clays exposed in the valley floors are, where wide enough, under cultivation.

By far the greater part of New Castile is occupied by La Mancha, a flat or slightly undulating plain, the largest and most monotonous expanse of level ground in the whole of the Peninsula. The clayey surface generally lies at about 2,200 feet, but rises to 2,600 feet in the east, where some limestone *páramos* occur. The plains are almost treeless and the vast, unenclosed steppes fade away into the distant horizon. North of the towns of Ciudad-Real and Daimiel the region becomes so flat that the drainage stands in reed-fringed pools and swamps. The river valleys are shallow, and in summer the minor streams dry up and the smaller pools evaporate into salt-encrusted hollows. Yet, in the slight undulations, the water-table is within a few yards of the surface and a shallow well usually yields an inexhaustible supply from an abundant underground reservoir.

West of a line from Toledo to Madrid the Meseta consists of old, often impermeable, rocks that have been buckled and worn into a series of east to west ribs and hollows. The northernmost area of higher land includes the Montes de Toledo, the Sierra de Guadalupe, and various other hill-blocks that terminate westwards in the Serra de S. Mamede in Alemtejo. This group of hills reaches a height of only 4,900 feet, but is rocky and clad with bushes and evergreen shrubs and almost devoid of settlements. The northern flanks of the Montes de Toledo and Sierra de Guadalupe, which descend fairly steeply to the depression drained by the middle Tagus, are covered by extensive deposits of sand and gravel that in La Jara favour a dense growth of bush and scrub. The Tagus flows in a deeply



19. *A typical landscape in New Castile*



20. *The Sierra Morena, west of Andújar, Province of Jaén, showing the Matorral*



21. *The Plateau of Soria*



22. *The escarpment of the tableland of La Madera at Uña, Province of Cuenca*

incised valley, the narrowness of which prevents it from being used by roads or railways.

The undulating tableland between the Montes de Toledo and the Sierra Morena forms the middle basin of the Guadiana river. The uplands, although floored by quartzites and granites, seldom rise much above 1,500 feet in Spain and 1,000 feet in Portugal. On the other hand, the Guadiana valley between the towns of Mérida and Badajoz opens out into a considerable lowland of younger rocks, barely 900 feet above sea-level. This river, like the Tagus, has eroded such a narrow, steep-sided valley that it is avoided by roads and railways.

In the south, the plateau of Spanish Extremadura and the high plain of La Mancha rise gradually to the Sierra Morena, which is only a little higher. In all, the mountain-block of the Morena stretches for 350 miles from the Sierra de Alcaraz south-west to Cape St. Vincent, yet throughout this distance it rarely exceeds 3,500 feet. Many minor sierras can be distinguished, such as the Sierras de Almadén and Madrona that run from north-west to south-east, and the Serra de Monchique (2,600 ft.), the main range of the Algarve mountains in Portugal. The relief of the Sierra Morena cannot, however, be judged solely from its lack of high ridges and elevated plateaux. On the south it rises fairly rapidly from the plain of Andalusia, and the fast streams which flow southwards to the Guadalquivir have cut deep gorges into its slopes. Consequently the surface of some parts of the Morena is much broken and rocky, although the prevailing note of the landscape is the dense thickets of evergreen bushes and shrubs. The geological structure is complex, as here the young rocks to the south were thrust against the harder rocks of the Meseta. One result was the formation of metals and minerals, which are now mined at Río Tinto (copper), Belmez (lead), Almadén (mercury), and Linares (silver, lead, copper), while small coal-fields also occur within or near to these districts. The manner in which many southward-flowing streams flow almost, or quite, across the Sierra Morena has assisted communications, and several railways cross the range. The chief of these—the Madrid-Manzanares-Córdoba line—mounts almost imperceptibly from La Mancha to the Puerto de Despeñaperros, where it follows the deep, rocky defile of a tributary of the Guadalquivir to cross the mountain range.

3. THE BARRIER RANGES OF THE SOUTH AND EAST

The Iberic Mountains

Region 3 (a)

The Iberic mountains stretch from Burgos south-eastwards to Valencia, a distance of nearly 300 miles. Throughout their whole length they present difficult country, about 60 miles broad, between the high, flat plains of the Castiles and the Ebro valley. They rise gradually from the western plains and fall abruptly in terraces to the Ebro trough, where they present an impressive and formidable barrier. The region may be divided into two natural areas separated by the valley of the Jalón river. The great mountain block to the north is grouped about the Sierra de la Demanda, Sierra Cebollera, and Sierra del Moncayo, which rise to over 7,000 feet and culminate at about 7,684 feet. The Demanda mountain group consists of slates, and the Cebollera group of softer sedimentary (cretaceous) strata, but both are equally high and mountainous. On the side of this main ridge is a series of lower ranges, at about 5,000 feet above sea-level, that form the foothills overlooking Old Castile. Throughout the northern part of the Iberic mountains the landscape is rounded or tabular, and, although the higher, heath-clad slopes are rocky and often precipitous, the predominating feature of the scenery is the wide, gently undulating tablelands lying between 3,500 and 5,000 feet, whose surfaces, denuded of tree-growth save for a few pines, are swept by strong, piercing winds. These bleak, inhospitable uplands occupy most of the province of Soria.

South of the Jalón valley the Iberic mountains are lower but markedly wider. The surface rocks, mainly sedimentary limestones and shales, have been eroded by streams into small plateaux (*páramos*). The flat-topped uplands are outlined by deep ravines whose steep walls reveal their limestone structure. The limestone cappings are often pitted with hollows and furrows, and occasionally, as in the Serranía de Cuenca and the Sierra de Gudar, assume wild, picturesque shapes. These dissected uplands lie mainly between 3,500 feet and 4,500 feet, and the higher sierras rise from 1,000 to 2,000 feet above them. The southern Iberic mountains are, however, divided into two zones by a depression drained southwards by the Jiloca river. The eastern zone stretches to the Ebro gorge near Tortosa and descends almost to the coast of Valencia. From its higher sierras (Gúdar and Javalambra 6,600 ft.), streams rush in deep, gorge-like

valleys to the Mediterranean. The western zone rises to 6,000 feet in the Montes Universales, whose pine-clad hollows are drained by the Júcar to the Mediterranean, and by the Tagus to the Atlantic. Here is the classic land of limestone *páramo*, abrupt *cuesta*, and narrow clay plain which merges through La Alcarria into the undulating expanses of La Mancha.

The Iberic mountains form, as already described, the great watershed of Spain, but the valleys are often so narrow and so frequently alined in a north to south direction that they hinder rather than assist communications. There are, however, two important natural route-ways in the region. The first, the valley of the Jalón, is used by the Madrid-Saragossa railway, the only direct east to west line of communication across the Iberic mountains. The second is the depression drained by the Jiloca that has encouraged the building of a road and a railway, which lead south from Calatayud to Teruel, and so to the coast of Valencia.

The Andalusian Mountains

Region 3 (b)

The Andalusian mountains extend for 360 miles north-eastwards from Cadiz to Cabo de la Náo, beyond which the system reappears in the Balearic Islands. The range is of great complexity, both structurally and topographically, and is divided into two parallel zones by a marked longitudinal depression (Fig. 7).

The southern section of the mountain system borders the Mediterranean coast from the village of Manilva, north of Gibraltar, to Cabo de Palos. It consists largely of slates and crystalline schists, that rise sharply from the seaboard, attaining 6,294 feet in the Sierra Bermeja, 6,822 feet in the Sierra de los Filabres, and 11,420 feet, the highest point in the Peninsula, in the Sierra Nevada. The range, however, is broken by north to south fractures into a number of high mountain-blocks. The fault depressions are occupied by rivers and by roads and railways that use these gaps to cross with comparative ease what would otherwise be an almost impassable barrier. Thus, the railway from Málaga to Córdoba traverses the whole mountain system in a fairly direct line, without making use of a major tunnel at the main watershed. Similar depressions allow Motril to be linked by rail with Granada, and Almería with Guádix.

The alinement of old, hard blocks described above is flanked on the north by a remarkable valley that separates it from the younger mountains overlooking the Guadalquivir lowlands. This depression

runs, with short interruptions, from the plain of Gibraltar to the high basins about Bobadilla and Granada, beyond which it reappears in the high plains near Guádix. The importance of the valley is shown by its numerous towns, and by the railway that follows it from Algeciras to Baza.

The young sedimentary rocks that form the northern zone of the Andalusian mountains seldom rise above 4,000 feet and very rarely to 5,000 feet. Owing to the large areas of limestone and clays, the region has been changed by the action of rivers into a land of abrupt escarpments and small flat-topped plateaux. Over large areas the scenery is rough and mountainous, while other districts are flatter and less dissected. The range stretches inland from the Strait of Gibraltar into the Sierra de Algibe (3,581 ft.), whence it continues through the picturesque scarp-land around Ronda into the wide plateau north of Granada. In the north-east the zone increases in width and height (La Sagra, 7,500 ft.) and forms several large sierras before merging into the Campo de Montiel, the high southern rim of the plain of La Mancha.

The diverse landscapes of the Andalusian mountains have two features in common: one is the deep, narrow gorges of the streams, many of which are waterless in the dry season; the other is the sparseness of vegetation. Only in the wetter south-west, near the Strait of Gibraltar, is the rainfall sufficient to support much tree-growth; elsewhere a thin covering of evergreen bush and esparto grass predominates on the arid slopes.

4. THE EBRO TROUGH

After crossing the eastern or central Pyrenees, the traveller finds himself shut off from the Meseta by the Ebro trough and the Iberic mountains. Indeed, the Ebro valley is a barrier to communications between Catalonia and Castile, and between the Pyrenees and the Meseta.

The trough is shaped like a large triangle that extends some 220 miles from east-south-east to west-north-west, and reaches a maximum width of 100 miles in its easternmost sector. The width, however, does not increase regularly, as the foothills of the Pyrenees and Iberic mountains restrict the valley near Tudela, almost enclosing an upper basin that lies between 1,000 feet and 1,300 feet above sea-level. The lower basin, which occupies four-fifths of the whole trough, has considerable areas between 600 and 1,000 feet but, on the other hand, rises to over 2,000 feet in a few upland blocks such as the Sierra

de Alcubierre. These so-called 'sierras' are merely the tabular portions of the plateau left upstanding when the action of rivers has eroded away the country about them.

The Ebro trough is a low plateau, floored by almost horizontal, sedimentary rocks which consist mainly of clays, marls, and sandstones. The soft, flat strata have been gullied by streams into low, flat-topped plateaux. The softer clays and marls are occasionally dissected into a maze of deep ravines and little tablelands, while the harder sandstones tend to form bigger plateaux or to stand as terraces. The constant repetition of these landforms gives a monotonous landscape in which the flat-topped uplands are always dominant. Streams flow in narrow, alluvial valleys, but the larger rivers have cut wide terraces in their banks. These terraces are extremely flat and are seen to perfection along the Gállego river near Saragossa, where their flat open surfaces are intensely cultivated (Photo. 23). The irrigated lowlands of the lower Segre, the Llanos de Urgel, are similar.

The Ebro basin is shut off from the Mediterranean by the Catalan mountains, which the river traverses in a deep gorge. Consequently the valley itself, although followed by a railway, is otherwise of little importance as a natural routeway.

A great part of the region suffers acutely from lack of drinking-water, as so many of the springs are either brackish or have a high mineral content. Both the upland areas, such as Los Monegros and the Sierra de Alcubierre, and the plains depend for their water-supply on the pools that collect upon the clays at the base of the sandstone slopes. Each settlement usually possesses two of these pools, the one for people and the other for stock, but in addition the householders carefully collect and store rain-water in large earthenware pitchers. East of Tudela the large tableland of Las Bardenas is practically uninhabited, because a supply of water is lacking.

THE PORTUGUESE COASTAL LANDS

Region 5 (a)

The coastal lands of Portugal stretch southwards from the Minho valley to Cape St. Vincent, and thence eastwards to the mouth of the Guadiana, the distances being some 340 and 85 miles respectively. North of Oporto the lowland plain on the granite coastline is narrow and often interrupted by mountains. South of the Douro it is marked off from the old rocks of the Meseta by a great fault-line that runs from near Oporto to the neighbourhood of Coimbra, and so to the

Tagus about Abrantes. The younger rocks, west of this fault-line, give rise to a landscape of flat, wide valleys, alternating with narrow hill ranges. The coastal plain proper (below 300 ft.) widens gradually south of Oporto until it is nearly 30 miles wide at Coimbra. The riverine districts of this area are flat and swampy, especially near the mouths of the Vouga and Mondego rivers, where a considerable acreage is under rice. The lagoons near Aveiro are encircled on the landward side by polders (reclaimed lands), crossed by a network of narrow canals. The flat or undulating sandy strips near the coast carry fine forests of pine, the most continuous high-forest in all Iberia. Away from the sandy stretches and the flat salt-lagoons of the coast, the lowland is undulating and occasionally interrupted by a line of small hills, of which perhaps the most notable is the Jurassic limestone ridge just north of the Mondego river (max. height 680 ft.) that terminates in Cabo Mondego. These low hills, which attract settlement, can be contrasted with the lower, floodable lands which are thinly peopled and avoided by routes (Fig. 6).

South of Coimbra the coastal plain becomes narrower and more undulating, and is largely replaced by the limestone hills of the Tagus peninsula. The lowlands seldom exceed 10 miles in width, and at many points the hills run almost to the sea, dividing the plain into a series of small basins. The little peninsula of Peniche is of limestone, while the abrupt sierra of Cintra (1,720 ft.) is of granite; further details of these coastal hills are given on page 67; here it must suffice to recall the north to south gaps that almost unite the Atlantic coastal plain with the alluvial lands of the Tagus. The gap (below 650 ft. in height) between Torres Vedras and Alhandra almost isolates the southern extremity of the hills, forming a small mountain-block whose steep northern slope was the famous natural line of defence in the Peninsular War.

South of the Tagus, the Portuguese lowlands form several wide, flat plains, enclosed, for the most part, by gently undulating peneplanes. The basin about the lower Tagus stretches, below 600 feet, some 70 miles inland from Lisbon to Aviz, but narrows to 25 miles between the Évora uplands and the Setúbal peninsula. The nucleus of this basin is the rich zone of fine alluvium, from 2 to 15 miles wide, stretching 50 miles from Barquinha to the sea. These wide flat riverine lands lie mainly below 100 feet, while most of the surrounding plain does not exceed 300 feet. The valley of the flood-plain of the Tagus has a gradual slope on the south or left bank, but rises fairly steeply on the north.



23. *River terrace of the Gállego near Saragossa*



24. *Pool used for drinking-water, near Almolda, Province of Huesca*



25. *A branch of the Guadalquivir in Las Marismas near Los Palacios, Province of Seville*



26. *Marshes SW. of Seville*

A slight fold of limestone, represented by the picturesque shrub-covered Serra da Arrábida (max. c. 804 ft.), marks the transition to the basin of the Sado, which has a similar topography to that of the Tagus plain. The flat Sado lowlands are almost encircled by low hills (700 ft. to 1,000 ft.). On the west the Serra de Grândola (max. c. 1,000 ft.) is at most hilly, while in the east a lower, undulating hill-land forms the watershed between the Sado and Guadiana. As the sandy, clayey soils of the Sado basin rest on impermeable schists, the lowest parts of the region are badly drained. Everywhere, as in the Tagus lowlands, the cork-oak flourishes (Photos. 59 and 60).

The Sado enters the sea through a vast estuary which is of little economic importance except for fishing. The coastal plain to the south of this estuary is fringed by a low sandy littoral that is broken by the volcanic outcrop at Cabo de Sinés. South of Cabo de Sinés the coastal plain is usually less than 5 miles wide, but is often edged by low cliffs where the old rocks of Alemtejo reach the sea.

In the extreme south of Portugal the lowlands are restricted by the Algarve mountains, a mountain mass, of carboniferous slates, that is the westward structural termination of the Sierra Morena. The main mass comprises two hill-groups, the Monchique mountains to the west and the Caldeirão mountains to the east. Between them is the low gap followed by the railway which links the south coast with Lisbon. These uplands are covered to their summits with tree-growth and dense shrub (*matorral*). On the south they drop steeply through limestone hills to a sandy coastal strip. The slope inland is occasionally as much as 1,700 feet in 5 miles, while south-east of Villa do Bispo a volcanic cone stands up to 300 feet near the seaboard.

The narrow southern coastal plain of Algarve communicates by the Guadiana valley with the basin east of the town of Beja. This undulating plain, with its abundance of oaks and fruit and cereal cultivation, is very typical of the somewhat monotonous lowlands of southern Portugal.

6. THE PLAIN OF ANDALUSIA¹

In the whole of Spain the only lowland extensive enough to permit easy access inland for some distance from the sea is the plain of Andalusia (Fig. 7). Shaped like a triangle with its base on the Gulf of Cádiz, it stretches for over 200 miles towards the north-east, narrowing from

¹ Region 6 is treated in this chapter after the coastal lands of Portugal (5a) and before the coastal lands of Mediterranean Spain (5b), as this is the more logical order.

about 100 miles at its mouth to 50 miles at Seville, 40 at Córdoba, and less than 30 miles near Andújar. It was depressed by fracturing or faulting and has been subsequently covered by Tertiary and later deposits. The soils are mainly of clay, but limestone outcrops in a few districts within the plain itself, in the hillocks just west of Seville near Carmona, and towards the foothills of the neighbouring mountains. The whole is drained by the Guadalquivir and its tributaries, which have modelled the soft rocks into gentle undulations.

The basin, although essentially a unit, may be divided into a lower and an upper section. The lower part, from Seville to the sea, is almost entirely below 300 feet, and forms, in its central areas, a plain so flat that the river divides into a number of branches. The tide reaches Seville, which, although 50 miles from the sea, is scarcely 50 feet above it. The marshy lands below the city, known as *Las Marismas*, are crossed by meandering streams and terminate seawards in low cliffs, against which ocean currents have piled up sand-dunes (Photos. 25 and 26).

The inner lowland, upstream from Seville, is gently undulating, but the flat riverine plain continues inland as far as Córdoba, which at 125 miles from the Atlantic has an altitude only just exceeding 300 feet. The greater part of this inner lowland, however, lies above 600 feet, and actually rises to 1,600 feet at its junction with the southern Meseta and the Andalusian mountains. The Guadalquivir flows at the base of the steep slope of the Sierra Morena, and consequently the left bank tributaries cross almost the whole width of the Andalusian valley and cut the gently rolling surface into alternate valleys and flat-topped uplands. This is of greatest importance in the east where the plain is highest; here, the river valleys are incised so deeply into the horizontal clays that the plateaux between them, although of no great height, appear like mountains when viewed from the valley bottoms. These higher tablelands, near Linares, mark the transition into the arid mountains of interior Spain. Throughout the inner lowland, the valley-bottoms are richly cultivated, while the flat surfaces of the low plateaux are more bare, especially after the wheat harvest; the peripheral hill-slopes are mainly under fruit or natural scrub.

Four flat terraces can often be recognized along the river Guadalquivir, at an average height of about 40, 100, 200, and 325 feet above its present course. These shallow terraces have been cut into low, wide platforms by the tributaries, thereby increasing the undulating nature of the inner lowland. It will be noticed, however, that in its

lower course the Guadalquivir flows more or less through the centre of the wide basin, and here the terraces are not developed.

As a routeway the plain of Andalusia is of considerable importance, being followed by the main routes from Cádiz and from Seville to Madrid. The Despeñaperros gap across the Sierra Morena provides the natural exit for the railways leading to Madrid, not only from the plain of Andalusia, but from all the mountains and coastal plains to the south of it.

THE COASTAL LANDS OF MEDITERRANEAN SPAIN

The Southern Coastal Strip

Region 5 (b)

The coastal fringe of the Andalusian mountains is narrow and discontinuous. From Tarifa to Estepona Secondary and Tertiary rocks come to the seaboard, the rock of Gibraltar, for example, being a limestone block linked by a sandy plain to the mainland. This coast consists of alternate rocky, cliffed headlands, like those near Tarifa, and low, sandy beaches, as north of La Línea. From Estepona east to Cabo de Gata, the shore is bordered by high mountains, mainly of slate (Cambrian) and crystalline rocks that stand up steeply from the sea for long distances, as from Marbella to Málaga, though in some districts they are separated from it by lowland basins. These vary considerably in size, and are floored by Tertiary deposits, or by more recent alluviums which are very fertile when irrigated. In general, they occur where rivers and ocean currents have built up deltas that have subsequently been raised above sea-level; the largest are near the towns of Málaga, Vélez-Málaga, Motril, Adra, and Almería (Fig. 7). The first is the greatest and is below 600 feet for some 16 miles inland along the Guadalhorce valley; its rich flat surface, criss-crossed with irrigation channels, contrasts with the low country north of Gibraltar. The one is a rich *vega*, the other a hilly region, whose slight eminences are often clothed with matorral and patches of cork-oak. Usually, however, the littoral fringe is from $\frac{3}{4}$ mile to $1\frac{1}{2}$ miles wide, often little more than a raised sea-beach. This narrow platform is used by the main coastal road but, except for a few miles near Málaga, is not followed by a railway. It is furrowed by many streams, whose beds, although usually dry, hinder communications. Very typical is the coastal road leading east from Málaga to Motril, which in the first 15 miles crosses at least twenty-five *arroyos*

or streams that are dry most of the year. Nor in this distance does the route depart more than a few hundred yards from the sea.

Communications inland are of much greater importance than the coastal routes in the region. By following the fault depressions, or valleys that tend to divide the Andalusian mountains into separate blocks, railways leading from Algeciras, Málaga, and Almería cross the mountain range.

The Levantine Lowlands

Region 5 (c)

From Cabo de Gata northwards to the Ebro delta the coastal lowlands are usually wider and more continuous. They are backed by lower mountains than is the southern coastal strip. The plains, however, are still floored mainly by clayey-limestone alluvium, with more recent muds and sands along the river valleys and within the coastal lagoons. Indeed, as far north as Cabo de Palos the mountains above the littoral are still mostly composed of ancient slates and crystalline rocks. Along this coast the lowlands are narrow; near Cuevas de Vera, where they are broadest, they are barely 10 miles wide. At Cabo de Gata, Pt. Peñón, and near Cartagena the rugged promontories are formed by volcanic rocks, whose cone-like shape is evident in the hills surrounding Cartagena harbour (Fig. 8).

The lagoons and flat plains of the coast between Cabo de Palos and Cabo de la Náo, which extend as far north as Villajoyosa, contrast with the high coast near Cartagena. The largest lagoons, the Mar Menor and those near Torrevieja, are limited seawards by a narrow pine-clad strip of sand-dunes, and landwards slope almost imperceptibly to a flat plain, whose soils are often ill drained and impregnated with salt. They are becoming gradually silted up, and near Torrevieja, where the process is nearly complete, are numerous shallow pits for the extraction of salt from sea-water. The most extensive lowland of this coast reaches inland to the rich *huertas* surrounding Murcia, where the river Segura provides not only water for irrigation but also a fairly direct routeway to the southern Meseta and to Madrid. This important valley is partly separated from the lowlands about Cartagena by a range of hills over 1,000 feet high (Photo. 61).

From Villajoyosa to Denia the Andalusian mountains run out to the sea and form a steep coast, with precipices occasionally 300 feet high. The ends of the various sierras are seen in the numerous capes

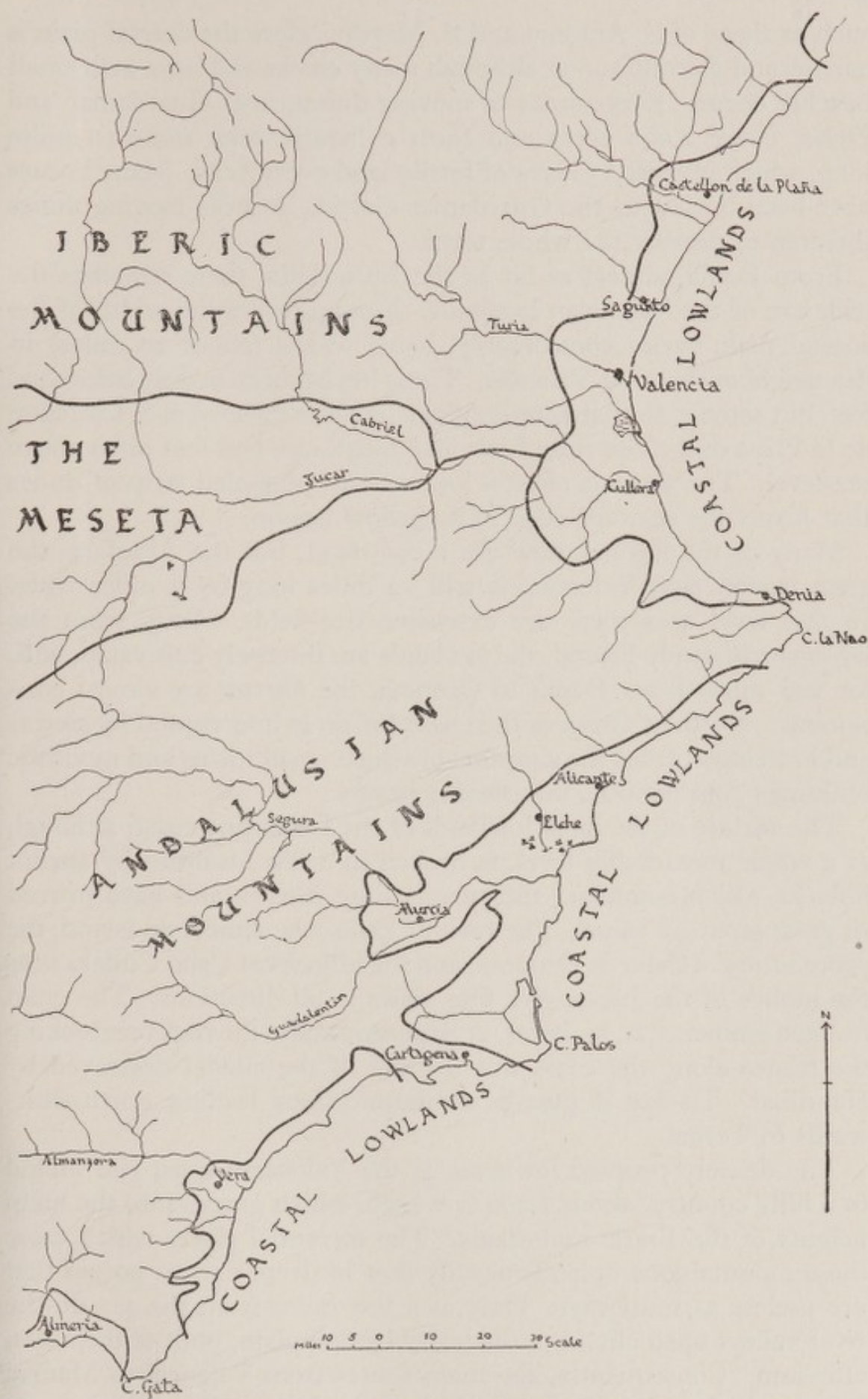


FIG. 8. THE PHYSICAL DIVISIONS OF EASTERN SPAIN

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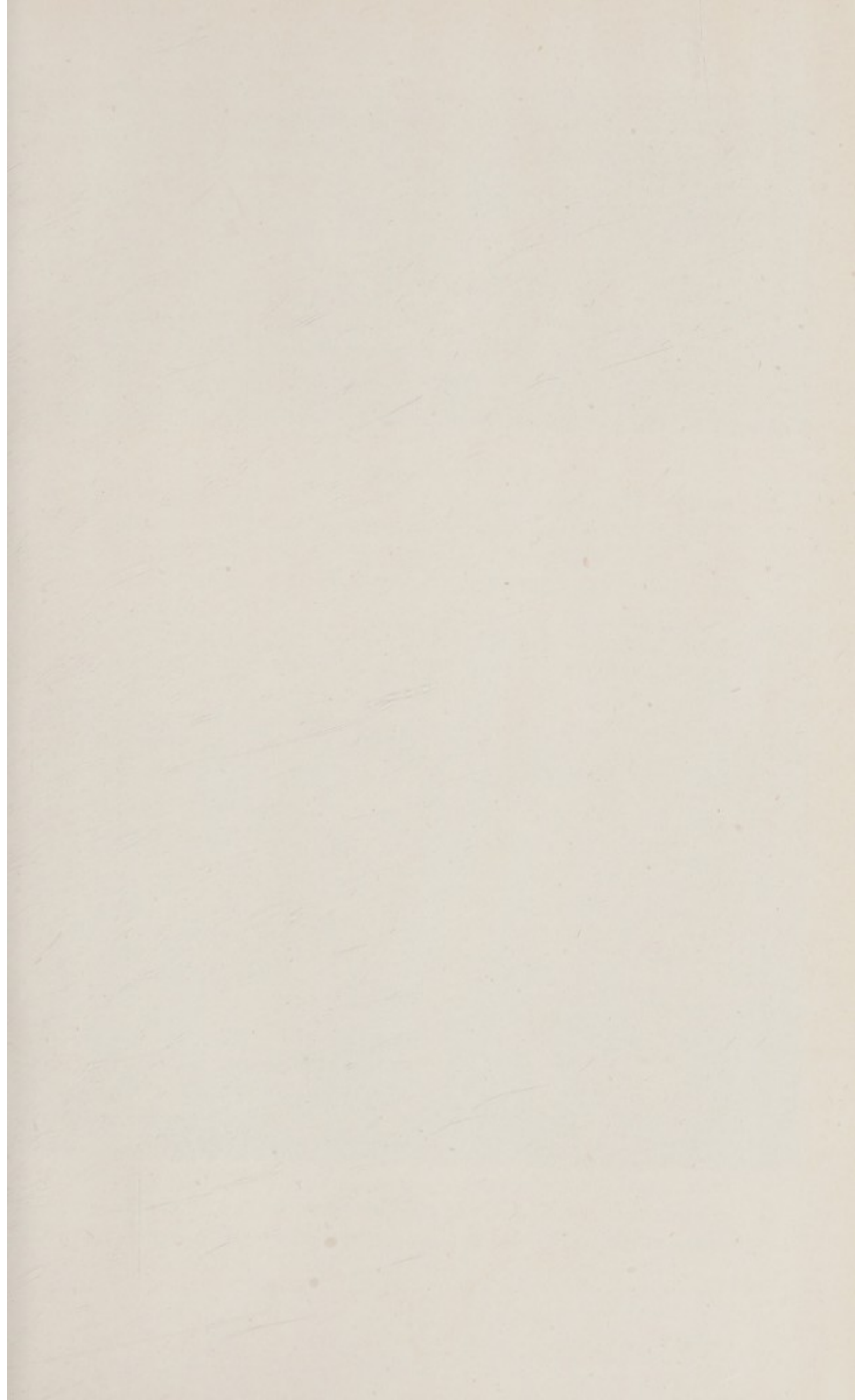
such as those of S. Antonio and S. Martín. Here the coastal plain is narrow and discontinuous, although many creeks and bays with small beaches occur. Large areas of moving dunes, near Guardamar and Elche, cover 2,000 acres and form a littoral zone some 10 miles long, which invades 15 acres of fertile land every year. Many houses have been buried in the Guardamar district, and the moving dunes threaten to destroy the whole town.

From Denia, almost as far as the Ebro delta, there stretches the wide arc of the Valencian lowlands. For 150 miles the width of the coastal plain varies considerably, being widest (about 20 miles) in the neighbourhood of Valencia. These lowlands lie mainly below 300 feet, but some of the flat, interior plains, such as those west of Castellón de la Plana and those near Liria and Játiva, are 600 feet or so above sea-level. The shore is often a low, narrow pine-clad strip of dunes that forms the seaward edge of a shallow lagoon.

Many of the lagoons now are marsh-land, but the Albufera, the great lagoon near Valencia, is still 12 miles long by 3 miles wide. In this level area there are extensive rice-fields. Away from the lagoons and sandy littoral, the lowlands are intensely cultivated, and, for 100 miles from Denia to Oropesa, the *huertas* are almost continuous. North of Oropesa the coastal plain is interrupted by sierras and low ridges, from the summits of which small towns and monastic buildings dominate the intervening basins.

The surface of the main lowlands of the Levantine coast, although as a whole remarkably level, is broken in a few localities by abrupt hillocks which command the surrounding district and have proved of great strategic value. The rock of Peñíscola, almost an island, the promontory of Cabo de Oropesa, and the hillocks at Cabo Cullera near the mouth of the Júcar, give fine views in all directions. The chief isolated eminence is, however, at Sagunto, where the rock overlooking the routes along the coast was the site of the citadel destroyed by Hannibal. To-day it guards communications leading north-westwards to Teruel.

The densely peopled lowlands of the Valencian coast rise inland to a hilly country, about 1,500 feet high, which grades into the main heights of the Iberic mountains. The torrential rivers which cross these mountainous uplands usually flow in deep, narrow gorges that are useless as routeways. Only at a few miles from the sea do the river valleys open out on to the broad littoral plain, built of their own alluvium. Consequently, the main routes from Valencia to Madrid keep to the less dissected uplands, and the Júcar valley, which topo-





27. *The Plain of Vich*



28. *The coast at Tossa*

graphically links New Castile with the Mediterranean, is of no value as a routeway.

In the Mediterranean coastlands of Spain, water is particularly vital to agriculture, and the problem of supply is increased by the length of the dry season. On the alluvial terrain of the coast, artesian wells and rising springs are common, there being more than 1,000 artesian wells in the province of Valencia alone. All possible sources of supply are fully exploited. Thus, at the small but fertile *vega* at Adra in the province of Almería, water is obtained from the river in springtime, either by pumping from underground, or from rising springs, or by tapping subterranean sources in the limestone hills at the inner edge of the lowland.

7. CATALONIA

In the Catalan provinces of Tarragona, Barcelona, and Gerona, relief is formed by two mountain ridges, separated by a lowland or depression, both parallel with the coastline. The coastal ridge being shorter than the inland one, the depression runs out to sea at each end of this shorter sierra (Fig. 9).

The coastal sierra begins in the limestone mountains near Villanueva where, although not above 2,000 feet, it gives rise to high, precipitous cliffs whose headlands occasionally enclose a flat sandy beach, as at Sitges where it is 2 miles long. Near Gava the calcareous rocks are replaced by granites and schists, which compose the coastal sierra north of the river Ter. This coast, from near Barcelona north-east to Blanes, is made up of a fairly broad ribbon of sandy alluvial deposits that widens opposite the mouths of the rivers. The deltaic plains of the Llobregat, just south of Barcelona, are from 5 to 10 miles wide, but the city has spread inland across the drier alluvium north of the delta to the steep, scarp face of the coastal ridge. Here the mountain of Tibidabo (1,745 ft.) overlooks Barcelona and gives views stretching away to the crests of the eastern Pyrenees, to the summits of the interior ridge, and, in clear weather, to the peaks of Majorca. The southern suburbs of Barcelona reach the flanks of an isolated hill, Montjuich (754 ft.), that rises abruptly from the coastal plain. Such hills occasionally appear above the flat sandy littoral in the coast as far as Blanes. North of Blanes granite enters more into the composition of the rocks and the coastal ridge has been fractured into several mountain-blocks. The Montes Gavarras, south-east of Gerona, have rounded domes typical of granite scenery, but where the mountains run out to the sea the waves have worn them into steep cliffs, rocky

promontories, islets, and stacks to form the *Costa Brava*. The headlands occasionally shelter a bay with a narrow, sandy beach, as at Tossa, and the landscape, but for the cork-oaks and aloes and blue skies, resembles that of Cornwall. This fretted coastline passes into the flat, swampy littoral of the Golfo de Rosas, beyond which another

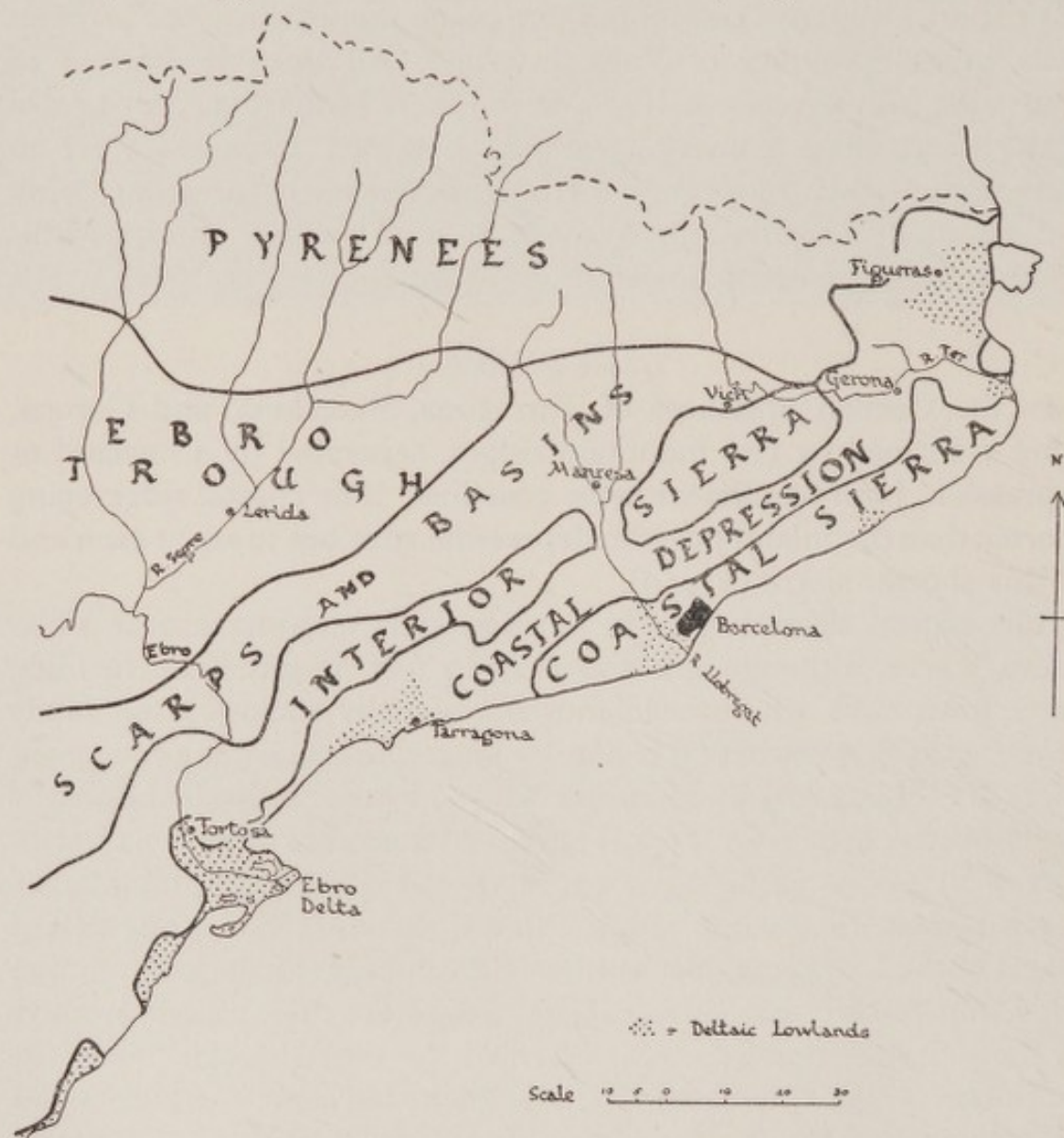


FIG. 9. THE PHYSICAL DIVISIONS OF CATALONIA

This diagrammatic map should be used with the folded map at the end of the volume.

outcrop of ancient schists causes the wild, majestic cliffs about Cabo de Creus.

The longitudinal depression behind this coastal ridge begins southwards in the Campo de Tarragona, a gently undulating plain, at most 13 miles wide, whose alluvial soils are occasionally interrupted by a low limestone hillock. From Tarragona it continues north-east as a valley of very uneven width, through the wine-land of the Panades,

west of the Llobregat. The long corridor of rolling hill-country can be traced to the small basin south of Gerona where the granitic soils hold up surface-water to form a small lake. The depression then forms the extensive lowlands of Ampurdán, a basin about 17 miles wide floored by silt from the rivers Ter, Fluviá, and Muga. Sand-dunes, and swamps in the north, fringe the coast except at the limestone block of Montgrí, which was formerly an island. Inland 'El Ampurdán' is an alternation of richly cultivated alluvial plains and low tertiary hillocks, covered with olives, carobs, and vines.

Facing this depression and forming its western or landward edge is a line of higher, more continuous mountains. In the south this interior ridge, composed mainly of Jurassic limestone (4,570 ft.), is crossed by the deep narrow gorge of the Ebro, debouching on to the vast rice-fields and flood-lands of its delta. North-east from Tortosa, the inner sierra is strongly developed where granite blocks appear above the sedimentary strata. This feature is well seen at Montbrío, Priorato, and above all in the north at Montseny, which exceeds 5,000 feet. The softer strata often form scarped lowlands. This well-marked ridge of old rocks is joined on its western side to a zone of scarps and basins, developed mainly on Tertiary material (Fig. 9). These young rocks floor the basins about Igualada, Manresa, and Vich, but they have also been raised into highlands and eroded into escarpments. Steep scarp ridges overlook the plain of Vich in the north and the lowlands near Reus in the south. More remarkable, however, are the fantastic crags at Montsant and Montserrat; at Montsant (3,500 ft.) some of the valleys have precipitous sides 400 feet sheer above the stream. At Montserrat (4,072 ft.) an isolated ridge of reddish-grey sandstones and conglomerates has been eroded into a chaotic mass of barren pinnacles, detached chimneys, and rocky buttresses.

This hilly land and the interior ridge terminate northwards, beyond Montseny, in the volcanic region of Olot, where lava fields and conical peaks bear witness to past vulcanism. Of the inland areas west of coastal Catalonia it is sufficient to say that the flat-topped sandstone uplands, the steep-sided labyrinth of river gorges, and the aridity of the soils all denote the transition into the Ebro trough (*see pp. 34-5*).

The Catalan coastlands control the east coast routes from France into Spain, and from the earliest times the longitudinal coastal depression has been an important routeway. This great gap is guarded in the north by Gerona, and in the south by Tarragona, the capital of Roman Spain. The first grew up on a high, steep bluff

above the river Ter, the second was placed on and around an isolated limestone hill, 260 feet high, and to-day the cathedrals of both towns crown these eminences and give distant views of the surrounding country. The main coastal routes from France to Barcelona use this depression (Fig. 9). The communications of Catalonia are further assisted by the fact that both the main mountain ridges are cut transversely by various river valleys, notably by those of the Ter, the Llobregat, and the Ebro. Consequently, from Barcelona, routes follow the Llobregat valley to Manresa (for Lérida), and the Congosto valley northwards to Vich, and so to Ax-les-Thermes in France.

8. THE BALEARIC ISLANDS

The Andalusian mountains that end on the mainland at Cabo de la Náo continue north-eastwards for a distance of 250 miles as a submarine sill on which the Balearic Islands are placed. Sixteen of the islands which emerge from the sill are inhabited, but there are many more rocky islets, some of which are not even named. A submarine channel, about 50 miles wide and over 250 fathoms deep, separates Iviza from Majorca and divides the Balearics into a western and an eastern group (Fig. 10).

The western group, which is about 57 miles from the mainland, includes Iviza, Formentera, and four small inhabited islets. Iviza (228 square miles) is composed of Secondary limestones which have been folded and eroded into very hilly country. Numerous small hills rise to between 700 and 1,000 feet, and culminate in Monte de Atalayasa (1,558 ft.) and Puig Furnas (1,337 ft.). The lower hill slopes are well wooded with almond, carob, and fig, and the higher with forests of pine. The coastline, especially in the north, is indented and usually cliffed; there is, however, a sandy beach south of the town of Iviza.

Formentera (37 square miles) is due south of Iviza and almost joined to it by a line of low islets. The island is floored by Tertiary deposits which form a plain that rises in the south-east to the pine-clad Monte de la Mola (628 ft.) and in the south-west to Puig Guillén (349 ft.). These southern hills expose the bare rock in their steep and often inaccessible cliffs, but the northern plains have low sand-beaches along the shore.

The eastern group of the Balearics is by far the more important as it includes Majorca (1,325 sq. m.) and Minorca (293 sq. m.), as well as Cabrera and seven other inhabited islets. Majorca, 62 miles from

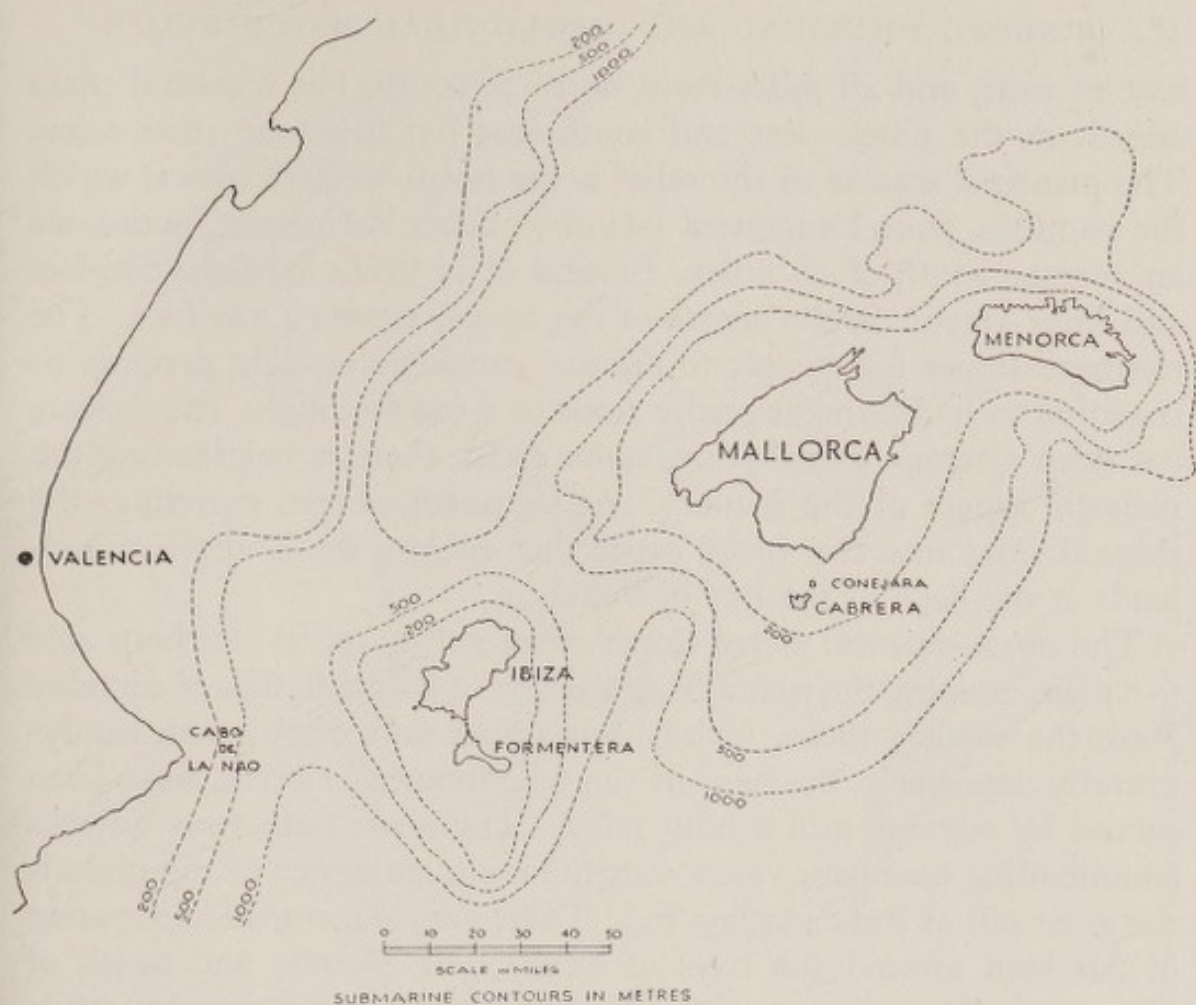


FIG. 10. THE BALEARIC ISLANDS

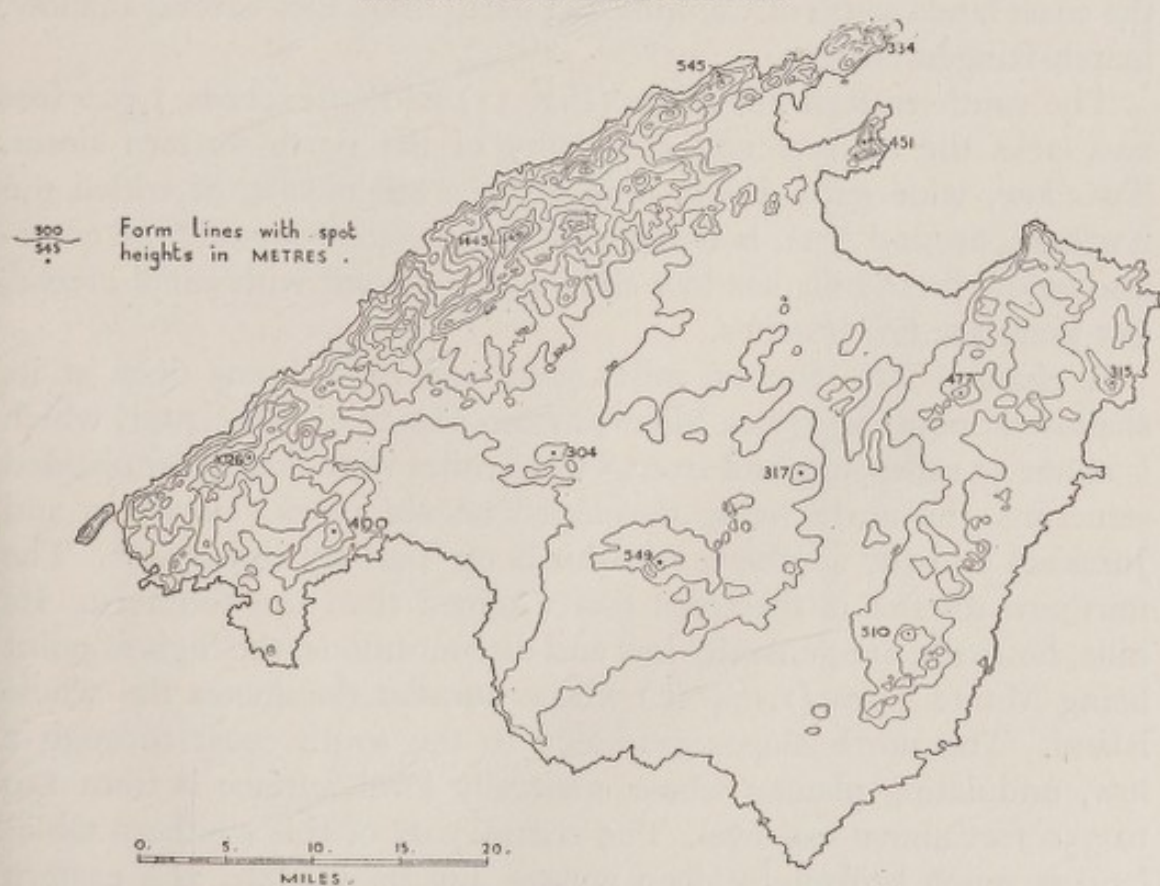


FIG. 11. THE RELIEF OF MAJORCA (MALLORCA) (after Gilbert)

east to west, and 48 miles from north to south, has a central plain edged on the north-west and south-east by limestone mountains. The principal feature of the relief is the north-western sierra, which for 50 miles, from Dragonera Island to Cabo Formentor, maintains an average width of 10 miles. Several of its peaks exceed 4,000 feet and Puig Mayor, in the centre of the range, attains 4,741 feet. The northern slopes fall steeply to the sea, causing a straight precipitous coastline with cliffs occasionally 1,000 to 1,500 feet high. Rivers have cut deep canyons into the limestone rocks, thereby heightening the majestic aspect of the scenery. At its north-eastern extremity the ridge divides into two rocky capes that enclose the ill-drained lowlands at the head of the Bay of Pollensa.

The north-western sierra slopes more gently on its southern side to a plain crossing the island from the Bay of Palma to that of Alcudia. Here the surface rocks, mainly limestones and marls, with sandy-gravelly deposits at the base of the neighbouring sierras, have been carved by streams into a hilly relief. There are numerous hillocks commanding extensive views, but the main eminence of the plain is the great hill of Randa (1,600 ft.). There are, too, considerable areas of flat land around the bays of Palma and Alcudia and south of Campos de Puerto; parts of the Alcudian lowlands are marshy, while the coast lands south of Campos de Puerto drain into several shallow, marsh-fringed lagoons.

The south-eastern hill-range (Fig. 11) seldom exceeds 1,500 feet and lacks the majesty and continuity of the north-western sierra. Two low, wide gaps divide it into three hill-blocks, of which the northern, around Artá, is famous for its limestone caves. The coastline below these hills has low cliffs and is fretted with small creeks, but there are few beaches.

A channel less than 25 miles wide and 50 fathoms deep at its shallowest point separates Majorca from Minorca. The latter, which is about 35 miles long and from 8 to 12 miles wide, has a complicated structure, the north being developed on old rocks (Devonian and Jurassic) and the southern two-thirds on Tertiary limestones. The northern district is therefore more rugged than the southern. Its hills, however, are generally low and discontinuous, the highest point being Monte Toro (1,174 ft.) whose summit dominates the whole island. The north slopes gradually to the south coast through a low, undulating plateau whose generally level surface is from 150 to 350 feet above sea-level. The central part of this southern tableland is much broken by deep gorges, but its western and eastern

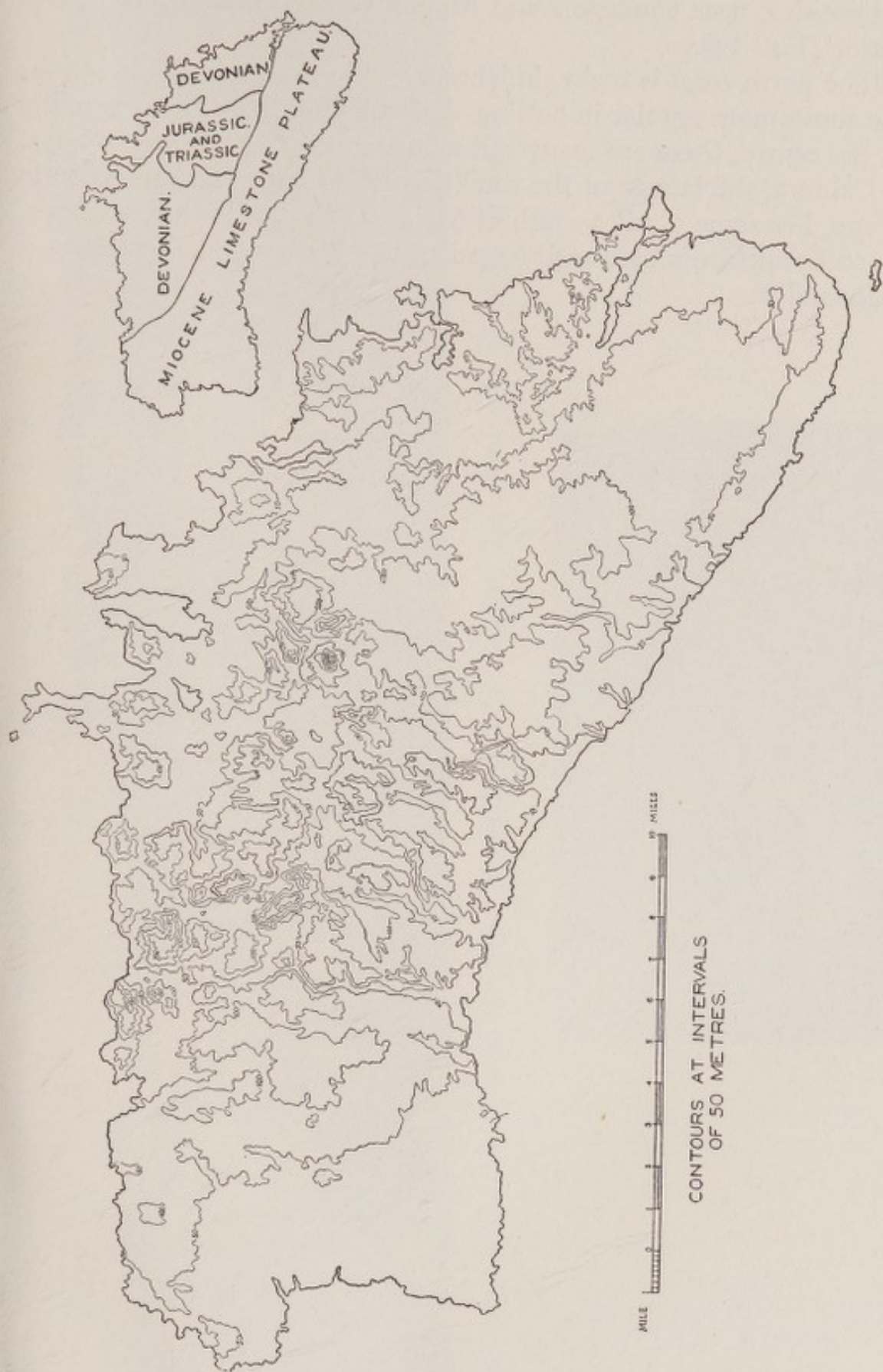


FIG. 12. THE RELIEF AND GEOLOGY OF MINORCA (MENORCA) (after Gilbert)

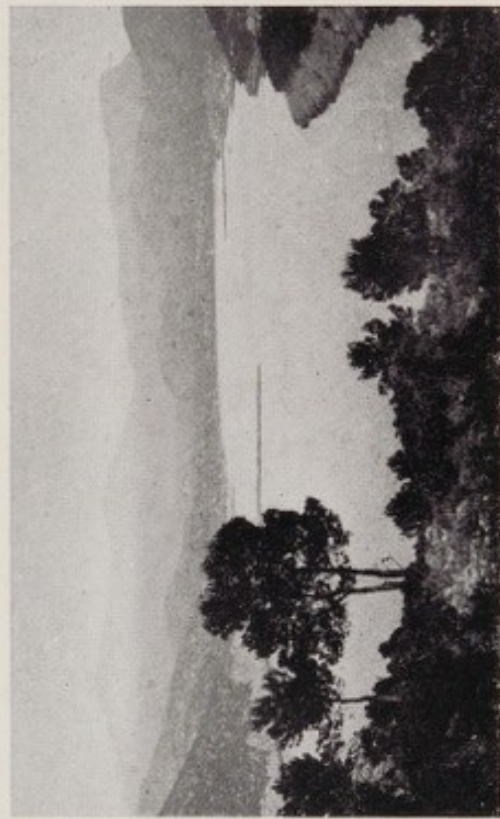
extremities, near Ciudadela and Mahón respectively, are lower and flatter (Fig. 12).

The north coast is rocky, indented, and in parts edged with cliffs; the south more regular in outline, and although there are some cliffs in the centre, there are many quiet creeks and small sheltered bays.

Cabrera, the largest of the satellite islands of the eastern Balearic group, lies some 7 miles south of Majorca. Except for a few woods, its rocky surface is bare and rugged and its high, steep coasts make it inaccessible.



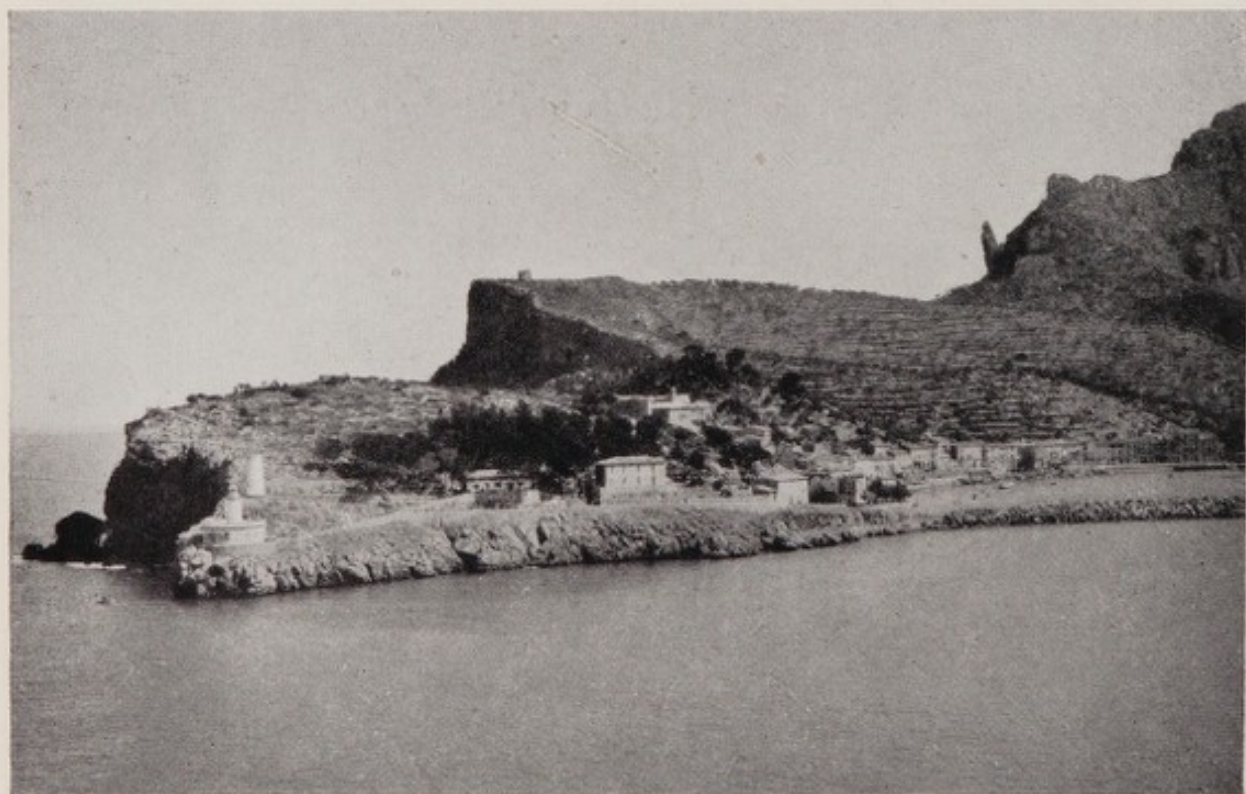
29. Entrance to Puerto de Andraitx from Cabo Mola in SW. Majorca. The island of Dragonera is seen on the left



30. Puerto de Andraitx



31. *The north-west coast of Majorca*



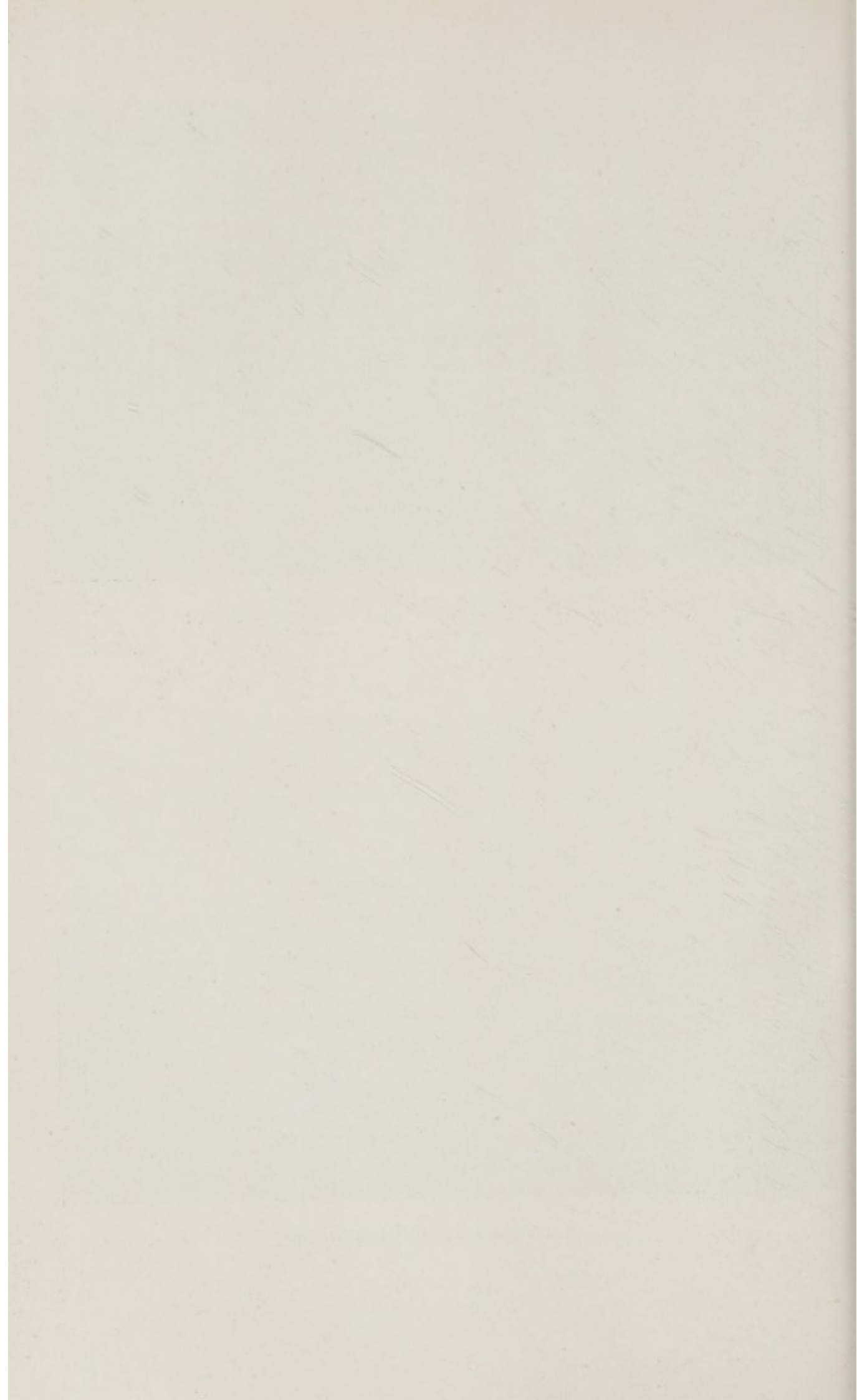
32. *Entrance to the Port of Soller, Majorca*



33. *The limestone plateau east of Ciutadella, Minorca*



34. *Monte Toro, Minorca*



CHAPTER III

THE COASTS OF THE IBERIAN PENINSULA

THE coastline of the Iberian Peninsula, 2,562 miles long, is divided between Spain, with nearly 2,000 miles, and Portugal, with over 500 miles. At a rough estimate, some two-fifths of the total coastline is bordered by the Mediterranean Sea, and the remainder by the Atlantic Ocean. It is important, however, to notice that the Atlantic coastline of Spain is almost twice as long as that of Portugal. In Spain the influence of the Atlantic has been dominant since the sixteenth century; in Portugal the Atlantic coast has always been the *only* outlook. Yet Spain, except in the north-west, is continental rather than oceanic in character, whereas Portugal is the reverse. This is reflected in the fact that for each mile of coastline, Spain contains 100 square miles of territory, and Portugal only 60.

The coasts of the Peninsula as a whole are relatively straight and inhospitable. On the Mediterranean the rivers have deltas at their mouths; on the Atlantic the river estuaries are small except in central Portugal and Galicia. The coast, except at the Tagus and Guadalquivir, is bordered by a narrow plain backed by mountains. Access to the interior is everywhere difficult.

In the following account the chief features of the accessible coastline are described in some detail, the more inaccessible parts being only briefly mentioned.

The Cantabrian Coast

The Cantabrian coastline stretches from the French frontier 450 miles westwards to the neighbourhood of Ribadéo, whence the character of the shore-line changes. This coast is steep and exposed to a tempestuous sea, which, north-west of Bilbao, deepens to 1,000 fathoms within 20 miles of the land. The inlets are small and, as they face the prevailing wind and lack ramifications, they are seldom well sheltered. The shores are usually steep, the cliffs reaching in places a height of 300 feet. Inland, the Cantabrian mountains rise to between 5,000 and 7,000 feet within 15 to 20 miles of the sea. The few ports, however, are important because both iron ore and coal are mined in their hinterland.

West of the French boundary the first sheltered inlet is Higer Road which has a beach 2 miles long along its southern side, close

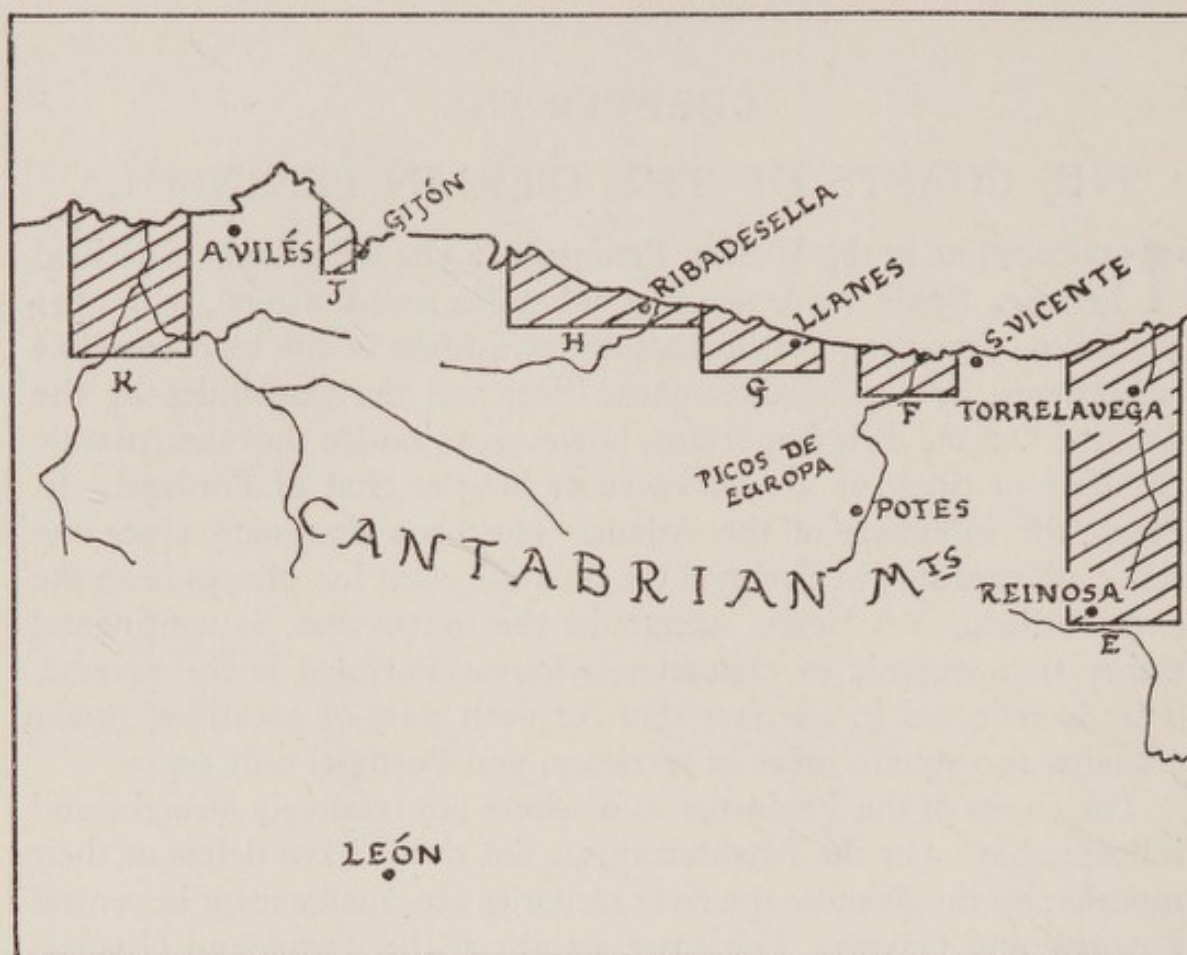


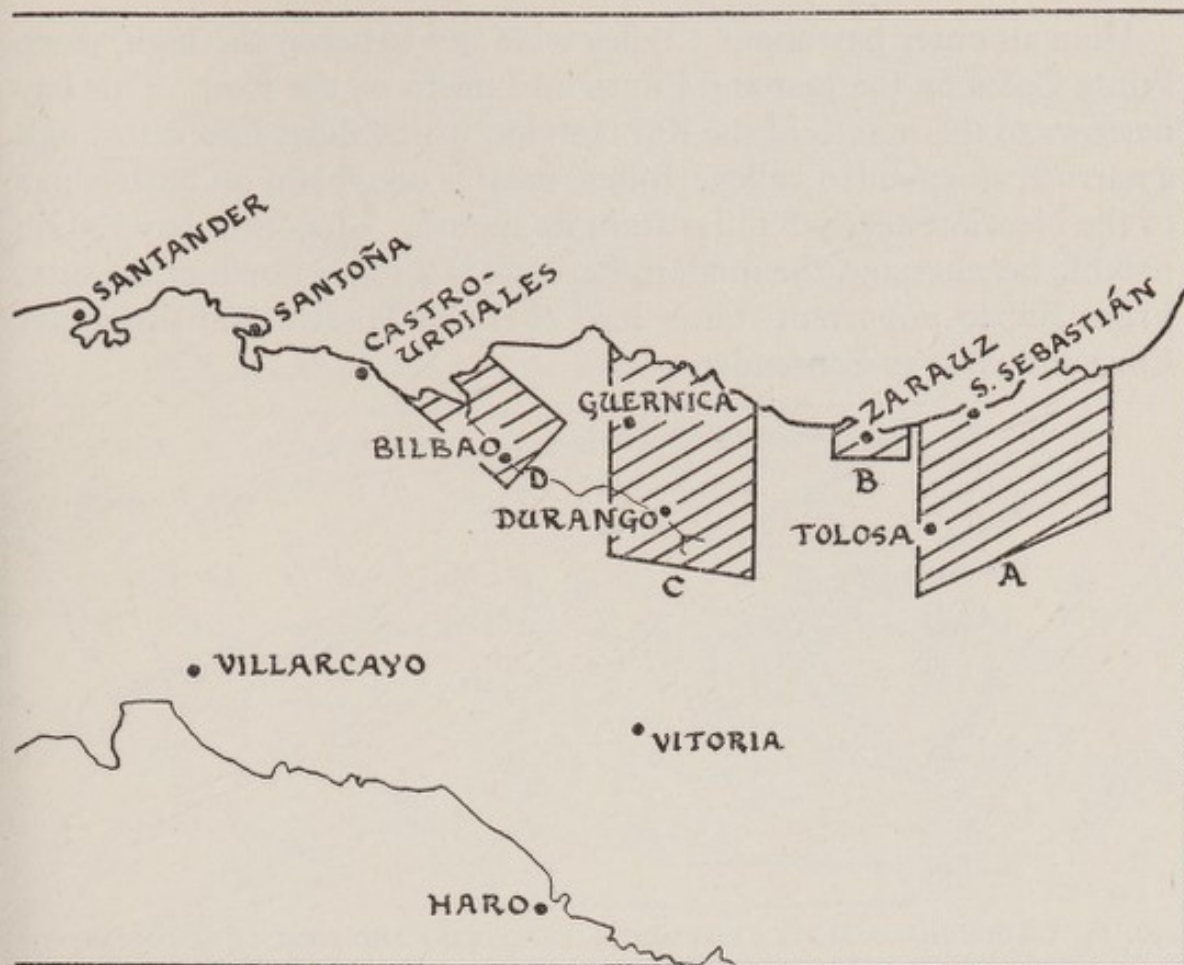
FIG. 13. INDEX MAP

The account of the Cantabrian coast is illustrated by a series of 10 block-diagrams, by letters, and the area covered by each is shown

to the main routes from San Sebastián to Irún. The Bidassoa valley opens south-east of Higer Road and is followed by a difficult route to Pamplona. Southwards, however, the easternmost ridges of the Pyrenees are over 3,000 feet within 15 miles of the shore.

From Cabo de Higuer west to Port Pasajes (7 miles) the coast is steep and difficult. At Pasajes a deep entrance, $\frac{3}{4}$ mile long and 200 yards wide, leads to an extensive basin surrounded by hills. The rugged country about the entrance rises to 777 feet on the east and 687 feet on the west, while 6 miles to the south Monte Urdabúru rises to 1,995 feet. Port Pasajes is the only landing-place in the vicinity and is close to the main routes from San Sebastián into France (Photo. 35).

Three miles west of Pasajes is the harbour of San Sebastián, which is not deep and shallows to a broad sandy beach on its southern and eastern shores. The west side of the harbour is formed by Monte Igueldo, which ends eastwards in Monte Frío, a promontory 824 feet high. The harbour itself is divided by Monte Urgull (439 ft.) into two sections. The entrance to the western section, which contains



OF BLOCK-DIAGRAMS

or sketches of the country drawn in perspective. Reference is made to the diagrams on the above index map (*diagrams after Scheu*)

the port, is broken by the Isla Santa Clara (148 ft.). Monte Urgull is joined to the mainland by a low sandy isthmus on which is the town of San Sebastián. The Río de Urumea enters the bay through the beach on the east side of this isthmus which, like the western beach, is close to the main routes to Irún. The country inland is hilly, but several river valleys provide routes to Tolosa and Pamplona.

The coast from San Sebastián for 30 miles westward to Cabo Ogoño is rugged and mountainous, with few sheltered anchorages and flat beaches. Five miles west of Cabo Ogoño is the inlet of Bermeo, frequented by fishing-vessels. The inner harbour is shallow and the surrounding country mountainous. To the south Monte Sollube (2,225 ft.) is within 5 miles of the sea and to the south-west Monte Jata reaches 1,530 feet in the same distance. A winding road and a narrow-gauge railway (from Pedernales) pass between the two mountain-blocks to Bilbao, 15 miles to the south-west. Beyond Bermeo the coast continues rocky and high for 17 miles to the estuary of the Nervión.

Here an outer bay about 3 miles wide lies between the high, steep Punta Galea on the east and Punto de Luzero on the west. This bay narrows to the mouth of the Río Nervión which flows into it through a narrow, steep-sided valley. Bilbao itself is on a plain on both banks of the Nervión nearly 8 miles from its mouth. The outer bay has no notable beaches and the modern harbour is 4 miles north of the city. From Bilbao important routes lead south to Madrid and the upper Ebro and west to Santander.

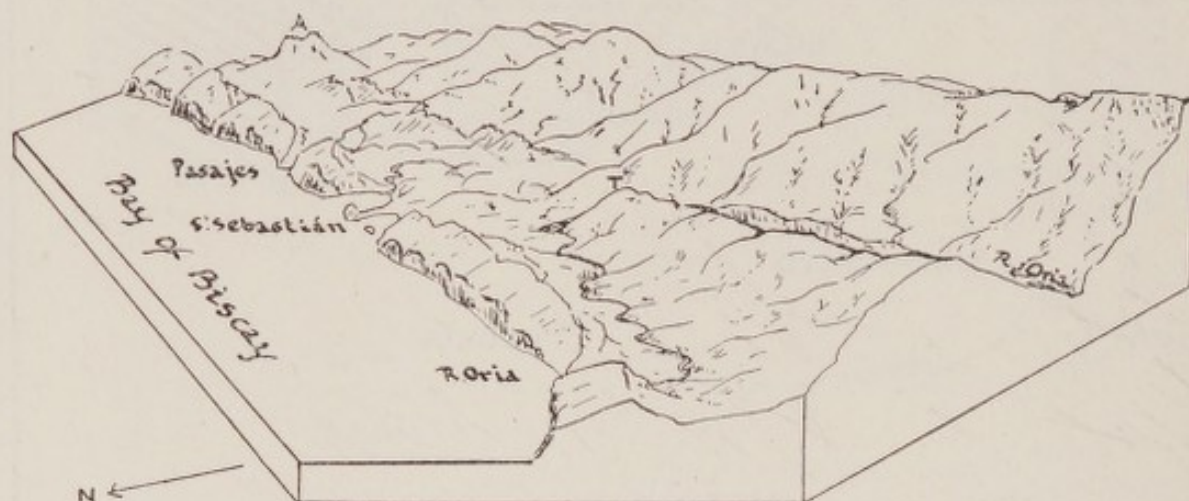


FIG. 14. (BLOCK DIAGRAM A.) THE COASTAL LANDS EAST AND WEST OF SAN SEBASTIAN
A. = MTE. AYA. T. = TOLOSA

The coast between Bilbao and the Río Deva, 64 miles to the west, possesses no harbour for large vessels. There are, however, several small harbours and useful sandy beaches of which the following are the chief.

At Castro Urdiales, 7 miles west of the Nervión estuary, is a small basin at the head of the harbour which is much frequented by fishing-vessels and coasters. Close southward of the harbour of Castro Urdiales is Brazomar Beach, a wide stretch of flat sands 400 yards long. The town is connected by a narrow-gauge railway and a winding road to Santander and Bilbao.

Westward of Castro Urdiales the coast is remote from communications, being backed by the steep slope of Monte Cerredo, which rises to 2,000 feet within 3 miles of the shore. At 12½ miles, however, there is the Ría de Santoña at the mouth of the Marrón river. As is usual on this coast of Spain, the strong sea-currents have built a bar across the mouth of the inlet which cannot safely be crossed in bad weather by vessels drawing over 20 feet. The harbour part of the river channel is a broad, low sandy spit faced by a beach 2 miles long. The northern arm of the inlet is a hilly promontory (1,310 ft.) linked westwards



FIG. 15. (BLOCK DIAGRAM B.) THE COAST BETWEEN ZARAUZ AND GUÉTARIA

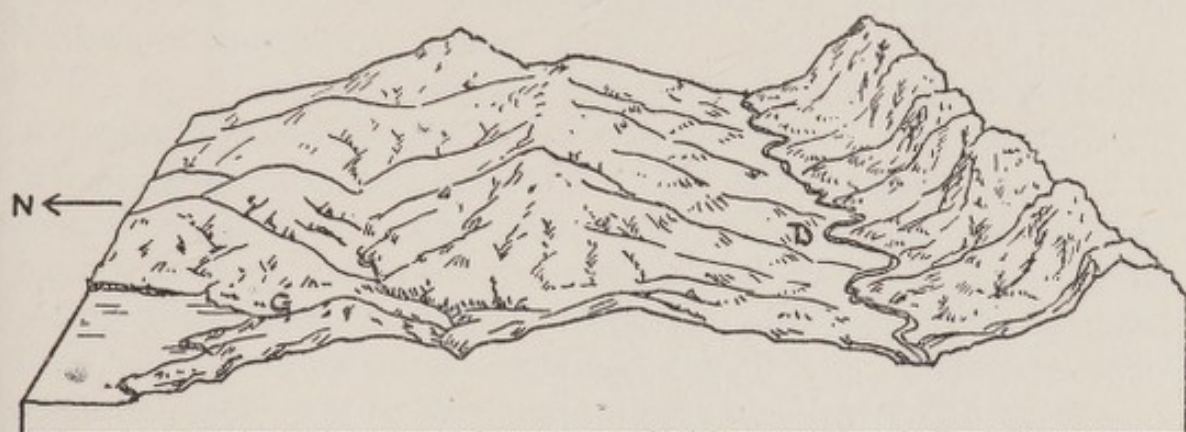


FIG. 16. (BLOCK DIAGRAM C.) THE HINTERLAND OF GUERNICA

G. = GUERNICA.

D. = DURANGO



FIG. 17 (BLOCK DIAGRAM D.) BILBAO AND THE RÍA DE NERVIÓN (LOOKING SEAWARDS)

B. = BILBAO.

P. = PORTUGALETE

to the mainland by a low narrow isthmus awash at high seas. Santoña is at the foot of the south-western slopes of the promontory, 29 miles from Santander. The narrow-gauge coastal railway is 6 miles to the south.

The coast westward to Santander (17 miles) is mainly rocky and

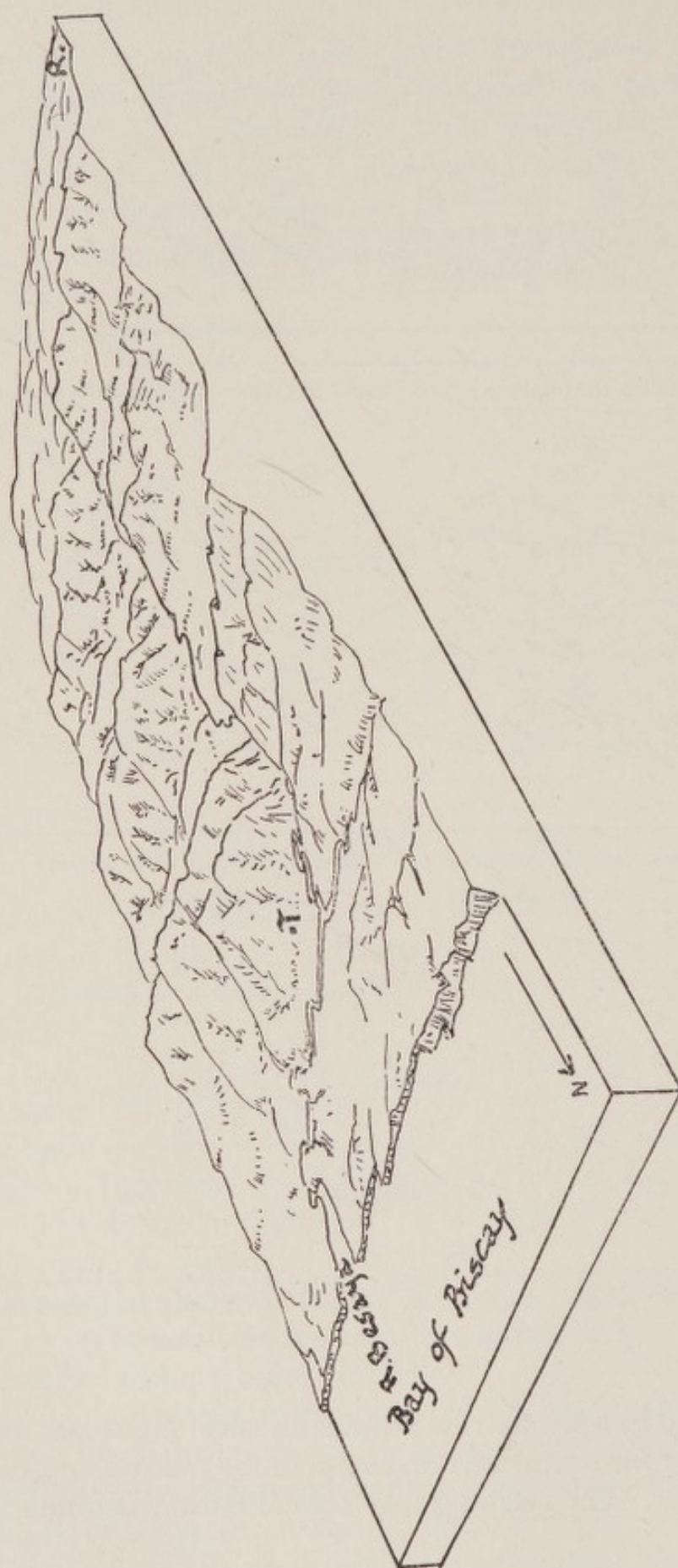


FIG. 18. (BLOCK DIAGRAM E.) THE COASTAL LANDS WEST OF SANTANDER

T. = TORRELAVEGA.

R. = REINOSA

inaccessible. Santander has the best natural harbour on the Cantabrian coast. The entrance, $2\frac{1}{2}$ miles wide, leads to an inlet which extends 5 miles south-westwards. The mouth is broken by the rocky Isla de Mouro and the low, bush-covered Isla de Santa Marina. The town is on the north-western shore of the inlet on the south side of the hilly promontory that forms the western bank of the entrance. This promontory is linked by a sandy tongue to a small headland on which is the *Palacio Real*. The eastern shores of the promontory contain the fine beaches of Sardinero, a suburb of Santander. Most of the shores of the inlet are bordered by extensive sand-flats which dry at low water. The quays of the port have a depth of from 13 to 31 feet, and their inland connexions include the important routes to Valladolid and Burgos (Photo. 10).

The coast between Santander and Gijón, 85 miles, is fairly straight and closely flanked by the Cantabrian mountains. The littoral strip is a platform, from 100 to 300 feet high and from one hundred to several thousand yards wide. This platform (*rasas*) is the base of an old terrace worn flat by the sea and since raised. Its level top can be plainly seen along the Asturian coastline, although rivers have cut deep valleys into its surface. Owing to its presence, there is no well-sheltered anchorage or easy natural landing-place on all this coast. The river mouths are usually fronted by a bar, which often limits their harbourage to vessels drawing less than 15 feet. Small craft can find facilities at the following places.

The estuary of the Río Besaya, 11 miles west of Santander, has a shallow and narrow (65 to 165 ft.) entrance. The country about the inlet is hilly, but there are beaches near Suances and Ribera. The town of Suances is rather isolated as the main coast road lies 3 miles, and the main railway route 6 miles, to the south at Torrelavega. The Besaya valley, south of Torrelavega, is used by the important railway from Santander to Reinosa and Madrid (Fig. 18).

Sixteen miles west of Suances is the Ría de San Vicente de la Barquera, a broad shallow inlet with low flat foreshores. East of the entrance is a wide sandy beach less than $4\frac{1}{2}$ miles from the coastal railway between Santander and Llanes.

Between San Vicente de la Barquera and Llanes (19 miles) the coastal platform is strongly marked and the shore becomes high and steep. Two creeks, the Rías de Tina Mayor and Tina Menor, afford shelter to small coastal vessels, but they are shallow, almost dry at low water, and have no landing facilities. Inland, the Sierra de Cuera (4,308 ft.) is within 4 miles of the sea. The coast continues

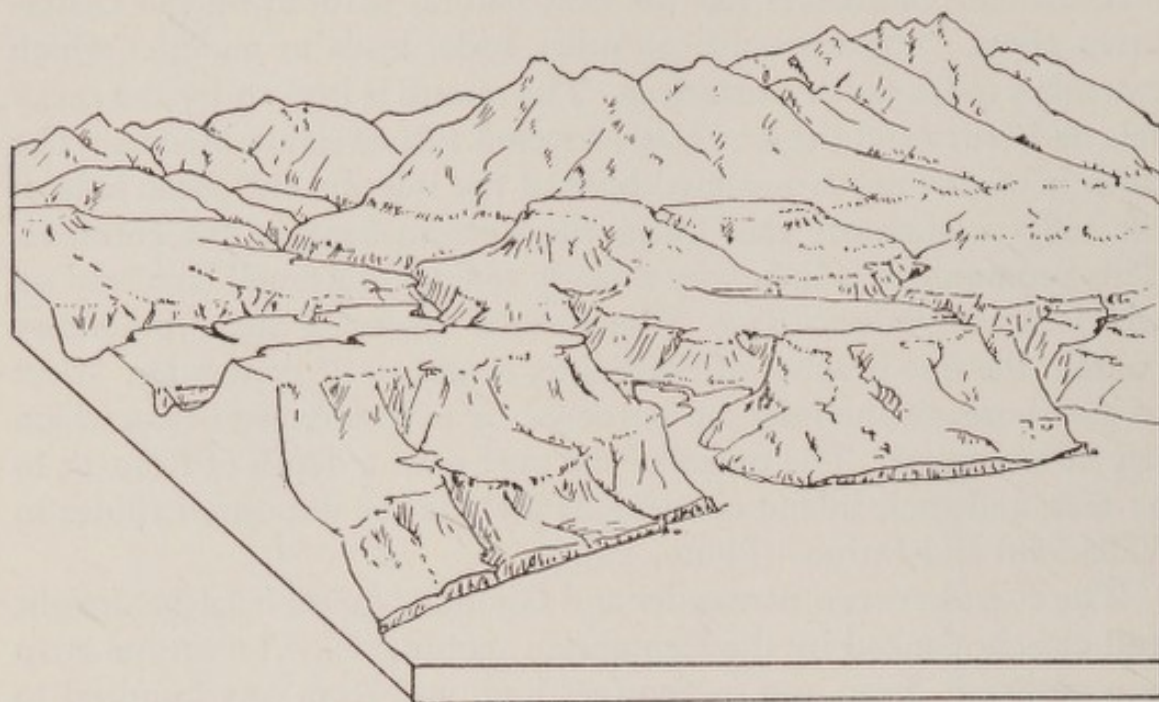


FIG. 19. (BLOCK DIAGRAM F.) THE COAST NEAR UNQUERA WITH THE PICOS DE EUROPA IN THE BACKGROUND



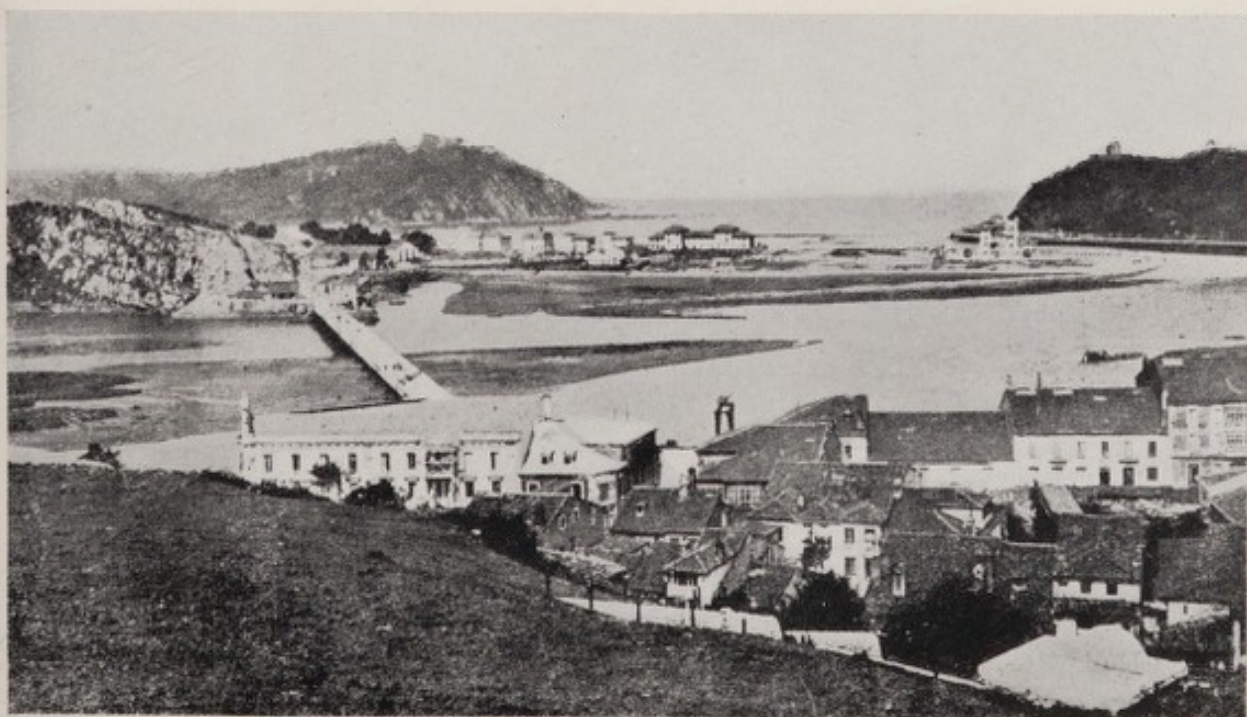
FIG. 20. (BLOCK DIAGRAM G.) THE COAST NEAR LLANES

straight, and is remote from inland routes as far as Ribadesella, 57 miles west of Santander and 27 miles east of Gijón. The harbour of Ribadesella is small and shallow, but there is a quay and, at Santa Marina, a broad sandy beach sheltered from all but north winds. The main coastal routes lie close to the port; west of Ribadesella they turn inland to Oviedo, and south of the town a difficult road leads across the Cantabrian range.

Between Ribadesella and Gijón the coast is backed by a broken coastal sierra which rises to 3,802 feet (Monte Corrandi) within a few miles of the sea. South of this coastal range is the long depression, occupied by the rivers Sella, Nora, and Nalón, which separates the coastal range from the Cantabrians proper. Several routes connect



35. *Entrance to Port Pasajes*



36. *Ría de Ribadesella*



37. *Ría del Barquero, as seen from the headland of Estaca de Vares*



38. *The coastal platform at Foz, Province of Lugo. The flat surface is 65 ft. above sea-level*

the coast to this depression. A road runs inland from Villaviciosa, which lies 12 miles east of Gijón and has a poor harbour with a jetty. At Gijón a bay 18 miles wide forms a harbour that is generally too shallow for vessels of much over 500 tons. The land about the southern part of the bay is low and sandy excepting a small hillock at the mouth of the Río Piles. On the west side of the bay is Port Musel, which accommodates transatlantic liners (26 ft. to 42 ft.).

The coast westward from Gijón to Avilés (13 miles) is generally difficult of access. The Ría de Avilés is over $6\frac{1}{2}$ feet deep for 3 miles as far as the town. South of the entrance is a broad, sandy beach, $1\frac{1}{2}$ miles long. Eight miles to the west is the Ría de Právia which stretches from the mouth of the Río Nalón, 5 miles southward to Právia. Eastward of the entrance stretches a broad sandy beach, which, however, is shallow off-shore. From Gijón, Avilés, and Právia there are good connexions to Oviedo, whence a main railway and a main road lead across the Cantabrians to León.

The coast westwards for 43 miles to the Ría de Ribadéo has steep cliffs broken by many points and inlets but generally impracticable for landing. The port facilities on this coast are very limited. There is a small bay at Artedo, $4\frac{1}{2}$ miles west of Pravia, where a small sandy beach (1,000 yards long) connects with the coastal road. Inland, however, the land rises steeply to 1,335 feet within a mile of the bay. The ports of Luarca and Vega are too small to be important, but from the Luarca district a difficult road leads across the Cantabrian range. Finally, a few miles on the Ría de Navia can be navigated by boats, and there is an open pier in Porcia Bay.

The Coast of Galicia

The coast of Galicia from Ribadéo to the estuary of the Minho (nearly 300 miles) contains more and better natural sheltered anchorages than are to be found on all the other shores of the Peninsula. The rías, or mouths of the rivers that have been drowned by a relative rise in sea-level, are deep and offer good shelter from the rough Atlantic seas. There are, however, two types of ría in Galicia: the *Rías Altas* of the north-east and the *Rías Bajas* of the south-west. The former are smaller, straighter, and shallower than the lower rías; the first are often fouled with sand at their mouths as a result of a steady westward sea drift, while the mouths of the second group are often fringed by rocky islands. The Galician coast suffers from isolation and regional remoteness; some of the rías are almost completely isolated on the landward side, and even the finer harbours



FIG. 21. (BLOCK DIAGRAM H.) THE COAST NEAR RIBADESELLA

R. = RIBADESELLA.

A. = ARRIONDAS

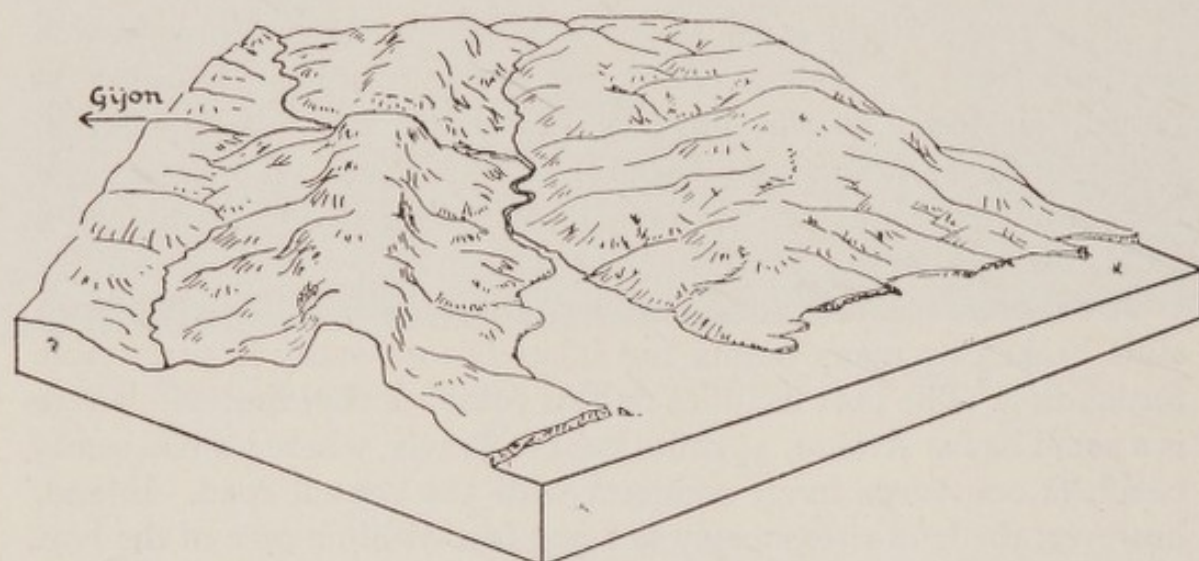


FIG. 22. (BLOCK DIAGRAM J.) THE COAST NEAR MUSEL, WEST OF GIJÓN

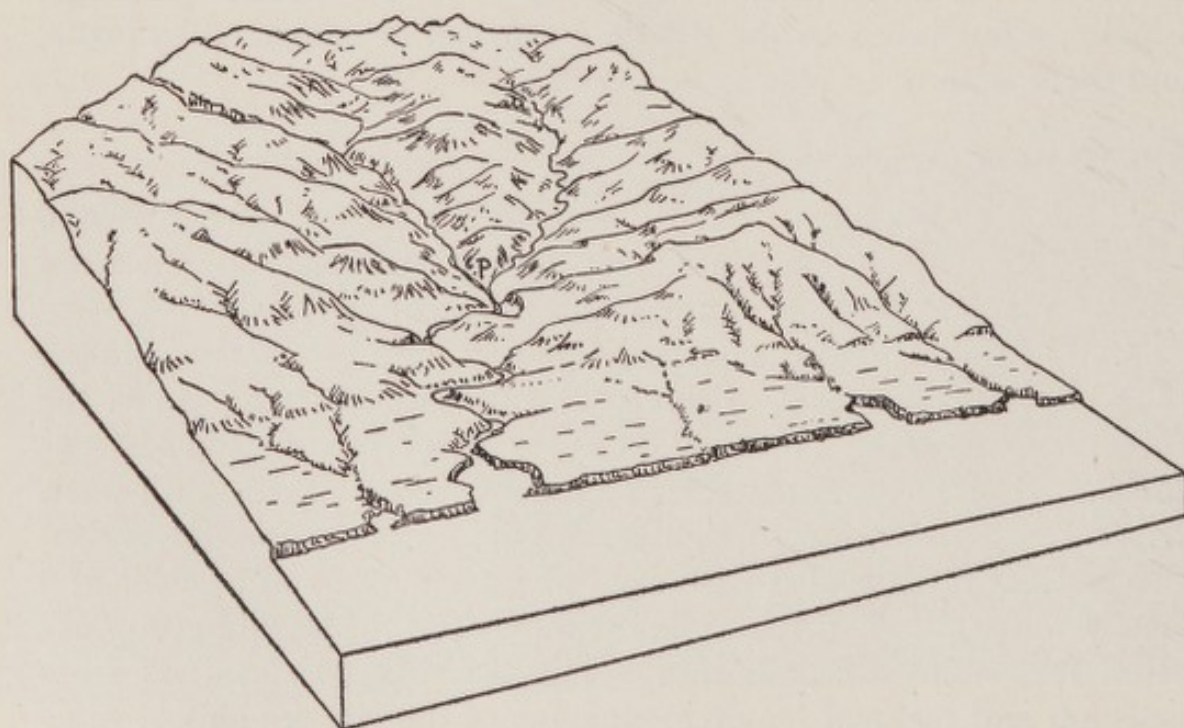


FIG. 23. (BLOCK DIAGRAM K.) THE COAST NEAR THE MOUTH OF THE NALON. (RÍA DE PRÁVIA)

P. = PRÁVIA

are a long way from Madrid. The following table illustrates this remoteness:

<i>Harbour</i>	<i>Distance by rail to Madrid</i>
Corunna . .	527 miles
San Sebastián .	387 „
Santander .	320 „
Gijón . .	370 „

The seaward end of the eastern boundary of Galicia is formed by the Ría de Ribadéo, which extends for $5\frac{1}{2}$ miles southward to the mouth of the Eo river at Vegadeo, where the estuary is first bridged. The outer anchorage is deep and fairly well sheltered, while the inner one has shelter for vessels drawing up to 11 feet. There is a quay at Ribadéo. The foreshores of the ría are mainly cliffed and rocky, but some landing-beaches have road connexions leading east to Oviedo (60 miles) and inland to Lugo (50 miles).

The coast westwards to the Ría de Foz (10 miles) is steep and inaccessible, and the Ría de Foz affords a very inadequate harbourage with no important connexions except a winding road to Villalba, nearly 30 miles to the south-west.

West of the Ría de Foz the coast is backed inland by the Montes de Cabaleiros, at 3 miles, and by the Monte de Buyo at 6 miles. Consequently the rocky and pine-clad coast is very remote, and the small beaches in San Ciprián bay lack inland connexions. At 20 miles from Foz the coast turns abruptly to form the Ría de Vivero, a deep and well-sheltered inlet with high, bold shores from which orchards and gardens look down on the ría. There are three large sandy beaches close to deep water and one close to the main coast road. The hills on either side of the ría rise fairly steeply to over 1,300 feet, with pine-covered lower slopes. The chief road connexion goes south across hills to Cabreiros (30 miles) on the main El Ferrol-Lugo road. There is a mole in San Juan bay.

Immediately west of the Ría de Vivero lies the Ría del Barquero, which, though nearly 2 miles wide at its entrance, is sheltered from all but easterly winds. The shores are typically high and steep, but there are several indentations with beaches. On the west side Bares bay has a beach with deep water close to, and there is a fair-sized beach at the head of the estuary; but all are backed inland by high hills and are within easy reach only of coast roads.

As far west as Ría de Cedeira the coast is inhospitable because of steepness or exposure. Its usefulness is further lessened by the

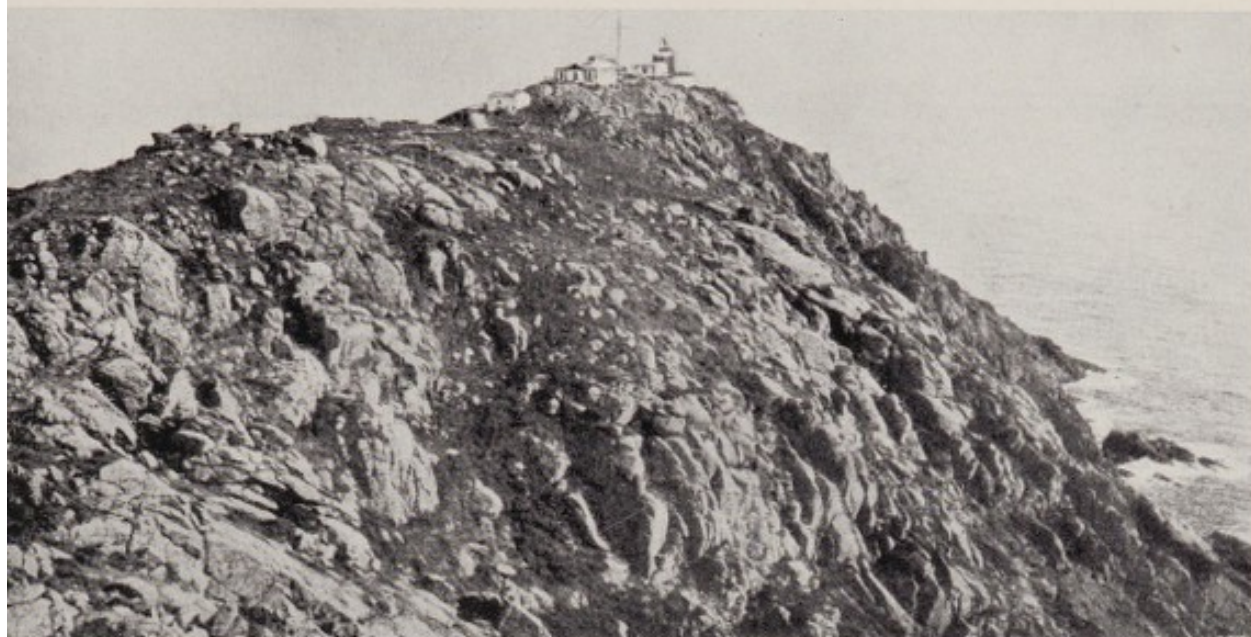
high hills which rise to between 1,300 and 2,000 feet within a few miles of the sea. The Ría de Cedeira is well protected except from the north and has shelter in its inner harbour for ships drawing less than 13 feet. The shores are generally steep except at the broad sandy beaches at Loira in the south and Cedeira in the north of the estuary. A road leads south for 12 miles to El Ferrol. The coast south-west to El Ferrol is exposed and lacks easy access inland.

The inlet of Ferrol has four rías which are the branches of the drowned valley of the Río Eume which enters the Ría de Ares. They are those of Ferrol, Ares, Betanzos, and Corunna. The combined inlet, which has an entrance 5 miles wide, forms one of the best and safest harbours in Iberia. The Ría de El Ferrol, the northern arm, extends eastwards between high land for 8 miles. About $1\frac{1}{2}$ miles inside its entrance it narrows to barely 400 yards, and then opens out into a spacious harbour. On either side of the narrows the hills rise, to 460 feet (Monte San Cristóbal) in the north and to 854 feet in the south. A railway and road lead south 25 miles to Betanzos, and so to the main Spanish railway system.

The Ría de Ares and Ría de Betanzos offer good shelter and many beaches but have no wharf or quay. Their upper parts are filled with sandbanks but lie close to the coastal railway. The east shore of the Ría de La Coruña is generally foul and the western shore is usually rocky. Corunna is on the west side of the harbour, where access is easy and simple. The port has railway connexion with Madrid (527 miles) and a good road leads to Santiago (35 miles).

The coast south-west from Corunna to Cabo Villano (40 miles) is rugged and indented, and although it contains several inlets with sandy beaches, these are exposed and remote. The Ría de Camarinas, which opens out 2 miles south of Cabo Villano, is frequented by coasters. The town of Camarinas stands on a small sandy bay and has two small piers. A circuitous road leads (45 miles) to Santiago, the capital of Galicia. The village of Mugía is on the narrow isthmus of a headland, on the south side of the ría, its houses lying around a sandy bay with a small landing-pier. The other shores of Ría de Camarinas are high and cliffed.

South to Cape Finisterre (20 miles) the coast is inhospitable and remote. Between the Cape and Punta Minarza is the large inlet of Corcubión, whose shores are also generally rocky, steep, and inaccessible. There is a small beach abreast the village of Finisterre and a longer sandy beach about 1 mile to the north. The ría on which



39. *Cape Finisterre*



40. *Mugia and the Cerro de Mugia*



41. *The Tagus at Vila Franca de Xira, from the island of Lezíria Grande*



42. *The promontory of Sagres from the east*

Corcubión stands has good anchorage for all classes of vessels and there is a small mole. The only inland connexions, however, are by hill-road to Corunna and Santiago, nearly 60 miles away. The sandy beaches on the eastern shores of the inlet are quite isolated by the Monte Pindo range, which rises to 2,057 feet within $1\frac{1}{2}$ miles of the seaboard.

South of Corcubión bay the coast of Galicia is broken by the *Rías Bajas*, whose wide, deep waters form excellent naval harbours (Fig. 24). The most northerly of these rías is that of Muros, which has an entrance $3\frac{1}{2}$ miles wide and extends for 14 miles north-eastwards to the mouth of the Río Tambre. The ría is hemmed in on the north (Monte Tremuzzo, 1,739 ft.) and on the south by high hills. Consequently the only inland connexions are from Noya, at the head of the estuary, to Santiago (20 miles) and Padrón (12 miles).¹

The high peninsula formed by the Montes de Barbanza separates the Ría de Muros from the much larger Ría de Arosa. The shores of this fine natural harbour are well populated with many towns and villages. Its banks, throughout most of its 25 miles, are pine-clad or cultivated, especially with maize. The main entrance channel is between the islands of Salvora and El Grove; the latter is much given over to vines and is connected with the sandy islet of La Toja and with the mainland by a bridge. The island of Arosa, with several smaller islands, on which are a few houses, lie within the ría west of Villanueva. The shores of the Ría de Arosa offer numerous landing-places, but only the eastern shores are near main routes. On this shore are the ports of Cambados, Villanueva, Villagarcía, and Carril. The chief town is Villagarcía, which has a large pier and is linked by road and rail to Vigo (25 miles) and to Santiago (20 miles).

The next inlet south of Arosa bay is the Ría de Pontevedra, whose entrance ($2\frac{3}{4}$ miles wide) is guarded by the Isla de Ons and the islet of Onceta. The ría extends about 8 miles north-eastwards and its shores are bordered by high land which is broken at intervals by well-cultivated valleys. The land on the north is hilly and rises to over 2,000 feet at Nogueira, about 4 miles from the head of the inlet. On the south the range consists of three main hill-blocks, the highest rising to about 2,000 feet but sloping fairly gently towards the town of Pontevedra. These high hills greatly diminish the importance of the several towns and small ports on the shores of the ría. Pontevedra is

¹ One of the very few sheets yet published of the *Mapa Militar de España* on the scale of 1/100,000 is sheet 42, which shows the Ría de Muros and part of the Ría de Arosa. The date of this sheet is 1919.

THE 'RIAS BAJAS' OF GALICIA

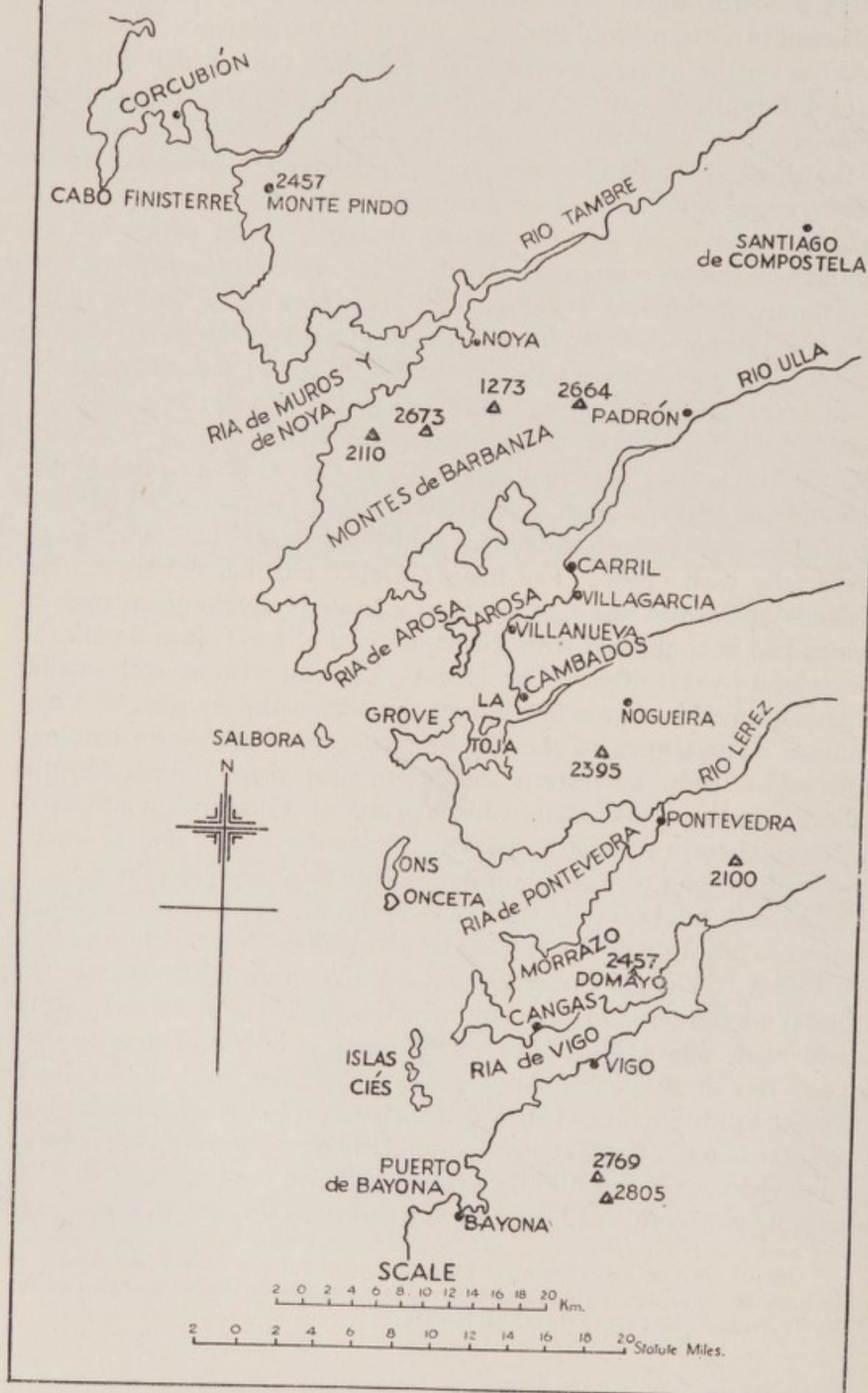


FIG. 24.

about 2 miles up the Río Lerez and has good connexions with Santiago (32 miles) and with Vigo (14 miles).

The peninsula of Morrazo that separates the Ría de Pontevedra from that of Vigo reaches 2,018 feet in Faro Domayo, a ridge falling abruptly to the north-western shores of Vigo Ría, and cutting off access except along the coastal strip. There is, however, a small beach at Cangas, and the slopes though steep are dotted with farms. As in the other rías of southern Galicia, the southern or eastern side is much the most important. Vigo, a fair-sized port with modern facilities, stands on the south side at about 7 miles from the entrance to the ría. From Vigo northwards to the head of the ría, which is 15 miles from the sea, the main routes run close to the shoreline.

Immediately south of the entrance to Vigo Ría is the inlet of Puerto de Bayona, the southern part of which is well sheltered and has several beaches. At the town of Bayona there are landing facilities and a mole near the coastal road that leads south to the mouth of the Minho.

From here the Spanish coast south to La Guardia is straight and high, and backed by craggy granite sierras between 1,300 and 2,000 feet high within 4 miles of the sea.

The Coast of Portugal

Portugal has a coastline of more than 500 miles, of which about four-fifths face westward and the rest southward to the Atlantic. Most of this coast is unbroken, being without considerable bays and indentations, except at the mouths of the larger rivers.

The river Minho, which forms part of the northern boundary of Portugal, is navigable at high water to Salvatierra, a distance of 24 miles. The valley is followed by a railway that joins, at Monforte de Lemos, the main line from Corunna to Madrid.

For 12 miles to the south of the Minho estuary the coast is of moderate height, but is backed by the Serra de Santa Luzia (1,805 ft.) about 3 miles inland. It is then broken by the estuary of the Rio Lima, which can be navigated for 9 miles by small craft, and which is crossed by routes leading south from Vianna do Castello to Oporto (34 miles). South of the Rio Lima there is a long, low, sandy beach, backed by hills which culminate inland, 6 miles from the shore, in São Gonçalo (1,579 ft.). The coastline is almost unbroken until the estuary of the Rio Cavado is reached. The river Cavado will take small boats (7 to 13 feet at bar) for 7 miles; the estuary, however,

hinders travel from north to south and the main routes cross the river at Barcellos, 10 miles from the coast.

The coast has few important features as far south as Oporto, except perhaps at Povóa de Varzim and Porto de Leixões, where road and rail connexions lead to Oporto. Some $\frac{3}{4}$ mile north of the entrance to the Rio Douro the sandy coast is replaced by a rocky, more elevated shoreline breached by the river at Oporto. The channel of the Douro in Portugal is narrow and rocky. Yet neither this handicap nor the great strength of the current prevents navigation as far as Fregeneda on the Spanish frontier. The city of Oporto stands on the north bank of the Douro where the slopes of the small Montes Sé and Victoria afforded a good site, about 3 miles from the river's mouth.

A low, sandy shore, generally unbroken, stretches from Oporto for 30 miles southward to the mouth of the Vouga river. The coastal lands consists of three belts: a low, sandy pine-clad fringe, the cultivated lands of the hill-slopes, and finally the serras, which are from 16 to 25 miles from the shore. Here Monte Pedro Valho (3,555 ft.) is $18\frac{1}{2}$ miles from the coast. The estuary of the Vouga interposes a large area of saline marsh and swamp between the sandy littoral fringe and the cultivated coastal plain. The estuary expands into a narrow lake nearly 20 miles long, parallel with the coast and separated from it by a narrow strip of sand. The town of Aveiro is on low ground 4 miles east of the entrance and is reached by channels through the swamps and marshy islets of the vast estuary. The river-banks and lagoon shores are often flooded to grow rice. From Aveiro there is rail and road communication to Oporto (31 miles) and Lisbon.

Between the Vouga estuary and Cabo Mondego the coast remains low and sandy, the dunes and pine-clad sands sometimes being over 4 miles wide. The Serra do Caramulo is almost parallel with this coast and rises to 3,509 feet within 28 miles of the sea. The slope to the serra from the coastal plain is often steep; thus, near Coimbra the plain (below 400 ft.) is nearly 12 miles wide, but in the next 4 miles the land rises to 1,792 feet at the peak of Bussaco. The level of the plain is, however, broken immediately north of the Mondego river by a line of low hillocks. These small serras extend intermittently from Bussaco to Cabo Mondego and are 825 feet high 1 mile north-east of the cape. The town of Figueira at the entrance to the Mondego estuary is linked by railway to the main routes of Portugal.

South of Figueira for 34 miles to the Bahia de Pederneira the shore is bordered by a sandy fringe with dunes and an occasional lagoon that merges inland into large expanses of pines and heather. In the south at Leiria from the abrupt hillock overlooking the town is seen a vast pine-forest, 9 miles by 9 in extent, that almost reaches the sea. Leiria, however, roughly marks the southern end of the broad, continuous coastal plain of northern Portugal, as at this point a low serra projects south-west to the rocky headland (363 ft.) of Nazaré. The Bay of Pederneira, on the south side of this headland, is connected by road with the main routes to Lisbon. The main ridge of the Serra de Candieiros lies from 12 to 14 miles from the coast, but spurs project from it and in parts almost reach the sea. Among these minor ranges are the sharp, narrow ridge of Aljubarrota, the scene of a battle in the fourteenth century, and the Serra da Bouro which stretches from São Martinho 6 miles south-westwards to near Caldas da Rainha. The last-named ridge falls very steeply on its north-western side from nearly 500 feet to the shore.

Ten miles south-west of the Obidos lagoon the coast is interrupted by the rocky headland (1110 ft.) of Peniche, which is joined to the mainland by a low, sandy isthmus, suitable for landing. From here main roads lead to Lisbon (40 miles) and to Santarem.

About $5\frac{1}{2}$ miles north-west of this peninsula are the Berlengas islands, the largest with a flat summit (302 ft.) and steep cliffs. Two narrow creeks, each with a small beach, almost divide this island into two. Four miles to the north-west is the rocky island group of the Farilhões, rising to 315 feet.

The coast of the mainland from Peniche southwards to Cabo da Roca is a succession of steep cliffs with breaks at the river mouths. The hills that separate this coast from the lower Tagus valley consist of two main north to south ranges divided by a central depression. The eastern range stretches from near Caldas da Rainha to Lisbon (40 miles) and culminates in Monte Junto (2,185 ft.), 15 miles east of the Atlantic coast at Porto Novo. The western range, the Serra de Cintra, extends from Peniche to Cintra, where it rises to 1,727 feet within 5 miles of Cabo da Roca. The depression between the two ranges is followed by the main routes to Lisbon, which consequently are guarded by Caldas da Rainha in the north, Torres Vedras in the centre, and Lisbon in the south. At Torres Vedras the western range is low and narrow and the main routes come within 8 miles of the coast. Connexions inland from the shore are poor. There are three sandy beaches near Ericeira, but from this point the coast is usually

cliffed as far south as the Bay of Cascaes, where a sandy beach is linked by railway along the coast to Lisbon.

The estuary of the Tagus is entered through a deep channel, about 1 mile wide and 8 miles long, bordered by low green hills. Opposite Lisbon the estuary widens into a vast expanse of water 12 miles long from south-west to north-east and from 2 to 7 miles wide. The river is not bridged below Muge, 40 miles from its mouth, and is deep enough to take 50 ton vessels as far as Barquinha, 65 miles from the sea. The western part of the estuary is generally deep with high shores, while the eastern and southern parts are shallow with a swampy, alluvial shoreline. The largest expanse of flat, swampy alluvium lies on the east bank about the mouth of the river Sorraia. The difference between the west and east banks of the estuary is remarkable. The one is densely peopled and served by roads and railways converging on Lisbon; the other is almost uninhabited and avoided by routes. In times of strong southerly gales the winds sweep with great force up the Tagus estuary and pile up high seas which may be driven across the edges of these riverine flats. During a gale in February 1941 over 100 workmen were drowned on the alluvial plains at the head of the estuary. The southern bank of the estuary is broken by two broad creeks, near the shores of which are the towns of Montijo, Barreiro, and Seixal. These settlements are only a few miles from Lisbon by water, but the railway journey is nearly 100 miles long (Photo. 41).

The coast south of the Tagus to Cabo Espichel (15 miles) offers few opportunities for landing. Cabo Espichel itself is nearly 500 feet high and marks the western end of the Serra da Arrábida, which borders the coastline stretching eastwards 20 miles to Setúbal. The Serra culminates in Formosinho (1,631 ft), which lies 1 mile inland, and in Monte Córdova, a few miles to the north-east. The coast is steep and cliffed, but there is a flat sandy beach nearly 1 mile long at Cezimbra whence a road leads northwards to the south bank of the Tagus. Setúbal is just within the entrance of the estuary of the Sado, where the steep shores flanking the Serra da Arrábida are replaced by flat, wide, sandy beaches typical of this estuary. Consequently, the shores west of the town are hilly and steep, and east of the town are low, flat, and sandy. Setúbal has connexions by road with Sinés and by road and rail with Lagos, but the land routes to Lisbon are extremely circuitous. The Sado is navigable for 25 ton vessels to Alcacer do Sal, 27 miles from the mouth, and smaller craft may ascend another 5 miles.

The remainder of the coastline of southern Portugal is remote from important routes and lacks important inlets. From Setúbal as far south as Cabo de Sinés (32 miles) the coast is generally low and sandy with some dunes. The low littoral fringe is usually covered by pine forests that grade inland to an undulating upland, the Serra Grândola, between 700 and 900 feet high within 10 miles of the coast. This hill country, however, is lightly wooded, mostly under cultivation, and in no sense difficult. From Sinés a main road leads east across the Serra de Grândola for 65 miles to the town of Beja. The coastline from Cabo de Sinés to Cape St. Vincent (65 miles) consists generally of long cliffs separated by sandy beaches.

The south coast of Portugal stretches for nearly 100 miles from Cape St. Vincent to the mouth of the Guadiana. The coast is backed by the Algarve mountains, part of which, the Serra de Monchique, borders Lagos bay with Monte Foia (2,954 ft.) about 12 miles north of Portimão. A gap, used by a road leading northwards from Portimão, separates Monte Foia from a slightly lower peak (2,534 ft.) about 3 miles to the east. The shores of Lagos bay are usually rocky and steep (Photo. 42).

East of this point the coast becomes lower and changes to a low, sandy beach, fringed generally by narrow lagoons and sandy islands. The Serra de Caldeirão and its eastern continuations rise to between 1,000 and 1,300 feet within 10 to 12 miles of the coast. Consequently communications are largely restricted to the coastal plain. From the Albufeira district a railway leads northwards between the Serra de Monchique and the Serra de Caldeirão, while a main road crosses the mountains from the town of Faro. The main coastal routes end abruptly at Villa Real on the Guadiana river, which forms the boundary with Spain.

The Atlantic Coast of Southern Spain

The flat, sandy coastline of the plain of Andalusia is for most of its length remote from important routes. Between the Portuguese boundary and Cádiz bay, a distance of 85 miles, the coast is straight and featureless except for the estuaries of the Guadiana, the Odiel-Tinto, and the Guadalquivir.

The Guadiana has a minimum depth of 7 feet to Villa Real, beyond which it deepens so that vessels drawing 12 feet can reach Pomarão, 22 miles upstream. Flat-bottomed craft can proceed to Mértola, 10 miles beyond Pomarão. The inland communications, however, are unimportant as Villa Real is only connected with the Portuguese

railways, though Ayamonte has a road and railway leading eastward to Gibraleón, whence circuitous routes go to Seville and Madrid.

From Ayamonte, for 27 miles eastwards to the mouth of the Odiel the shore is flat, low, sandy, and bordered in parts by long, narrow lagoons, whose landward edge is not infrequently covered by brush-wood. The main routes are about 5 to 10 miles north of the shore.

Beyond the low, bush-clad arm of Punto de Umbría the coast is broken by the combined estuary of the Odiel and Tinto. The entrance to the estuary is divided into two channels by the Isla de Saltes, a low sandy island, partly cultivated and partly under stunted brush-wood. The banks of the estuary are low, and flats line the Odiel for 13 miles and the Tinto for 10 miles. A channel across the bar (24 ft. deep) allows vessels to reach Huelva. The port stands on the east bank of the Odiel, in such flat country that the chief feature of the landscape is a pine-clad hillock, merely 135 feet high, about 1 mile north-west of Punta del Padre Santo. Huelva is connected by road and railway with Seville, 60 miles away.

South-east of Huelva the coast continues straight, low, and sandy for 42 miles to the mouth of the Guadalquivir. The coastal sand-dunes now increase in size and present a steep face to the sea. In the middle of this coastline they form the *Arenas Gordas*, a line of dunes nearly 18 miles long, generally 100 feet high, and 328 feet at one place. Communications inland are absent and the main Huelva-Seville route is from 20 to 25 miles north of the shore.

The Guadalquivir estuary is navigable to Sanlúcar de Barrameda (17 ft. over bar), while boats can ascend 40 miles to Seville. Between these two towns the river-banks are low and flat and approached by neither road nor railway. The marshy grasslands are practically uninhabited.

From Sanlúcar to Cádiz bay the coast remains low and is fringed with sand-dunes. Here, however, a main railway runs parallel to, and within a mile of the shoreline. The shores of Cádiz bay are mainly low and flat, becoming swampy in the north-east about the mouth of the Guadalete river.

The coast south to Cape Trafalgar is sandy but unbroken. North of the cape the land rises to between 500 and 700 feet in the Cerros de Vejer, which is one of the southern ends of the Andalusian mountains. East of the cape a sandy beach is formed by the small bay at the mouth of the Río Barbate. Here there is a flat beach about 3 miles long, near the town of Barbate, from which a road leads north $6\frac{1}{2}$ miles to the main Cádiz-Algeciras route at Vejer de la Frontera.



43. *The estuary of the river Odiel, Province of Huelva*



44. *Coastal dunes in the Province of Huelva*



45. *The coast near Tarifa*



46. *The coast near Cape Trafalgar*

South-east of Barbate the coast continues low and sandy, but rises inland to the Sierra de Retín (2,132 ft.) within 4 miles of the beach. This sierra and its southern continuation, the Sierra de la Plata, separate the littoral from the broad interior lowlands about the extensive lagoon of Janda. The main routes keep to these inner plains, and consequently the sandy beach at Bolonia is 6 miles distant from good inland connexions.

North-west of Tarifa the main road passes south between the Sierra de la Plata and the Sierra de Enmedio and runs close to the coast for 11 miles. The coast is usually sandy, and a beach over 3 miles long stretches from the mouths of the small Ríos Salado and Vego to Tarifa.

The coast between Tarifa and Gibraltar bay is rocky and exposed, consisting generally of cliffs interspersed by sandy beaches. Commonly the shore is fringed by a flat, rocky bench that in places extends a short distance below sea-level and is sometimes above high-water level. The country close to the shore is undulating and hilly; farther inland is the Sierra de Nuestra Señora de la Luz (2,283 ft.). Here the main road to Algeciras (15 miles) crosses the coastal hills.

The west side of the Bay of Algeciras is high and lacks direct road connexions inland, the only tolerable road northwards leading across the southern end of the Andalusian mountains to Medina Sidonia nearly 50 miles away. The main railway line passes north to Ronda, threading the deep, narrow gorges of the river Guadiaro.

The Southern Mediterranean Coast of Spain

The Mediterranean coast of Spain between Gibraltar and Cabo de Gata (167 miles) has several peculiarities. No other coast of Mediterranean Spain is bordered inland by such high mountains, nor fringed by such a persistently narrow plain. Along no other stretch of similar length is the main railway forced so far inland, or the main road driven so close to the sea. Yet in many ways the coast is typical of Mediterranean Spain; it lacks natural harbours and navigable river estuaries, but paradoxically it has a wealth of landing-beaches. The larger coastal plains are deltaic in origin and gave sites for the larger towns, which owe their wealth to irrigation and to artificial harbours.

The coast north-east from Gibraltar, for 20 miles to Estepona, is almost straight, with a few shallow bays. The isthmus of Gibraltar is a low, level sandy plain from the foot of the Rock nearly $1\frac{3}{4}$ miles northward to the foot of the Sierra Carbonera, where it is $2\frac{1}{2}$ miles

wide. Its surface is generally barren except for a few patches of scrubland. The land between this plain and the river Guadiaro is broken by numerous small sierras, and the main railway from Algeciras to Ronda runs west of these hill groups, about 7 to 8 miles from the Mediterranean shoreline. The Guadiaro plain, although forming a natural route from the sea to this railway, is low and lagoon-dotted, and devoid of even tolerable roads. From the mouth of the Guadiaro north-eastwards the inland mountains are higher and come closer to the shore, and near Estepona the Sierra Bermeja (4,728 ft.) is within 6 miles of the sea.

The coast from Estepona to Málaga (47 miles) is formed by a series of sloping beaches and exposed shallow bays, backed by mountains of moderate height. Monte Mayor, a pyramidal hill 1,870 feet high, lies $3\frac{1}{2}$ miles north of Torre del Saladillo, and the sierra behind Marbella rises to 4,039 feet within a similar distance of the shore. Farther east the town of Fuengirola is on a beach about $3\frac{1}{2}$ miles long, and backed by the Sierra de Mijas (3,789 ft.) 5 miles distant. Consequently, although a landing could be made in suitable weather on most of these beaches, progress inland would be greatly hampered by lack of communications and difficult country.

The lowlands immediately west of Málaga have the advantage of a railway leading to Bobadilla (43 miles), whence connexion can be made with all parts of Spain. The mountains east and north of the Málaga lowland are over 3,000 feet and over 4,000 feet respectively, but the railway uses the deep gorge of the Guadalhorce river. Málaga has grown up at the foot of several isolated hillocks, the chief of which, Monte de Gibralfaro (550 ft.), overlooks the central and eastern parts of the city.

East of Málaga the coast for 4 miles is rocky and elevated, with occasional cliffs and coves, and then, for the next 9 miles, it becomes sandy. At Torre del Mar, about $3\frac{1}{2}$ miles south of the town of Vélez-Málaga, is a beach suitable for landing with a possible entrance to the interior between the Sierra de Loja and Sierra Tejeda, first to Alhama de Granada, and then by difficult roads to Loja and Granada. This beach is somewhat isolated from coastal approaches by the elevated coast near Málaga and by a similar rugged shoreline between Punta de Torrox and Nerja about 10 miles to the east. To the north-east the lowland is shut in by the Sierra Tejeda, which attains 7,000 feet within 8 miles of Vélez-Málaga (Photo. 47).

The coastline from this beach east to near Motril is very effectively isolated from the interior by sierras between 5,000 feet and 7,000 feet

high. At Salobreña, however, the Río Guadalfeo has built up a gently sloping plain 7 miles along the coast to the high, rocky Cabo Sacratif. In the middle of this lowland, on a slight rise, is the town of Motril, which is connected with El Barradero, its small artificial port, by a road and tramway. A route from Motril to Granada (30 miles) follows the Valle de Lecrín between the high Sierra Nevada and various lower sierras to the west.

From Cabo Sacratif to Almería (60 miles) the coastal strip is backed by a double mountain barrier formed by the Sierra Contraviesa and



FIG. 25. CABO DE GATA

Sierra de Gádor (7,621 ft.) in the foreground and the Sierra Nevada (11,420 ft.) inland. Consequently the flat plains east of Adra, with their sandy beaches, connect only with Almería, 28 miles to the east. The town of Almería is on the seashore and in a valley that incises a bare mountain ridge, the eastern slopes of which are riddled with caves. From the summit of the ridge excellent views are obtained of the town and port.

The shore from Almería to the rugged headland of Cabo de Gata is flat and sandy and backed for some miles inland by a low plain, but it is remote from inland connexions except at Almería.

Fifty miles south of Adra is the tiny flat-topped island of Alborán which, though only 66 feet high, is almost surrounded by cliffs.

The Levantine Coast

Between Cabo de Gata and Cabo de Palos the coast is backed by a hill belt about 20 miles wide, where several small ridges run almost parallel with the shore and often end in cliffs. Towards the interior this belt merges into the high sierras of the Andalusian mountains, which, because of their width, barrenness, and deep river-gorges, form a very effective barrier to communications northwards. No coastal strip of Mediterranean Spain is more remote; here, alone in all Mediterranean Spain, is there no main coastal road, nor any line, however short, of coastal railway. The main routes run between the

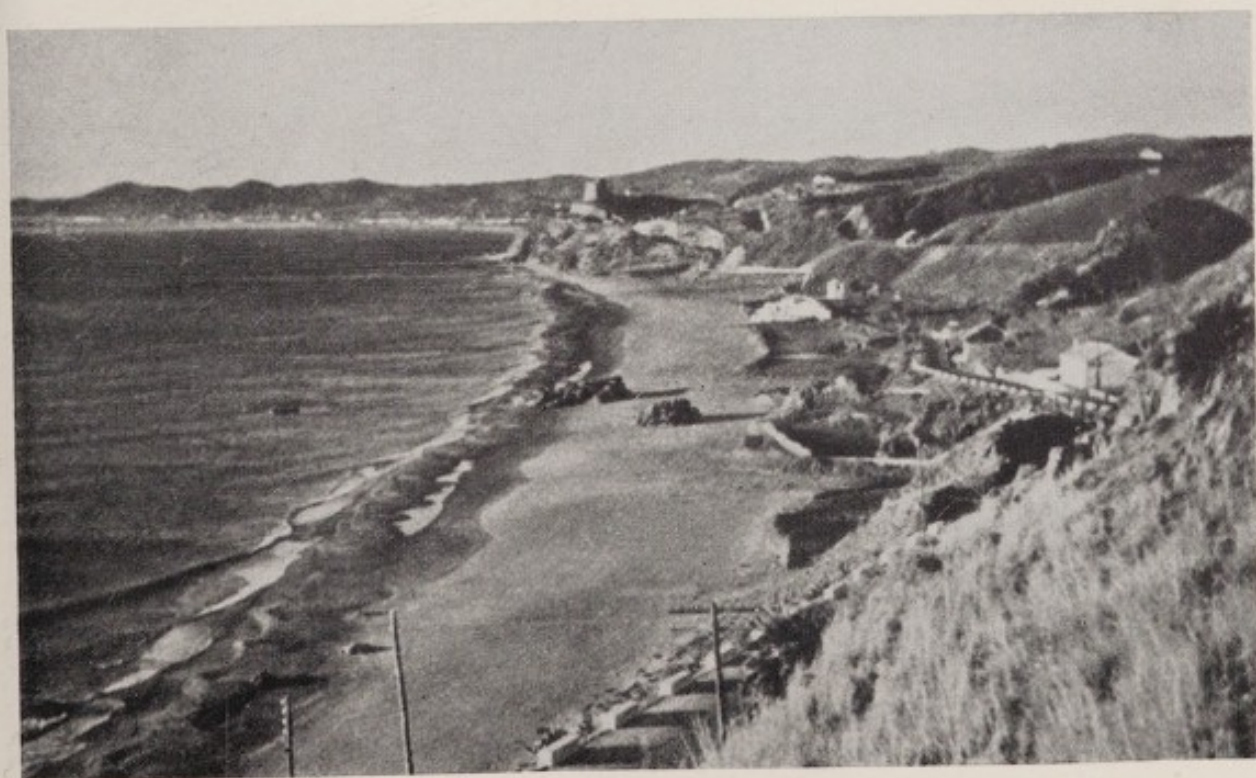
hill belt and the high sierras, keeping at a distance of 15 miles or more from the sea. Only near Cartagena, which possesses the finest natural harbour on the east coast of Spain, are there direct communications with the interior.

The coast from Cabo de Gata north-east for 50 miles to Aguilas is mainly high and steep, but contains several bays and small beaches which are generally too remote to be important. At La Garrucha, however, a low sandy beach lines the shore for 5 miles to the mouth of the Río Almanzora, the valley of which leads (17 miles) to the main road and railway from Murcia to Granada. Port Aguilas is separated from the valley of the Guadalentín (or Sangonera) by the Sierra de la Carrasquilla and the Sierra de Almenara (2,900 ft.), both of which are alined from north-east to south-west. A railway skirts the south end of these sierras and a road utilizes the lower hill country between them.

The coast continues as a succession of cliffed headlands and remote sandy beaches as far as Mazarrón, where a road passes north through a wide gap between the Sierra de Almenara and the Sierra de Carrascoy. From Mazarrón to Cabo de Palos a low coastal chain forms high, rocky headlands. At Cartagena it is broken and invaded by the sea to form a fine natural harbour, almost surrounded by steep conical hills, such as those of Atalaya (790 ft.) and Galeras (656 ft.). Six miles eastward of Cartagena is Portmán bay, which is entered between slight hills, and has, at its north-eastern corner, a sandy beach, with a road leading inland. To the north the country is broken by steep hills (Santi Spiritus, 1,447 ft.), and to the west the plains are lower but dominated by isolated hillocks, such as Los Juncos near the seaboard, and Monte Escucha (460 ft.), 2 miles south-west of Cabo de Palos. From Cabo de Palos north-east to Alicante (45 miles) the coastline changes completely in character, the shore becoming low, sandy, and fringed with lagoons and marshes, while the plain becomes wider and more continuous. A long, narrow strip of sandy deposits extends 12 miles northwards to enclose the Mar Menor, a large lagoon which has a maximum depth of 25 feet, but is entered by a very shallow channel. The main railway to Cartagena is only $6\frac{1}{2}$ miles from the flat western shores of the lagoon. Beyond this railway the land rises to the low sierras (2,000 ft.) that intervene between the coastal lowlands and the densely peopled valley of the Segura river near Murcia and Orihuela. About 4 miles north-west of the Mar Menor an isolated hill-block, the Cabezo Gordo (993 ft.), dominates the coastal plain.



47. *Sierra de Tejeda and the coastal plain at Vélez-Málaga*



48. *The Gibraltar-Málaga road*



49. *Monte Ifach near Calpe, Province of Alicante*



50. *Rosas*

Northwards the land adjoining the shoreline becomes increasingly ill drained, but from the small bight at Torrevieja the railway and road run between extensive saltpans and lagoons to join the main coastal routes. White sandhills, often unstable, occupy the coastal strip on each side of the mouth of the Segura river, and are also found farther inland in the neighbourhood of Elche. Half-way between Torrevieja and Alicante there is a sandy beach at Santa Pola bay, with two piers on its western side, whence a road leads across a sandy landscape to the oasis of Elche. The northern shores of the bay rise to the little Sierra de Santa Pola (450 ft.). The most direct route inland from this coastline commences at Alicante, which possesses an artificial harbour. The town grew up between the beach and the foot of a precipitous, conical hill which is capped by an ancient castle and whose slopes have recently been planted with pines. The lowlands about this hillock are almost enclosed on the landward side by higher hills; to the north-east are the Cerro de Molinet and Cerro de San Julián, while 3 miles to the west lies the Cerro de la Foncalent (2,376 ft.), and to the south is the Sierra de Portichuelo. Routes, however, find no difficulty in passing over these sierras towards Murcia and Madrid.

North-eastwards the coast declines in importance, and becomes, as far as Denia, a succession of high points and sandy bays backed by mountains. There is good anchorage at Altea and sandy landing-beaches at Calpe and Morayra, but both are remote from routes to the interior. Here the Andalusian mountains run out to sea, forming high rocky promontories such as Cabo de la Náo, Cabo de San Martín, and Cabo de San Antonio (529 ft.).

The coast from Denia, for 75 miles north to Cabo de Oropesa, forms a gently curving bay, which, except at Cabo Cullera, is low and sandy. The coastline is almost featureless, its smooth outline being broken only by small river mouths and a few artificial breakwaters. The beaches are exposed, but in suitable weather could be approached close to, and landed on anywhere. Connexions with the interior are, however, practically limited to the roads from Valencia and the little port of Sagunto. About 25 miles north of Denia there is a small bay on the southern side of Cabo Cullera, where a gently sloping beach affords facilities for landing and a narrow-gauge railway leads to Valencia.

The coastal strip between Cullera and Valencia is occupied mostly by a fresh-water lagoon, about 5 feet deep, which is surrounded by rice-fields and separated from the sea by a pine-clad strip of sand.

The main routes pass west of this lagoon and lead to Valencia, which stands in a flat plain on the right bank of the river Turia and about 3 miles from El Grao, its artificial port. From the city a railway leads 304 miles to Madrid. North of El Grao the coastal plain continues unbroken for 13 miles to Sagunto, where a hillock rises abruptly above the south bank of the Palancia river. Modern Sagunto, which lies some 5 miles from its small artificial harbour, has good road and rail communications with the main Saragossa-Madrid routes at Calatayud. As far north as Castellón-de-la-Plana the flat, coastal plain is from 10 to 15 miles wide, and the main routes traverse the central parts of this littoral zone. Beyond Castellón a hilly land, with numerous conical hill-groups, invades the lowlands and runs out to sea at Oropesa. The summits of this area, which is known as the Desiertos de las Palmas, seldom exceed 2,000 feet. From Cabo de Oropesa northwards the coast is low and marshy as far as Torreblanca (8 miles), beyond which a steep mountain range runs close to the sea. This range, the Sierra de Irta, is 1,500 and even 2,500 feet high within 3 miles of the coast. Consequently the coastline for 9 miles as far north as Peñíscola is high, with several ravines and small sandy beaches. The main routes run on the landward side of the Sierra de Irta which form a well-marked barrier, some 4 miles wide, between them and the shoreline. North of the small headland of Peñíscola (240 ft.) the coast again becomes low and flat, and during a stretch of 12 miles includes the three artificial ports of Peñíscola, Benicarló, and Vinaroz. The sandy shores can be approached close to, and are within easy reach of, the main coastal routes.

Some 27 miles east-south-east of Cabo de Oropesa are the Islotes Columbretes, a number of rocky islands for the most part inaccessible (Fig. 27). The northern island, El Columbrete Grande, is by far the largest and rises to 224 feet near its northern extremity. It resembles a horseshoe in shape and opens out to the north-east, enclosing a semicircular bay, the Puerto Tofiño (Fig. 26). The higher northern and southern extremities are covered with vegetation.

The Catalan Coast

The boundary of the province of Catalonia is crossed about 4 miles north of Vinaroz. The Catalan coastline south of the Ebro delta is bordered by the Sierra de Montsiá (2,376 ft.), which presents a steep face to the sea, and is flanked on the west by a sierra over 4,000 feet in Monte Caro. This coast consists of cliffs and small beaches as far north as San Carlos, which is on the slope of Mount Guardiola on

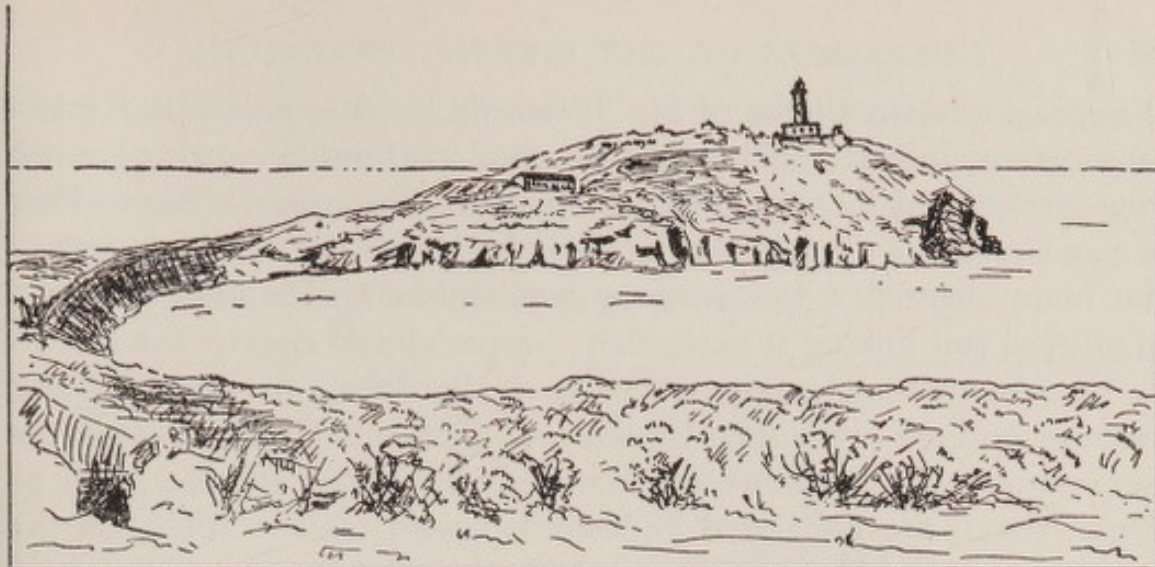


FIG. 26. PUERTO TOFIÑO, COLUMBRETE GRANDE

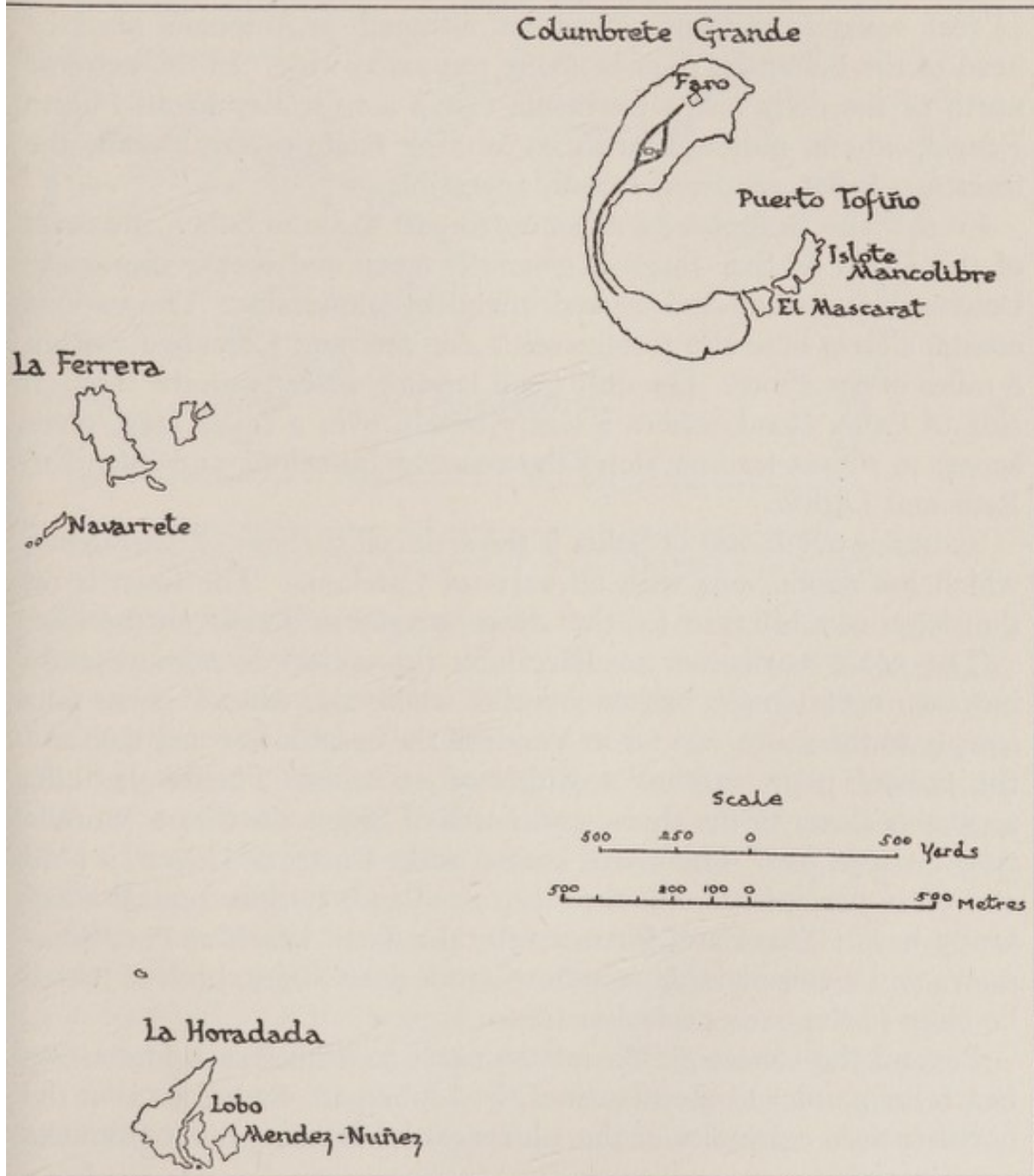


FIG. 27. THE COLUMBRETES

the rocky western shores of the Puerto de los Alfaques. Here communications inland are limited to a poor road and a canal, $5\frac{1}{2}$ miles long but only $1\frac{1}{2}$ feet deep, that leads to Amposta on the Ebro. East of San Carlos are the wide lowlands of the Ebro delta, where, south of the main channel, a low swampy peninsula and the muddy tongue of alluvial soil linking it to the delta proper almost enclose the Puerto de los Alfaques. The seaward parts of the deltaic flats are low and swampy and are divided by lagoons and innumerable channels into a vast number of reed-covered islands. The larger islands, such as Buda island, are cultivated and clothed with trees. Otherwise the surface is almost featureless except for the raised banks of the main streams. A bar at the mouth of the river, with a maximum depth of $4\frac{1}{2}$ feet, severely restricts navigation, although at Amposta, near the head of the delta, the river is about 300 yards wide. In the extreme north of the delta a low peninsula forms a wide bay about Puerto Fangal, where, although artificial landing facilities are absent, the foreshore is flat, sandy, and easily accessible.

From Cabo Roig, for 23 miles north-east to Cabo Salou, the coast of the Golfo de San Jorge is generally steep and rocky, the sandy beaches being small and backed inland by mountains. The various coastal sierras here rise to between 1,000 feet and 3,000 feet, within 8 miles of the shore. The only good landing-place is on the western side of Salou Road, where a sandy beach, over 2 miles long, gives access to routes leading along the coast to Barcelona and inland to Reus and Lérida.

Six miles north-east of Salou is the artificial harbour of Tarragona, which has connexions with all parts of Catalonia. The town is on the slopes of a hill (361 ft.) that drops steeply to the sea on the east.

The coast north-east to Barcelona (45 miles) is mainly sandy beaches, occasionally broken by cliff where the coastal sierra falls steeply to the shore. As far as Vendrell the coast is low and flat, and the coastal plain reaches a width of 10 miles. Thence the hills approach closer to the shore, and north of Sitges the Sierra Morella rises to 1,952 feet. This coast, known as the Costas de Garraf, is bold and often precipitous, but the steep headlands enclose several small sandy bays. There are, for example, the small beach at Port Villanueva and a considerable stretch of sands near Sitges, both of which lie close to the main coastal routes.

Beyond the Costas de Garraf the coast continues as a low sandy beach for 9 miles to the mouth of the Llobregat. Barcelona is at the north-eastern extremity of the Llobregat lowlands, 3 miles from the

river, at a point where an isolated hill, Montjuich (679 ft.), dominates the shoreline. Three and a half miles north-west of the city the plain rises abruptly to the hill range of Tibidabo. Access inland, however, is provided by the wide valleys of the Llobregat and Besós, which run north and south, respectively, of Tibidabo.

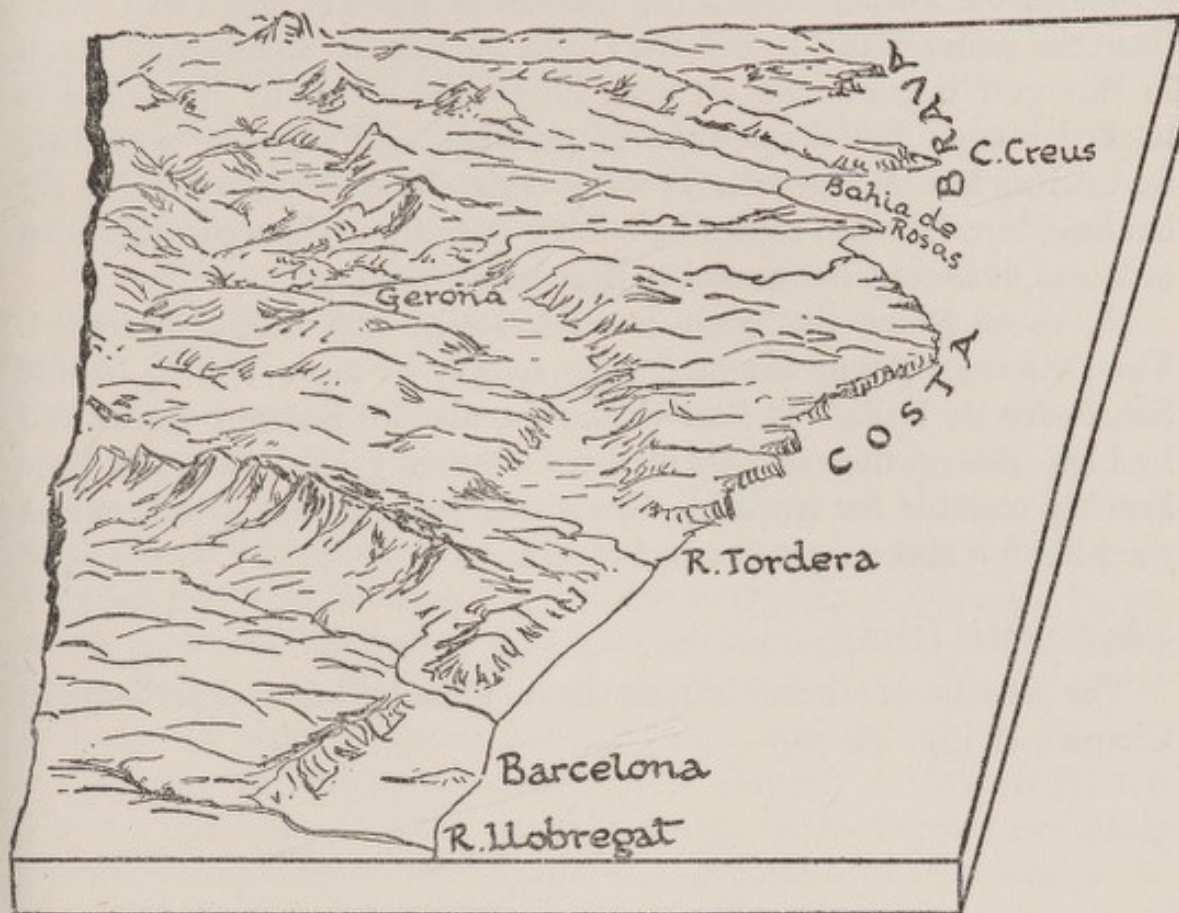


FIG. 28. THE COASTAL LANDS OF CATALONIA (after Carandell)

The coast from Barcelona 30 miles to Tordera point is straight and is backed inland by a steep hill range. Routes run alongside the beach, and serve numerous coastal towns, but landing is difficult. On reaching the delta of the Tordera river these main coastal routes turn inland to Gerona, and are separated from the shore by a belt of hills from 12 to 20 miles wide. Immediately north of this small delta lies Blanes Bay, which has a clear beach, half a mile long, within easy reach of the main routes.

North-east of Blanes, for 30 miles to Cabo Negro, the coast is rugged and irregular, often rising steeply to hills between 1,000 and 1,500 feet high. Of the several small bays sheltered by rocky headlands, only San Feliu and Palamós have rail connexions inland. At San Feliu there are quays, a mole, and a sandy beach, suitable for landing; a narrow-gauge line leads 25 miles to Gerona. At Palamós,

5 miles to the north-east, the beach is 2 miles long, steep to, and suitable for landing, but Gerona is 31 miles away by rail.

North of Cabo Negro, as far as Rosas, the coast becomes flat and, in parts, marshy except for a short distance where the steep, indented Sierra Catalina (1,000 ft.) borders the sea. This small hill-block separates the lowland about the mouths of the Ter and Daro rivers from the vaster plains round the Golfo de Rosas. The 9-mile beach in this gulf is protected on both north and south by hills, and is backed inland, first by a strip of marshes, and then by a slightly undulating lowland, at least 15 miles wide. The beach is suitable for landing, but the main routes lie 6 miles or more to the west; the town of Rosas, however, has a road to Figueras (Photo. 50).

North of Rosas the coast is wild, steep, and deeply indented. Towards the interior the land rises steeply to 2,260 feet in Monte San Pedro de Roda. At Port Cadaques, a small harbour dominated by high hills on the east side of this mountain group, there are three beaches suitable for landing. From this point a road winds across the hills for about 24 miles to Figueras.

The Balearic Islands

The coasts of these islands have already been described in Chapter II (pp. 46-50).

CHAPTER IV

THE CLIMATE OF THE IBERIAN PENINSULA

I. GENERAL FACTORS

The Main Pressure and Wind Belts

THE climate of the Iberian Peninsula is affected by the winds of the two great pressure systems of the North Atlantic Ocean:

- (a) the high-pressure over the neighbourhood of the Azores.
- (b) the low-pressure centred upon the neighbourhood of Iceland.

These pressure systems expand and contract at the expense of each other. When the Azores high-pressure is well developed, the Iceland low-pressure area is pushed northwards; when the Azores high-pressure weakens, the Icelandic low-pressure expands southwards.

There are, however, rough limits. The Azores high-pressure is most strongly developed in the northern summer, when it commonly expands north as far as 40° N. on the west side of Europe. In the northern winter the Azores high-pressure weakens and the Icelandic low-pressure area frequently expands south as far as about 30° N. latitude. Between latitudes roughly 30° N. and 40° N. the pressure system therefore changes from high in summer to low in winter. The Azores high-pressure tends to bring to the Iberian Peninsula northerly winds from the European land-mass, and they tend to be dry. On the other hand, the Icelandic low-pressure area tends to give the Iberian Peninsula moist westerly winds.

The Iberian Peninsula, however, lies between latitudes 36° N. and 44° N. Therefore the northern half of the Peninsula should be mainly under the influence of moist westerly winds all the year round, and the southern half of the Peninsula, south of 40° N., should have moist westerly winds in winter and dry northerly winds in summer.

Mediterranean Effects

This theoretical scheme is affected in both southern and eastern Spain by the Mediterranean Sea and by the African land-mass. For example, the low-pressure over the Sahara in summer increases the strength and constancy of northerly winds blowing over eastern Spain at this season; and, very occasionally, scorching winds from the Sahara cross the Mediterranean to south and south-eastern Spain.

Effects of the Iberian Land-mass

The climatic effect of the two North Atlantic pressure belts is modified by the size and compactness of the Iberian Peninsula. The central tableland is relatively cold in winter and forms a local high-pressure area; in summer it is relatively hot and is covered by a local low-pressure system. In winter, when moist Atlantic winds are most common, the local high-pressure precludes their influence from central and eastern Iberia, and Spain derives much less benefit from them than might be expected.

Maritime influences on the climate of Spain are still further lessened by the coastal ranges. The Pyrenees and the Cantabrians restrict them almost to their seaward slopes. The altitude of the central tableland has a similar but less marked effect on them. It is not, therefore, the northern half of the Iberian Peninsula that has a damp oceanic climate, but only a mere strip along the north and north-west. The smallness of the 'pluviose' or rainy region of the Peninsula and the vastness of its 'arid' area is perhaps the most important fact in its geography, and one which has far-reaching effects on every aspect of its life.

II. GENERAL ACCOUNT OF THE CLIMATE

Direction and Characteristics of Prevailing Winds

Along the north and north-west coasts of the Iberian Peninsula, as far south as Lisbon, the prevailing winds are northerly. At Bilbao 68 per cent. of all winds come from this quarter, at Corunna 52 per cent., at Pontevedra 64 per cent., and at Lisbon 65 per cent. These winds frequently show a westerly bias, but where, as in the Basque lands, the bias is often easterly, the winds still blow from the sea. Indeed, throughout the north and north-west, winds from the interior are rare. The bitter winter weather and the dry, scorching summer heat on these occasions are all the more unpleasant, in contrast to the moist, equable nature of the prevailing winds from the Atlantic.

The coastal lands from Lisbon to Cádiz experience prevailing westerly winds. The plain of Andalusia permits these winds to blow far into south-western Spain. In winter, however, winds from the east are frequent upon the coastal strip from Cape St. Vincent to Sanlúcar.

In the Strait of Gibraltar west and east winds predominate all the year. Westerly winds prevail from November to March (50 to 60 per

cent.), and easterly winds from July to September inclusive (45 to 55 per cent.).

On the Mediterranean coast of Spain there is a seasonal change in wind direction, the winds blowing outwards from the land-mass in winter and inwards in summer. It is most noticeable on the southern coastal strip and in the Levantine lowlands, where easterly winds prevail from April to September inclusive, and westerly winds with a northern bias predominate from November to February.

Along the Catalan coast also, westerly winds with a northerly bias prevail from October to March. The winds from April to September are, however, mainly from the south and west. The frequency of westerly and northerly winds on this coast is typical of the northern half of the Iberian Peninsula.

Effects of Depressions

Cyclonic depressions, which occur especially in winter, often pass across the neck of the Iberian Peninsula from the Bay of Biscay to the Gulf of Lions. The northerly winds associated with the rear of these depressions may give tempestuous weather to the north coast of Spain. The passage of the depression may also assist or favour peculiarly unpleasant winds elsewhere in Spain. A cold wind, called the *mistral*, that chills the lowlands of Catalonia, is probably born in the rear of a depression. A dry, scorching wind of south-eastern Spain, known as the *leveche*, is induced in the front of a depression. The strong, often squally, south-west winds (*vendavales*) of the Strait of Gibraltar also come with advancing depressions, from late autumn to early spring.

Local Winds

Land and sea breezes are experienced on most shores of the Peninsula. They occur during clear, calm weather, especially in summer, when they blow regularly over a strip from 10 to 15 miles wide on either side of the coastline. The bays and coasts of Spain are highly favourable for these breezes, which are often strong enough to obscure the prevailing wind. The sea breeze disappears inland at heights of between 500 and 1,000 feet. It usually begins about 0900 hours, reaches its greatest force about 1500 hours, and dies away towards sunset. The land breeze assumes control about three hours after nightfall, and gradually increases in force until daybreak, after which it fades away.

Whenever these breezes are strongly developed upon the coast, mountain and valley winds may occur in the enclosed basins and

steep-sided valleys of mountain districts inland. The mountain wind is a current of relatively cold air that begins to blow into the valley a few hours after sunset; the valley wind is a gentle breeze of relatively warm air that rises up the valley-side during the late afternoon. The mountain wind is of considerable importance on calm, clear nights in

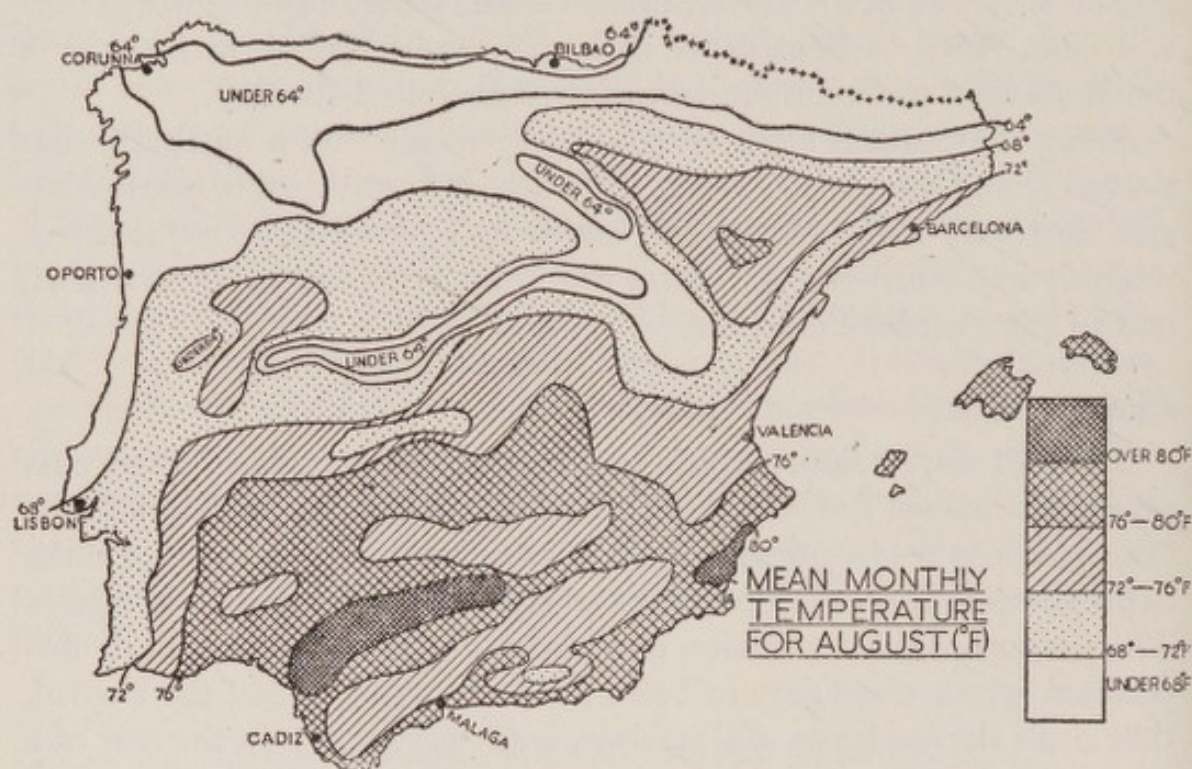


FIG. 29. (After Semmelhack)

winter when the downhill flow of cold air makes the valley-bottom colder than the mountain-slopes above it. Consequently on the lower land the night frosts are often more severe and more prolonged.

Yearly Temperature Distribution¹

The height of the noonday sun above the horizon at Madrid is about 26° in mid-winter and 73° in mid-summer. Daylight varies from 9 hours in December to 15 hours in June. Compared with London the winter day of Madrid is $1\frac{1}{2}$ hours longer, the summer days are $1\frac{1}{2}$ hours shorter, and the sun is about 10° higher in the sky all the year.

August (Fig. 29) is usually the hottest month throughout the Peninsula, although it differs little from the normal July. In the lower parts of the north and north-west the mean temperature in both months is from 65° to 70° . The northern districts of the central

¹ All temperatures are in degrees Fahrenheit.

tableland are equally hot in spite of an altitude of about 2,500 feet. Even the Iberic mountains between 3,000 and 4,000 feet are slightly hotter than the northern coastal lowlands. In the Ebro trough and on the central tableland south of Madrid the average August temperatures increase to 75° and 78° . The greatest heat, however,

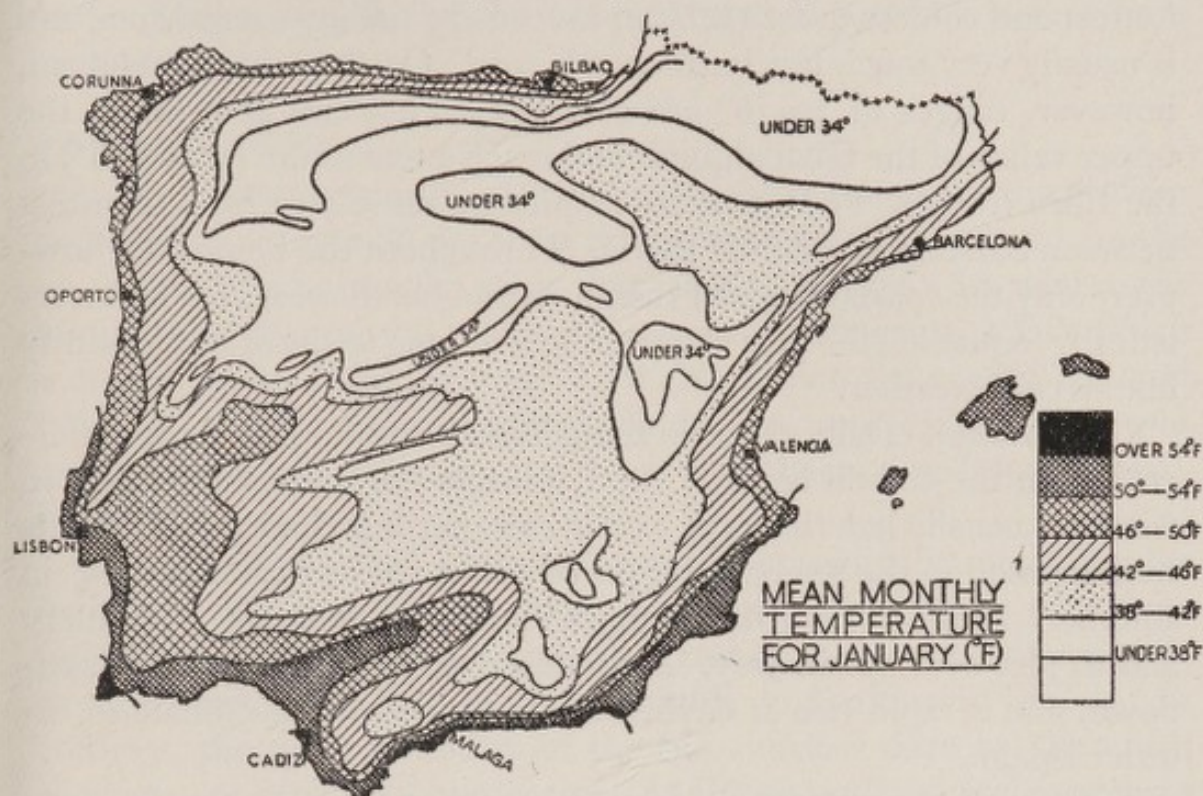


FIG. 30. (After Semmelhack)

occurs in the Guadalquivir valley near Seville, where July and August have mean temperatures of 84° and 85° .

The coastal lands of Portugal and Spain are hot in spite of proximity to the sea. In Portugal the mean temperature of the hottest month increases from 67° in the north to about 76° in the south. The southern strip of Mediterranean Spain and the Levantine lowlands experience mean August temperatures of 75° to 79° , and this heat continues along the Catalan coast.

January (Fig. 30) is normally the coldest month almost everywhere in the Peninsula. At this season the average temperatures of the north and north-west lowlands range from 45° to 47° . The interior lands of northern Spain, including the Ebro trough, are much colder than the Atlantic coasts and seldom experience mean monthly temperatures above 35° to 38° . Even the southern half of the central tableland is colder than the north and north-west coasts, and only in its lowest and most sheltered places experiences mean monthly temperatures of 45° . The contrast between the warm coastlands and colder interior is

further emphasized by the warmth of the winters in southern Portugal and in southern and south-eastern Spain. Here mean January temperatures of $50-54^{\circ}$ are common, and the winters are the warmest in the whole of the Peninsula.

Seasonal Range. The range between the mean temperatures of the hottest and coldest month seldom exceeds 25° in any coastal area, and is usually very much less in the north-west. On the central tableland, however, ranges of $30-36^{\circ}$ are common. They are as great in the upper valley of the Guadalquivir and reach a maximum (about 38°) in the Ebro trough. Few statistics emphasize more clearly the contrast between coastal and interior Iberia. Throughout the Peninsula, however, only the coastal lands of the north and north-west are characteristically 'equable', for they alone are free of long spells of unpleasantly hot or cold weather.

Daily Range. Daily range in temperature emphasizes these differences. In the coastal lands of the Peninsula the mean daily range in winter is usually less than 15° , and in summer less than 22° . Districts well exposed to the sea have ranges of about 10° in winter and 15° in summer. In the interior these ranges increase to about 18° in January and to just over 30° in July. A sudden drop of temperature at sundown, and a rapid rise at daybreak, are typical of the climate of interior Spain.

Extreme Temperatures. Almost throughout the Peninsula temperatures of about 100° may be expected, the only notable exceptions being the higher mountain areas and the most maritime parts of the Atlantic coast. On the north and west the thermometer does not reach 100° in every year, but at Bilbao 110° has been recorded. Temperatures of 100° are usual and 105° is occasional over most of central and southern Spain. Even at Soria, 3,500 feet above sea-level, the temperature has reached 108° in the shade, and most districts on the central tableland, especially in the south, have had temperatures as high or higher. Whereas at Lisbon and Gibraltar the heat recorded barely exceeds 100° , on the Mediterranean coasts between Málaga and Murcia 100° occurs in most summers and from 110° to 118° has been known. The plain of Andalusia is the hottest part of Spain; Seville experiences 114° in most years and has recorded 122° .

The mean minima temperatures show that the coastal lowlands from just south of Coimbra to Cabo de Gata rarely, if ever, experience frost. Slight frosts occur occasionally for short periods in winter on the other coastal lands. In the interior of the whole of the northern

half of Spain there may be frost at any time except in summer and early autumn.

The greatest cold in Spain (outside the high mountains) occurs, however, in the southern parts of Old Castile and in the upper Ebro trough. Nearly the whole of this area has experienced 27° of frost, and in the Burgos neighbourhood temperatures of just below zero have been recorded.

Relative Humidity

In the north and north-west the atmospheric humidity ranges from 70 per cent. to over 80 per cent. throughout the year. Elsewhere the summer air is markedly drier than that of winter. In winter the humidity of the central tableland is over 80 per cent., a fact which accounts for its bitter 'rawness'. At this season the coastal lands of Portugal and of Mediterranean Spain are appreciably drier and warmer than the interior, and have long been noted for 'genial', balmy winters.

In July the seasonal change of relative humidity is much greater in the interior than on the coast. Throughout the whole of the interior the summer air is dry and parching and this atmospheric dryness makes the heat more favourable to health and labour. In contrast, the great humidity of the hot summer days on the north coast can be extremely oppressive. At Bilbao one may feel overcome or even prostrate with the temperature at 100° , but at Seville the same degree of discomfort is not experienced with temperatures of over 110° .

Cloudiness and Sunshine

The average cloud-cover in the various regions of the Peninsula is shown in the following table:¹

Region	Average cloudiness	
	Jan.	July
North and North-west .	6.5	5.5
Northern tableland . . .	6.5	3.3
Southern tableland . . .	5.3	2.0
Ebro trough	5.0	2.5
Coastal lands of Portugal .	5.8	3.5
Plain of Andalusia and coasts of Mediterranean Spain .	3.8	1.0
Catalan coast	5.0	4.0
Balearic islands	4.5	1.5

¹ The degree of cloudiness is given by the figures 0-10, in which 0 represents a

In summer, clouds are common only in the north and north-west and even here long spells of sunny weather are not unusual. Over the remainder of the Peninsula cloudless skies are the rule except during occasional brief storms. In winter, although clear days are less frequent than in summer, the cloud-covering is usually broken to permit 5 or 6 hours of sunshine a day, even in January. Consequently the sky in the north and north-west is seldom completely overcast; during an average year in this region 75 days with cloudless skies may be expected. Inland, however, on the high tableland of León and Old Castile, 100 cloudless days commonly occur. The number increases southwards and eastwards to about 165 days in New Castile, and to 200 days in the plain of Andalusia, the southern coastal strip of Mediterranean Spain, and the Levantine lowlands. Intense blue skies and long hours of sunshine are characteristic of Spain and Portugal. These qualities, although most strongly developed in the interior of Spain and the Mediterranean coastlands, are noticeable even on the coastlands of Portugal, where Coimbra has 2,510 hours of sunshine a year and averages 10 hours a day in July.

In the plain of Andalusia and the Mediterranean coasts south of Catalonia the sun shines from a brazen sky, and at night the moon and stars light up the landscape with remarkable brilliance. But visibility is usually poor during the hot seasons; the rising air-currents pick up fine dust that forms the *calina*, a haze common in July and August on the central tableland and Mediterranean Spain. The *calina* appears as a narrow bluish or greyish band, about 15° above the horizon. When the dusty breeze has set in, the sun and moon become tinged with red at their rising and setting, distant objects look blurred, and the skyline gradually fades out of sight.

Many of the characteristics of the architecture of Spain and the habits of the people are connected with the heat and long hours of summer sunshine. The *patio*, or inner courtyard surrounded and shaded by verandas, occurs everywhere in Spain and especially in Andalusia; the *siesta*, or noon-day rest, and the hustle and bustle that precede it, alike reflect the need of avoiding the great heat of the day.

Precipitation

The Iberian Peninsula may be divided into two distinct regions of sky quite free from cloud and to an entirely overcast sky. The figures of cloud-cover given in this chapter are therefore 'tenths', but the word 'tenth' has been omitted throughout. It should be remembered that the figure refers solely to the amount of sky covered and not to the density or to any other quality of the cloud.

precipitation: the rainy north and north-west, and the remainder of the country (Fig. 31). The former receives from 30 to 45 inches of rain a year; the latter, with very few exceptions, has less than 30 inches; and large areas of the central tableland and Mediterranean coast have less than 20 inches. The highest and lowest annual rainfalls occur on almost diametrically opposite coasts of Spain, Cabo de Gata having only 5 inches a year and Santiago in Galicia nearly 70.

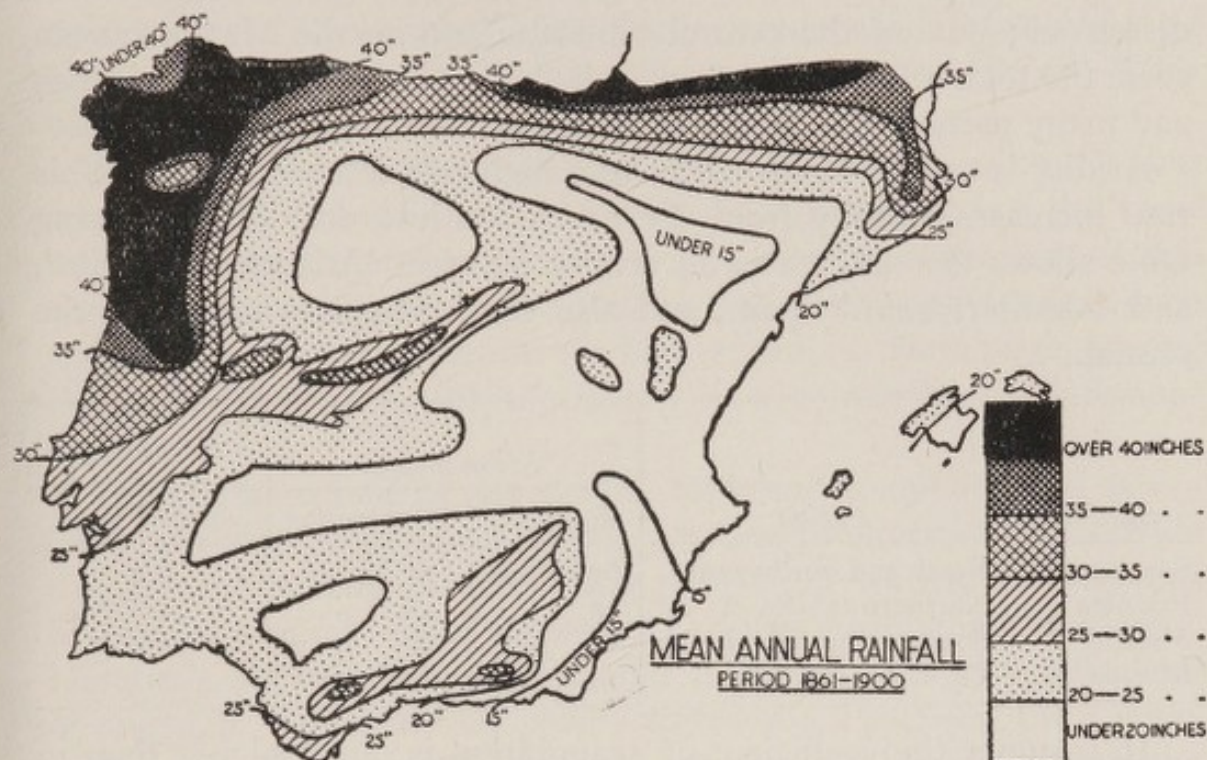


FIG. 31. (After Semmelhack)

August is normally, and July occasionally, the driest month. In the north and north-west, however, $1\frac{1}{2}$ –3 inches fall during the driest month, while elsewhere there is less than one inch.

The rainy season varies. In the north and north-west it is from October to January; in the interior there are two rainy seasons, spring and autumn, and of these spring has generally the greater fall; on the coastal lands, including the plain of Andalusia, the rainiest period is late autumn (November to January).

Throughout the Peninsula rain falls in short, sharp, heavy showers. Most of the coastal districts have had 3 or 4 inches in a day and at Gibraltar no less than 7·8 inches have fallen in 24 hours. From May to September, anywhere in Iberia, the brief, heavy storms may be accompanied by thunder. It is especially during the torrential storms of the summer half-year that sudden spates fill the almost

streamless beds of the great Spanish rivers and cause disastrous floods.

Rainfall and its time of fall vary much from year to year. Even in a 'normal' year the annual rainfall of any place in the southern half of Spain may differ by 15-25 per cent. from the average. The usual yearly variation is about 10 per cent. in the north and north-west. The periods of drought matter most. In the north and north-west the driest years still have 30 inches of rain, so that drought is not disastrous; but on the central tableland and on the Mediterranean coast the total may be less than 10 inches. Madrid has had 9 inches and many parts of the Mediterranean coast have had only 7 inches.

Aridity is caused by drought and a high rate of evaporation. This rate increases steadily from the north southwards. The following table shows the differences in aridity between 'Atlantic', 'interior', and 'Mediterranean' Spain, and also the inadequate nature of the rainfall.

Station	Region	Mean annual		Relation of evaporation to rainfall, E/R
		Rainfall	Evaporation	
Santiago	North and north-west	65 inches	35 inches	0.5
Palencia	Northern tableland	12 "	48 "	4.0
Madrid	Southern tableland	17 "	60 "	3.5
Murcia	Levantine lowlands	14 "	74 "	5.3

In summer the coefficient of evaporation is much higher than in winter and a 15 years' mean for August at Guadalajara in New Castile shows a rainfall of less than half an inch and an evaporation 26 times as great.

Periods with exceptionally heavy rainfall occur on an average every 10 or 12 years. In the north and north-west the heaviest falls

Station and region	Highest rainfall		Lowest rainfall in year	Mean annual rainfall
	In month	In year		
Santiago. North-west	19 inches	90 inches	35 inches	65 inches
Burgos. Northern tableland	9 "	30 "	12 "	22 "
Madrid. Southern tableland	6 "	23 "	9 "	17 "
Valencia. Levantine lowlands	10 "	28 "	7 "	17 "

in a month are 15 to 19 inches; Madrid has experienced 6 inches, Murcia 8 inches, and Alicante 14 inches in one month. These rare

periods are more destructive than useful to man, for they cause serious floods and much soil erosion, and by covering the land with thick layers of infertile sand and gravel may throw it out of cultivation. The table at foot of p. 90 shows the heaviest and the lowest rainfalls yet recorded in various regions.

Snowfall and Snow-cover

Snow is a factor of great importance in the northern half of Spain, as in winter it blocks many of the higher roads which lead to Madrid across the Pyrenees, the Cantabrians, and the Central Sierras. Railway communication is similarly interrupted.

As a general rule, the lowland areas of the north and north-west receive a few falls of snow from October to March, but the snow seldom lies or accumulates to any depth. On the mountains of this region, however, except in the Basque lands, the snow-cover is deep and lasts until midsummer on the highest points. Here roads passing above 4,000 feet are usually blocked by snow, at least during December and January.

The northern half of the central tableland frequently has snowfall between November and April. In the province of Old Castile the ground is snow-clad for long periods in winter, the adjacent highlands keeping their snow-cover almost throughout the year. Here only between July and October is the weather sure to be free of snowfall. In winter all passes across the Pyrenees, the Cantabrians, the Iberic mountains, and the Central Sierras, except the lowest, are usually blocked with snow for periods ranging from a few weeks up to 3 or 4 months. Passes above 5,000 feet may be closed from November to March, and, after a bad winter, routes at about 6,000 feet may be open only from June to September. Railways across these mountains are sometimes blocked by snow. In the winter of 1940-1 heavy snowfall held up trains to Madrid from Burgos, Valladolid, and Ávila; and a train between Saragossa and Teruel was snowbound for 3 days. In a normal year most of the passes between 4,500 and 5,500 feet across the Pyrenees open between 15 May and 1 June. It is, however, in the northern half of Spain only that snow is a serious hindrance to communications in winter. On the southern tableland snow falls on 3 or 4 days each winter, and even in May and June sudden cold spells may bring air flecked with falling snow at Madrid; but the snow-cover is negligible except on the higher mountains, where winter ski-ing can be practised. Snow is almost unknown on the Atlantic coast south of Lisbon and

on the Mediterranean coast south of the Ebro delta. The following table gives the average number of days with snow at typical stations:

Station	Position	J.	F.	M.	A.	M.	J.	Jy.	A.	S.	O.	N.	D.	Av. yrly total
Jaca	Foot of Pyrenees	3.3	3.6	2.0	1.0	0.3	..	..	..	..	0.3	0.9	2.8	14.2
Guarda	Lower slopes of Central Sierras	5.4	3.8	4.4	2.3	0.4	0.2	0.1	..	0.1	0.5	2.1	5.8	25.1
Ávila		6.2	3.6	5.3	3.4	0.5	..	..	..	0.1	0.7	2.6	4.5	26.9
Burgos	Northern tableland	4.3	3.0	4.1	1.9	0.2	..	..	..	..	0.4	1.5	3.3	18.7
Madrid	Southern tableland	1.0	0.4	0.6	0.4	0.1	..	..	..	..	..	..	1.3	3.8
Santander	Northern coast	0.8	0.3	0.4	0.2	0.1	..	..	..	..	..	0.2	0.3	2.3

The table at the end of this chapter gives a list of Spanish roads that may be blocked by snow during the winter months. The name of each pass, its height, and the period during which the road may be blocked are given. The passes are arranged in four groups: (a) the Pyrenees; (b) the Cantabrian mountains; (c) the Iberic mountains; (d) the Central Sierras (Gredos and Guadarrama).

Swell

In May the whole of the Atlantic coast of the Iberian Peninsula is normally free of appreciable swell on only 1 day in 4.

During June, July, and August swell is most frequent off the coast of Galicia between Cabo Ortegal and the estuary of the Minho. Here the chances of encountering slight or no swell remain at not more than 1 in 4 throughout the period.

Elsewhere on the Atlantic coast of Spain and Portugal the chances of slight or no swell increase during these months (June–August), to 2 in 4. In August, however, the coast of the Bay of Biscay as far west as Avilés or Gijón is relatively free of swell, the chances of experiencing slight or no swell being 3 in 4.

Statistics on swell are not available for the Mediterranean coast of Spain. Violent swell, however, occurs at times in fine weather on the coasts of the provinces of Alicante, Valencia, and Catalonia. The waves, which are known locally as *las tascas*, seem to originate with northerly and easterly winds over the head of the Gulf of Lions. On the Catalan coast this swell is the precursor of north-east and east-north-east winds, which may be expected to set in within 24 hours. In the Bay of Valencia the swell is a sure sign of an easterly wind and in the Bay of Alicante of a northerly wind. Tables showing the state of the sea in relation to wind direction at Almería, Barcelona, and Port Mahón are given in Appendix I, Section III.

III. REGIONAL ACCOUNTS OF THE CLIMATE

A study of the climatic factors already summarized shows that the Iberian Peninsula may be divided into three major climatic divisions:

(a) The rainy zone of the north and north-west, which is a land of oceanic winds, mild winters, and, from a Spanish point of view, cool summers, cloudy skies, and sufficient rains. Its climate is also distinguished by equable temperatures, both monthly and daily ranges being small, and by rainfall all the year. [Region 1.]

(b) The continental or inland area, whose climate is characterized by great ranges of temperature, both seasonal and diurnal, by raw, cold winters and dry, hot summers, and by a scanty rainfall that comes chiefly in spring and autumn. This area includes the central tableland, the Ebro trough, and the mountains which separate these two regions. [Regions 2, 3, and 4.]

(c) The areas with a 'Mediterranean' climate, characterized by mild, rainy winters, dry summers, and frequent sunny skies. The rainfall is small and torrential, the air dry, and evaporation intense. Included are the coastal lands of Portugal, the plain of Andalusia, the Mediterranean coastal lands of Spain, and the Balearic islands. [Regions 5, 6, 7, and 8.]

The extent to which different parts of the country vary from these general conditions will be found in the following account of the climate of each region. The regional division already adopted (Fig. 1) is adhered to in this chapter. The reader is thus enabled easily to extract the climatic description of the region in which he is especially interested.

1. THE NORTH AND NORTH-WEST

The Pyrenees

Region 1 (a)

Few reliable climatic statistics are available for the Spanish side of the Pyrenees. The mountainous relief almost makes its own climate and the great valleys usually control the direction of local winds. Nevertheless winds from a northerly and westerly quarter prevail, although southerly winds occur occasionally. The northerly and westerly winds often bring cloud and rain; the southerly winds, especially on the French side, are dry and warm.

The temperature decreases irregularly with increase of altitude, and there are great differences between the sunny and the shaded slopes. On the Spanish side the temperature decreases with altitude more slowly in winter than in summer. Thus Jaca, at 2,700 feet in the

Pyrenean foothills, is 20° warmer than the Pic du Midi (9,380 ft.) in January and 24° warmer in July.

The Spanish side of the Pyrenees is much drier and less cloudy than the French; and the eastern Pyrenees than the western. A narrow zone stretching seawards from the Pic du Midi receives 65 inches precipitation in a normal year, and has had over 100 inches, a phenomenal figure for Spain. All the higher western half of the Pyrenees has probably at least 50 inches precipitation, but in the Spanish foothills less than 30 inches. On the mountains the rainiest season lasts from December to May, but on the Spanish piedmont spring and autumn are the rainy periods.

During the winter half-year most of the precipitation falls as snow above 3,000 feet. The Col de Roncevalles (3,468 ft), north-west of Pamplona, is usually snow-bound from November to February. Passes at 5,000 feet, as that between Jaca and Oloron, are usually impassable from November to May, while those over 6,000 feet, such as that between Balaguer and St. B  at, are usually blocked until June. The snow-cover descends to about 3,500 feet in the heart of winter, retreats to 5,000 feet by the end of May, and by July and August has reached the snow-line,¹ which is between 8,000 and 9,000 feet above sea-level. The depth of snow-cover on the French side occasionally reaches 14 feet in the colder valleys (about 4,500 ft.) that are exposed to damp winds. The following tables show the general difference in climate between the Pyrenean crest zone and the adjacent foothills on the Spanish side.

Mean Monthly Temperature ( F.)

Station	Alt.	J.	F.	M.	A.	M.	J.	Jy.	A.	S.	O.	N.	D.	Yr.
	feet													
Jaca	2,720	38	40	43	46	56	62	68	69	61	51	45	38	..
Pic du Midi	9,380	18	19	19	23	29	37	44	44	28	31	24	20	..

Mean Monthly Precipitation (inches)

Jaca	2,720	1.2	2.8	2.5	3.0	2.6	3.3	2.0	2.3	3.0	2.7	2.8	1.3	28.8
Pic du Midi	9,380	7.2	6.5	6.3	6.7	5.6	5.0	2.8	2.9	4.3	4.5	5.4	6.4	64.2

The Basque Lands and the Cantabrian Mountains

Region 1 (b) and (c)

Winds

The prevailing winds on the north coast of Spain blow from a

¹ The 'snow-line' is the lower limit at which snow lies throughout the year.

northerly quarter all the year. North-west winds are common at all seasons and especially from April to June, when they make up about 50 per cent. of all observations. North-east winds prevail during July and August, but are also frequent from May to October inclusive. Changes between these two directions give rise to north winds on 1 day in 9. These prevailing winds usually blow onshore, and from November to March inclusive they reach gale force about 4 times a month.

The inhabitants have local names for certain of the more unpleasant winds. South and south-west winds, which are rare except from December to March, are called *terreros*. North winds are *travesías*. A north-west wind can bring severe gales to the Basque lands between July and September, and is known as *galerna*; it usually rises during the afternoon of a very hot day and brings tempestuous, squally, rainy weather that ceases before nightfall. Another unpleasant wind is *nordeste pardo* or the grey north-easter, that persists for 2 or 3 days in winter, and usually brings very dirty weather.

In addition to these major winds, land and sea breezes are common on the coast, especially in summer, and during periods of calm weather.

Temperature

The coastal areas have mean temperatures of about 68° in July and August, during which period the hottest days usually rise to 96° , and the coldest nights sink to about 50° . Near the shore the temperature seldom reaches 100° , but in the deep, sheltered valleys, a few miles inland, temperatures of over 100° occasionally occur even in May and October. At Bilbao, which is situated in a valley of this kind, 111° has once been recorded.

January, the coldest month, has a mean temperature of about 47° . Throughout the winter the warmth of the days occasionally exceeds 60° , while the night temperatures may fall slightly below freezing-point. Temperatures of over 70° have been recorded in January, and 14° of frost.

Immediately inland from the coastal strip, the winters become less mild. Oviedo, at 800 feet and only 20 miles inland, is at least $4-6^{\circ}$ colder than the coast all the year. Pamplona is barely 40 miles inland, yet its bitter winters, with a January mean temperature of 38° , show that it does not benefit from the warming influence of sea-winds, in spite of the low altitude of the coastal mountains in the Basque lands.

Relative Humidity and Fog

On the coast the relative humidity is between 70 and 80 per cent. all the year. Inland in summer it decreases rapidly, especially towards the Ebro trough. On the coast, fogs are slightly more frequent in summer than in winter, there being 5 days a month, against 4. Summer fogs are common in the Golfo de Foz; Bilbao has about 50 days with fog, but on the coastal fringe there are probably 70.

Cloudiness

The average monthly cloudiness varies from just over 6 in winter to just over 5 in summer. Even in December, the cloudiest month, not more than 7 of the sky is covered; in August long spells of sunshine are to be expected. The inland districts have appreciably more cloud than the coastal districts during the winter half-year.

Precipitation

On the lowlands the annual rainfall is from 35 to 55 inches. October to January is the rainy season, with from 4 to 6 inches a month, but April often brings a period of rain. From May to August (the drier season) monthly falls of 2 or 3 inches occur on the coast, and slightly smaller amounts in the sheltered valleys, a few miles inland.

The number of rain-days varies from 150 to 175 in different localities. Generally, about 15 rain-days¹ occur in each month from October to January inclusive. April, however, usually has as many as any of the winter months, but the falls are less heavy and less protracted. From June to September about 11 days a month, or 1 in 3, have some rain.

The intensity of the rainfall in winter is not exceptional for Spain, but in the warmer months, from June to September inclusive, $3\frac{1}{2}$ to $4\frac{1}{2}$ inches have occurred in 24 hours. In summer even the heavy showers are of short duration and the sky soon clears. Thunderstorms are commonest in July and August, when they occur 2 to 3 times a month.

The reliability of the rainfall is remarkably high for Spain. Even the driest years have 30 inches of rain, and few records of almost rainless months exist for the whole of the north-coast region. The heaviest fall recorded in a month is 19 inches.

On the coast snow falls occasionally from November to April, but

¹ The term 'rain-day' as used in this chapter, unless otherwise stated, means a day with a trace or more of rain.

seldom on more than 4 days in the year. Even in January, not more than two days with snowfall are to be expected. On the mountains inland, snow occasionally blocks the passes above 3,000 feet from December to February and March. The higher parts of the Cantabrian mountains retain their snow-cover until June and the Picos de Europa (over 8,000 ft.) has patches of snow throughout the year.

Galicia

Region 1 (*d*)

The climate of the Galician coastlands closely resembles that of the north coast of Spain, except that the oceanic influence is slightly greater.

Winds

On the Galician coast northerly winds prevail for most of the year, and are especially predominant from April to October. Winds are more variable from October to March when south and west winds, called *vendavales* often bring dirty weather and poor visibility. In winter, when a depression passes eastwards over the Bay of Biscay, a south wind often veers to north-west and reaches gale force. Throughout the north-west of Spain, winds from the land are unusual, and east winds are to be expected only 3 or 4 times a month, even in January, the season when they are commonest.

Gales decrease in number and severity towards the south. In the neighbourhood of Corunna they occur most frequently from December to March, when there may be three or four in each month. It is usual, however, for the northern coast to have at least one gale every summer month. The southern parts of the Galician coast seldom have more than 4 or 5 gales during the whole period from April to November, and even in winter not more than one gale a month is to be expected here.

Land and sea breezes are well developed in the *rías* of the coastlands, while inland mountain and valley winds also occur during calm weather. The valley winds probably assist the formation of the *bretema*, a soft, white mist that occasionally veils the landscape in autumn.

Temperature

The climate is mild in winter and warm in summer, although English visitors find that July and August days are 'very hot' away from the coast. The coldest month, January, has mean temperatures

of 47–49°, and at this season the weather is mild and equable. Frosts are not common on the coast, and when they occur, are slight. The coldest temperatures ever recorded at coastal stations are only about 20° or 12° of frost. The midday temperature often exceeds 60° in January and the daily range is small, between 15° and 20°.

July and August, the warmest months, have mean temperatures of 65–68°, and during this period the heat rises to between 70° and 80° on most days. The nights are warm and seldom fall much below 56°. The noonday heat is rarely excessive; 100° is seldom experienced on the coast, but is usually recorded once a year at the lower and more sheltered inland stations. Near the coast, temperatures of from 90° to 95° are to be expected in most years.

Relative Humidity: Mist and Fog

The coastlands of Galicia are the most humid part of Spain. During most of the year the relative humidity remains slightly above 80 per cent., and even in the south, where conditions are less oceanic, it is about 70 per cent. in summer. Consequently, fogs are relatively common, over 80 a year occurring near Corunna. Here, every month usually has 6 foggy days, and from June to September about 8 days with fog a month are to be expected. Farther south, near Pontevedra, fogs are much less frequent and are rare from March until May.

Cloudiness

On the seaboard, the mean monthly cloudiness varies from about 6.5 in January to 5 in July and August. Inland, however, especially in the deep Minho valley, the summer cloud-cover decreases to about 4. From October to March sunny periods are relatively few, but from June to September long periods of cloudless blue sky are common even on the coast.

Precipitation

The mean annual rainfall varies from 30 to 65 inches on the coast and probably reaches 80 inches on the higher levels of the Galician tableland.

The rainiest months are from October to March, with a maximum in November and December, when from 4 to 6 inches a month are to be expected near the coast and 6 or 7 inches on the mountain slopes. The rainfall is regular and reliable. Even during the rainy winter months not more than 2 or 3 inches of rain have been recorded in one day.

During the drier season, from June to August, the rainfall is seldom below 1 inch each month, which is more than elsewhere in the Peninsula.

The number of rain-days varies from 135 on the coast to about 180 on the inland slopes. From October to January inclusive there are about 14 rain-days a month, or about 1 day in 2. From June to August 7-9 days have rain a month; and September has only a few more rainy days than August, although the rain is much heavier. Thunderstorms are commonest from May to July, when they occur about once a month.

Snowfall is uncommon on the coastlands and lower areas of Galicia. Corunna has snow about once every three years; Santiago, although over 800 feet above sea-level, about three days a year. Yet on the mountain slopes and the summits of the inland plateaux, snow may accumulate sufficiently to obstruct transport. Here, passes at 3,000 feet are rarely blocked with snow, while those over 4,000 feet are only occasionally closed during the period from December to March.

The Sil Basin

Region 1 (*e*)

The Sil basin has a climate similar to that of the upper Minho valley in eastern Galicia. Both are almost completely surrounded by mountains, although the Sil basin is farther inland and the mountains encircling it are much higher. The following brief account therefore applies equally to the deep, sheltered valleys of the interior of Galicia and to the Sil basin.

Here the winters are 4° or 5° colder than in the coastal strip, the mean January temperatures being about 44° against 48° or 49° near the coast. The nights, however, are considerably colder inland. Orense, a station probably typical of the basins of the Minho and the Sil, commonly has minimum temperatures of 23° in January, while those of the coastal areas are only just below freezing-point. Indeed, on most winter nights the interior basins are 6° colder than the coastlands.

In July and August the mean monthly temperatures of both coastal and inland districts are about 67-70°, but these figures are highly misleading. Inland, the nights are several degrees cooler than on the coast and the midday heat considerably greater. From June until the end of September the mean maximum temperatures inland are often 10° higher than those on the coast. In the former, temperatures of over

100° are to be expected in July and August, and 104° has been recorded; on the coast the corresponding temperatures are 95° and 100°.

In the interior basins the humidity remains at about 80 per cent. during the winter months, but from July to August it falls to 60 per cent. The average cloud-cover decreases more from winter to summer inland than on the coast (inland cloud-cover 6 January, July—August 4).

The Sil and Minho basins experience from 24 to 28 inches of rain a year, or about half that of the coastal areas. Both July and August have less than one inch of rainfall and together they form a well-marked dry season.

There are about 130 rain-days. Spring and winter (October to May) normally have from 10 to 14 in each month, but in July and August about 1 day in 6 brings rain.

The climate of these areas is transitional between that of the rainy humid coastlands of Galicia and that of the bleak, arid tableland of the northern Meseta. To the people living in both areas, El Bierzo (the local name for the Sil basin) appears to enjoy an ideal climate.

The Douro Plateaux and the Portuguese Central Ridge

Region 1 (f), (g), and (h)

Winds

Throughout the north Douro plateau, the south Douro plateau, and the Central Serra of Portugal the prevailing winds blow from a northerly quarter. These winds, which generally have a westerly bias, predominate especially from May to October. In winter, winds from a southerly quarter are common and winds from an easterly direction are occasionally experienced. In Trás-os-Montes, where the deep valleys have a north-east to south-east trend, north-easterly winds may occur at any time of the year.

Mountain and valley winds are to be expected whenever the weather is calm, but they are especially frequent in the much dissected country north of the Douro.

Temperature

As nearly the whole of this area is over 1,000 feet, and most of it above 2,000 feet, altitude affects temperatures considerably. As a rule, the deep, sheltered valleys are mild and dry compared with the rainy western heights exposed to sea-winds. Temperatures and

humidity decrease inland rather than from north to south, but the whole area is characterized by warm summers and mild winters.

On the uplands north of the Douro, mean January temperatures range from 37° to 44° , according to altitude and exposure. The plateau south of the Douro is slightly milder (40° to 70°), except on the high Central Serra, where, at 4,700 feet, the mean temperatures only just exceed freezing-point.

On the northern plateau 21° may be recorded during January, but the coldest nights on the Serra de Estrêla itself are little colder than this (January mean minimum 18°). Frosts are common in December and January, Torre de Moncorvo, 1,250 feet above the sea, in the deep valley of the Douro, having frost on 14 days in most years, and Guarda, at 3,500 feet on the northern slopes of the Central Serra, over 30 days, of which half occur in December and January, and most of the remainder from February to April. Yet, considering the altitude of these uplands, the frosts are not severe, temperatures below 15° being rare, even on the highest summits.

During the warmest season, July and August, the lower areas experience mean temperatures of 70 – 76° , while the mean temperature of the more elevated districts is between 60° and 70° . Only in the sheltered valleys and basins is it usual for the midday heat to exceed 90° . Yet, in August even the highest summits normally register over 80° in the shade. The diurnal range is considerable in summer when the night temperatures may fall below 50° .

Relative Humidity

In January, when the relative humidities are between 75 and 80 per cent. in the north, and 70 and 75 per cent. in the south, the whole region is moist. In contrast, during July the relative humidity decreases rapidly inland from about 65 per cent. in the damper north-west to under 50 per cent. in the east and south.

Fog or mist, which is fairly common in winter and autumn but rare during spring and summer, occurs both in the deep valleys and on the plateau areas. At Moncorvo, in the Douro valley, fog is recorded on about 27 days each year, of which 14 are in winter. Most of the mountainous districts have mist or fog on over 20 days a year. It is commonest on the higher slopes of the southern mountains where Guarda, for example, normally experiences it on 70 days a year. It must be expected in winter at the summits of the roads traversing the Central Serra of Portugal and, as in the Central Sierra of western Spain, may prove a serious hindrance to traffic.

Cloudiness

The average cloud-cover in January varies from 6 to 6.8 throughout the whole region. At Guarda in the south the cover remains constantly at just over 6 from October to March inclusive. During July and August the cloudiness decreases from about 4 in the north to just under 3 in the extreme south. It is noticeable that even on the south Douro plateau the summer months begin to assume some of the brilliance typical of the Mediterranean lands.

Precipitation

The climate of the plateau and highlands of northern Portugal is characterized by its high rainfall. Almost the whole region has over 35 inches a year, and the higher lands to the west have more than 50.

On the north Douro plateau the annual fall exceeds 47 inches in the mountainous west, but may not reach 30 inches in the east and in the deep, sheltered valleys. Thus Torre de Moncorvo, although at 1,250 feet, is so enclosed that it seldom has 30 inches of rain a year.

On the plateau south of the Douro the western uplands have 40-50 inches a year, the rainfall decreasing eastwards to under 30 inches near the international boundary.

The Central Ridge causes a marked increase in rainfall. The Serra da Louzã has 50 inches while the summits of the Serra da Estrêla over 110 inches, by far the highest precipitation on the Peninsula. Even on the southern slopes of the ridge and on the lands as far south as the Tagus the rainfall usually exceeds 30 inches.

Everywhere from October to March monthly falls of $3\frac{1}{2}$ -6 inches are to be expected, except on the highest summits of the Central Serra where over 10 inches are normal.

The dry season usually lasts throughout July and August with under one inch in each month. South of the Douro the dry season lasts into September, and longer near the Spanish frontier. Here in summer the vegetation is less green and less prolific than to the north, and the olive and hard-leaved, short-growing trees and scrubs begin to appear. On the Central Ridge the dry season is shorter, and August has well over one inch of rainfall.

The northern uplands usually have about 130 rain-days, the southern districts about 100. Much depends on the relief. Thus, on the north Douro plateau the seaward mountains have as many as 150 rain-days, 20 more than in Trás-os-Montes, while the most sheltered districts of the middle Douro valley have less than 100.

From October to March 10-15 days a month usually bring rain. In both July and August, however, the higher western mountains alone have more than 5 rain-days. From June to August inclusive the north Douro plateau has a total of $4\frac{1}{2}$ inches, falling on about 16 days. South of the Douro the dry season is more marked, and $3\frac{1}{2}$ inches, which fall on 12 days, is the total of the three hottest months. It is rare for the south to have rain on more than 1 day in every 10 during July and August. From May to September the few storms are often accompanied by thunder, and on the high mountains rain seldom falls then without it.

Snow falls in the lower western areas and sheltered valleys on a few days only each year, but more falls towards the east. In the north, Montalegre (3,300 ft.) has snow on 23 days a year, and the road from Bragança to Oporto is occasionally snow-bound. On the high serras in the south much of the winter precipitation is snow. At Guarda snow falls on 25 days a year; and on the Serra da Estrêla on 36 days, where December and January, with 5 or 6 snowy days each, have the greatest fall. On Monte Junto (2,184 ft.), 35 miles north of Lisbon, snow lies for a few days each year, but the Serra da Louzã (3,942 ft.) is snow-covered from December to late January, and the Serra da Estrêla (6,000 ft.) from November to April.

2. THE BASINS AND RANGES OF THE CENTRAL TABLELAND (THE MESETA)

The Northern Tableland

Region 2 (a)

Winds

Reliable statistics are not available, but northerly winds prevail, and these show a westerly bias in León. The whole tableland is notorious for its cold, biting, winter winds.

Temperature

The climate is characterized by excessive diurnal and seasonal changes in temperature. During July and August mean temperatures of $66-72^{\circ}$ are usual, and at midday it is often from 90° to 100° . On the hottest days the temperature is 100° in the north, and 105° in the lower south-west, while 112° has been recorded in the neighbourhood of Salamanca. After sunset the thermometer commonly drops to 47° and occasionally to 42° .

Winters are cold, the mean January temperatures ($36-38^{\circ}$) being just above freezing-point. At night temperatures of $20-24^{\circ}$ are common and 12° occasional. Long severe frosts are to be expected, and in extreme winters zero temperatures occur in the neighbourhood of Burgos. At daybreak the air grows appreciably warmer, and by noon the temperature often increases to 50° ; 60° has been sometimes recorded.

Relative Humidity

Relative humidity remains at 80-85 per cent. from November to February inclusive and makes the winds seem raw and unpleasant. In July and August the humidity sinks to between 50 and 60 per cent.

Cloudiness

The cloud-cover varies from about 6.3 from November to January, to 3 in July and August. Long spells of cloudless skies are usual in summer, and even in winter cold, sunny days are not uncommon. In the whole year 100 days with clear sky are to be expected.

Precipitation

Annual precipitation is low and diminishes gradually from about 25 inches in the north and west to about 12 in the central districts. The maximum fall is in May or June, when $1\frac{1}{2}-2$ inches of rain is common in each month. There is, however, a lesser rainy season in late autumn (October and November) which may be almost as wet.

July and August, the driest months, are practically rainless.

Between May and early August 2 or 3 thunderstorms may occur in each month.

During the four rainy months of late spring and autumn, 9 to 11 days each month have some rain, but July and August have only about 3. January and often February form a distinctly drier season between the wetter months, with one wet day in six.

The total rain-days in the year averages from about 105 in the north to 75 in the south-west, but the fall is unreliable. Exceptional years may bring 5 inches of rain above or below the average, and periods of prolonged drought, when some districts have less than 6 inches in the whole year, result in serious crop failure.

The climate of the northern tableland is further characterized by a fairly heavy snowfall. At Burgos and León 3 or 4 snowy days a month are common from December to March inclusive, but in many years snow falls as early as October and as late as mid-May. In the

south-west, round Salamanca and Valladolid, the period liable to snowstorms is just as long, but normally snow falls on only 8 days in the year. On the tableland of Old Castile traffic is sometimes interrupted by snow-cover between December and March.

The Central Sierras

Region 2 (b)

The climate of the Central Sierras is similar to that of Old Castile modified by altitude. The available statistics mainly relate to the northern slopes (at about 3,500 feet), which are both wetter and colder than corresponding heights on the southern slopes.

Temperature

Temperatures of the northern slopes, up to about 3,500 feet, are similar to those of Old Castile, except that the hottest summer days seldom exceed 96° and the winter night temperatures fall to 15° . Thus, the lower slopes of the Sierras are cooler in summer and are colder in winter than the northern plateau. The extreme temperatures on the mountains, however, are not so low as those of the Burgos area, and southern slopes are 4° or 5° warmer than northern ones at all seasons.

Relative Humidity

Relative humidity ranges from 70 to 75 per cent. in winter (November to February) to 40 per cent. in July and August. Fogs are common in the cold season, especially on the south-west ridges. Traffic on the road leading south from Ciudad-Rodrigo to Cáceres is sometimes hindered by fog (December to February) on the pass across the Sierra de Gata.

Cloudiness

On the lower slopes the cloud-cover is 5.5 from November to February inclusive and 2 in July and August.

Precipitation

The Sierras cause a marked increase of precipitation, with 25 inches on most of the highland areas and over 30 inches on the highest districts of the Sierra de Gredos and Sierra de Gata (*see* pp. 101-2 for Central Ridge in Portugal). Two or three inches a month fall in the chief rainy season (April to June) and slightly less in the minor one from September to November. Each of these wetter months usually

has rain on 11 days. Most of the rain comes in brief thunderstorms. Two or three thunderstorms a month occur between May and September.

Snowfall is heavy and lies on the higher summits until late summer. Between 20 and 30 days a year with snow are usual on the northern slopes, even at 3,500 feet. Only June, July, and August are completely free of snowfall, whereas each month from December to March inclusive has 3 to 5 snowy days. Consequently the roads linking Old and New Castile, if they rise above 3,000 feet, are occasionally blocked with snow at some period from December to March.

The Southern Tableland

Region 2 (c), (d), and (e)

The southern tableland includes the plateau of New Castile (La Mancha), the Tagus-Guadiana tableland, and the Sierra Morena mountains.

Winds

Westerly winds predominate from May to September and these show a northerly bias in the Tagus-Guadiana tableland and a southerly bias near Madrid. From October to February and March westerly winds are still common but easterly winds with a northern bias predominate. Some air movement is nearly always present even on the calmest days. The air is searching, and pierces through flesh and bone to the very marrow, hence the proverb:

El aire de Madrid es tan sutil
Que mata a un hombre, y no apaga un candil.

The air of Madrid is so subtle that it will not blow out a lamp but will put out a man's life.

Temperature

As in all the Meseta lands the seasonal and diurnal changes of temperature are excessive. The cold of winter changes so rapidly into the heat of summer that the climate is said to consist of

Tres meses de invierno nueve de infierno—three months of winter and nine of hell.

Mean January temperatures range from 40° to 43° in La Mancha to 45° in the west. The midday heat may exceed 60°, but at night temperatures of 18–24° are usual. In the severest weather 10° occasionally occurs, and on the high eastern plateau zero temperatures

have been recorded. At Madrid, on an average, one night in two may be frosty from early December to late February. Ice often forms at night on the rivers but usually melts in the daytime, although skating is possible in exceptional years. The south-western tablelands are appreciably warmer than New Castile, Madrid usually having more frosts in January than the Portuguese uplands experience in ten years.

August and July, the hottest months, have mean temperatures of $75-79^{\circ}$. During this period $98-105^{\circ}$ are normally recorded, and in most districts $105-110^{\circ}$ occur once in the year. At sundown the temperature drops rapidly about 30° , and although the night air seldom cools below 50° F., it seems bitterly cold after the scorching heat of the day. The same contrasts appear between sun and shade temperatures. On leaving the direct sunlight, shadows strike cold, and at Madrid it is said that the shaded side of a street may be 20° colder than the sunny side.

Relative Humidity

In winter (November to January) relative humidity remains at 80 per cent., so that the air is raw and the winds, especially when they come from the north, are penetrating and biting. In summer the air becomes dry and parching, the relative humidity during July sinking to about 40 per cent. in the east and 50 per cent. in the west. At this season the dusty heat-haze known as the *calina* often limits visibility on the plains of La Mancha.

Cloudiness

Skies are relatively clear all the year, the average cloud-cover being 5 from October to April and 2 during July and August. In spite of their more oceanic position the western districts of the tableland are even sunnier than New Castile. Madrid usually has 390 hours of sunshine (85 per cent. possible, or 12 hours a day) in July and 134 hours (46 per cent. possible, or 4 hours a day) in December. The number of cloudless days varies from 160 in the north to 190 in the south-west. The nights, too, are often of remarkable brilliance.

Precipitation

Precipitation ranges from 16 inches in the east to 20 in the west.

The seasons of greatest rainfall are spring (March to May) and late autumn (October to November) when 2 inches a month fall in the east and 3 in the west. The difference in the total falls of these

periods is usually small, and November is often the rainiest month. During the rainy seasons, clouds gather gradually for about three days and then, when the sky is overcast, short, torrential showers occur intermittently for a week, a fortnight, or even longer. When the rain has stopped the sky is clear 3 days later, remains cloudless for a month or so, and the flooded rivers rapidly subside. July and August are practically rainless, and even June and September often have less than an inch of rainfall.

The number of rainy days in the year varies from 60 in the east to about 95 in the north and west. The rainiest months each have 10-12 days with rain, while the driest (July and August) seldom have more than two rain-days. In June and September, when one day in six may bring rain, the falls do not last long. In July and August the few rain-storms are usually accompanied by thunder.

The rains are extremely unreliable, both in amount and in time of fall. Although 9 inches have been known to fall in a month, the total annual rainfall rarely reaches 25 inches in the east and 30 inches in the west. Large areas of the southern tableland have experienced less than 10 inches in a year. Everywhere the rains may come as heavy storms which may be followed by weeks of drought.

In spite of long spells of night frost in the north and east the snowfall is relatively small. On the eastern plains snow may occur from May to November, but does not often fall on more than 4 days in all. Snowfall is rare on the warmer lands near the Portuguese frontier.

3. THE BARRIER RANGES OF THE SOUTH AND EAST

The Iberic Mountains

Region 3 (a)

Few figures are available, except for Soria (3,500 ft. altitude) and Teruel (3,000 ft. altitude). The climate is transitional between that of Old Castile and the Ebro trough, but as much of the region exceeds 3,500 feet the effect of altitude is appreciable. This is probably the bleakest and most inhospitable land in the whole of Spain. 'At Soria, the winter wind blows mercilessly across the bleak, treeless uplands and men go with cloak wrapped over mouth and chin, leaving only their eyes visible' (J. B. Trend).

Temperature

In January (mean temperatures 35-37°) the cold at night often falls to between 12° and 15°, and long spells of frost are common.

In extreme years zero temperatures are recorded even on the lower lands.

Winter lasts long and the transition between the cold and hot months is sudden. The Spanish proverb,

Cast not a clout till May
Has reached its fortieth day,

is more applicable to Soria than to Madrid. By July and August the mean temperatures reach $68-72^{\circ}$ on the lower slopes. The noon heat may attain 96° at Soria, and 100° at Teruel, while over 106° has been experienced in both districts. At sundown the night air chills rapidly and often falls to 45° in summer.

Relative Humidity

The bitterness of winter is increased by the high relative humidity, which remains over 80 per cent. from October to January. Even in July the humidity usually exceeds 60 per cent.

Cloudiness

Cloud-cover is greatest at about 6 in April and May, but any month from October to March may normally have more than half of the sky covered. July and August, with only 2 or 3, are intensely sunny.

Precipitation

Annual precipitation varies from 20 to 25 inches in the north and on the highlands above 5,000 feet, to about 15 inches on the lower basins of the south.

April and May, with about 2 inches each, form the chief rainy season, but 'lesser rains' occur from September to November. The driest months, July and August, each have one inch of rainfall.

The number of rain-days decreases from 100 in the north to 70 in the south. April and May have some rain on about 10 days each, whereas July and August seldom have more than 4 or 5 days with rainfall. From May to September storms are accompanied by thunder 2 or 3 times a month.

Snowfall in winter is as common as thunder in summer. Even in the warmer south near Teruel, 14 days a year are snowy. In the north 20 such days a year are usual, and snow may fall any time between late October and mid-May. The period from December to March inclusive, with about 3 snowy days in each month, is most

liable to snowfalls, which the blustering winds blow into drifts, sometimes deep enough to obstruct the summit (5,700 ft.) of the road from Soria to Logroño.

The Andalusian Mountains

Region 3 (b)

Figures available for this region relate mainly to the lower northern slopes (Jaén) and to sheltered basins (Granada). Altitude ranges from 2,000 to 11,000 feet, so that the higher slopes average 20° or 30° colder than the foothills.

Temperature

Below 3,000 feet, mean temperatures of 42–46° are usual in January. Frosts occur on the coldest winter nights, but are never severe (Jaén, absolute minimum 17° F.). Days are warm and often exceed 60°.

In July and August these lower slopes have mean temperatures of 76–79°, and probably all the area below 6,000 feet has means above 65°. At Granada (2,261 ft.) the noon temperature reaches 97° in the average year, while at Jaén the greatest recorded heat (112°) shows its affinities with the Guadalquivir valley.

Throughout the Andalusian mountains the daily range is considerable and often exceeds 30° in summer and 15° in winter. On the higher slopes, in late August, day temperatures of over 68° may sink to below freezing-point at night.

Relative Humidity

Relative humidity ranges from about 80 per cent. during the period November to January to about 50 per cent. in July and August. The winters are keen rather than raw, but the rest of the year is invigorating.

Cloudiness

February to May is the cloudiest period, but during any month of the winter half-year not more than one-half of the sky is normally covered. The cloudiness, which has decreased to 3 by June, remains at scarcely 2 from July to mid-September. Sunshine is intense and the clear mountain air usually ensures excellent visibility, except when the *calina* occurs. At Granada some 190 days are cloudless.

Precipitation

The Andalusian mountains have over 18 inches of rain in a normal

year, but the highest areas probably receive over 30 inches. In all parts of the region March and April are the rainy months, with over 2 inches even on the lower slopes and basins, while October and November form a lesser rainy season.

The dry season is long, July and August being practically rainless, while June and September each has less than one inch of rain.

March and April each has 10 rain-days, but the two hottest months have each less than 2 such days. The winter months, December to February, with about 8 rain-days each, are less rainy than those of spring and autumn. During the whole year about 80 rain-days are to be expected.

Thunderstorms occur on the mountains at any time, but are commonest in the hotter months, and especially in May and June (2 or 3 each). The rain sometimes falls in torrential storms lasting only a few minutes.

No part of Spain has such heavy falls in the rare months of exceptional rains. Granada has had nearly 25 inches, and Jaén 20 inches of rain in one month. The annual totals are equally erratic; those at Granada vary between 48 inches and 12 inches. The periods of prolonged torrential rains, with the resultant floods, are more disastrous than the extreme droughts.

Snowfall is not common on the lower slopes (Granada experiencing about 3 days a year), and comes mainly in March, when usually at least one day is snowy. Each of the months from October to May has a snowstorm about once every 4 or 5 years. Above 8,500 feet, patches of snow remain in shaded hollows throughout the year, but the snow-line is about 1,000 feet higher. Water from the melting snows of the mountain slopes in spring, and from the crests of the Sierra Nevada all the year, is indispensable to the *huertas* and *vegas* of the adjacent Mediterranean lowland.

4. THE EBRO TROUGH

The climate of the Ebro trough is characterized by its extremes, which are among the greatest in Spain.

Winds

The prevailing winds are westerly, with a northerly bias all the year, and especially from October to March. Southerly and easterly winds are common from May to September, when they usually blow on one day in six. Throughout the year the winds may be strong, but normally bring little rainfall.

Temperature

In January the mean temperatures range from 38° to 42° , according to altitude. The night temperatures often fall to between 18° and 21° , and in severe weather to between 15° and 18° . During the coldest winters the temperature has fallen almost to zero ($2-5^{\circ}$). Towards midday the heat often increases rapidly by 15° and even 18° , so that the warmest days of January may exceed 60° .

In July and August the Ebro trough becomes unpleasantly hot. Mean temperatures of $72-77^{\circ}$ prevail, and the noon heat usually attains 98° in the north (near Huesca, 1,650 ft.) and 104° in the lower south-east. In exceptionally hot summers Huesca has experienced 104° and Saragossa 112° . After sundown, however, the air becomes cooler and a drop in temperature of 30° is common during the night. In the hot season the temperatures of the coolest nights very occasionally fall to 52° .

Relative Humidity

From November to January inclusive, relative humidity exceeds 80 per cent. and winds are raw and penetrating. In July and August, except for the moister lowlands near the Ebro, the relative humidity sinks to between 50 and 60 per cent.

Cloudiness

The amount of cloud is low for the latitude. At Huesca the cloud-cover is scarcely 5 from October to May and only just over 2 in July and August. The number of clear, sunny days in the middle Ebro trough often reaches nearly 200, which probably has no equal in the northern half of Spain.

Precipitation

The annual rainfall is low, only the higher slopes bounding the trough having over 20 inches a year, and most of the lower areas only 12 or 15 inches.

The rainy periods last from April to June and from September to mid-November; the former has $1\frac{1}{2}-2\frac{1}{2}$ inches a month, slightly more than the latter. These two seasons are separated in winter by a distinctly drier period, from December to February, when large areas have less than an inch of precipitation a month. The real dry season, however, lasts from the beginning of July until early September, when most districts have monthly falls of from half to one inch.

Rain falls on a few days. Huesca, on the higher northern slopes of the trough, has 75 rain-days; Saragossa, in the middle of the trough, 70 days; and Lérida, in the lowlands of the north-east, only 60. During the rainy period from April to May, 8 to 9 rain-days a month are to be expected, but each month from November to February has not more than 5. At Saragossa February has no more rain-days than July, and at Lérida both November and December (with 3 days each) have no more than August.

During July and August, the hottest months, rain falls on about 4 days a month, and is often accompanied by thunder. Thunderstorms occur most frequently during the hot season, when Huesca has 3 or 4 a month, and Saragossa less than 2.

The time of heavier rainfall is markedly unreliable, especially in spring. Tortosa, which may be taken as typical of the eastern Ebro trough, in 1906 had 3 inches of rainfall in March and 7 in April, but in 1907 March was practically rainless and April had less than half an inch.

The heaviest known monthly falls are 6 inches near Saragossa and over 11 on the Pyrenean foothills. Such exceptionally wet periods are so often followed by droughts that the yearly rainfalls are seldom high. On the higher districts 30 inches may fall in extremely wet years, but the greater part of the Ebro trough has yet to record 25. During years of drought most of the lower areas have less than 10 inches.

Snowfall is not common on the lower and eastern districts. Huesca and Saragossa have only 3 or 4 snowy days a year, one of which normally occurs in January. The other months, from November to April inclusive, experience a fall of snow once in every two to four years.

THE PORTUGUESE COASTAL LANDS

Region 5 (a)

Winds

The Portuguese coastal lands extend over a distance of 275 miles from north to south. Throughout the whole region northerly winds with a western bias prevail all the year, and especially predominate from early April to late September.

From November to February winds from a direction between south and east are common (25 to 35 per cent. of all observations) in north Portugal, but are rare at Lisbon. In summer these winds, which

come from the calcined interior, are hot and dry, and, under their influence, the lands away from the coast have experienced temperatures exceeding 110° . The Portuguese dislike of these winds and their place of origin is reflected in the proverb, 'Neither a good wind nor a good wife comes from Spain'.

At Lisbon north-east winds normally blow on one day in seven during the winter half-year (October–March) and south-west winds, which often bring rain, are to be expected about one day in eight at any season.

The prevailing northerly winds are strong and may prevent fishing. They obliterate the land and sea breezes, clear the sky of clouds, limit morning fogs to the coast and cause the landscape inland to appear with a remarkable distinctness. Yet, especially in the south, they seldom reach gale force. Of the three gales normally experienced at Lisbon in a year, most occur from December to March. They can prove very destructive to shipping on the Tagus, for the wide estuary favours northerly winds. On 15 February 1941 a gale caused much havoc on the Atlantic coast of the Peninsula. At Lisbon much house property was damaged, scores of small ships foundered, and the pier at Cabo Ruivo, the seaplane base, was washed away and a large flying-boat was destroyed; all overhead telegraph wires were severed and express trains were prevented from running. The waters piled up in the Tagus, flooded the plains at the head of the estuary, and drowned 100 workmen.

On the coastal strip, and especially in the south, land and sea breezes are common in summer, and during calm weather in winter. Their influence extends about 30 miles inland, but a slight elevation, or even a large belt of tall trees, considerably restricts their landward extension.

Temperature

The mean January temperatures range from 49° in the north to 52° in the south. The colder nights of winter may experience 33° at Oporto, and 35° at Lisbon. In the north, slight frosts occur two or three times a year, but the temperature rarely, if ever, falls below 24° .

South of the Tagus the temperature occasionally falls to 34° and, although 30° has been recorded at Lisbon, frost is practically unknown in all the coastal lands of south Portugal. The noon heat may sometimes reach 60° throughout the whole of the coastal lands of Portugal, and the region has long been famous for its mild winters.

In July and August mean temperatures of 69° in the north and 75° in the south are common. Then the noon heat may reach 91° at Oporto and 94° at Lisbon. The highest temperatures during the year are usually a few degrees higher than these figures, but 100° may occur at coastal stations and 108° at stations 20 to 30 miles inland.

The daily range of temperature is relatively small, seldom exceeding 10° to 12° in winter and 15° to 17° in summer, but at Coimbra (25 miles inland) in July it has increased to 20° .

Relative Humidity

Relative humidity of the coast of north Portugal remains at 70 to 80 per cent. throughout the year. At Lisbon, and to the south, these humidities prevail only from October to April, and the summer air is distinctly drier (July and August 60 per cent.).

Fog and coastal mist become rapidly less southwards. In north Portugal mist occurs on 70–80 days a year and is most common in late autumn, and at Lisbon, fog on about 24 days a year, most between November and January, when 5 days each month are usual. In the hot season, fogs are unlikely on more than one day in 3 months. In summer the hills near the coast may occasionally be veiled in mist. At Cintra, for example, the dense mist often covers the foot of the hill in the morning and then gradually rises as the day advances, and hovers about the top in the afternoon. At Lagos, in the extreme south of Portugal, fogs are practically unknown.

Cloudiness

From November to January inclusive, the monthly cloudiness varies from $5\frac{1}{2}$ to 6 north of the Tagus to between 5 and $5\frac{1}{2}$ in southern Portugal. In summer (July and August) the whole region enjoys long spells of clear skies; the average cloudiness decreases from about $3\frac{1}{2}$ in the extreme north to less than 2 in the extreme south. In December, about 130 hours of sunshine (over 4 hours a day or 45 per cent. possible) are experienced at Coimbra and Lisbon. In both July and August the same stations have 310 hours (70 per cent. possible) and 345 hours (11 hours a day or 80 per cent. possible), respectively. In southern Portugal the almost cloudless period includes June and September.

Precipitation

The mean annual rainfall decreases southwards; Guardia having 55 inches, Oporto 46 inches, Coimbra 35 inches, Lisbon 27 inches, and

Faro and Lagos 20-23 inches. In the extreme south the Algarve mountains cause an increase to 25 and even to 35 inches.

Throughout this coastal strip the rainiest season is October to December, November being usually the wettest month. Near Oporto 5-6½ inches of rainfall a month is usual, near Lisbon 3½-4½ inches, and in the south 2 or 3 inches.

Rainfall decreases steadily from January to July and August. In the north the dry season (under 1 inch a month) lasts throughout July and August, but drought intensifies southwards. At Lisbon this dry period is almost rainless, while in the extreme south it lasts from June to late September.

The number of rain-days decreases from 115 to 120 north of the Tagus to about 90 in the south near Lagos. From October to April, 11-13 rain-days a month are to be expected. In July and August, only 3-5 days a month have rain in the north, and 3 in the south; in the latter area both June and September usually have only 5 rain-days.

The rainfall is fairly reliable. Yet in exceptional months Oporto has had nearly 20 inches, and Lisbon nearly 16 inches; Lisbon has recorded 4½ inches in one day. The annual fall varies between 80 and 31 inches at Oporto, and between 44 and 17 inches at Lisbon, but, compared with Mediterranean and inland Spain, sudden floods and prolonged droughts are rare. Near the coast there are few thunderstorms in the year (Oporto 10, and Lisbon 7), March to June and September occasionally having more than one.

Snow falls on about 3 days a year in the extreme north, where March usually experiences one snowy day, but it is very rare in the coastal lands south of Coimbra.

6. THE PLAIN OF ANDALUSIA¹

Climatically, this region includes the coastal lands of the Strait of Gibraltar as far east as Gibraltar itself, beyond which the influence of winds from the Atlantic rapidly declines.

Winds

At Seville the prevailing wind is south-westerly; but the very unpleasant east wind, the *solano*, brings in spring and summer unbearably hot, dry, suffocating weather. In winter the *solano* is stronger, but fresh and of shorter duration.

¹ Region 6 is described before Regions 5 (b) and 5 (c), as this is the more logical sequence in this chapter.

On the coastal strip, from Cape St. Vincent to Gibraltar, easterly winds alternate with westerly winds all the year. The easterly winds (*levantes*) prevail from June to October when they may blow hard for 15 consecutive days, bringing dry, clear weather. Westerly winds, with a northerly bias (*ponientes*), prevail from November to May, but they are usually less strong and persistent. In winter and spring south-west winds (10 per cent. all observations) usually bring clouds, rain, and squalls with bright intervals.

One gale a month may be expected from November to March in most years, but at other times they are rare.

Land and sea breezes are strongly developed and prevail during summer, and during calm weather in winter. The sea breeze commences about 0900 hours and blows strongest after midday. The land breeze sets in about midnight and lasts until sunrise.

Temperature

The January mean temperature is 52° . Occasionally there is a slight frost inland but near the coast the temperature seldom falls below 34° , frosts being unusual at San Fernando and almost unknown at Gibraltar. At noon it is usually over 60° and occasionally 65° on the coast, and 70° at Seville.

During July and August the heat becomes excessive inland; Seville has a mean temperature of 84° , and a normal maximum exceeding 110° ; on rare occasions the heat increases to 116° . The district between Seville, Écija, and Córdoba has truly African summers and has been called the 'frying-pan of Spain'.

On the coastal lands the mean monthly temperatures range from 73° to 75° , and, although the heat often reaches $91-97^{\circ}$, it seldom exceeds 100° . Throughout the region the summer nights are cool and pleasant. At Seville the temperature often falls 35° after sundown, so that night temperatures of $60-70^{\circ}$ are common. Near the coast the normal diurnal range in summer is about 16° and, here, in spite of the less torrid days, the nights are slightly warmer than at Seville.

Relative Humidity

Inland, relative humidity remains at 82 to 85 per cent. from November to February, and sinks to a minimum of under 60 per cent. in July and August. Consequently, the summer air is dry without being excessively parching and makes the heat more bearable. Hence the Spanish proverb, 'in summer no one dies at Seville'. On the coastal lands the mean relative humidity remains between 70 and 80

per cent. all the year in the Strait of Gibraltar, and between 65 and 75 per cent. in the Gulf of Cádiz.

Fogs are uncommon, Gibraltar having 3 and Cádiz 10 in a normal year. At the former station fogs occur chiefly in the hot season, and at the latter in the cooler months.

Cloudiness

Inland, the cloudiness is low all the year, the greatest cloud-cover being from October to May, when 3 to 4 is usual. July and August are practically cloudless, and even in June and September not more than 2 tenths of the sky is usually obscured. The cloud-cover of the coastal strip is quite considerable from September to April, with 4 to 5, and a tendency to be at its greatest in November, February, and March. In summer (June to August), rather less than 3 tenths of the sky is covered in the Strait of Gibraltar, and about 1.5 on the shores of the Gulf of Cádiz. Throughout the whole region the nights are often clear and remarkably brilliant.

Precipitation

Annual rainfall is 20-24 inches on the coastal strip as far east as Cádiz, but increases eastwards to 35 inches at Gibraltar. Inland it decreases gradually to about 18 inches in the neighbourhood of Seville.

The rainy season lasts from October to March, the wettest month being either November or December. The monthly falls during this period (October to March) vary between $3\frac{1}{2}$ and $6\frac{1}{2}$ inches at Gibraltar, $3\frac{1}{2}$ and $4\frac{1}{2}$ inches at San Fernando, and 2 and 3 inches at Seville.

The dry season lasts from June to August on the coast and from June to September inland. It is almost rainless, particularly in July and August.

The number of rain-days ranges from 85-95 in the Strait of Gibraltar to 65-70 inland. Normally there are only 6-8 from June to September inclusive. By contrast, March, with 10 rainy days at Seville and 12 on the coast, is very wet. From November to February there are 8 rain-days a month at Seville, and 11 near the coast.

Thunderstorms occur about 10 times a year on the inland plains, including two each in May and June. On the coast they are commoner in September and October.

The rainfall is unreliable and can be torrential. At Gibraltar, daily falls of over 5 inches have been recorded in all but the hottest months, and in both January and March 7.8 inches have been recorded in

24 hours. At Seville, 15 inches have fallen in a month, and serious floods must be expected at least once a year. The yearly rainfall usually varies by 15 per cent. from the mean. Seville has experienced annual extremes of 34 and 6 inches; San Fernando of 48 and 15 inches. The spring rains are especially variable in amount and time of fall, but the hot season can be relied upon to be free of heavy rainstorms.

The Southern Coastal Strip

Region 5 (b)

The southern coastal strip between Gibraltar and Cabo de Gata differs little in climate from the Atlantic coastlands of Huelva and Cádiz, except that the weather becomes increasingly drier, sunnier, and hotter eastwards along the coast from Gibraltar.

Winds (see Region 6)

From May to September easterly winds prevail and, when well established, will blow for a week at a time. From November to April winds from the south-west (*vendavales*) set in, and alternate with northerly and north-easterly winds. Winds from a westerly quarter prevail especially in winter (November to January), when they bring bad weather and heavy rain. By March the *vendavales* are being displaced by easterly winds which, at this season, may cause thick, boisterous weather.

Temperature

Winters along the coast from Gibraltar to Cabo de Gata are the warmest in Spain. The January mean temperature is about 55° and the warmest days are then 65° or 67°. Frosts are unknown and the temperature rarely falls below 39°.

Summers are hot (mean July and August 79°). Between 98° and 100° is recorded in most years and sometimes the thermometer reaches 110°. Summer nights are relatively warm, and seldom much below 66°.

Relative Humidity

From September to April relative humidity remains at 65–70 per cent. and then decreases to almost 60 per cent. during the summer. The low humidities in July and August make the days less oppressive and the nights fresh and pleasant.

Cloudiness

The cloud-cover from October to April is about 4, the maximum of 4.5 occurring in March. From mid-June to early September it is not more than $1\frac{1}{2}$ and the summer sky is almost clear.

Precipitation

Rainfall decreases rapidly eastwards from about 25 inches near Málaga to 12 inches near Cabo de Gata.

The chief rainy season lasts from October to January ($3-3\frac{1}{2}$ inches a month at Málaga), but there is a distinct shorter rainy season in March. The dry season begins in May and continues to mid-September, and has scarcely $1\frac{1}{2}$ inches of rain. June, July, and August are almost rainless.

The number of rain-days seldom exceeds 50; of these 7 are in March, and 6 a month in winter. From May to September inclusive only 9 days in all bring rain. The 3 wet days between June and August have brief storms only.

Upper Winds

Some data about upper winds are available for Almería and are included in Appendix A (Section II).

It appears that calms are exceptionally frequent below 6,000 feet all the year. In winter and spring 30 per cent. of all observations at 1,500 feet, 25 per cent. at 3,000 feet, and 15 per cent. at 6,000 feet are calms.

At 1,500 feet the prevailing winds are centred about west-south-west (30 per cent. of total), and to a lesser degree about east-north-east. The westerly winds veer with increase of height, and are distributed between south-west and north-west at 3,000 feet, and between west and north-west at 6,000 feet and at 10,000 feet, where they comprise 52 per cent. of all observations. North-easterly winds form 28 per cent. of observations up to 6,000 feet, but increase to 38 per cent. at 10,000 feet. Easterly winds with a southerly bias are seldom experienced.

In winter, winds exceeding 28 knots blow most frequently from the west and north-west. Gales (over 40 knots) only occur with north or north-west winds at 6,000 feet. In spring, winds at 6,000 feet are generally less strong than in winter, but speeds of over 40 knots are recorded, also occasionally from south-west at 1,500 feet, from north at 3,000 feet, and from south-west and north-east at 10,000 feet.

Calms are frequent in summer, but decrease by one-half in autumn to 13 per cent. of observations at 1,500 feet and 7 per cent. at 6,000 feet. During the summer half-year, winds at 3,000 feet have a slightly different direction from those at 6,000 feet and 10,000 feet. At 1,500 feet the prevailing winds centre about north-east; at 3,000 feet they lie between north-east and east and between south-west and west, the former totalling 44 per cent. and the latter 28 per cent. of observations. At 6,000 feet and 10,000 feet south-west and west winds greatly predominate.

In summer winds seldom exceed 27 knots, even at 3,000 feet, whereas occasionally in autumn north-east winds may reach 40 knots at this height. Above 6,000 feet speeds of over 40 knots are experienced (7 or 8 times per half-year), most often from the south-west and west.

The Levantine Lowlands

Region 5 (c)

Winds

The winds on this coast of Spain are mainly offshore in winter and onshore during summer. From October to March westerly winds prevail, and are especially dominant in November and December. When they are south-west they often bring bad weather and squalls; when north-west they are often strong enough offshore to cause vessels to seek shelter in the Balears.

From April to September inclusive, easterly winds predominate, especially on the coastlands south of Cabo de la Náo. These often have a southern bias on the coasts of Murcia and a northern bias in the Bay of Valencia. At this season north-east winds are light, and even south-west winds, which occur occasionally, are not strong.

A narrow coastal strip stretching from Cabo de Gata to Cabo de la Náo occasionally experiences a hot, dry, dust-laden wind blowing from a quarter between south-east and south-west. This wind, the *leveche*, occurs chiefly in spring and has a blighting effect on vegetation.

Gales are fairly frequent from November to March in the Bay of Valencia, where they usually blow violently from the north-west, but may occasionally come from the north-east bringing rain, thunder, and heavy squalls. Farther south, at Cartagena, only 4 gales a year are normally experienced.

Land and sea breezes occur frequently on the coasts and especially

at the heads of the numerous small bays. (For time of occurrence *see* p. 83.)

Temperature

The winter is distinctly mild, night temperatures seldom falling below 40° and day temperatures frequently reaching 60° or 70° . In January mean temperatures of $49-52^{\circ}$ prevail. On cold nights, 34° is occasionally registered at Cartagena and 36° at Valencia. South of Cabo de la Náo frosts are almost unknown on the coast, but occasionally occur 20 miles inland at Murcia, where 29° is registered once a year and 26° very rarely. North of Cabo de la Náo it freezes slightly in most winters, and Valencia has known 14° of frost; and these rare, cold spells, though short, are disastrous for the sub-tropical vegetation of the *huertas*.

In July and August, the hottest months, the mean temperatures range from 75° to 79° . Then, the noon heat often reaches $85-95^{\circ}$ on the coast and 100° inland. The hottest ever recorded at Cartagena is 104° , at Valencia 109° , and at Murcia 114° .

As the daily range of temperature is relatively small (16° in July and August at Cartagena and 26° at Murcia), the temperature of summer nights rarely falls below $60-65^{\circ}$ even in the north.

Relative Humidity

On the coast relative humidity remains at 65-75 per cent. throughout the year; and at Cartagena and Alicante even July and August have humidities of about 70 per cent. This summer humidity decreases to about 65 per cent. in the north, and to under 60 per cent. a few miles inland. It increases with easterly winds, when a thin mist may hang about the coast, and light, white clouds may form on the slopes of the mountains.

At Cartagena fogs (7 a year) occur mostly from December to March.

Cloudiness

During the period between September and May the cloud-cover seldom exceeds 4 except in March and April, the cloudiest months. From June to the end of August it is 2.5 at Valencia and 2 at Alicante.

Precipitation

The yearly rainfall is under 20 inches throughout most of the region (Valencia 19, Alicante 17, Murcia 14). The lowest rainfall in

Spain is on the lowlands east and west of Cartagena, where Cabo de Palos and Cabo Tiñoso have less than 10 inches.

The winter has most rain ($1\frac{1}{2}$ – $2\frac{1}{2}$ inches a month from September to March), with small maxima in September and November. The dry season (under 1 inch a month) lasts from June to August inclusive, July and August being almost rainless in the south. On the lowlands near Cabo Tiñoso the whole summer rainfall falls in 5 hours. Here, only November, March, and April have an inch of rain.

The number of rain-days is small throughout the Levantine Lowlands. Valencia and Murcia have 60 each, Alicante 40, and Cabo de Palos less than 20. The rainiest months (September, November, and March) have 5–7 days and the driest months (June to August) 1 or 2 days. Near Cabo Tiñoso, March alone has as many as 3 days with rain.

Rainfall is unreliable and varies 15 per cent. from the mean. Alicante has had 14 inches in a month and Valencia 10; at both places 30 inches have fallen in a year. Such heavy falls are, however, less frequent than severe droughts, when only 7 inches of rain may come in the year. The most prolonged droughts occur at the capes near Cartagena, which, during the three years 1916 to 1918, experienced a total of only 6 inches of rain that fell on 20 days. At Cabo Tiñoso there was only one wet day (0.5 in.) between February 1917 and June 1918.

At Alicante thunderstorms are most frequent in May and September, when 2 a month are to be expected. These sudden storms may give heavy rain, and at Cartagena 4 inches have fallen in 24 hours in September. In July and August, however, 0.5 inch in a day is practically unknown.

Upper Winds

For Alicante there are sufficient data available to estimate the broad differences between the winds at various heights.

During the winter half-year calms may be expected at 1,500 feet and 3,000 feet, about once in 4 or 5 days.

In January and February the winds at 1,500 feet blow chiefly between south-west, north, and north-east. At this height east and south winds are infrequent, but they increase in number at 3,000 feet.

Winds over 40 knots are occasionally experienced from south and

south-west at 1,500 feet and occur about 7 times a season, largely with west and south-west winds, at 3,000 feet.

In spring west to north-west winds predominate, and may be over 40 knots at 1,500 feet, and about once a fortnight at 10,000 feet. Very rarely is 40 knots recorded at 3,000 feet during south-east and south winds.

In summer (June–August) calms are almost as frequent as in winter below 3,000 feet. At 1,500 feet and 3,000 feet the prevailing winds blow between north-east and east, but at 6,000 feet west and south-west winds predominate. Winds of over 40 knots occur below 3,000 feet with north-west and north winds. At this height strong winds are occasionally experienced from the south-east, as happens also in spring.

During autumn the upper wind conditions are similar to those in summer, except that calms are relatively few and at 1,500 feet winds between south-west and north become less infrequent. The wind is stronger at this season, and exceeds 40 knots once or twice at 1,500 feet and 3,000 feet, with a direction between north-west and east, and about twice at 6,000 feet during south or south-west winds.

7. CATALONIA

The historical province of Catalonia includes the Spanish slopes of the eastern Pyrenees (Region 1 (*a*), pp. 93–4), a portion of the Ebro trough (Region 4, pp. 111–13), and the Catalan mountains with their coastal lowlands. The latter region is the real Catalonia, and for it climatic statistics are available from Barcelona on the coast and from Igualada (1,017 ft. altitude) in the mountains.

Winds

Winds from a westerly quarter prevail from October to April and are common throughout the year. From November to January they usually blow strongly from west-north-west, bringing with them fine, clear weather, but at times they may be cold and piercing, and cause severe gales in the Gulf of Lions. North and north-east winds are fairly frequent throughout the year, and particularly in autumn and winter. Southerly winds are common from May to September. In spring (April and May) east winds occasionally bring rain and heavy seas. Calm weather is often experienced, especially in summer, when it occurs, on an average, on 5 or 6 days a month.

During these calms, land and sea breezes are well developed,

especially on the flat plains of the Ebro delta, where the breeze usually blows from the south-west in the morning and north-east at night.

Gales are frequent (Barcelona 15 a year) and chiefly occur from November to April. In the north, most gales blow from the north-west and north.

Temperature

On the coastal strip the winters are mild, the mean January temperatures ranging from 47° in the south to 43° in the north. On the Catalan mountains the mean monthly temperatures decrease to 39° at Igualada (1,017 ft.). At Barcelona the night temperatures in January usually fall to 40° , and occasionally below freezing-point. During the severest cold spells 15° has been recorded. The day heat usually reaches 55° and occasionally exceeds 60° .

The weather is hottest in July and August, when mean temperatures of 70° to 75° are usual, even on the mountain slopes below 2,000 feet. At midday the temperature usually rises to 82° and occasionally to 90° . The south, however, is considerably hotter than the north; at Barcelona the heat probably never exceeds 100° , whereas on the Ebro delta over 100° is registered daily for weeks on end in summer.

Relative Humidity

Mean relative humidity remains steadily at about 70 per cent. each month at Barcelona, but inland, on the lower mountain slopes, there is an increase to over 80 per cent. from October to March. Mean monthly humidity of July is about 66 per cent. throughout the region. These figures hide the considerable diurnal variations of humidity that occur, especially in the south. Thus, on the Ebro plains the humidity usually rises to over 90 per cent. at night and falls very low at noon. Here, mists are rare in summer and only occur about once a month in winter. At Barcelona fogs are experienced on 24 days a year and chiefly from November to February (3 to 5 a month).

Cloudiness

The cloud-cover is usually 4 to 5, except in July and August, when 3 to 4 only is to be expected. This is the least sunny area on the Mediterranean shores of Spain, yet even in winter the cultivators of the Ebro delta wear broad-brimmed hats as a protection against the intense sunlight.

Precipitation

The annual precipitation of the coastal strip increases gradually from 16 inches near the Ebro to 25 inches in the north. The mountains behind the coast cause a slight increase in rainfall, but their influence is only appreciable north of Barcelona.

Autumn (September to November) is the chief rainy season, when 2 to 3 inches a month can be expected. There is, however, often a period of lesser rains in March and April.

The dry season lasts throughout July and August, when about one inch each month normally falls at Barcelona. December and January form a distinctly drier period after the autumn rains, and seldom have more than $1\frac{1}{2}$ inches a month.

The number of rain-days varies from 60 in the south to 75 in the north. At Barcelona any month from September to May normally has 6 to 8 rain-days. During July and August 3 to 4 days are usual.

Snow is rare in the south and at Barcelona it falls only on 3 days a year.

Thunderstorms are rare in winter, but common enough in late summer and autumn (July to September) when Barcelona has 2 or 3 a month.

Owing to the unreliability of these thunderstorms, the autumn rains are more variable than the smaller rains of spring. During September and October, 4 to 5 inches have been recorded in 24 hours, and even in July and August over 2 inches have fallen in one day. These midsummer deluges are extremely rare, but they are significant as they have no equal on the Mediterranean coast of Spain. The relative absence of thunderstorms in spring is shown by the fact that at Barcelona over 2 inches of rain have never yet fallen in 24 hours during February, March, or April.

Here, the annual rainfall varies considerably from the mean, but rarely exceeds 35 inches or falls below 15 inches in the neighbourhood of Barcelona. In the south, dry years are more common but are of no more significance, as agriculture is based on irrigation.

Upper Winds

Data of upper wind conditions are available for Barcelona. These show that in winter (December to February) west winds predominate at 1,500 feet, being followed in frequency by north-west and north-east winds. At 10,000 feet the prevailing winds come more from the north, and centre about north-north-west.

Winds exceeding 40 knots are recorded occasionally from the west, north-west, and north-east up to 3,000 feet, but occur more commonly from north and north-east at 10,000 feet.

In spring, westerly winds comprise 50 per cent. of observations at 1,500 feet. These winds increase in frequency but change to about west-north-west between 6,000 feet and 10,000 feet.

Winds of over 40 knots are not known at 1,500 feet, and only occur once in 3 seasons at 3,000 feet, and once or twice a season at higher levels. Such winds usually blow between west and north-east.

From June to August inclusive the winds have a stronger southerly component at all heights than in spring. At 1,500 feet the prevailing winds are south-west and west; at 10,000 feet they lie between south-west and north. East winds, which are fairly common at 1,500 feet, cease to be recognizable above about 3,000 feet.

The upper air conditions in autumn closely resemble those of summer. At 10,000 feet the prevailing winds are north-west. Winds from an easterly quarter are still noticeable at 1,500 feet and actually increase in frequency at 10,000 feet, whereas during other seasons east winds decrease markedly at higher levels.

Winds exceeding 40 knots are infrequent and usually blow from west or south-west. Calms are to be expected on about 1 day in 7 at 1,500 feet, 1 in 14 at 3,000 feet, and rarely above that level.

8. THE BALEARIC ISLANDS

There are appreciable differences between the climates of the two larger islands of the Balearic group, as the low relief and small size of Minorca make it windier, wetter, and milder than Majorca.

There are only two meteorological stations with long records in the islands, namely, Palma in Majorca and Port Mahón in Minorca. In the smaller islands of Iviza and Formentera climatic conditions are generally similar to those prevailing in Majorca, but detailed statistics are lacking.

Winds

The most frequent winds in the Balearic islands are those which blow from a direction between north-east and north-west. In Minorca the predominance of these northerly winds is remarkable, especially between October and March. These winds (*tramontana*) blow at Port Mahón on at least 165 days in the year. They are generally

strong, dry winds and on 105 of the 165 days can be classed as either 'fierce' or moderate in velocity. At times they blow with such force as to carry spray across the whole island, covering the ground with a slight coating of salt. During the winter this wind may continue to blow for 15 or more consecutive days; it has been known to persist almost uninterruptedly from a north-westerly quarter for two months. The first few days on which these winds occur in winter may be stormy, but clear weather follows and in summer long spells of fine weather usually accompany them.

From May to September inclusive, southerly and easterly winds are common in the islands. South-westerly winds (*llebeig*) are frequent all the year at Palma, but are especially prevalent in the spring and summer. In spring they are usually wet and warm; in winter they occasionally increase to gale force, bringing thick weather and poor visibility.

South-east (*xaloc*) and north-east winds often occur at Port Mahón from April to August, when they are usually warm and dry. Occasionally, however, the *xaloc* may be unpleasantly hot and humid.

The high Sierra in the north-west of Majorca is responsible for decreasing the force of the north and north-west winds. Nevertheless, cold north-east winds are known in Majorca, and when they occur they sweep across the central plain of the island and may damage the orchards. A north-east wind is still known in Algiers as the 'majorca carpenter'. On the whole it is true to describe the bleak and flat island of Minorca as 'the island of stones and winds', and Majorca as 'the island of calm'.

Port Mahón normally experiences winds twice as strong as those at Palma. At the former the wind reaches gale force nearly 30 times a year, and each month from October to April brings more gales (2-4) than Palma experiences in a whole year. At Palma for half the year (mid-April to September) the prevailing winds blow gently from the south and south-west and never reach gale force; at Port Mahón the destructive power of the gales is increased by their squally nature.

Temperature

The winters in the island group are generally mild. In January (mean *c.* 50°) night temperatures usually fall to 45° and occasionally below freezing-point. Protection against the cold is very inadequate and there is no provision for heating even in the most modern schools

in Majorca. In the daytime the heat seldom fails to reach 56° , and temperatures of 60° and even 70° are occasional.

The summers are hot without being torrid. During July and August (mean temperatures 75° to 78°) the noon heat commonly rises to 82° and at times to over 90° . At Port Mahón the heat very seldom reaches 97° and then only in periods of calm during a change of winds. Palma is hotter and has had 100° in June, July, and August.

Summer nights are warm throughout the Balearics, the temperature seldom falling much below 63° .

The daily range of temperature is smaller than on the mainland, and even in summer the nights are only 10° to 15° cooler than the days. In Minorca these uniform conditions of temperature are interrupted 2 or 3 times a year by an unusually sudden onset of the *tramontana*, which causes a fall in temperature of about 15° to 18° . On 17 April 1926 the temperature at Port Mahón fell 11° in half an hour.

Relative Humidity

In Majorca relative humidity ranges from 75 per cent. in winter to about 70 per cent. in summer. In Minorca, owing to the greater prevalence of northerly winds, the summer air is slightly drier (63 per cent.), and the strength of the *tramontana* makes the colder days of winter more keen and piercing.

Fogs are rare except in spring, and even then, in calm weather, they vanish at sunrise.

Cloudiness

During winter and spring, cloud-cover is $4-4\frac{1}{2}$ at Palma and $4\frac{1}{2}-5$ at Port Mahón. From June to August inclusive the cloudiness decreases to between 2 and 3 in all the Balearic Islands. The *tramontana* often clears the skies in Minorca, and in July and August several consecutive cloudless days often occur.

Precipitation

The mean annual rainfalls of Port Mahón and Palma are 24 and 18 inches respectively, Minorca being more favoured in this respect than Majorca or Iviza.

Autumn is the rainy season, although the rains are plentiful from September to January (2-4 in. a month). Normally the heaviest rainfall comes in September and October.

The dry season lasts from June to August with only one inch in this period; in some years July and August are absolutely rainless.

The average number of rain-days in a year varies from 70 to 80 on the lowlands. Autumn, with 9 or 10 rain-days a month, and winter, with 8 or 9, are most liable to storms. From June to August 2 rain-days a month usually occur at Palma and 3 at Port Mahón.

The rainfall shows considerable variations. In Minorca the yearly fall may decrease to 15 inches or rise to 35 inches. The wet years are usually due to exceptional rains in autumn; in one September nearly 5 inches fell in $2\frac{1}{2}$ hours, and during October nearly 4 inches were recorded in one day. Very rarely July and August have heavy storms. At Port Mahón over 3 inches have fallen in one day in July, and at Palma the heaviest fall yet recorded in 24 hours (over 4 inches) occurred in August. Snow and hail are generally rare throughout the group of islands, but snow does fall in the high Sierra of Majorca and hailstorms may occur in the same island as late as April, though they seldom injure the crops.

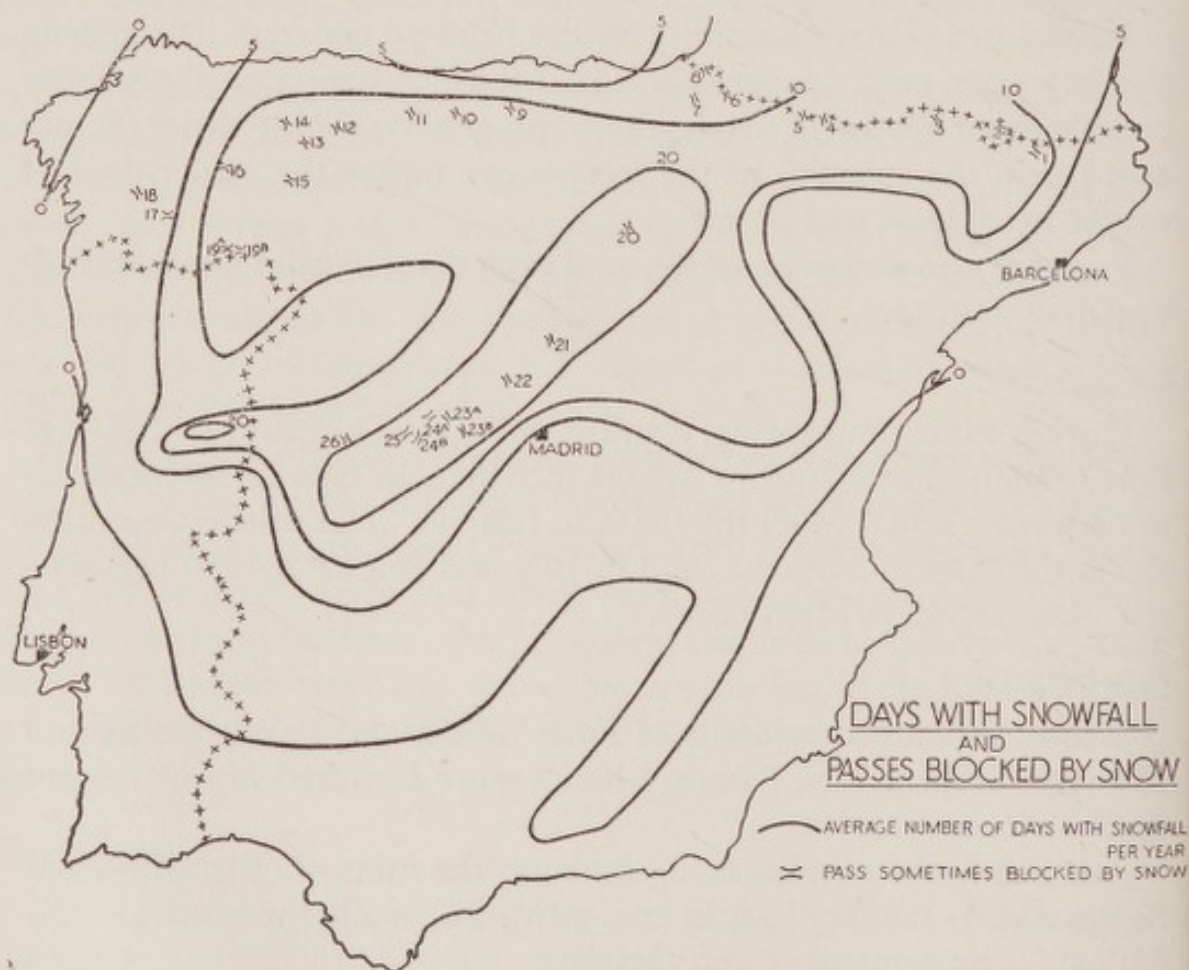


FIG. 32.

The number given to each pass is used in the table which gives further details.

TABLE OF SPANISH ROADS BLOCKED BY SNOW DURING WINTER MONTHS

Each pass has been given a number in the table and these passes are marked by their respective numbers on the accompanying map.

No.	Road	Pass	Height in feet	Period during which road may be blocked by snow
A. THE PYRENEES				
1	Barcelona to Puigcerda	Pto. de Tosas	5,906	From Dec. to March
2	Andorra La Vieja to Ax les Thermes (France)	Port d'Envalira	7,897	From Nov. to June
3	Balaguer to St-Béat (France)	Pto. de Bonaigua	6,798	From Nov. to June
4	Biescas to Laruns (France)	Pto. de Sallent (or Hormigal)	5,873	From Nov. to June
5	Jaca to Olorón (France)	Pto. de Somport	5,381	From Nov. to May
6	Pamplona to St-Jean-Pied- de-Port (France)	Pto. de Roncesvalles (or Ibañeta)	3,468	From Nov. to Feb.
7	Pamplona to Irún and Bayonne (France)	Pto. de Velate	2,913	Sometimes from Dec. to Feb.
8	Pamplona to Bayonne (France)	Pto. de Otsondo	..	Sometimes from Dec. to Feb.
B. THE CANTABRIAN MOUNTAINS OF THE NORTH AND NORTH-WEST				
9	Burgos to Santander	Pto. del Escudo	3,241	From Dec. to March
10	San Vicente de la Barquera to Saldaña	Pto. de Piedras Luengas	..	Sometimes from Dec. to March
11	Cangas de Onis to Riaño	Pto. del Pontón	4,570	Sometimes from Dec. to March
12	León to Oviedo	Pto. de Pajares	4,475	From Jan. to March
13	Cangas de Tineo to León	Pto. de la Magdalena	3,665	Sometimes from Dec. to March
14	Ponferrada to Oviedo	Pto. de Leitariegos	3,940	From Dec. to April
15	Astorga to Ponferrada	Pto. de Manzanal	3,750	Sometimes from Dec. to March
16	Madrid to Corunna	Pto. de Piedrafita	3,638	Sometimes from Dec. to March
17	Orense to Ponferrada	Alto de Rodicio	..	Rarely from Dec. to March
18	Santiago to Orense	Alto de S. Domingo and Alto de San Martín	..	Very few occasions from Dec. to March
19	(a) Verín to Zamora	Portilla de la Canda	4,140	Sometimes from Dec. to March
	(b) Verín to Zamora	Portilla de Pardoneiro	4,462	Sometimes from Dec. to March
C. THE IBERIC MOUNTAINS				
20	Soria to Logroño	Pto. de Piqueras	5,610	From Dec. to March

<i>No.</i>	<i>Road</i>	<i>Pass</i>	<i>Height in feet</i>	<i>Period during which road may be blocked by snow</i>
D. THE CENTRAL SIERRAS (SIERRAS DE GREDOS and DE GUADARRAMA)				
21	Madrid to Burgos	Pto. de Somosierra	4,757	Sometimes from Dec. to Feb.
22	Madrid to La Granja	Pto. de Navacerrada	5,833	From Dec. to March
23	(a) Ávila to Toledo	Pto. del Boqueron	..	Rarely, only when it snows very conti- nuously
	(b) Ávila to Toledo	Pto. de Arrebatacapas	..	Rarely, only when it snows very conti- nuously
24	(a) Ávila to Talavera de la Reina	Pto. Menga	..	Sometimes, when it snows very conti- nuously
	(b) Ávila to Talavera de la Reina	Pto. del Pico	..	Sometimes, when it snows very conti- nuously
25	Ávila to Piedrahita	Pto. de Villatoro	4,698	Sometimes, when it snows very conti- nuously
26	Salamanca to Cáceres	Pto. de Béjar	3,438	Sometimes, when it snows very conti- nuously

CHAPTER V

THE VEGETATION OF THE IBERIAN PENINSULA

IN the number and variety of its species the flora of the Iberian Peninsula is richer than that of any other region of equal size in Europe. This wealth of plant life arises from the great variety of climates, altitudes, exposures, and soils, and from the bridge-head position at the meeting-place of western Europe and north-western Africa. Furthermore, during their great age of colonization in the sixteenth century the Spaniards overran territories in certain respects like their own, and consequently the Iberian flora was enriched by the introduction of foreign species, some of which flourish so well that they appear more 'Spanish' than the endemic plants. Of the 5,660 recorded species about two-fifths are Central European and Alpine, one-quarter is endemic, one-fifth is Mediterranean, and one-twelfth is African in character.

The vegetation cover closely reflects the distribution of rainfall and of sunshine. The humid north and north-west and the higher, moister mountainous areas are dominated by 'mesophytic' (moisture-loving) formations resembling in character those of central and western Europe. Throughout most of the other districts of the Peninsula a 'xerophytic' (drought-resisting) type of flora, eminently characteristic of the Mediterranean lands, predominates. The transitions and variations of these two major types are many and indefinite. In the steppe-lands of the interior of Spain endemic species often prevail, and in the arid south-east African and semi-desert characteristics are strongly developed.

The limits of certain plants throw much light on the rough distribution of vegetation, both natural and cultural (Fig. 33). The evergreen oak occurs everywhere, except in the north-west and on the higher districts. The birch, however, finds its southern limits in the Sierras de Cuenca and Toledo, while the beech is not found on the southern slopes of the Sierra de Guadarrama. Inversely, the Cluster pine, the olive, fig, and almond are not found in the colder lands of the north. On the Meseta the xerophytic associations, characteristic of the Mediterranean lands, seldom appear north of the valley of the middle Tagus and, therefore, the vegetation of the northern tableland is best considered as transitional between that of central Europe and

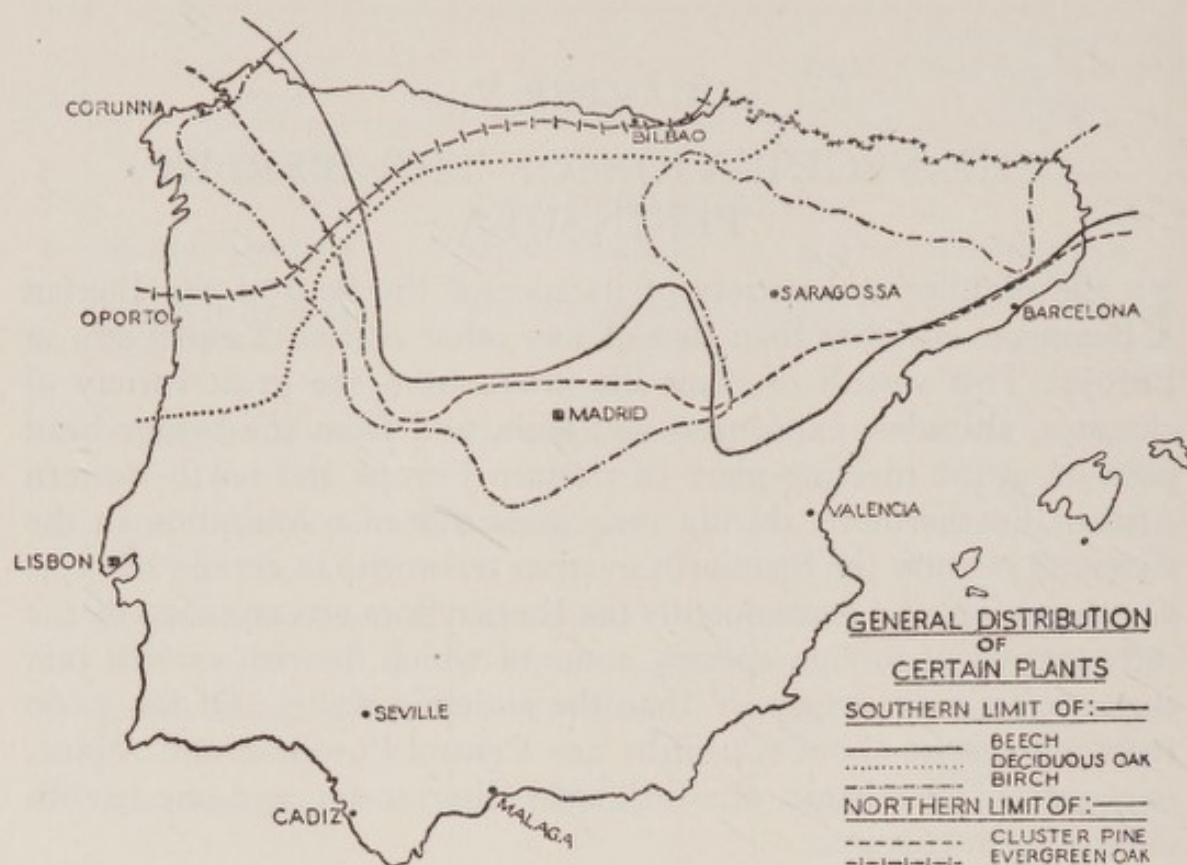


FIG. 33. (After Willkomm)



FIG. 34. (After Willkomm)

that of Mediterranean Spain. The same transition occurs more gradually in Catalonia, north of Barcelona, and in Portugal, north of the Central Serra. The strengthening of the xerophytic associations south-eastwards towards the Mediterranean coast may be judged from the distribution of the esparto-grass and of the oleander (Fig. 34).

Woodland

The Iberian Peninsula is poor in woodland, scarcely 10 per cent. of Spain and 25 per cent. of Portugal being under woods and forests.

Deciduous forests are practically confined to the north and north-west where oaks, beech, birch, ash, and sweet chestnut abound (*see pp. 138-40*). This region is the only one in Iberia where forest communities develop to the same extent as those in England. Consequently the area is the least 'Spanish' part of the Peninsula.

In arid Spain forest growth is practically confined to the watercourses and wetter mountain slopes. Deciduous trees occur in the more humid depressions of the Central Sierra, and poplars line the watercourses as far south as Granada, but the typical trees of arid Spain are the pines and the evergreen oaks. *Quercus ilex*, the evergreen oak, is widespread, but seldom forms high forest; the cork oak covers over 2 million acres, especially in Portugal and southern Spain, but even where it forms groves and woods (*alcornocales*) the trees are usually widely spaced and there may be bush growth and meadows between them. Indeed, most of the so-called 'forest' of arid Spain and Portugal is more akin to parkland or savanna than to the woodland associations of northern Spain and of western Europe. Over one-third of the forested area of Spain consists of pines, the chief trees being the Aleppo pine, the Cluster pine, the Corsican pine, the Stone pine, and the Spanish fir. Another evergreen conifer, the juniper, and especially the incense juniper, occurs commonly on the drier upper slopes of the chief mountain ranges. The pines often form dense, compact groves (*pinares*), but frequently they grow isolated or in small clumps.

The present woodland areas of the Iberian Peninsula are the relics of much greater forests that have been ruthlessly cleared and exploited by man. In few countries has the natural forest-growth encountered so many enemies as in Spain. The need of wood for fuel, which continues even to-day, the great seasonal wanderings of flocks and herds in the past, the ravages of the ubiquitous goat, and the great destruction of forests during wars, especially the Carlist civil wars, when the woods sheltered rebels and bandits, are alone sufficient to

account for a serious deforestation. But to these and other causes must be added the cardinal fact that once an area has been deforested, the arid climatic conditions and soil erosion prohibits the natural re-establishment of tree growth. Instead there arises shrub- and bush-land and other degenerate forms of vegetation.

Matorral

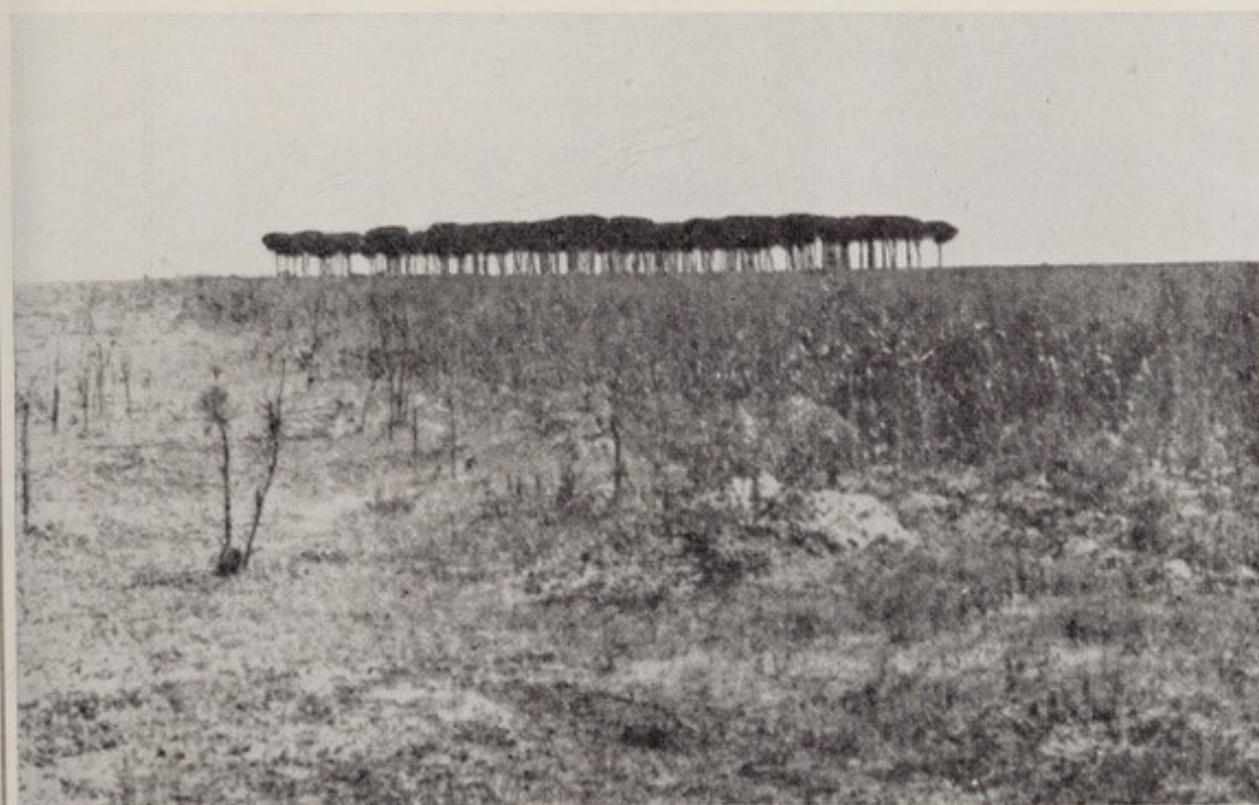
The most characteristic feature of the natural vegetation of Iberia is the *matorral*, an expanse of bushes and evergreen shrubs. The *monte bajo*, as the Spaniards call it in contrast to the *monte alto*, the forest, consists largely of plants of the *Cistaceae*, *Labiatae*, *Leguminosae*, and *Ericaceae* families. Many of the plants have small, leathery leaves, many are aromatic and spiny, and most flower in spring and autumn on the Meseta and throughout the year on the Mediterranean coast. Matorral develops spontaneously and flourishes in areas where the rainfall is small, the evaporation high, and sunshine abundant. Frequently many families form an association, but occasionally one particular species predominates and then the Spaniards distinguish the matorral by the name of the predominating plant. Stretches of *cistus*, known as *jarales*, form one of the most typical plant associations of Spain and cover enormous areas of the southern Meseta lying between the Toledo mountains and the Sierra Morena. The most characteristic *Labiatae* are the thyme, which forms *tomillares* (*tomillo* = thyme), the lavender (*esplegares*), and the rosemary (*romerales*), all of which cover considerable areas on the hills and sunny slopes of southern Spain. The bushes may form dense cover up to about 10 and even 15 feet high, but the typical matorral is usually half this height. In southern Portugal, however, the resin laudanum often grows to a height of nearly 10 feet.

The *Leguminosae* plants usually consist of xerophytic bushes, between 20 and 40 inches high, that are interspersed in the matorral of *cistus*, thyme, lavender, &c. The Spanish broom and gorse are common on the Meseta south of the Sierra de Guadarrama. The Peninsula is exceptionally rich in these species, fifteen out of twenty-four species of the gorse genus and thirty out of forty-seven classified brooms being endemic. In spring the *retamales*, or broom-heaths, form a carpet of gold in the northern parts of Ciudad-Real province.

The plants that occur frequently in the matorral, but rarely form scrubland alone, are the myrtle, mastic-bush, wormwood, sage, sweet marjoram, arbutus, tree-heath, and many stunted varieties of oak, including the evergreen, kermes, and scarlet-oak. The density of the



51. *Matorral of thyme (tomillares) near Badajoz*



52. *Pine grove near Valladolid*



53. *Steppe near Espartinas, Province of Madrid*



54. *The Plain of Daimiel (Province of Ciudad-Real), showing the seasonal lake of Albuera*

matorral varies considerably. In the driest areas the bushes and herbaceous plants are spaced at intervals, but when the association is fully developed, it either clothes the whole district with low bush-growth, or forms dense impenetrable thickets. A ground-flora of bulbs and tubers is not uncommon, tulips, lilies, and asphodels blooming in spring and the saffron crocus in autumn. The matorral burns easily and much is used for making into charcoal, but its chief economic importance is for the grazing of cattle.

Steppes

The matorral grades through many types of impoverished scrub-land into the steppe, a desolate expanse of bare soil with a sparse covering of low, isolated bushes and of dry, tufted grasses. The steppes are characterized by their lack of trees and of woody plants, by the extreme xerophytic nature of their vegetation and the thinness of their plant-cover. Generally speaking, they occur where the climate is most arid, and where the soils, owing to their saline, permeable, or infertile nature, are least favourable to plant life. The area under steppe fluctuates considerably and, being a transitional stage of vegetation, its limits are naturally indefinite, but it seems that nearly 25,000 square miles of Spain (almost the size of Scotland) are either steppe or steppe-like in character.

The main expanses of steppe are the following (Fig. 34):

- (1) The steppe of La Mancha, comprising part of the provinces of Madrid, Toledo, Ciudad-Real, and Cuenca.
- (2) The steppe of Murcia and Valencia, which extends inland along the dry Segura valley almost to La Mancha and stretches along the coast northwards to Cabo de la Nao and southwards to beyond Almería.
- (3) The Ebro steppe (*Los Monegros*), which extends on both sides of the river from Alfaro to Mequinenza.

There are, in addition, three smaller areas of steppe in Andalusia (near Écija, Baza, and Mancha Real) and one round Valladolid on the northern tableland.

Although so sparsely covered with vegetation, the steppes are rich in species. Esparto-grass predominates in the south and south-east, where its economic uses, such as sandal-making, helps to support hundreds of villages. Wormwood is common in the Ebro steppe, the dwarf palm in the Andalusian steppe, and glassworts, purslain, and medicinal plants throughout the districts. The saline steppe, characterized by the presence of salt-loving plants such as saltwort, is

usually set within the esparto or grassy steppe, just as the latter is set within the degenerating scrubland.

The vegetation of the Peninsula has been greatly altered by cultivation, and large areas are under the olive, vine, and cork-oak. Indeed, these trees frequently grow wild, and 'cultivation' has often merely meant the assistance of natural growth and the exploitation of the fruits. In the following account, the vegetation of each geographical region is described from the point of view of the traveller rather than of the botanist, cultural plants being included where they are especially typical of the landscape.

I. HUMID OR PLUVIOSE SPAIN AND PORTUGAL

The North and North-West

Region 1 (*a-e*)

The middle slopes and river valleys of the Spanish Pyrenees are wooded with beech, chestnut, and deciduous oak to about 5,000 feet altitude, above which height conifers are common. The chief tree, the silver fir, grows in groves, often in association with the Mountain pine and Scots pine, but the birch is often dispersed among these conifers. Above 8,000 feet the vegetation is alpine in character, consisting mainly of meadow and heaths of blackberry, cranberry, and similar shrubs. The tree-growth of the Spanish slopes, owing to the drier climate, is thinner and more restricted than that of the French side and extensive woodlands are seldom found.

The lower mountain slopes of the Basque lands and Cantabrians are well wooded with beech, oak (deciduous and evergreen), birch, ash, sweet chestnut, and maple. Holly, currant, service-tree, and hawthorn frequently occur in the woods, and the alder is common near the streams. Conifers, also, are to be found and the eucalyptus (blue gum), which is often planted to replace felled woodland.

The higher, bleaker slopes are heathlands of box, ferns, heather, gorse, and blackberry but are more like the moorlands of western Europe than the true matorral of arid Spain. The open country and forest clearings are mainly under meadows, and the characteristic cultural tree is the apple. Near the coast maize is commonly grown, and in sheltered spots the fig, orange, and lemon flourish side by side with temperate fruits.

The vegetation of Galicia and the Sil basin closely resembles that of northern Spain. Pine, eucalyptus, and various species of oak form

VEGETATION AND LAND UTILISATION OF PORTUGAL

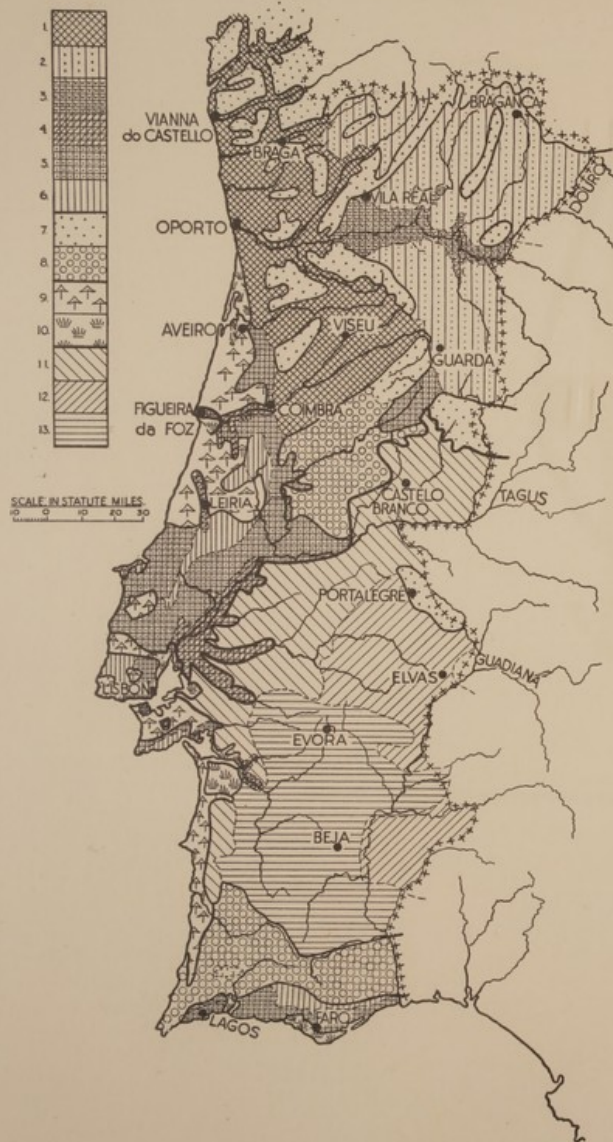


FIG. 35. (After Lautensach)

KEY

1. Intensive cultivation of maize, beans, rye, and vine. Forests of pine and deciduous oak.
2. Olive and vine in lowlands; potatoes and cereals (mainly rye) on uplands. Woods of sweet chestnut and evergreen oak.
3. Predominantly vine-growing, with fruits and rye in west.
4. Intensively cultivated alluvial soils. Much rice, maize, beans, and oats.
5. Intensive cultivation of cereals, maize, and fruit. Large vineyards and olive groves. Pines near coast and cork-oak inland.
6. Chalk hill-lands; stunted oak-growth with small cultivation of cereals and some fruit. Fig and carob in Algarve foothills.
7. Highland of granite and gneiss; oak and stunted shrub-growth in west, sweet chestnut and low growth of lavender, sage, and steppe in east.
8. Schistose mountains with large expanses of heath and *cistus* matorral.
9. Sandy areas; largely under pine and heath with sand-dunes near coast.
10. Salt marsh and unutilized coastal areas.
11. Extensive cultivation of wheat, beans, oats, rye, and maize, much olive, vine important locally. Large areas under cork-oak and matorral.
12. Plateau and uplands of north Alemtejo. Cork-oak and evergreen oak are abundant. Extensive cultivation of cereals and beans, olives frequent.
13. The lowlands of south Alemtejo. Much wheat, olive, and beans. Cork-oak and evergreen oak abound; heath and rough pasture common on foothills to west and south.

the fundamental elements of the forest. The dense groves of deciduous oak largely take the place of beech, which here finds less favourable soils than in the Cantabrians. The poplar and alder often line the streams, and dogwood, maple, lime, and holly are common enough in the woodlands. Sweet chestnuts abound in the province of Lugo, but here, as elsewhere, are large stretches of meadow land. The extensive scrub and heathland of the rougher, bleaker mountain areas consists mainly of gorse, broom, heather, and fern.

Northern Portugal

Region 1 (*f-h*)

Galicia roughly marks the southern limits of the dominance of deciduous forest in north-west Iberia; south of the Minho valley evergreen types become more prevalent, and certain Mediterranean cultures, notably the olive, begin to take an important place in the vegetation. In many ways the whole of Portugal forms a somewhat distinct floral region, as the rainfall favours the growth of central European and of Mediterranean plants. North of the Tagus this transitional vegetation invades the western Meseta in the provinces of Salamanca and Zamora, but south of the Tagus the typical vegetation of the Meseta invades the major part of eastern Portugal. Yet the vegetation cover shows no great contrasts and changes progressively towards the interior rather than from north to south. Throughout the uplands and mountains of Portugal the oak, and especially the cork-oak, is the typical tree. On the north Douro plateau the western slopes and valleys are clothed with oaks (evergreen and deciduous), elms, and poplars. These deciduous trees and arbutus give way at 4,500 feet to birch and yew, which grade into shrubland of heather and myrtle.

To the east, however, in Trás-os-Montes, the landscape becomes gradually barer and rougher, and the vine and olive, which here bears little fruit, increase in importance (Photo. 18).

South of the Douro the coastal strip carries rich pine groves that even spread over the lower slopes and ridges of the hills. Inland, the oak predominates, the grey oak of Beira being interspersed with the evergreen oak, the deciduous oak, and the Lusitanian oak. The sweet chestnut is also common in the mountain zone. The shrubland consists mainly of ferns and lavender near the coast, and of gorse, heather, and ferns farther inland. Generally speaking the western regions are

well wooded, but the eastern parts of Beira show much affinity with the barren landscapes of Old Castile.

The Central Ridge of Portugal forms the southern limit in Iberia of the deciduous oak. The slopes between 2,500 feet and 5,000 feet are wooded mainly with oak and chestnut, but the dominant vegetation is scrub of cistus and fern. From 5,000 feet upwards a stunted growth of holly, birch, and yew grades into a rocky region dotted with dwarf juniper and Nard grass. On the warm southern foothills, where the evergreen oak mixes with the sweet chestnut and the olive with the cork-oak, the predominance of Mediterranean plants is no longer in doubt. (For southern Portugal *see* p. 143).

II. INTERIOR SPAIN

The Central Tableland

Region 2 (*a-e*)

The northern tableland has been largely denuded of natural vegetation and great parts of it are now under cereals and pasture. In the plains of Zamora and Salamanca the Stone pine and Cluster pine form fine groves in the sandy soils, especially south of the Douro. In the north a few woods of evergreen oak and grey oak remain, but these, and the poplars along the streams, only serve to emphasize the bleak, open nature of this unenclosed country. A thin scrub grows on the higher areas, while around Valladolid the rough, dry pastures are included among the steppelands of Spain.

The Central Sierras, with a heavier rainfall, were formerly well wooded with conifers and deciduous trees, but only a few fragments of these extensive forests have escaped destruction. On the Sierra de Guadarrama a few pine forests and some oak woods are to be found in the larger hollows or valleys. Black poplar and ash occur in the few woods and on the river-banks of the lower slopes. Large areas are covered with a thin matorral, mainly of broom-heath, which dominates on the deforested districts and on the slopes above 7,000 feet.

On the Sierra de Gredos pines are fewer and the grey oak and sweet chestnut are dominant in the scattered woods of the middle slopes and cooler valleys. In the warmer south, fruits such as the olive, fig, and vine increase the sylvan nature of the valley-bottoms. The rocky slopes of the west of the Central Ridge (*Las Hurdes*) have been ruthlessly deforested and, apart from the strips of cypress and evergreen

trees in the deep, narrow valleys, they are mainly covered with a very complex scrub. Over vast areas of this desolate region, woody *Labiatae* (rosemary, thyme, French lavender), cistus, gorse, and heather form the chief matorral associations.

The southern half of the Meseta carries two main types of vegetation, namely, steppe and matorral. The steppe, which consists especially of esparto-grass and thyme growing in widely spaced tufts, occupies the greater part of the high, eastern plains. Over large areas the esparto-grass predominates and is of considerable economic importance. North of Ciudad-Real the indefinite drainage of the Guadiana river gives rise to large stretches of saline soils that support a sparse vegetation, technically known as 'halophytic' (salt-loving). On the vast plain of La Mancha tree-growth is rare except for a few pines near the widely spaced farm-houses, and the cultivated groves of olive and vine, that are restricted to the districts where river or underground water is accessible.

The matorral predominates in the north-west, especially on the Toledo mountains, and in the south upon the Sierra Morena. The typical plant associations are the *retamar* (broom-heath) and the *jaral* (cistus), hence the district of La Jara south of the Tagus in the province of Toledo. Over vast areas the scrub of broom, gorse, rosemary, lavender, thyme, sage, and heather forms an almost continuous cover, and in some districts it grows in thickets so dense and impenetrable that they were formerly a favourite refuge of bandits.

In the Sierra Morena the evergreen oak is the chief tree, while ash, alder, black poplar, &c., are found along the river-banks. These, however, rarely form even groves. To the south-west, in Spanish Extremadura and in eastern Portugal adjoining it, the greater rainfall is reflected in the luxuriance of the matorral and the abundance of the cork-oak. On the Serra d'Ossa in Portugal cistus grows to a height of nearly 10 feet. The *jarales*, chiefly of resin laudanum, contain occasional bushes of mastic, arbutus, evergreen oak, and more rarely of cork-oak. By destroying the matorral and sparing the oaks, rough pastures dotted with oak-growth can be formed in the flatter districts. Consequently below the vast *jarales* on the mountain slopes stretch park-lands and occasionally arable fields, which, if neglected, soon revert to matorral. On the mountains in the west of the southern tableland some groves of oak (cork-oak, evergreen, and Lusitanian) and sweet chestnut are to be found, but even in these forests the trees are widely spread. Locally, especially in the better watered valleys, the *alcornocal* or cork-oak plantation may develop to give a park-land

scenery, but throughout the whole of the middle Guadiana basin the matorral is as predominant as the steppe is in La Mancha.

The Iberic Mountains and the Ebro Trough

Regions 3 (a) and 4

The wetter slopes and valleys of the Iberic mountains north of Soria, especially about the headstreams of the Douro, have magnificent pinewoods, perhaps the best in Spain. In the less exposed valleys of the Sierra de la Demanda are thick woods of beech, birch, and oak, deciduous and evergreen. The bleakest and alpine areas carry a dense, low-growing matorral which gives much of the region a desolate aspect and affords no shelter from the strong, cold winds of winter.

In the south, around Teruel, the mountains have been largely deforested except for a few pine- and oakwoods on the east and the junipers, sables, and yews which occur throughout the Iberic mountains. West of Teruel, on the Serranía de Cuenca, the extensive pine groves and juniper woods give rise to forest industries, especially in the valleys of the upper Tagus. On the bleaker slopes, stunted junipers, sables, and oaks rise above the scrubland, which varies considerably in composition, consisting mainly of lavender in the west and of rosemary in the east. The warmer valleys usually contain the oleander, while the driest slopes and saline districts (about Calatayud and Ateca) only support a sparse steppe vegetation.

Generally speaking, the scenery of the Iberic mountains is bare and desolate, and, apart from the forested valleys of the Sierra de la Demanda and of the Serranía de Cuenca, the vegetation is transitional between that of the plains of Old Castile and the steppes of the Ebro.

Large areas of the Ebro trough consist naturally of impoverished steppe-land in which the thin clumps of plant-growth, largely of wormwood, cannot hide the bare earth. Tree-growth is scanty; the feeble pine groves on the Sierras de Alcubierre and Monegros and the scattered junipers in some of the hilly districts alone remain of the former forests. The semi-desert aspect of the major part of the Ebro trough is broken in the irrigated areas, and also in the north-west, where the river Aragón crosses an undulating land, bearing coppices on the hills, and groves of pine and oak at intervals on the lower districts. In the east, between the Segre and Cinca, the industriousness of the Catalans is reflected in the plantations of poplar and in the irrigation of a large area that was formerly steppe-land.



55. *Evergreen oaks in Valle de Alcudia, Province of Ciudad-Real*



56. *Steppe vegetation on Sierra de Alcubierre, Province of Saragossa*



57. *Marshes near Aveiro*



58. *Pine woods near Setúbal*

III. 'MEDITERRANEAN'¹ LANDS OF SPAIN AND PORTUGAL*The Portuguese Coastal Lands*

Region 5 (a)

The coastal plain north of the Tagus is largely under Cluster pine with stretches of heather. The alluvial areas are intensely cultivated with maize and rice, but in the damper parts there are saline marshes such as those near Aveiro and Figueira. Between Caldas da Rainha and the estuary of the Tagus the coastal plain is much interrupted by hills. The sandy lowlands, however, still carry extensive pinewoods and on the hills is scrubland with many stunted oaks, especially Scarlet oak.

South of the Tagus the pinewoods continue to border the coast, but here the Stone pine occurs with the Cluster pine and the forests are less extensive than in the north (Fig. 35). The coastal hills, and notably the Serra da Arrábida of the Setúbal Peninsula, support a matorral of great luxuriance, and this scrubland increases in extent, but not in density, to the south and east. At the foot of the hills sweet chestnuts and oak, both evergreen and cork, abound. Although in some localities the holly, the wayfaring tree, and a species of laurel form a dense undergrowth, the landscape is essentially park-like. The cork-oak is so common on the wide lowlands about Beja that the whole area can be regarded as a vast *alcornocal*, where the tree flourishes better than anywhere else in the peninsula (Fig. 35). In Algarve the western coast is densely wooded with pines, but the warm southern coastal strip is cultivated with fig, orange, apricot, olive, carob, pomegranate, melon, and almond. These fruits, together with the wild vine, form a luxuriant vegetation on the wetter slopes and valleys, but the highland areas are largely covered with matorral. Here, however, as in south-western Spain, large areas of scrub-land have been turned into park-land of cork-oak and evergreen oak. (Photos. 59 and 60).

The Plain of Andalusia

Region 6

A large part of the plain of Andalusia is under cereals and legumes, while still greater areas are clothed with vineyards and with olive and orange (Fig. 36). There are, however, considerable

¹ The word 'Mediterranean' is used in a climatic sense. The strict numerical order of the regions is not followed, as this sequence is not logical in the account of the vegetation.

stretches of steppe on the southern borders of the plain about the Genil valley, and extensive grasslands near Córdoba, Utrera, Huelva, and Jerez de la Frontera. Near the mouth of the Guadalquivir stretch *las marismas*—flat, marshy expanses of reeds and marine plants, with an abundant herbaceous vegetation all the year. The littoral strip often consists of bare sand-dunes with an occasional pine grove at long intervals. Inland from Jerez, dwarf palms, the mastic bush, and prickly pears are common, and the Century plant borders the routes and the oleander the streams. Inland from Huelva

THE VEGETATION AND LAND UTILISATION OF THE PLAIN OF ANDALUSIA

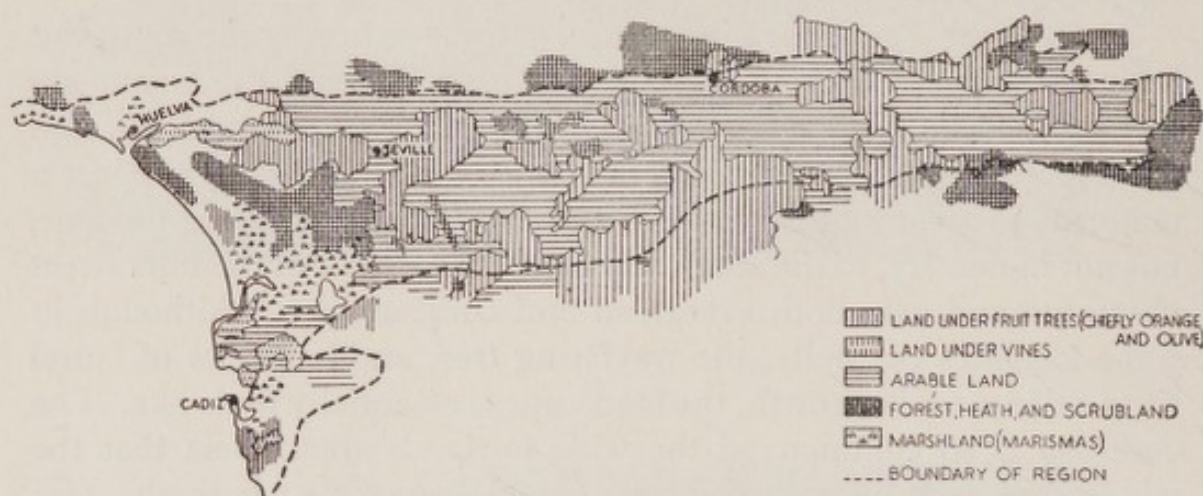


FIG. 36. (After Niemeier)

is a land rich in cork-oak and evergreen oak, similar to the *alcornocales* of southern Portugal.

The Andalusian Mountains

Region 3 (b)

The inner zone of the Andalusian mountains, that overlooks the Guadalquivir valley, is covered mainly with xerophytic scrubland and with esparto-grass steppe. Evergreen oak is scattered in the whole region, chiefly in the west, and olives occupy large areas in the provinces of Jaén, Córdoba, and Granada. It is only near the head-streams of the Segura and Guadiana (on the Sierras de Segura and Cazorla) that pinewoods flourish, rising amidst bare crags and surrounded by bare, deforested mountains.

The seaward strip of the Andalusian mountains, the high crystalline zone, is least barren in the south-west where the rainfall is heavier. Here, in the districts most exposed to sea-winds, forest

formations of oak, largely cork and evergreen, and wild olive alternate with wide stretches of semi-desert. In the hollows, dense pine groves occasionally are to be found, and on the Serranía de Ronda some woods of Spanish fir still remain. The matorral, which is dense in favoured spots, consists largely of cistus and *Labiatae*, but where sea-influence is strong the dwarf palm is common. In the cool valleys alder, ash, and poplar line the watercourses, and it is not surprising that to a Spaniard this region seems an island of pluviose Spain. To English eyes, however, the landscape is grey and bare.

Eastwards from Ronda the mountains become increasingly desolate. From Granada to Guádix the normal vegetation consists of poor scrubland of thyme with occasional clumps of wormwood and esparto and, at long intervals, a solitary evergreen oak or pine. From Guádix to Baza the steppe of New Castile is continued across the gaunt mountain ranges almost to the coast and the vegetation degenerates into thin, isolated tufts of esparto-grass, thyme, and wormwood.

On the Sierra Nevada the typical Mediterranean fruits grow at an altitude of about 5,000 feet, beyond which stretches a matorral of gorse and aromatic shrubs, such as the grey dwarf wormwood.

Where water is available for irrigation, the hollows and valleys are transformed into green gardens, known as *vegas* or *huertas*, of which those around Granada are the finest; here fruit-trees abound.

The Southern Coastal Strip and the Levantine Lowlands

Regions 5 (b) and (c)

The chief contrast in the vegetation of the Mediterranean coast of Spain is between the green luxuriance of the irrigated lands and the barrenness of the brown or dull-green steppe and matorral. On the southern coastal strip from Gibraltar to Almería irrigated land is restricted, but the mountains support isolated trees and some pastures.

From Cabo de Gata to Cabo de la Náo the irrigated areas are more extensive, but are largely inland around Murcia and Elche, the date-palm centre. In all these *vegas*, tropical cultures of banana, rice, sugar, and cotton are possible. Inland, however, the mountains are lower and more desert-like, the typical vegetation being esparto-grass steppe and thin matorral. These associations invade the coastlands wherever cultivation or irrigation is impracticable (Photo. 61).

From Cabo de la Náo to the Ebro delta, *huertas* are almost continuous along the whole length of the Valencian coastline, and consequently the natural vegetation is less important than the cultivated. On the

hills inland, pines, oaks, and the carob are found. On the coastal areas the jujube, almond, olive, fig, and pomegranate grow in profusion, either wild or cultivated. The hills that interrupt the coastal plain are usually clothed with matorral of rosemary, thyme, cistus, and myrtle. The mastic bush, Christ's thorn, and sweet laurel (on banks of streams) are common in the lowlands, while the dwarf palm forms patches on the driest, sunniest slopes below 2,500 feet. Steppe is less developed than to the south, but it includes the characteristic plants, with certain varieties of *salsola* that are also found in Andalusia.

Catalonia

Region 7

Catalonia carries a denser vegetation cover than the other coastal lands of Mediterranean Spain. In addition to the typical matorral, as described in previous sections, the littoral strip south of Barcelona is enriched with pinewoods and plantations of cork-oak. North of Barcelona a great cork industry has arisen, and the increasing wealth of pine, cypress, and eucalyptus, together with the riverine stretches of reed and poplars, show the influence of a greater rainfall. The Catalan mountains are also more wooded than the highlands to the south of them. At Montserrat bare rock and matorral still predominate, but woods of pine and oak are common. Farther north, at Montseny, the presence of beech, spruce, and deciduous oak show that the Mediterranean vegetation has already merged into that of the eastern Pyrenees.

The Balearic Islands

Region 8

The vegetation of the larger islands of the Balears shows slight differences, both between the islands themselves and between the island group and the mainland. Iviza is characterized by its plantations of pine, the result of a recent reafforestation.

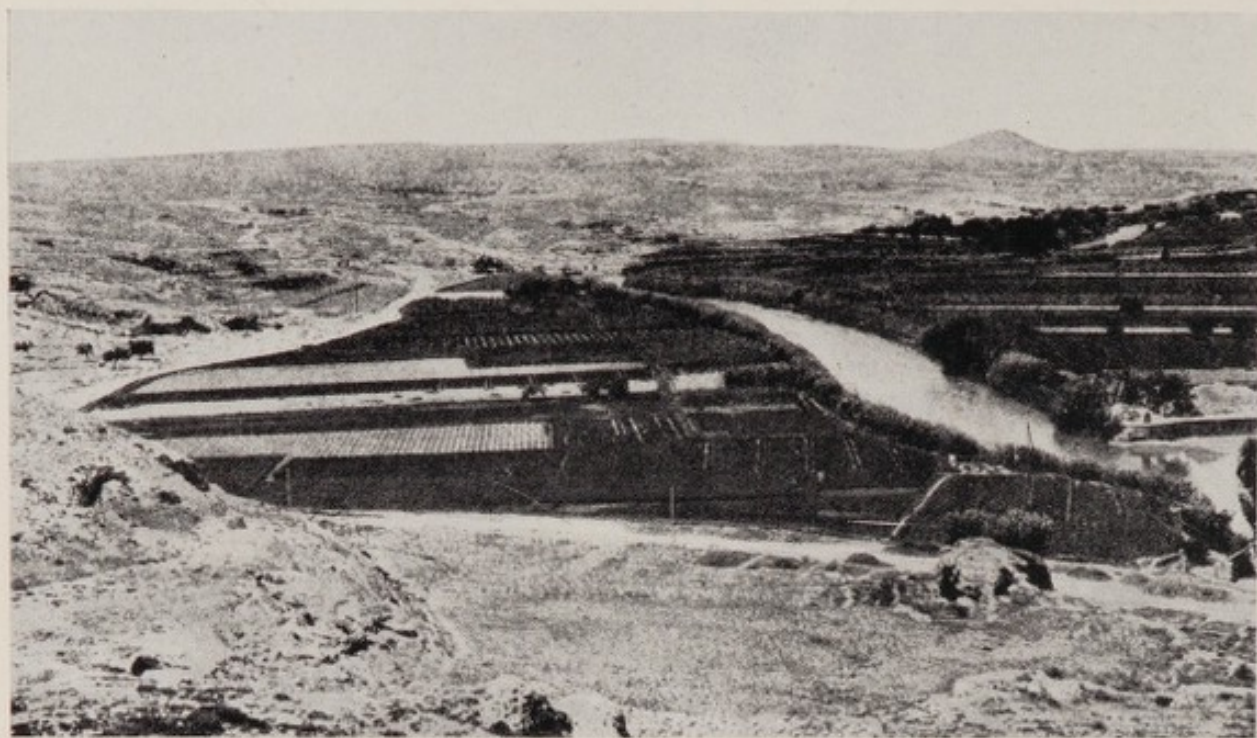
The woodland of Majorca is also chiefly of Aleppo pine and evergreen oak, with an occasional grove of Stone pine. These forests, which occur mainly on the northern Sierra, have been steadily decreasing owing to the spread of carob, olive, and almond cultivation. Much of the central plain of Majorca is under orchards, especially of almond, fig, vine, cherry, and olive. Where not cultivated there arises a scrubland of mastic bush, cistus, rosemary, wild olive, and asphodel. This matorral, which in appearance more resembles English heath and bushland than the dense scrubland of southern Spain, predom-



59. *Typical landscape of southern Alemtejo*



60. *The northern foot-hills of the Algarve Mountains*



61. *The Segura near its mouth at Guardamar, Province of Alicante, showing the contrast between the irrigated valley-bottom and its barren slopes*



62. *Woods of evergreen oak in the north-western Sierra of Majorca*

ates upon the hills in the east and upon the coastal areas in general. The insularity of the flora is reflected in the fact that the matorral is poor in species and individuals, such typical Mediterranean plants as thyme and box being absent. Indeed, it is fortunate for Majorca that its few endemic species (which comprise only one-fifth of the 1,250 recorded vascular species) flourish so well that the vegetation has an air of luxuriance. The presence of certain plants, such as the cyclamen, emphasize the relations of the flora to the Mediterranean islands farther east.

The vegetation of Minorca is very similar to that of Majorca, except that it is sparser and more stunted, owing partly to the strength of the winds. Except on the triassic soils of the central north coast the woods of evergreen oak and Aleppo pine have been almost entirely deforested. Large parts of the flatter land are under cultivation, but other areas form bleak stony heathland.

CHAPTER VI

DISEASES AND HYGIENE

THE two principal sources of information about the prevalent diseases in any country are scientific papers and official statistics. Scientific papers tend to be written about the rare, curious, or novel; an example appears below in the rather full information available about infantile visceral leishmaniasis, a relatively unimportant cause of illness and death in Spain and Portugal.

The only available official statistics for Spain and Portugal are those relating to deaths or diseases compulsorily notifiable. It is impossible from these facts alone to present a reliable survey of disease incidence in the Peninsula, for a variety of reasons. Registration of deaths has been compulsory since 1871 and probably few deaths escape registration, but though the fact of death may be recorded accurately, the recorded cause cannot be regarded as reliable. The attending physician was required to ascribe the cause on the death certificate, and to relate it to the appropriate title number in the Abridged International Nomenclature. This nomenclature, which provides thirty-eight causes only, means that many titles are masked under group headings. For example, though sixteen diseases are compulsorily notifiable, the Abridged Nomenclature provides for the tabulation of only seven or eight of these, the remainder being grouped under 'other infectious diseases'. All the deficiency diseases and about 150 other specific titles would be lost under 'other diseases'.

As a further obstacle to accuracy it may be noted that in remote country districts death often occurs before medical help is available. In such cases the certificate of cause would be completed from information supplied by surviving relations, or by neighbours, and in any case of doubt about the death of an aged person, the cause would usually be ascribed to senility. The following observations must be considered in the light of these restrictions.

The imperfection of the records is shown by these figures for deaths from 'unknown or ill-defined causes' per thousand deaths from all causes:

	1932	1933	1934	1935
Spain	36.2	36.5	38.9	37.1
Portugal	7.8	7.4	..	..
England and Wales	2.8	2.6	2.6	2.7

It will be seen that mortality in this group is very many times greater in Spain than in England and Wales: even in Portugal it is three times greater. Another difficulty is that the system of registration is different in the two countries, some diseases (*see* trachoma, below) being notified in one country only.

Spain was not directly affected by the war of 1914-18, but the Civil War of 1936-9 resulted in much disorganization of Spanish medical and social services, mixing of population (the importation of Moorish troops being particularly significant), and scarcity of food. It may be supposed to have increased epidemic and other diseases, particularly those which are of greatest military importance, but no precise information is available on these points.

Even before the Civil War, the hygienic state of the Iberian Peninsula must have been somewhat primitive. This is seen by comparing the general death-rates (mortality from all causes per thousand living):

Spain	1934,	16.01	1935,	15.62
England and Wales	„	12.51	„	12.49

The same difference is even more apparent in the infant mortalities (deaths under 1 year, per thousand live births):

Spain	1935,	109.0
England and Wales	„	56.9

TABLE

Showing the death-rates (i.e. deaths per hundred thousand living) from certain causes

	1934	1935
Typhoid and paratyphoid:		
Spain	12.8	11.3
England and Wales	0.4	0.4
Diarrhoea and enteritis (all ages):		
Spain	188.5	165.0
England and Wales	12.9	13.3

It seems certain that a considerable proportion of deaths in Spain are due to the intestinal diseases, i.e. to such causes as a low standard in the disposal of excrement, and the use of impure water and contaminated milk and other foods. The difference is brought out in the death-rates for typhoid and paratyphoid, also for diarrhoea and enteritis (*see* Table above). The prevalence of intestinal worms (*Ascaris*, &c.) in the Iberian countries points to the same conclusion.

On the other hand, the apparent rarity of typhus and the absence of epidemic relapsing fever may be taken as evidence of a considerable standard of bodily cleanliness. There is also evidence that small-pox has been efficiently controlled in Spain, and in the period prior to the Civil War a considerable reduction had been made in infant mortality and in deaths from infectious gastro-intestinal diseases. There has also been a notable reduction in malaria.

MALARIA

From the amount of attention which has been given to it, malaria should be one of the most important epidemic diseases of Spain and Portugal. Perhaps therefore it merits a rather full treatment.

1. *Anopheles Mosquitoes*

The key to the understanding of malaria lies in a study of the *Anopheles* mosquitoes, the only agent by which the malaria parasite (*Plasmodium*) passes from one man to another. In the Iberian Peninsula the only widely distributed species is *Anopheles maculipennis*: it is probably also the only species concerned in the spread of malaria. This insect breeds in stagnant or slow-moving water, often in shallows among grass or reeds: it does not breed in large sheets of water unless vegetation is present. Some of the breeding-places are very large, such as great areas of natural swamp, or of rice-fields: others are small, such as pools in partly dry river beds, irrigation ditches, and open wells. It follows that the insects (and generally the malaria) are found not only in marshy alluvial areas in the lower parts of great valleys but also in small cultivated spots on the arid Meseta. In many parts of the country the extent of open water in summer depends on the rainfall of the previous winter and spring (see pp. 104 and 107). In years when this has been heavy there may be a great expanse of water, lasting into the summer, and causing a great increase of *A. maculipennis* and of malaria. It seems possible that the fact that certain provinces in the Meseta (such as Salamanca and Zamora) have a rainfall maximum in spring, rather than in winter, accounts for an unexpectedly high incidence of malaria.

The adult *A. maculipennis* are known to fly several miles in numbers sufficient to cause malaria, so that the range over which they should be controlled is great. Unfortunately, the females are attracted to human habitations, stables, rabbit hutches, &c. Though the blood of domestic animals is preferred, some feed on man, so

that the insect is an effective carrier of malaria. The insect passes the winter in the adult stage alone, the females hibernating in houses and stables. They do not sleep profoundly, but feed intermittently, and probably transmit malaria in houses during this season.

At or about sea-level, hibernation ends in mid-February, when the

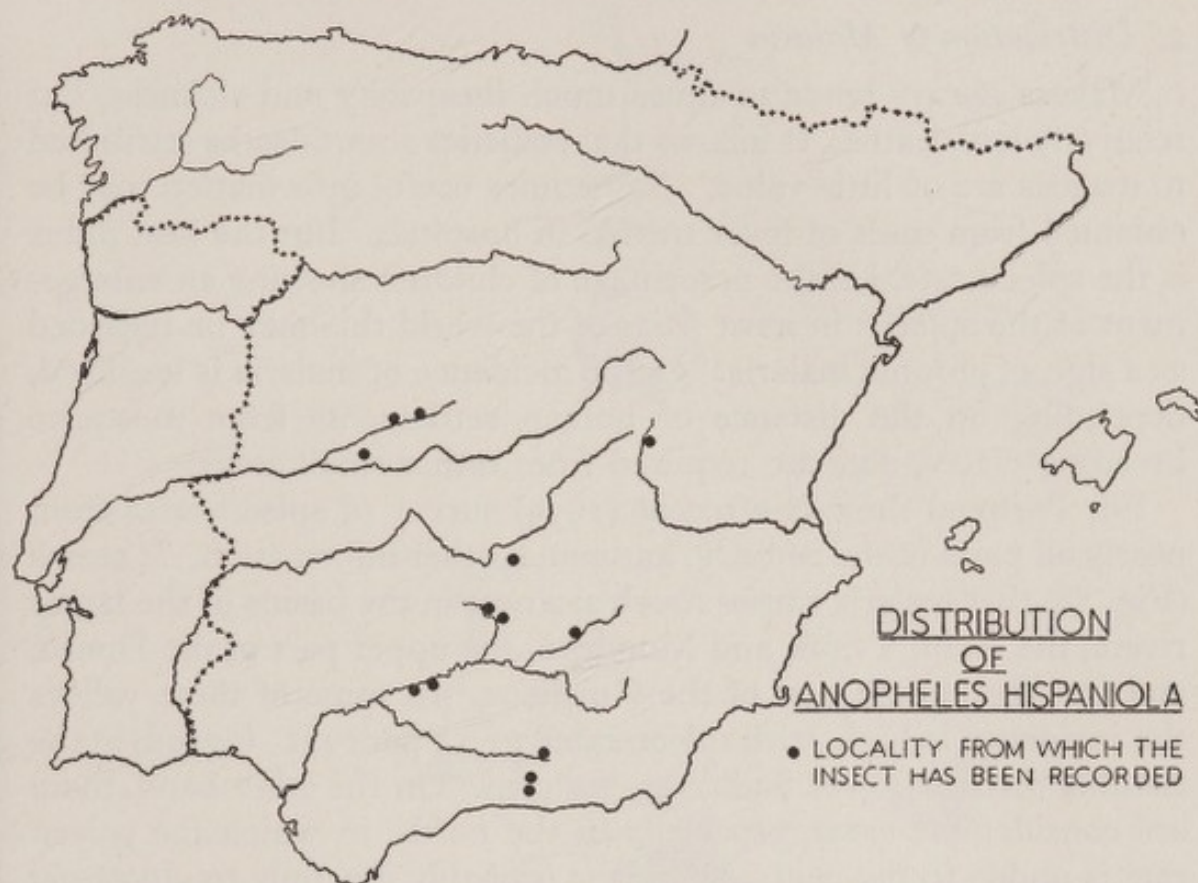


FIG. 37. THE RECORDED DISTRIBUTION OF *Anopheles hispaniola* IN SPAIN (mainly from Gomez and Paniagua, 1934)

first eggs are laid: anti-larval measures (*see below*) must therefore be undertaken by the middle of March.

As in most other countries surrounding the Mediterranean, several distinct races of *A. maculipennis* occur. The most important to the student of malaria is *atroparvus*, which is dominant in most parts of the Iberian Peninsula, including nearly all the centre and south. In the coastal parts of Alicante and Murcia (Region 5 c) the race *labranchiae* replaces *atroparvus*. Both races of mosquito are known to be serious vectors of malaria: the first is certainly the most important in Spain and Portugal. To what extent the comparative rarity of malaria in some regions of the north and west (*see below*) may be due to absence of these races, and the presence of others, is not yet known.

Three or four other species of *Anopheles* mosquitoes occur in

Spain, but only one, *A. hispaniola*, is at all common. It is widely distributed in the southern half of Spain, though not recorded from Portugal (present, approximately, in Regions 2 *c*, *d*, *e*; 3 *b*; 5 *b* and *c*; 6. Fig. 37), and it breeds in hill-streams often in very small trickles of water, or among growths of filamentous algae, up to 4,000 feet.

2. *Distribution of Malaria*

Malaria always tends to cause much incapacity and sickness, but relatively few deaths. It follows that statistics about deaths attributed to malaria are of little value. Sometimes useful information may be obtained from cases of fever treated in hospitals. But the best index is the spleen rate, i.e. the percentage of children showing an enlargement of the spleen: in most parts of the world this may be regarded as a sign of chronic malaria. As the incidence of malaria is localized, depending on the distance of human settlements from mosquito breeding-places, data are required from rather small areas.

For Portugal there is a recent (1935) survey of spleen rates from nearly all parts of the country, and much other information. It seems (Fig. 38) that malaria causes much sickness in the basins of the larger rivers, the Sado, Tagus, and Mondego, the upper part of the Douro, and the Portuguese part of the Guadiana. In some of these valleys the incidence is high, with spleen rates 30–55 per cent., indeed, in the Setúbal district (lower Sado), 95 per cent. On the other hand, there are considerable areas, especially in the north, in which the spleen rate is under 10 per cent. Malaria is probably due only to *Anopheles maculipennis atroparvus*, and much of it results from the breeding of this insect in rice-fields, though there are also numerous malarious areas where no rice is grown. Deaths notified as due to malaria number about 140–150 per annum (1931–3).

For Spain the only statistics are deaths (not cases of illness) registered as due to malaria: they are only available for provinces, an unduly large unit, and only up to 1925. It seems that deaths from malaria tended to be highest in the south and south-east of Spain: of the forty-seven mainland provinces there were eleven in which the malaria deaths exceeded 15 per hundred thousand living per annum: one may group these eleven as follows:

Seven southern provinces with much low-lying ground near rivers:
Huelva, Seville, Córdoba, Cádiz, Jaén, Murcia, Alicante.

Two central provinces containing the wide marshy valleys of the upper Tagus and Guadiana: Cáceres, Badajoz (*see* Photos. 63 and 64).

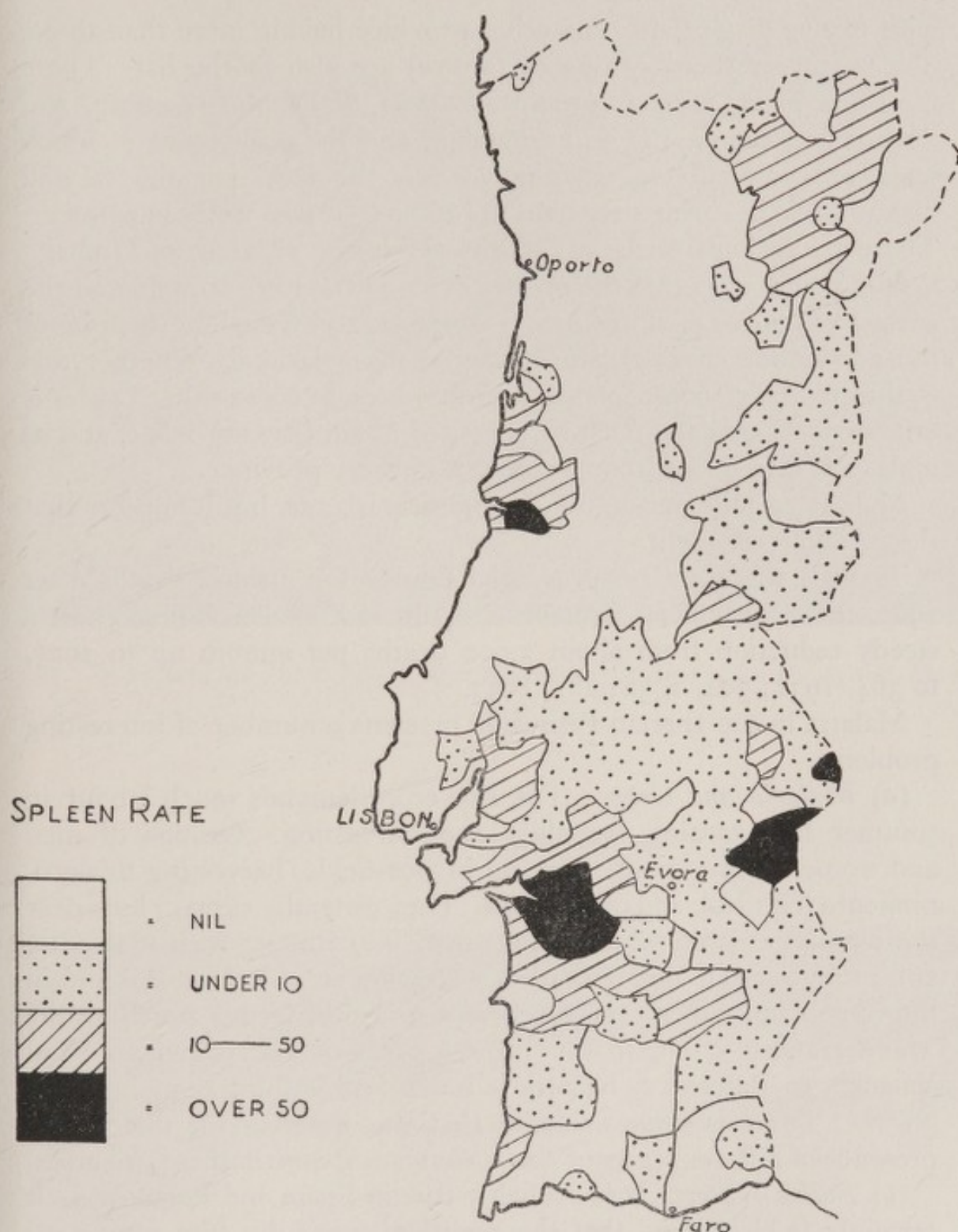


FIG. 38. MALARIA IN PORTUGAL. CHILDREN'S SPLEEN RATES (after Landeiro and Camburnac, 1935)

Two central provinces, almost entirely above 1,600 feet: Ciudad-Real (with its numerous marshes, *see* p. 30), and Salamanca (with rainfall maximum in spring).

This information is borne out by the distribution of special anti-malarial dispensaries (1933). The province of Cáceres heads the list

with twelve dispensaries, no other province having more than three. The seven southern provinces (above) are also in the list. There is also a block of four provinces, Ávila, Valladolid, Zamora, and Salamanca; the area is arid and high, and the occurrence of much malaria is difficult to explain, though the fact that the rainfall maximum is in spring may tend to produce surface water in summer. There are also anti-malarial dispensaries in the province of Orense.

It is noteworthy that the provinces along the Ebro trough, and the coastal provinces of Barcelona, Tarragona, and Castellón (in spite of the production of rice), are not seriously malarious. Whether this is due to their more northerly position, or to some other cause, is unknown. Along the Atlantic coasts of Spain (Region 1 *b*, *c*, and *d*) malaria is infrequent, though present in every province.

Malaria certainly occurs in the Balearic islands, but it appears that the incidence is slight.

Though there are no provincial figures for malaria deaths after 1925, there are official figures for Spain as a whole. These show a steady reduction from about 2,000 deaths per annum up to 1925, to 364, 1931; 304, 1932; 281, 1933.

Malaria in the Iberian Peninsula presents a number of interesting problems.

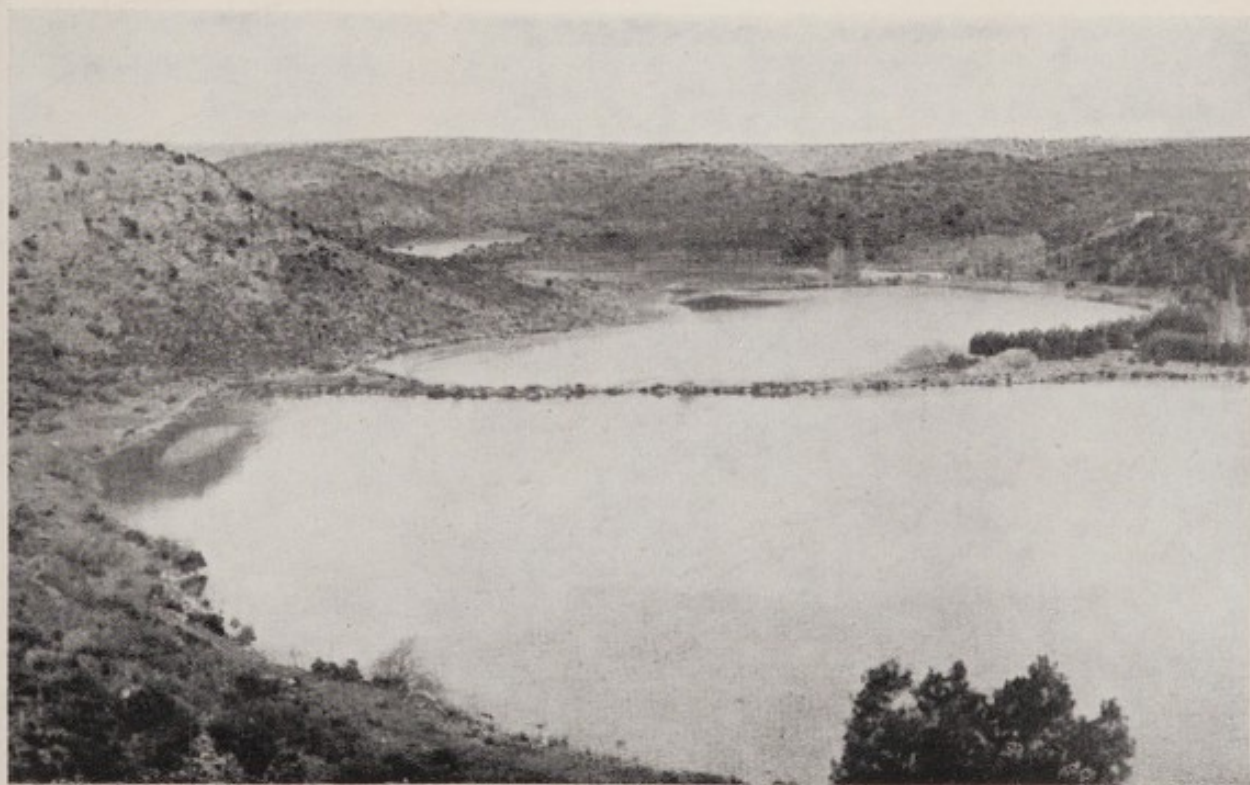
(*a*) *Malaria and Crops*. The rice crop demands much labour in summer for planting, weeding, and harvesting. Groups of men and women move about, working in rice-fields, harvesting tobacco, pimiento (chillies), and other crops. They generally sleep in huts near the work, a custom which brings man into contact with mosquito, and produces much malaria in rice-growing areas in Portugal and in the Spanish provinces of Murcia and Alicante: farther north on the Mediterranean coast, in the littoral parts of the provinces from Valencia to Barcelona, malaria is much less serious, though rice is grown. There is some evidence that this difference is due to the presence of different races of *Anopheles maculipennis* in these two areas.

(*b*) *Saline Waters*. It is probably true in Spain and Portugal, as it certainly is elsewhere, that the prevalent mosquito (the *atroparvus* form of *Anopheles maculipennis*) cannot breed in waters which are even slightly brackish; the *marismas* of Andalusia should therefore be free of this insect, and of malaria. On the other hand, in Region 5 *c*, brackish marshes might well produce great numbers of the local form (*labbranchiae*) of mosquito, and also much malaria.

(*c*) *Anopheles hispaniola*. It is not yet known whether this species, the adults of which commonly visit houses, is a vector of malaria,



63. *Swamps in the Tiétar valley, near the railway station of La Bazagona, Province of Cáceres*



64. *Surface drainage of La Mancha; Lake Ruidera*



though Spanish malariologists regard it as insignificant. Should it prove to be a vector, it would be necessary to carry out control work in hill-streams, a difficult matter. For geographical distribution see Fig. 37.

3. *Malaria Parasites*

Examination of large numbers of blood films has only been reported from a few places. In most parts of the Peninsula it seems that the benign tertian parasite (*Plasmodium vivax*) is much the commonest, making up 80-95 per cent. of all positive films, in the Ebro delta, the Spanish province of Toledo, and at Buenavente in Portugal. In the south a higher proportion of the malignant tertian (*P. falciparum*) is to be expected: in the province of Huelva it amounts to 30-45 per cent. of all positives. Quartan malaria (*P. malariae*) is rare in all parts.

In most parts of the Iberian Peninsula malaria should therefore be clinically mild. Black-water fever has not been recorded.

4. *Control of Malaria*

In Spain and Portugal there is much surface water in certain large valleys: some of this is used for rice cultivation, of which there are over 120,000 acres in Spain and about 50,000 in Portugal: the population as a whole is neither densely distributed nor rich, so that certain types of control are too costly. The situation is made easier because the mosquito (*atroparvus*) is not an efficient vector of malaria, so that the disease is only frequent if the mosquitoes are extremely numerous: a somewhat imperfect control will therefore make a great reduction in malaria.

In general the radical, engineering methods of controlling *Anopheles*, such as draining or filling breeding-places, have not been employed because of expense. An important exception is the Guadalmellato swamp in the Guadalquivir valley near Córdoba: this was drained from 1925 onwards, but the work was only rendered possible because it brought valuable agricultural land into use.

In most places a sufficient reduction in the numbers of mosquitoes has followed the introduction of the small fish *Gambusia*, which eats all the aquatic stages of the mosquito. This fish multiplies rapidly and is voracious: it has been introduced into a very large number of permanent swamps and pools throughout Spain. It is very adaptable, and will live in a variety of types of water (e.g. marshes, ditches, irrigation basins, concrete tanks), but not in running water. It is easy to transport in containers and can be introduced as required.

The fish survive the winter, but in reduced numbers, so that in early summer they are sometimes too few to control the *Anopheles*: but by mid-summer they are effective.

In rice-fields a considerable degree of control of *Anopheles* is obtained by periodically withholding water, even while the rice is growing. It has been shown in the Ebro delta in north-east Spain, and also in other parts of the Mediterranean, that the crop is not harmed if water is cut off periodically: indeed, the drying sometimes improves the crop by killing weeds which compete with the rice plants. It is impossible to define how long the waterless period should be, for that depends on local circumstances, but approximately two consecutive dry days in every ten are required in order to kill the *Anopheles* larvae. The essential thing is that the mud in the rice plots and the irrigation channels should become quite firm.

Spanish malariologists have relied on the distribution of quinine to those exposed to infection, and figures published by de Buen appear to show that in Spain the disease has been effectively controlled in this way in places where no other measures have been taken. For instance, in the work on the Guadalmellato swamp from 300 to 1,300 men were employed for six years: they were given prophylactic quinine (1 gm. on two consecutive days each week), and the malaria rate among them was much lower than among unprotected men in the neighbourhood. Even in the province of Cáceres, which contains some malarious areas, a great reduction in malaria has been achieved, mainly by the distribution of quinine.

Under certain circumstances the question of cost might become less important. Other methods, such as the reduction of breeding-places by drainage, and the use of oil or Paris Green on the remaining waters, would then suggest themselves. It seems clear that the control of malaria in nearly all parts of Spain and Portugal is not extremely difficult.

The protection of individuals by the use of mosquito-nets from April to November is essential.

RELAPSING FEVER

In many parts of the Mediterranean area two types of relapsing fever occur. The causative organism of the one (*Spirochaeta hispanica*) is transmitted by ticks (*Ornithodoros erraticus*), and normally occurs in rats and wild rodents; occasionally a man who works in close association with rats, for instance in a granary or pigsty, may acquire the infection, but human cases are sporadic. The other type, due to

Spirochaeta recurrentis, is transmitted by lice, direct from man to man, no other host being infected. This disease is generally epidemic and apt to occur in crowded, lousy populations; it is particularly likely to break out after famine, war, or some other calamity. The two infections are distinct, and each organism can only be transmitted by its proper host, tick or louse as the case may be.

In the Iberian Peninsula much attention has been given to the

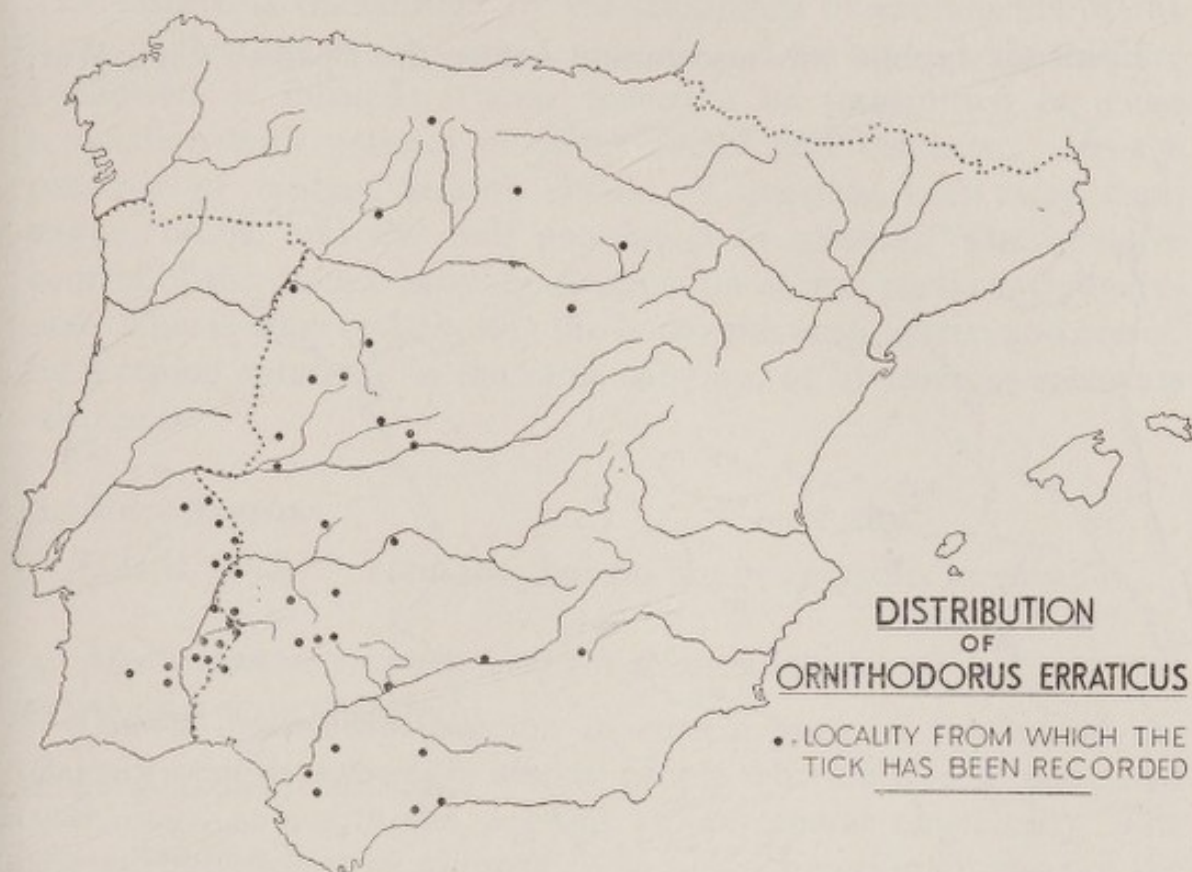


FIG. 39. (After Gil Collado, 1938; de Carvalho Dias, 1937)

tick-carried disease, which is known to occur widely in central and southern Spain, but not along the east and north coasts; in Portugal it is found south of the Tagus, along the Spanish frontier. The distribution of the tick has been mapped with care; as Fig. 39 shows, it has been found in Regions 2 *a*, *b*, *d*, and *e*; 3 *b*; 5 *b*; and 6. Tick-carried relapsing fever is quite common, one observer having seen 250 cases in a year without devoting time to searching for them. The disease occurs in the warm months, in people of all ages. As the spirochaete is sometimes resistant to arsenic, treatment is unsatisfactory.

It is difficult to distinguish relapsing fever from malaria except by microscopic examination, which is therefore of great importance.

There seem to be no records of epidemic, louse-carried, relapsing

fever in Spain or Portugal, and the disease can hardly have been overlooked; it is possible that outbreaks occurred during or after the Spanish Civil War, but records are not available. The control of this disease is by the destruction of lice, and by preventing contact between clean and lousy persons.

TYPHUS AND RELATED DISEASES

1. *Typhus*

Epidemic typhus was uncommon before the Spanish Civil War,

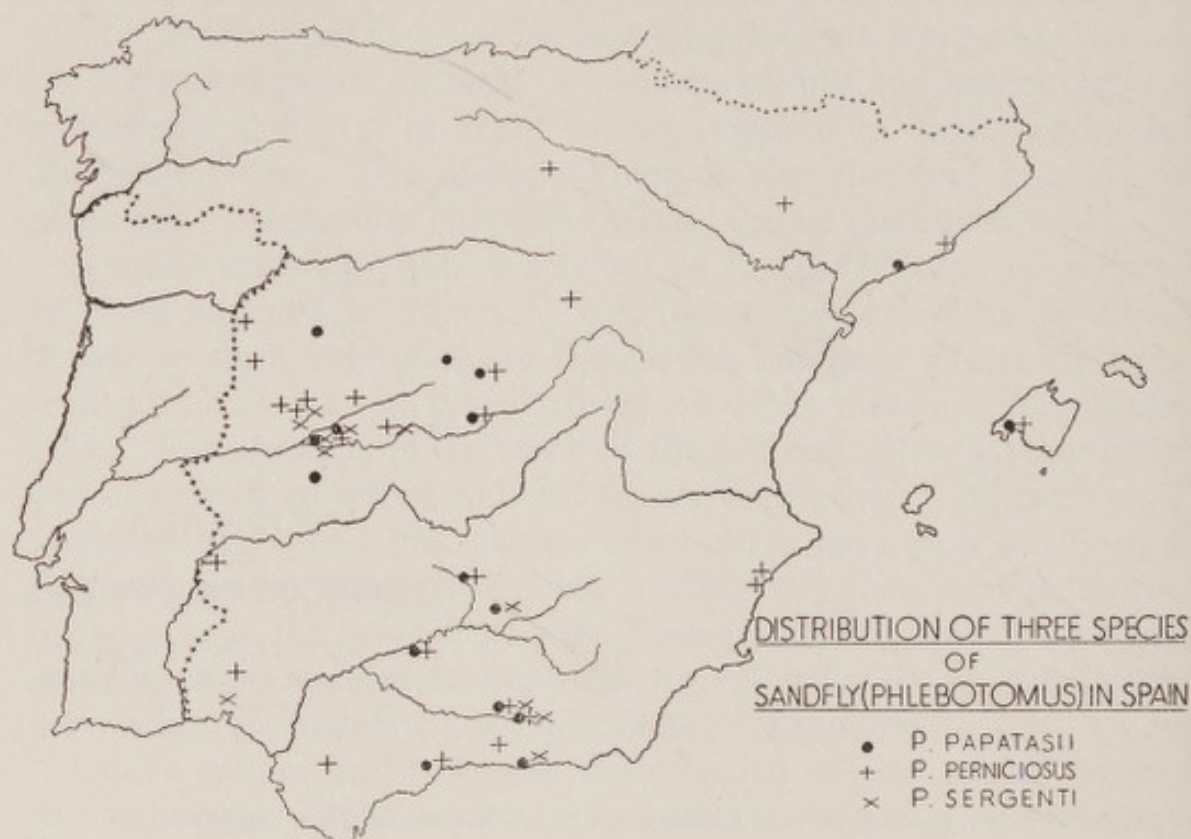


FIG. 40. THE RECORDED DISTRIBUTION OF THREE SPECIES OF *Phlebotomus* ('SAND-FLY') WHICH BITE MAN (after Angulo, 1935: early records have been omitted)

the number of deaths reported annually for Spain and Portugal ranging from nil to about 30. The comparative rarity of the disease if not due to failure of notification is remarkable, in view of the regular movements of agricultural workers between the south of Spain and Morocco, where typhus frequently produces great epidemics, the last in 1938-9. This rarity seems to indicate that lice are relatively rare in Spain and Portugal, a view borne out by British medical men who served in the Spanish Civil War. In view of the disorganization and distress, and of the presence of Moorish troops, it seems probable that typhus became commoner in Spain during and after the Civil War. The infection continues, at least in cities: it is understood that

there were 300 cases (27 deaths) in Madrid in the early months of 1941, and special permits were required by people travelling from that city to Barcelona: there were also cases in Seville, Granada, and Almería. In spite of all precautions the epidemic increased and was causing a large number of deaths in the latter months of that year.

After a louse has fed on a patient, the organism which causes typhus (*Rickettsia prowazeki*) multiplies in the insect's intestine. The disease is transmitted by the droppings or excrements of the louse, if they are rubbed into a scratch, and perhaps also if they are swallowed or inhaled; it may therefore be transmitted by close association with patients or their clothes and blankets. In the presence of typhus, visitors should, if possible, keep away from towns, trains, and the civil population in general. The effective control of the disease is by the destruction of lice, particularly body-lice. This is done by lathering the body with soap, water, and cresol, by steeping garments in the same solution, or by treating garments with heat.

2. *Murine typhus*

This is probably common, but no doubt sporadic, in man.

3. *Mediterranean eruptive fever* (or *fièvre boutonneuse*)

This is apparently common in certain parts of Spain and the Balearic islands, especially among people who are closely associated with dogs, and with the dog-tick (*Rhipicephalus sanguineus*). The disease only occurs in summer. The tick is found in all parts of the Peninsula.

SAND-FLY FEVER AND DENGUE

These diseases are not always easy to distinguish clinically: they also resemble one another in that they may cause great epidemics, in summer, among those who have not previously been exposed to risk of infection.

Sand-flies (*Phlebotomus papatasi* and other species), which are the transmitters of sand-fly fever, are widely spread in the Peninsula, except the north-west and north: they also occur in the Balearic islands. They probably occur in all the geographical regions, except 1 (Fig. 40). Dengue is transmitted by the same mosquito (*Aedes aegypti*) as yellow fever: the insect is widely distributed at least in ports and cities. Both it and the sand-fly are only active in summer.

YELLOW FEVER

Yellow fever is an acute disease which produces epidemics with a high death-rate among those who have not previously acquired immunity by exposure to the infection or by inoculation. In the Mediterranean region it is transmitted only by the bite of one particular mosquito, *Aedes aegypti*. This insect breeds in small domestic water-containers, such as buckets and flower vases. Measures for controlling it are therefore different from those for controlling other mosquitoes which breed in marshes and similar areas.

The possibility that yellow fever might reach the Iberian Peninsula and other Mediterranean lands merits serious consideration. Up to the middle of the nineteenth century there were many records of so-called yellow fever occurring in Spain and Portugal (particularly the south) and the Canary Islands. These outbreaks were clearly due to introduction by shipping, either from the West Indies or the west coast of Africa: most of them did not spread from the port of introduction, though there were notable exceptions to this. Most students agree that some of these outbreaks were due to yellow fever in the sense in which that term is now used.

Nowadays, owing to improved ship and port hygiene and better storage of drinking-water, the risk of introduction by shipping is slight. But it must be recognized that, if the matter is not regulated, there is grave risk of the spread of yellow fever by plane to areas in which the mosquito, but not the disease, at present occurs: introduction might occur by either of two ways, by infected mosquitoes (the accidental carriage of mosquitoes by plane being well established), or by a man in the early stages of the disease. In peace-time these risks are greatly reduced by international conventions, which provide for mosquito control in and about aerodromes in infected areas, and the medical inspection of travellers who wish to leave such places. In war-time the air traffic in certain directions is greatly increased, and perhaps the sanitary conventions are relaxed, or even in abeyance.

So far as Spain is concerned, it seems certain that the French in Dakar are in frequent communication with Europe by air, via Spain and the west coast of Africa. French authorities claim that there have been no cases of yellow fever in Dakar itself since 1927, but the disease still occurs frequently in the vicinity: moreover, dengue fever, which is carried by the same mosquito, continues to be common. The yellow fever mosquito (*Aedes aegypti*) is found in Spanish and Portuguese ports and in a number of inland cities, so that if the

infection were introduced it might spread. The insect is abundant in summer, rare and inactive in winter. It seems therefore clear that yellow fever might be (accidentally) introduced by air, from West Africa to Spain or Portugal, and that it might then produce considerable epidemics with a high death-rate, though only in the hot part of the year. It would be an easy matter to control it, if it were correctly diagnosed at the start, and if the local health authority took immediate energetic steps to destroy domestic mosquitoes. Human beings can also be effectively and permanently protected by vaccination.

INTESTINAL DISEASES

In Spain and Portugal the methods used for the disposal of excrement are primitive. There is not the least doubt that diarrhoea, enteritis, dysentery, and enteric are prevalent; strangers must expect to suffer from them particularly in summer. Figures already quoted (p. 149) show how much more prevalent these diseases are in Spain than in England and Wales.

Microscopic examination of human faeces in several parts of the Peninsula have revealed small percentages of the causative organism of amoebic dysentery, *Entamoeba histolytica*, and of the other generally distributed Protozoa.

It must be understood that all these infections (and several parasitic worms mentioned below) enter the human body by the mouth, that is to say in food or drink. One source of danger is water which has been contaminated by the excrement of some other human being: that risk is avoided by abstaining from any water which has not been chlorinated or boiled. Another channel of infection is the house-fly, which breeds in human excrement, and often feeds from its surface: at other times it rests on sugar, bread, or other foods, and there deposits the germs and parasites which it has picked up in the latrine. Killing flies, particularly in kitchens, is also important, as is the protection of human food from them. Salads and unboiled milk should never be taken. Fresh fruit, provided it is in good condition, and with unbroken skin, should be treated with a disinfectant and washed before it is eaten. The risk of typhoid and paratyphoid is greatly reduced by inoculation.

HELMINTHIC DISEASES (PARASITIC WORMS)

Schistosomum haematobium ('Bilharzia') goes through a part of its life-cycle in a fresh-water snail. In Spain the water temperature,

even in summer, is too low to permit the worm to develop in the snail. Foci of the disease are therefore extremely limited, but where there is a hot spring (as at Lorca, in the province of Murcia) many people who bathe or wash clothes may be affected. The disease is also endemic in a few places in southern Portugal, such as Tavira and Alportel.

The pork tape-worm (*Taenia solium*) is probably not rare. People can be protected from acquiring the actual tape-worm by the thorough cooking of pork (till it is white), and by careful meat inspection (the cysticercus generally occurring under the pig's tongue). There is also the risk that men may develop the larval or cysticercus stage (not the tape-worm itself): this is more serious, for the cysticercus develops in the brain, and may cause incurable symptoms. Man acquires this stage either by infesting himself from his own tape-worm, or by swallowing eggs which some other human being has passed. The first possibility is avoided by treating men who have tape-worms, the second by better general sanitation and disposal of excrement.

The widely distributed intestinal round-worms *Trichuris* and *Ascaris* are apparently very common. Spanish workers have made surveys in several parts of the country and report infestations between 10 and 50 per cent. with either parasite: there is a record from Santander that 82 per cent. of 125 children were found to harbour one or more sorts of intestinal worms (of which the two mentioned above were the commonest). The hook-worms (*Ancylostoma* and *Necator*) are rare and sporadic, except perhaps in heavily irrigated areas, such as the *huertas* in Murcia, where 13.3 per cent. of 1,700 local people were found to be passing eggs of *Ancylostoma*. It seems probable that heavy infestation might also be found in mines. The hook-worm is not likely to be of military significance.

LEISHMANIASIS

Visceral leishmaniasis (Kala Azar) occurs throughout the Iberian Peninsula except the north and north-west (approximately, Region 1 *a*, *b*, *c*, *d*). Nearly a hundred cases are diagnosed annually. The disease is commonest in young children, as it is in other Mediterranean countries, and very rare after the age of 16. The infection has also been demonstrated in dogs.

Dermal leishmaniasis (oriental sore) is not rare. It occurs only along the east and south coasts (Tarragona to Cádiz provinces, inclusive).

Both diseases are almost certainly transmitted by sand-flies (*Phlebotomus*), though the exact relation between species of sand-fly and disease remains to be worked out. The map (Fig. 40) shows that three species which are known to bite man are widely distributed in Spain, except in Region 1: similar information is not available from Portugal.

PLAGUE

Plague in human beings has been recorded in ports, and less often in inland cities, in all parts of the Mediterranean. Epidemics might occur in Spain or Portugal, though none have been recorded in recent years: for 1933-5 (the last years for which figures are available) no deaths were notified for Spain, and in the two previous years the figures were 8 (1932) and 11 (1931).

The tropical rat-flea (*Xenopsylla cheopis*) is probably widely distributed in ports, though it is only recorded from Barcelona: in a survey of rat-fleas in that town, 96 per cent. were found to be of this species.

OTHER DISEASES

Many other diseases of wide distribution occur in Spain and Portugal, but do not merit more than casual mention. In these countries small-pox is commoner than in northern Europe, though its incidence has been greatly reduced by vaccination, in Spain particularly. Undulant fever is not rare, and tularaemia might be encountered. It is almost certain that deficiency diseases, and diseases due to malnutrition are common, though little has been recorded. Diseases of the eye may be troublesome, and there is much conjunctivitis. As to trachoma, it provides an interesting example in differences in registration, for Portugal notifies no cases: on the other hand, Spain treats 15,000-25,000 per annum, by a system of special ophthalmic clinics.

There are a number of flies which put their eggs or larvae either in wounds or natural orifices, producing the condition known as myiasis. For instance, maggots of *Wohlfahrtia magnifica* may be found in the external ear, or in the nasal cavities where they rapidly cause extensive damage and grave general symptoms. The most satisfactory treatment is immediate instillation of chloroform water, or chloroform (1 per cent.) dissolved in medicinal paraffin: life may be saved by remembering this point. Wounds also are liable to be attacked by other flies and to become 'fly-blown': the same treatment is suitable, but the matter is generally less grave and urgent.

The only poisonous snakes are vipers, which occur in all parts of the Peninsula, and are probably common in rough uncultivated country. Though occasional deaths may occur, it is probable that the bite is not usually very serious.

DISTRIBUTION OF CERTAIN DISEASES

An attempt is made below to indicate the parts of the Iberian Peninsula in which certain diseases are believed to occur, or to be absent. It will be understood that in some respects information is still imperfect. Many diseases (tuberculosis, measles, syphilis, enteritis, and others) might doubtless be found in all regions.

<i>Region</i>	<i>Malaria</i>	<i>Relapsing fever (tick carried)</i>	<i>Bilharzia</i>	<i>Sand-fly fever</i>
1. North and north-west . . .	+	o	o	o
2. Central Tableland . . .	++	+	o	?
3. Barrier ranges . . .	+	+	o	?
4. Ebro trough . . .	+	o	o	?
5. Coastal . . .	++	+	parts	+
6. Andalusia . . .	++	+	o	+
7. Catalonia . . .	+	o	o	?
8. Balearic Islands . . .	+	?	o	+

CHAPTER VII

THE HISTORY OF THE PENINSULA TO 1815

I. THE EARLY SETTLEMENT OF IBERIA

Pre-Roman Spain

IBERIA is rich in traces of prehistoric man, who found throughout the Peninsula caves suitable for habitation. Remarkable mural drawings in caves are preserved at Serinya in the province of Gerona, at La Menza near Antequera, and at Altamira near Santander, where the huge coloured bulls or bisons have no equal in prehistoric art.

The less speculative history of the Peninsula begins in the twelfth century B.C. when the Phoenicians founded a colony at Gadir (Cádiz). During the next six centuries the Phoenicians set up many trading-centres, most of which were on islands near the mainland or on easily defended promontories, which are common on the Mediterranean coast of Spain. They also penetrated the interior of Andalusia and Murcia and controlled the Balearic Islands. Towards the end of this period (after 630 B.C.) the Greeks were also trading with Spain and founded settlements, especially on the Levantine coast.

At this period Iberia was inhabited by the Ligurians, Iberians, and Celts. One wave of Celts entered Iberia from south-west France about 900 B.C. and a second invasion began in the seventh century. The Celts spread over the western and central parts of the Peninsula. The Iberians, who probably came from north-west Africa, settled mainly in eastern and southern Spain but made considerable inroads upon the Meseta. They were later described by the classical writers of Roman times as arrogant, lazy, and independent. These various invaders were organized in tribes, and their territories were in a constant state of flux.

Roman Times

About 242 B.C. the Carthaginians, having been expelled from Sicily by the Romans, began to conquer Iberia. They made *Nova Carthago* (Cartagena) a great naval base and within twenty years had subdued the territory south of the Ebro and Douro. They actively worked the silver-mines of Murcia and Andalusia and made the island of Iviza a flourishing commercial centre. The tribes living between the Ebro and the Pyrenees remained friendly to the Romans, and, when attacked by Hannibal, held out bravely in *Saguntum*. This hill-top

fortress was eventually taken (220 B.C.), but in the war that followed the power of Carthage was broken. For the next 600 years the Romans were dominant in Spain. During a period of 200 years the tribes of the centre and north resisted Roman advance, but by the time of Augustus even the Cantabri and Astures of the wild north had been pacified. Augustus Caesar is remembered in the names of several towns, including Astorga (*Asturica Augusta*), and Saragossa (*Caesarea Augusta*). Under him, Iberia was split into three main divisions, *Tarraconensis* (north, north-west, and central Spain), *Lusitania* (modern Portugal) and *Baetica* (south Spain). He it was who built or repaired the great thoroughfare from Italy, along the coast of southern Gaul and down the whole length of Spain to *Gades* (Cádiz). Spain flourished under Roman rule and produced the Emperors Trajan and Hadrian and the classical authors Seneca, Martial, and Quintilian. The Romans constructed about 12,000 miles of roads and developed mining and agriculture. Among the finer memorials to their occupation are the bridge at Alcántara in Spanish Extremadura and the great aqueducts at Segovia and Mérida.

Visigoth Invasion

Soon after the year A.D. 400 Roman rule in Spain began to weaken and various hordes of Barbarians invaded the country. The Suevi occupied and long held their ground in Galicia; the Vandals and Alani pillaged large areas of Iberia, and then fell to fighting among themselves. In 414 the Visigoths came from France and took possession of parts of Catalonia. Within a few years they had restored the greater part of the Peninsula to Rome, and when, in 476, the Roman Empire collapsed they were left in control. They did not finally subdue the Suevi in Galicia until 585. For 300 years (415-711) the Visigoths maintained a form of military supervision from their capital, Toledo. During the early eighth century, in spite of the adoption of Christianity as their official religion, the country was still being weakened by incessant civil strife.

Moorish Occupation

Such was the condition of Iberia when, in A.D. 711, the Moors landed near Gibraltar and routed the Visigoths at Vejer de la Frontera. Within six years the Moors had overrun all the Peninsula except for small districts in the Pyrenees and Cantabrians, where the mountain tribes repulsed them. The Arabs settled mainly in the sunny south, the Berbers being given the colder north. Numerically the Berbers

were in greater force, but the Arabs were the leaders. The Moslem empire in Iberia suffered many vicissitudes, including numerous revolts, civil war, spasmodic attacks by Christians in the north, and large-scale invasions by other Moorish tribes from North Africa. In A.D. 758 the Moslems in Spain broke away from their Asiatic caliph and set up an independent rule at Córdoba. In the tenth century Córdoba became the most brilliant city of Europe, the 'Jewel of the World' when the rest of the continent was immersed in the Dark Ages. The city was reputed to have 200,000 houses, 600 mosques, and no less than 900 public baths. During and after the eleventh century Moslem Spain was increasingly troubled by wars between its own religious sects, and by the growing power of the Christian kingdoms in the north. The decline of the Moors became apparent in 1212, when Alfonso VIII defeated them at Las Navas de Tolosa. During the next 200 years they were gradually driven back to the Kingdom of Granada, where they ruled until their final defeat in 1492.

The Moorish occupation has had a permanent effect on Spain and especially on the southern and south-eastern districts. The development and extension of an elaborate system of irrigation was the most lasting benefit. Arabic influence on the Spanish vocabulary is great in matters relating to water and extends beyond the technical terminology of irrigation to rivers in general (*Guadiana*, *Guadalquivir*), to coastal waters (*Albufera*—a lagoon), and to bridges (*Alcántara*—a bridge). Architectural influence is summarized in the Alhambra, the palace of the Moorish rulers at Granada. Finally, no other invasion of peoples did so much to differentiate Spain from the rest of western Europe.

2. THE GROWTH OF POLITICAL UNITY IN SPAIN

The Growth of the Christian Kingdoms

The story of the reconquest of Iberia begins in A.D. 718, when Pelayo, a chief of the Asturian tribes, checked the Moorish advance and set up an independent Kingdom of the Asturias. This stronghold of the northern mountains was later incorporated into a new Kingdom of León which, in 842, consisted of the Asturias, Santander, Galicia, north Portugal, and part of the present province of Burgos. There were three other main centres of resistance against the Moslems: Castile, which is said to have got its name from the castles built as outposts against the Moors; the Kingdom of Navarre, which was formed in the ninth century by the Basques in the Pyrenees; the Kingdom of Aragon, which lay east of Navarre and included the

eastern Pyrenees. The details of the expansion and territorial changes are beyond the scope of this volume. Suffice it to say that they constantly warred against each other and suffered incessant civil strife, but from their vicissitudes there always seemed to emerge some independent State on the northern tableland, another at the western Pyrenees, and another about the Ebro trough and eastern Pyrenees.

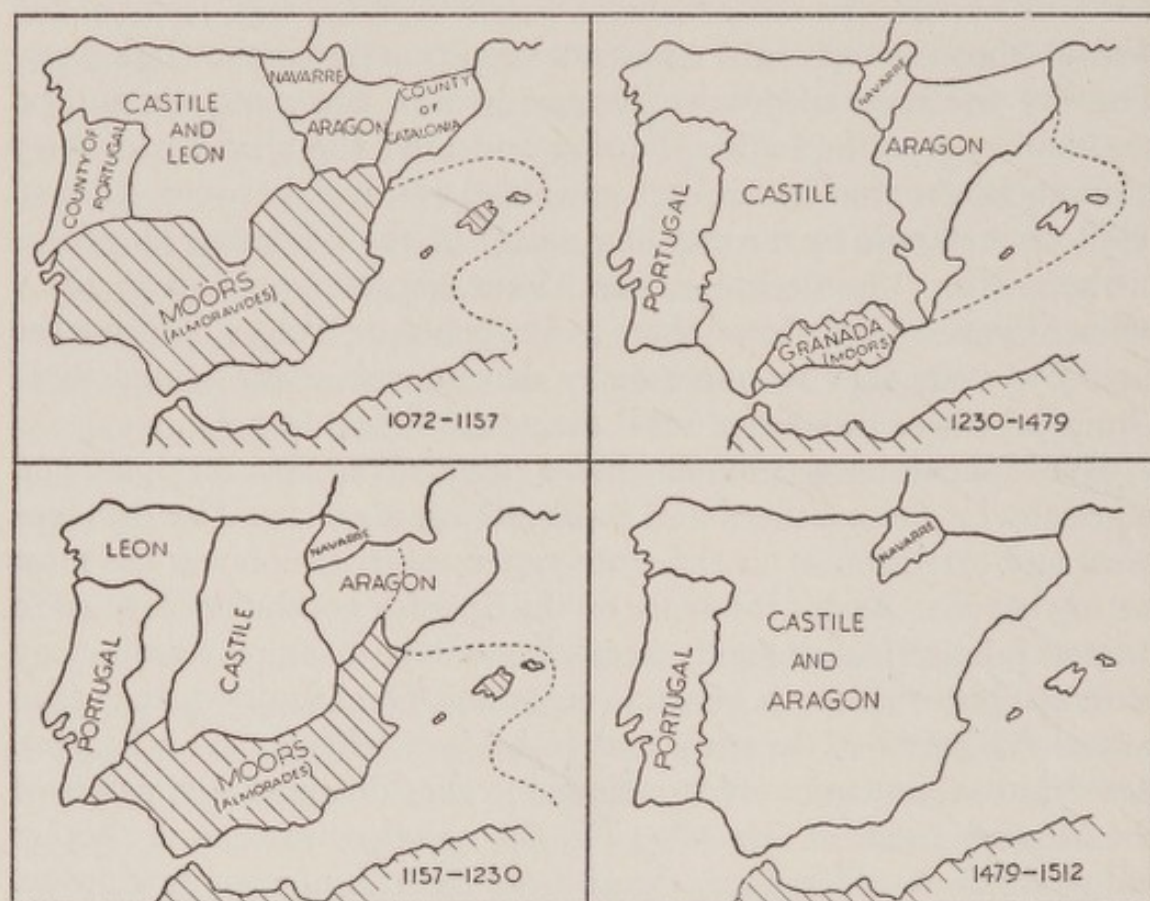


FIG. 41. TERRITORIAL CHANGES IN IBERIA 1072-1512

The antagonism of the peripheral regions to an absorptive Castile seems to have been born in these centuries: the Kingdom of Aragon, including Catalonia, looked eastwards to the Mediterranean rather than to Castile, from which it was partly separated by the wide barrier of the southern Iberic mountains. Navarre grew up in the refuges of the western Pyrenees, and in the lee of the northern Iberic mountains. The present-day Basque provinces were usually autonomous, although they repeatedly fell, for short periods, under the rule of Castile.

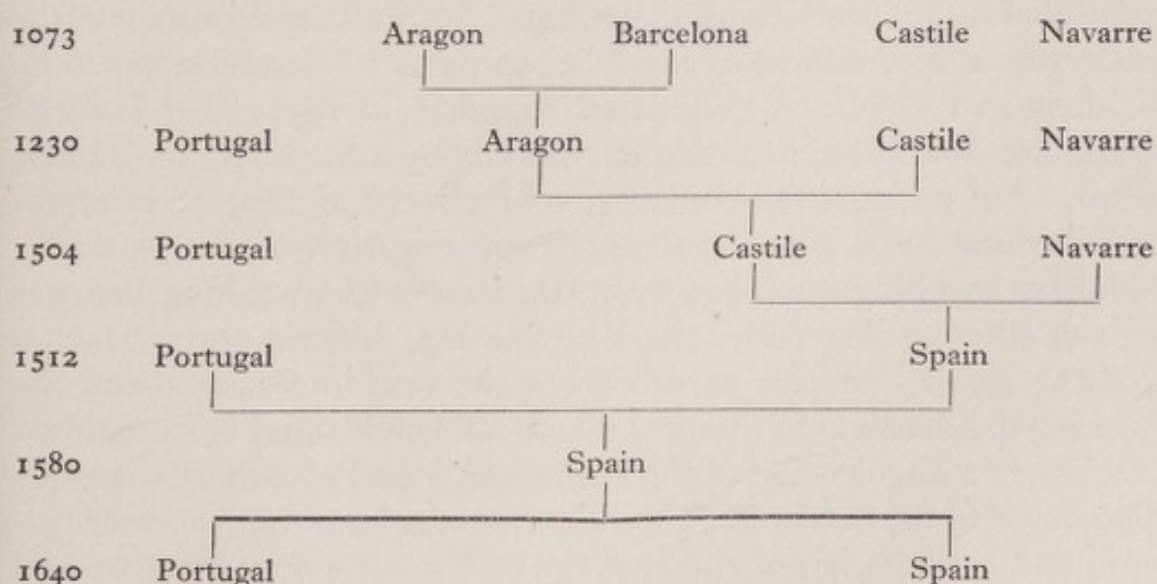
Needless to say, the expulsion of the Moors proceeded spasmodically according to the state of peace between the Christian kingdoms. Rapid progress was made under Ferdinand III (1217-52), who, having united Castile with León, undertook a great campaign and recaptured the cities of Córdoba, Murcia, and Seville (1248). About

the same time, Jaime I, *el Conquistador*, King of Aragon (1213-76), conquered Valencia, Alicante, and the Balearic islands, a fact which is partly reflected in the present distribution of Catalan-speaking people. There were, however, few signs of national unity until after the marriage of Ferdinand of Aragon with Isabella of Castile in 1479.

The Political Union of the Christian Kingdoms

Castile and Aragon were not at first politically united by the marriage of Ferdinand and Isabella, but their rulers, although independent, were content to follow a policy agreed upon by both. Ferdinand remained ruler of Aragon, and Isabella of Castile, until her death in 1504, when her husband assumed control of both territories. In this year Ferdinand expelled the French from Italy, where he had carved out an Aragonese Empire, and then attacked them in Navarre. By 1512 he had added to his realm all Navarre south of the Pyrenees. There were now in Iberia only two independent States, Spain and Portugal, but the degree of unity in Spain was only such as could be imposed by the personality and power of the monarch. Thus, under Ferdinand, Aragon had three separate *Cortes*, or governing councils, one for itself, one for Catalonia, and one for Valencia. The monarch avoided the clash of opposed policies; he could not instil a unity based on sympathy and understanding.

The general growth of political union in Iberia is shown by the following list of independent States in the Peninsula at different dates.



The Golden Age of Spain

The union of Castile and Aragon by marriage was followed by the most momentous events in Spanish history. In 1492, after a campaign

lasting nearly ten years, Granada was captured from the Moors. In this same year Columbus discovered the West Indies. Spain now acquired a vast colonial empire and, as if that were not enough, had many European territories thrust upon her. Ferdinand of Aragon was succeeded by Charles I (1516-56) who, as the Emperor Charles V, inherited Flanders, the Low Countries, Artois, and the Franche-Comté. Nor was this all. In 1580 his successor, Philip II, became king of Portugal and of all the extensive Portuguese colonial possessions. Now the king of Spain ruled an empire which included the south of Italy, Holland, Belgium, all Iberia, large parts of France, Central and South America, most of southern and south-western North America, the Philippines, Madeira, Azores, and Cape Verde Islands, Guinea, Congo, Angola, Ceylon, Borneo, Sumatra, Moluccas, and many smaller settlements on the Asiatic seaboard. Truly it was said '*Como se mueve España, la tierra tiembla*'—when Spain moves, the whole world trembles.

Of the great age of Spanish colonization we can say but little here. It is a remarkable story of superhuman valour and endurance. In 1517 Hernán Cortés with a few hundred Spaniards, a few horses, and eleven cannon conquered Mexico, the empire of Montezuma. Panama was founded in 1519, Nicaragua was explored two years later, and within a few years small bands of *conquistadores* had penetrated northwards to the Mississippi and north-westwards to California. The conquest of South America soon followed. In 1531 Pizarro, formerly a swineherd of Trujillo, undertook the conquest of Peru and overcame the Inca empire with a force of scarcely 200 men. Chile was annexed by Valdivia and Mendoza. The latter founded, in 1534, 'Our Lady of the Good Winds', the settlement now known for short as Buenos Aires. But perhaps the crowning achievement of this age of extraordinary successes was the first circumnavigation of the world by Magellan and his crew (1519-22). It matters little that Magellan was a Portuguese sailing under the Spanish flag. The important fact is that the Iberian peoples parcelled out the world between them, the Spaniards, according to a papal bull, claiming all land discovered west of a line 100 leagues west of the Azores, and the Portuguese the lands discovered to the east of it. The subsequent colonization, administration, and exploitation of the vast Spanish empire was characterized by greed of things material and by a too lavish generosity in things spiritual. Farming was developed and mining most actively pursued, but equal efforts were made to 'enlighten' the conquered peoples. Colleges and universities were founded and Christianity was intro-

duced together with the sciences and arts. To-day Spain has lost her American and Asiatic empire, but the influence of the Spanish occupation is still plainly visible in the world-wide distribution of the Spanish tongue, of Spanish institutions, Spanish culture, and the Spanish attitude to life.

The treasures of the New World might have caused a great economic revival in Spain. But the money was not spent on Spain alone, as at this moment she became the centre of European politics and the enemy of all Protestant peoples. Her wealth also proved a great temptation to other nations for, as the Spaniards say, 'Sobre dinero no hay amistad', there is no friendship in money matters. Under Philip II (1556-98) Spain's troubles in Europe began to increase; the Low Countries revolted and the ensuing war proved a continual drain on Philip's resources. The English chose this period to challenge Spain's supremacy in the Atlantic and, after the death of Queen Mary of England, the 'bloody Mary' who was Philip's wife, began seriously to hamper Spanish commerce. The naval struggle culminated in the great Armada (1588) which was defeated by a combination of brilliant English seamanship with dirty English weather. By the end of the sixteenth century Spain was showing signs of decline and her chief rivals, the Protestant States of England and Holland, were both achieving a greater national unity. Yet the 'Golden Age' of Spain lasted nearly 100 years, which, judged by the length of the 'Golden Ages' of other nations, is a long time.

One important fact concerning the discoveries and achievements of this period should be mentioned. They were the work of the Castilians and not of the Aragonese. The kingdom of Castile sought the sea through the wide plain of the Guadalquivir, by way of Cádiz, Seville, and San Lúcar, while Aragon continued to look eastwards to Italy; Portugal, and not Aragon, was Castile's companion and competitor in the great expansion overseas. If the proud bearing of the Castilian or Andalusian perplexes the modern visitor, he would do well to recall the days of the *conquistadores*, of Cortés and of Pizarro. To-day, when Spain has lost her far-flung empire, the typical Castilian still retains the air of a conquering race.

The Decline of Spanish Power

The seventeenth century in Spain was a period of decline, a time of reaction and exhaustion after the efforts of the previous age. Among the few outstanding events is the expulsion of the Moriscos by Philip III in 1609. These people, who were Moors that remained in Spain

after the Reconquest and became Christians willingly or unwillingly, had already been expelled from Granada and distributed over the remaining provinces by Philip II. Their complete expulsion was, however, a more serious matter, as thereby Spain lost the most industrious element of her population.

The following reign, that of Philip IV, is notable for the breaking away of Portugal and for a long revolt by the Catalans. In 1640, the year in which Portugal won back her independence, the Catalans massacred Castilian soldiers billeted on them by Philip IV. These 'regional' revolts were not new to Spain; in 1470 the Catalans had revolted; in 1591 Philip II had to crush a rebellion of the Aragonese whose 'sturdy liberties' he always hated. The rising of the Catalans in 1640 was, however, of a more protracted nature. The Catalans, always mindful of their links with France, were joined by her and together they kept alive the struggle for twelve years (1640-52). During this prolonged war the Catalan desire for complete independence was nourished.

The eighteenth century opened with the accession of Philip V (d. 1746), the grandson of Louis XIV and the first Bourbon ruler of Spain. During this century Spain was involved in most of the political conflicts of Europe. In 1704 the English captured Gibraltar, and later held it in spite of many desperate attempts at recapture. The port, however, was undeveloped and could afford no facilities beyond an anchorage for the fleet. Consequently the British sought a better harbour nearer to Toulon, which was the main French base in the Mediterranean. The Admiralty saw that Port Mahón in Minorca was the only suitable port 'where twenty ships of war may safely winter'. The Duke of Marlborough also suggested the capture of Port Mahón. Accordingly, in September 1708, the English fleet landed some artillery and 2,000 men near Cala Alcaufa on the south-east coast of Minorca and captured the island without difficulty. Minorca was later taken and occupied by the French (1756-63), and again by the Spanish (1782-98), but, apart from these interludes, it remained under British control until 1802. The expedition from Gibraltar which retook it in 1798 was said to be a model of what such operations should be.

'Ample force and good equipment were provided, and every possible care was taken to conceal its destination, the ships ostentatiously being provisioned with twelve months' supplies as though for a voyage to some distant part. At the last moment when all was ready, it was learned that a Spanish spy was in the dockyard trying to discover the destination of the army. Orders were at once given to put yet another six months' provisions

on board; and then a great to-do was made about getting the fleet to sea to catch an *easterly* wind, thus indicating an intention to pass into the Atlantic. The spy, satisfied that nothing within the Mediterranean was endangered, sent his reassuring news to Spain, and the fleet, when out of sight of the Rock, altered course for Minorca where it landed and took the island without difficulty' (*Admiral Sir Herbert Richmond*).

Throughout the British occupation Port Mahón was an important rendezvous for our fleet in the Mediterranean. To-day the houses of the port, with their lace blinds and sash-windows, remind one forcibly of an eighteenth-century English town and appear very strange in the Mediterranean world. About 100 English words, mostly in a corrupt form, are still in use on the island: many of them are concerned with games, carpentry, and drink.

Although during this century Spain lost Flanders and a few islands and other small patches of territory, she retained her vast possessions in the New World. Under the beneficent rule of Charles III (1759–88) the homeland began to recover some of her former prosperity, but the incompetence of Charles IV (d. 1808) soon ruined this progress and helped to bring about the Peninsular War, and in its train the loss of the overseas territories.

3. THE EARLY HISTORY OF PORTUGAL

The Growth of Independence

The country between the Minho and Douro rivers was one of the earliest territories recaptured from the Moors by the Kingdom of León. In 1109 Alfonso VI, King of León, married his natural daughter to Count Henry of Burgundy and sent them to live at Guimarães in the county of Portugal, so called from *Portus Cale*, the Roman name for Oporto. Under Henry's son, Alfonso I of Portugal, the territory was declared independent (1143), and within the next forty years Alfonso had captured Lisbon from the Moors. In 1217, during the reign of Alfonso the Fat, the Portuguese, with the help of an English contingent, drove the Moors back beyond the Sado river, and by 1280 all present-day Portugal had been taken. Under Diniz the Worker the country began to prosper; agriculture was improved, reforestation undertaken, and trade stimulated by a commercial treaty with Edward I of England. Henceforward, the history of Portugal became increasingly linked with that of England. In 1385 English bowmen helped to defeat the Spaniards at Aljubarrota. In the following year Portugal and England were declared by treaty to be

'allied for ever', and John the Great married Philippa, daughter of John of Gaunt of England. As long as Portugal was sure of English support she knew her independence was secure. Hence the saying:

'Com todo o mundo guerra, paz com a Inglaterra'—
War with the whole world, but peace with England.

The Great Age of Portuguese Colonial Expansion

Portuguese colonial expansion may be said to have begun about 1400 when John I captured Ceuta from the Moors. During the next half-century great progress was made in the exploration of the west coast of North Africa. With the help and encouragement of Prince Henry the Navigator (d. 1460) the Portuguese passed southwards down the Saharan coast and reached the lands of Guinea. Madeira, the Azores, and other Atlantic islands were also discovered or rediscovered. During the reign of John II, Bartolomeo Diaz rounded the southern tip of Africa and called it *Cabo Tormentoso*—the Cape of Storms, a name which was tactfully changed to *Cabo de Boa Esperança*. Thus the Portuguese had made remarkable discoveries and had almost found a sea-route to the East before Columbus sailed to the West Indies. When, in 1493, the Pope formally restricted Portuguese activities to the east of a line some 100 leagues west of the Azores and Cape Verde islands, he forestalled possible quarrels between Portugal and the new-comer, Spain.

The greatest Portuguese expansion occurred in the time of Manoel the Fortunate (1495–1521), after Vasco da Gama had reached India in 1497. Soon afterwards, Alfonso de Albuquerque became governor of India, and under his guidance the Portuguese empire expanded beyond Goa and the Malabar to Ceylon and Malacca and thence through the tributary kingdoms of Pegu and Siam to the frontiers of China. To this eastern empire was added the great province of Brazil in South America, which had been claimed for Portugal by Cabral when he landed there in 1500 on a voyage to India.

The Portuguese Empire was second only to that of Spain, which it resembled. The Portuguese showed the same ardent desire to convert the natives to Christianity; the homeland received a similar flood of wealth with no more beneficial results; their empire, however, disintegrated more rapidly than that of Spain, the strain proving excessive for a country numerically so weak.

In 1580, the Portuguese throne having fallen vacant, Philip II claimed and assumed the kingship. The fortunes of Portugal were now bound up with those of Spain and she shared in Spain's decline.

The Decline of Portugal

By 1635 the Dutch had captured most of the Portuguese Asiatic possessions except a few small coastal territories and the eastern part of the island of Timor. They also gained control of the trade of Brazil and, with the English, took the place of Portugal and Spain as the leading maritime powers.

Portugal finally broke away from Spain in 1640 and, some twenty years later, consolidated her independence by a great victory over the Spaniards. English troops assisted in this battle and henceforward Portugal is again linked with Britain rather than with Spain. The Portuguese became increasingly 'Atlantic-minded' and gradually lost touch and understanding with the people of Castile.

The subsequent history of Portugal is marked by a succession of rulers who, except Pombal, were exceptionally extravagant and improvident. The country was bound even more closely to Britain by the Methuen Treaties (1703), whereby Portuguese wines were given preference over the French in English markets. The agonies of gout that afflicted eighteenth-century English statesmen bear testimony to the popularity of this trade. Perhaps the most momentous event was, however, the great Lisbon earthquake in November 1755, when between 30,000 and 50,000 people lost their lives.

Remaining closely allied to Britain, Portugal in 1801 refused to accept Napoleon's terms. Thereupon she was invaded by Spain and forced into neutrality. The next twelve years are among the most unfortunate in her history; three times invaded and devastated, she found herself, at the end of the Peninsular War, poverty-stricken and disorganized.

4. THE PENINSULAR WAR

General Military Geography

Four considerations should be borne constantly in mind in any study of the Peninsular War: the length and vulnerability of land communications; the value of fortified centres; the general shortage of local supplies; and the effectiveness of guerrilla warfare in a country especially suited to it. Each is connected with the others, and all depend on geographical conditions.

The key to the control of Spain is the Meseta, which, owing to its network of roads, can be most easily ruled from Madrid. From Madrid, however, the peripheral areas (Catalonia, Valencia, Andalusia, and Galicia) are remote, and transport, especially for horse-drawn

guns, is difficult. Yet these regions, together with northern Portugal, are the chief areas in Iberia where a large force could find adequate local supplies of food and fodder. Any struggle in Catalonia was in reality a local war cut off from the main campaigns. To a lesser but still marked degree an occupation of Valencia and Andalusia, although desirable from the point of view of local supplies, carried the troops so far from their northern bases that they were temporarily lost to the main scheme of affairs. The truth is that Iberia contains no vital strategic centre, the occupation of which gives control of the whole Peninsula. In occupying Spain against the wishes of its inhabitants, an invading army is helpless without a vast sedentary force to garrison the conquered territory. There are, however, extensive areas in Spain, especially on the southern Meseta, where any large force must take its own supplies or starve.

The vital French bases and lines of supply lay between Madrid and Bayonne. The British and Portuguese had their main base at Lisbon and their source of supply was the sea, a line of communication the French were never able to sever. To attack the French bases the British had two natural routes open to them; that from Coimbra to Almeida, which occupies the hilly depression between the lofty Serra da Estrêla and the rugged Douro plateau, and that from Lisbon eastwards to the Guadiana valley at Badajoz, whence routes lead to Madrid. The Tagus valley was, and still is, useless as a routeway into central Spain, while routes along the south of the Serra da Estrêla suffered from lack of water.

The routes via Coimbra and Almeida were guarded on the Spanish side by the great fortress of Ciudad-Rodrigo. The routes eastward from Lisbon to the Guadiana were controlled by Elvas in Portugal and by Badajoz in Spain, two towering citadels set on rugged hills. The first routeway is wet and occasionally snow-bound; the second is pestilential and climatically abominable in summer. Moreover, this latter ended westwards on the eastern bank of the Tagus estuary, which can only be crossed by boat.

The problem of communication was greatly complicated by the presence of strongly fortified towns. In addition to those already mentioned along each side of the Spanish-Portuguese frontier there were several strongholds guarding the routes across the western Pyrenees. In the Ebro valley the main routes to Saragossa were well protected, and along the east coast, all the way from Figueras to Cádiz, a line of fortresses controlled the coastal routes and the main natural routeways leading towards the interior.

The importance of the fortified towns was great, but probably no greater than that of the *guerrilleros*. The rugged, mountainous nature of much of Iberia, with its deep ravines and matorral-clad slopes, formed good shelter for guerrilla warfare. Every French line of communication, if not fully protected, was cut or weakened by these local fighters who slaughtered escorts and couriers, cut off stragglers, ambushed forage parties, and, in one way or another, kept half the French forces occupied throughout the war.

One other feature of the Peninsular War remains to be mentioned. The peninsular nature of Iberia gives any Power in command of the sea access to all those areas which are most remote, and therefore most difficult to rule, from Madrid. Absolute command of the sea had been gained by the British fleet under Nelson, on 21 October 1805, when the French fleet was destroyed off Cape Trafalgar. This battle foreshadowed the frustration of two of Napoleon's most ambitious projects—the intended invasion of Britain and the attempted conquest of Spain. From this date, although French privateers preyed heavily on our commerce, the British lines of sea communication with Iberia were never seriously threatened. After Wellesley's landing in Mondego Bay (1808) the British poured men and supplies into Portugal. Lisbon was the great base to which supplies were sent, but Cádiz was fed from the sea, and our naval activities extended around the coast from Galicia to Catalonia and the Balears. When evacuation was necessary, the Navy was there. In January 1809 the Navy evacuated Sir John Moore's army from Corunna. A raging south-wester drove the transports to England in four or five days, and the miserable, exhausted troops were landed in almost every harbour between Falmouth and Dover. Yet of the 26,000 men that embarked only a few hundred were lost in the passage, and most of those from the foundering of two transports off the Cornish coast.

The Course of the War

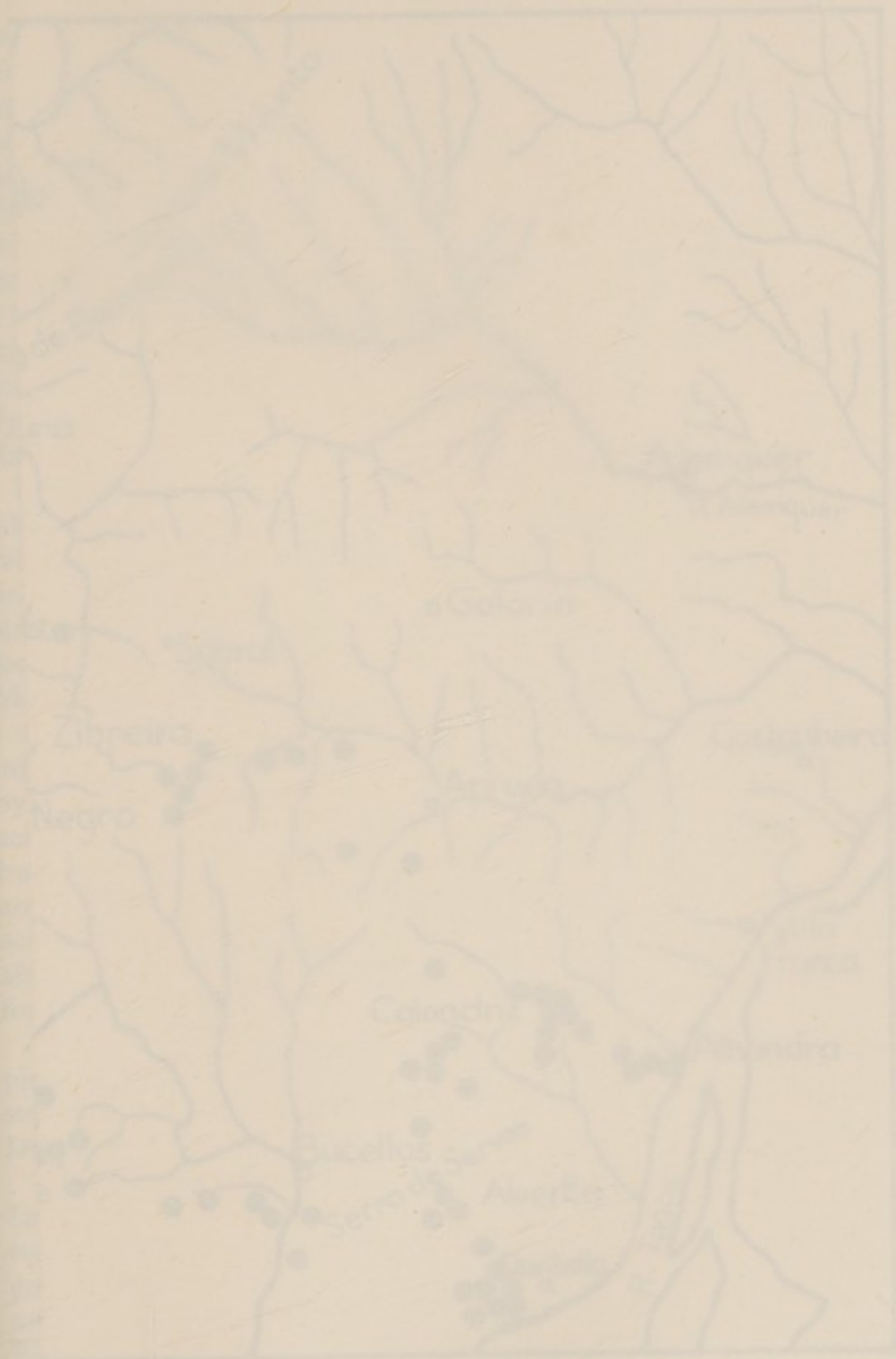
Napoleon, in an effort to extend his blockade of Britain, had already forced the Portuguese to join the 'Continental System' when, late in 1807, he commenced an invasion of Portugal. The invading French and Spanish force crossed into Portugal in the neighbourhood of Almeida, at the time of year when the heavy autumn rains had soaked the treacherous mountain tracks and had swollen the rivers. The Spanish troops alone lost 1,700 men from starvation and from drowning in fording the swift tributaries of the Douro. By the time Junot

reached Lisbon, the Prince Regent and the Court had made good their escape to Brazil.

The army that invaded Portugal was followed by others that surprised and captured the fortresses of Pamplona, Barcelona, San Sebastián, and Figueras. The Spanish king, however, was embroiled in domestic troubles and did not oppose the treachery of his French ally. Thereupon the people of Madrid revolted and King Charles IV resigned in favour of his son Ferdinand VII. Napoleon then inveigled both father and son into France, where he pensioned off Charles and put Ferdinand in prison. At this the people of Madrid again revolted—the famous rising of the *dos de mayo* (2 May 1808)—and killed many Frenchmen before they were overcome by the militia. When Napoleon declared his brother, Joseph Buonaparte, King of Spain and the Indies, the revolt spread and Frenchmen were massacred wherever they could be found.

The position in May 1808 was that French troops controlled the territory between Toledo and Madrid in the south and San Sebastián and Pamplona in the north, as well as most of Portugal and the city of Barcelona. Napoleon decided to dispatch expeditions to quell the resistance of the chief provinces. The expedition to Valencia returned unsuccessful to Madrid after losing 1,000 men in attempts to take the city. Another expedition crossed into Andalusia through the Despeñaperros pass and captured Córdoba. The French general, however, allowed his communications to be cut in the rear and, after enduring a few weeks of the heat of an Andalusian midsummer, surrendered with 18,000 men at Bailén. In the following August (1808) Arthur Wellesley landed at Mondego Bay in northern Portugal and, with the aid of the Portuguese, defeated Junot, thus ridding all Portugal of the French.

In October of this year (1808) Napoleon himself collected an army of 200,000 men and won a series of sweeping victories, including the recapture of Madrid. During this successful campaign he had ignored the presence of an army of some 27,000 men under Sir John Moore that was gathered upon his western flank. Moore, to create a diversion, marched to Sahagún and so threatened the main French line of supply. Napoleon seized the opportunity to cut off Moore's retreat to the sea. The Madrid troops were hounded across the snow of the Guadarrama pass in the midst of a blinding blizzard and were forced across the bleak plains of Old Castile. Moore, realizing that he could not reach Lisbon, slipped westward to Astorga and in twelve days reached Corunna. His men marched, on an average, 17 miles a day



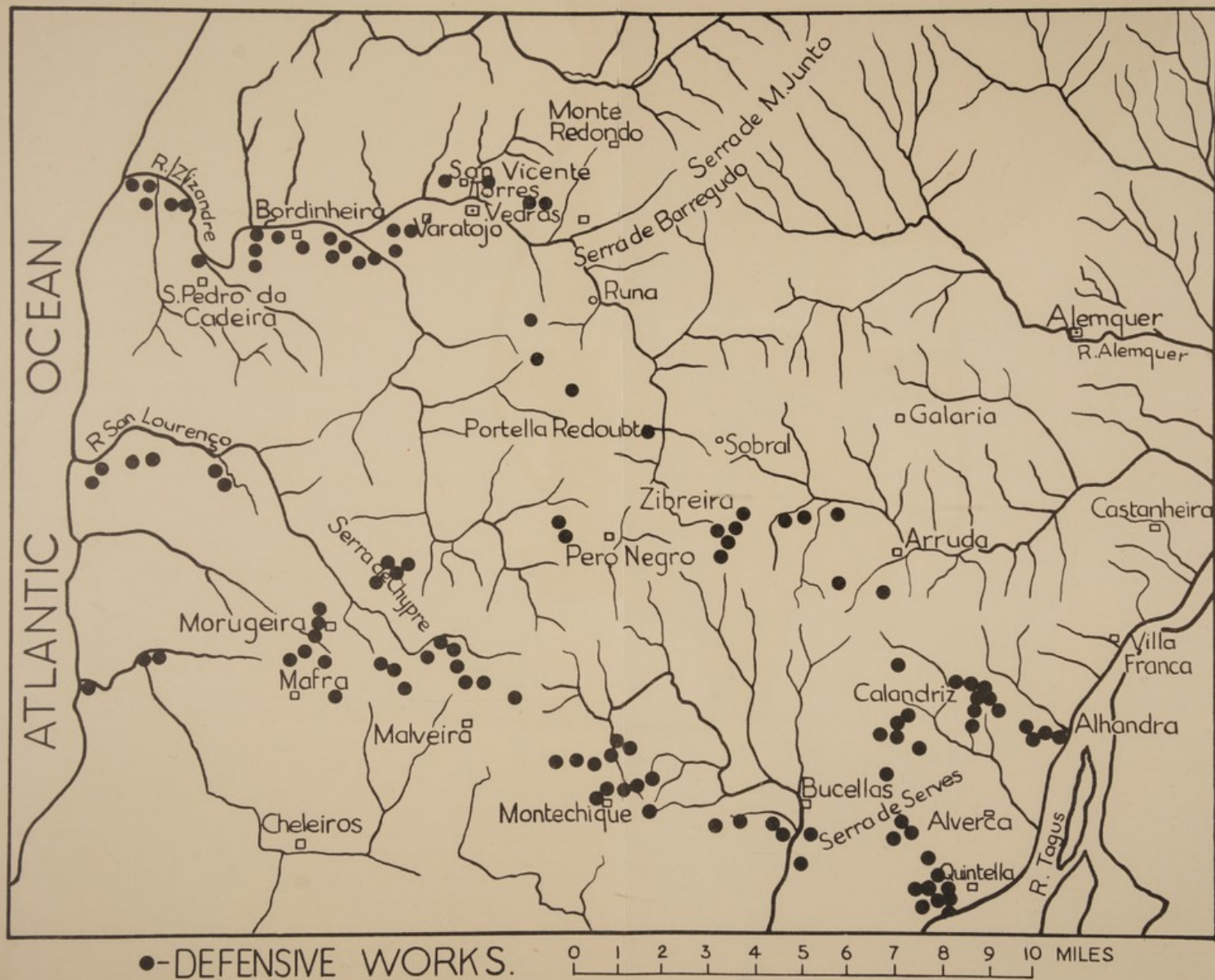


FIG. 42. THE LINES OF TORRES VEDRAS (after Oman)

through rugged snow-clad country, where almost every valley was a treacherous defile, and every track a quagmire. Napoleon gave up the chase to Soult, who overtook the British near Corunna. In the battle that followed (January 1809) the French were so badly mauled that they withdrew, leaving the British to embark at their leisure. Moore fell in the fighting, but his diversion had succeeded, as a large French force had been enticed into a remote corner of the Peninsula far from the other armies in Aragon and Catalonia.

In March 1809 Soult led the army in Galicia southwards and captured Oporto, only to find that *guerrilleros* had cut the communications in his rear. Consequently he remained in the neighbourhood of Oporto, where supplies of corn and fodder were relatively easy to obtain.

Meanwhile the Spanish forces defending Andalusia made the mistake of fighting the French in open country near Medellín in the valley of the middle Guadiana. When beaten, the Spaniards could find no sheltering ravines or brush-clad mountain slopes and were slaughtered in thousands. The French, however, were so short of food and so disturbed by revolts in their rear that they stayed near Medellín and sent for reinforcements.

Such was the state of affairs when Wellesley made his second landing in Lisbon, in April 1809. He first attacked Soult who, surprised by Wellesley's crossing of the Douro, retreated hastily northwards across the mountain tracks of the Douro tableland. Wellesley then hurried south to attack the French force in the Guadiana valley. This army, however, had found so little sustenance in a land of pigs and acorns that it had retired to the Tagus valley about Talavera. Here, after a two-day battle fought in the heat of a Spanish July, the British forced the French to withdraw, but were too weakened to pursue them.

During this year, 1809, the war in Catalonia was being fought out in piecemeal fashion after the nature of the country. Gerona, the great stronghold guarding the east-coast route, held out from May to December, and on capitulation had cost the French 20,000 men.

In 1810 Napoleon turned the whole of his strength against Spain. Early in the year Soult captured all Andalusia except Cádiz, which could be continually supplied by the British from the sea. Another great French expedition marched on Portugal and, after long delays owing to the stout resistance of the strongholds at Astorga, Ciudad-Rodrigo, and Almeida, moved south-west into the coastal plain near Coimbra. At Bussaco the main road to Coimbra and Lisbon traverses a small serra that rises precipitously above the adjacent lowlands.

Wellington, as Wellesley was now called, took up a strong position on this ridge, and the French, falling to the bait, lost 4,000 men in attacking it. The British then retired south-westwards behind the lines of Torres Vedras. The following details of these great fortifications are taken from Sir Charles Oman's *History of the Peninsular War*.

The character of the peninsula on which Lisbon stands lends itself sufficiently well to defence. The whole mass of land between the Atlantic and the Tagus estuary is a continuation of the ridge of the Serra de Monte Junto, the main mountain-chain of Portuguese Estremadura. From the backbone of the highland many large spurs are thrown out to each side, and these are themselves high and steep. The two chief hill-blocks in the backbone are the Monte Agraça above Sobral, and the Cabeça de Montechique 6 miles south of it; these form the central points respectively of the first and second lines of defence which were finally laid out. Besides the outer defences there was an inner ring of works covering only a small area on the sea-shore, at the southernmost point of the peninsula, to the west of Lisbon. This was merely intended to cover an embarkation, if by any unforeseen disaster the lines themselves should be pierced.

The total frontage of the southern and stronger series of lines was 22 miles from sea to sea. The outer and northern series of works, which was originally only a supplement and outer bulwark to the other, extended for 29 miles as it crossed the peninsula in a diagonal fashion. Lastly, the small interior line round St. Julian's and Oyeras had a circumference of about 2 miles.

The lines were in essence a series of closed earthworks, dotted along the commanding points of the two ranges of hills chosen as the first and second fronts of resistance. Some few of the earthworks rose to the dignity of fortified camps, armed with many scores of guns. Most of them were small redoubts, constructed to hold from three to six guns and garrisons of two or three hundred men only. The normal ditch was 16 feet wide and 12 feet deep, the parapets 8 to 14 feet thick, and all were properly fitted with banquettes. They were, in addition, well palisaded and had outer obstructions scattered in front. The strength of the whole series was that they were placed in scientific fashion, so as to cross fires over all the ground on which an attacking force was likely to present itself. No practicable point of assault could be found on which advancing columns would not be cut up by flanking fire for a very long distance, before they drew near to their objective. Mounds which might have given cover had been removed, hollow roads filled up, houses pulled down, trees uprooted in order to

give a perfectly smooth and featureless ascent to the line of redoubts. The result was a complete clearance of cover.

It was not necessary, or indeed possible, to slope into a glacis the whole of the ground in front of each of the lines of defences. At the north-western front of the first line, between Torres Vedras and the sea, for nearly 6 miles, a long marsh had been created: the river Zizandre had been dammed up, and had filled the whole of the narrow bottom in which it flows. Two similar inundations on a smaller scale had been caused at the other end of the lines, by damming up the Alhandra and Alverca streams, each of which spread out in a marsh a mile broad, reaching to the foot of the heights above the Tagus, and could only be passed on the narrow paved high-road from Santarem to Lisbon (Fig. 42).

In other places a very different method of making the lines unapproachable had been adopted. Where the heights were very steep, but not absolutely inaccessible, the slope had been cut or blasted away in bands, so as to make absolute precipices on a small scale. Ravines which ran deep into the line were stuffed, at chosen points, by a broad entanglement, mainly of olive trees, which could not be crawled through. The chief of these traps was that laid across the long ravine above the village of Arruda, down the bottom of which flows one of the winter torrents which fall eastward into the Tagus.

The works were divided into three lines, the first composed of four sections, the second of three, and the third of one. Of the outer or advanced line the four sections were:

(1) A front of 5 miles from the Tagus at Alhandra along the crest of a steep ridge as far as the great ravine that overlooks the village of Arruda. This front was elaborately fortified, by twenty-three redoubts, precipices and floods, as it blocks the great road, in the flat by the waterside, which forms the easiest approach to Lisbon from the north.

(2) The second section, from the ravine above Arruda to the west of the steep Monte Agraça, had a front of about $4\frac{1}{2}$ miles, which included the most lofty and defensible part of the backbone range of the Lisbon peninsula. One of the four great paved roads entering the capital from the north passes over the shoulder of these heights, and they were therefore very heavily fortified with seven large redoubts.

(3) The front of 8 miles from the west of Monte Agraça to the pass of Runa had not entered into Wellington's original plan of fortifications and was guarded by four divisions and a few redoubts.

(4) The fourth section, from the gorge of Zizandre or pass of Runa

to the sea, was about 12 miles long, but 6 of these were covered by the impassable bog formed by the dammed Zizandre and another mile by the formidable entrenched camp above the town of Torres Vedras. It should be noticed that the geography of the peninsula at this point is peculiar: north of the gorge of the Zizandre the great backbone range, the Serra de Barregudo and the Serra de Monte Junto, extends for 15 miles without being crossed by anything more than goat-tracks. Therefore, any considerable body of French troops sent to this western section would be separated by two days' march from the rest of the army, and liable to be crushed, before it could be succoured, by the defenders of Lisbon, who had good cross-roads by which they could transfer themselves on interior lines from point to point under the protection of their works.

The second main line of defence consisted of three sections:

(1) There was over a mile of impassable inundation at the eastern end, between Quintella and Alverca. Above Quintella was an isolated hill, which was strongly fortified to enfilade the high-road across the inundated lower ground. Then came the Serra de Serves, 3 miles of lofty and difficult hill which had been scarped into almost perfect inaccessibility. In a sudden dip west of this range was the pass of Bucellas, through which runs one of the three great high-roads that enter Lisbon. It was easily defensible, as it lies between two high and steep mountain-sides, and is only a couple of hundred yards broad.

(2) The second section of the inner line extended from the pass of Bucellas to the Park of Mafra, a front of over 6 miles. The eastern part of this was formed by the towering heights of the Cabeça de Montechique, almost steep enough to defend itself without fortification. But from the pass of Montechique westwards to Mafra the ground was less well marked and much fortification, therefore, was lavished on these 4 miles.

(3) From Mafra to the sea, nearly 10 miles, there was for the most part a well-marked line of heights protected in front by the ravine of the river San Lourenço, a deep, rugged, and in many parts inaccessible, cleft only crossed by the road from Torres Vedras to Mafra. The eastern part of this section was its weakest portion, and consequently was well protected with redoubts and other earthworks.

The smaller line near Lisbon was strongly entrenched and could be easily defended by a few battalions.

For the full realization of the meaning of the lines of Torres Vedras, two general facts should be mentioned. Firstly, they were garrisoned by troops which formed no part of the field army. Wellington's

60,000 regulars were not frittered away in the garrisoning of redoubts, but were held massed in general reserve behind the lines, ready to reinforce any threatened point, and to deliver a pitched battle in the open, if the French army penetrated the defences.

Secondly, the most careful arrangements for the transmission of orders and intelligence from end to end of the lines had been made. There were semaphore stations worked by seamen at intervals along the main lines, and a message could be sent from one end to the other of the 29 miles of the first line in 7 minutes.

It only remains to be added that the Navy had been utilized for auxiliary service. A strong flotilla patrolled the Tagus estuary, and the guns of our vessels covered any attacks made on the ends of the lines. It was a cannon shot from a British gunboat that cut in two General Sainte-Croix, the most brilliant cavalry officer of the French force, when he was reconnoitring on the banks of the Tagus.

The Lines of Torres Vedras came as a complete surprise to the French who, after an attack in the Sobral area, decided that their forces were insufficient to pierce the fortifications. They then retired to Santarem, where they remained from November 1810 to March 1811, although suffering from sheer starvation. Their pillaging columns were often caught by *guerrilleros*, and when they finally decided to retreat they had lost about 25,000 men mainly from sickness and starvation. The defence of Lisbon proved the turning-point in the Peninsular War.

During the ensuing year, 1811, operations were limited mainly to sieges and guerrilla warfare. Wellington recaptured Almeida in May 1811, but failed to take Badajoz. The French, however, took Tarragona (June 1811) and so deprived the Catalans of the last port at which British ships could succour them with supplies. The *guerrilleros* were active throughout Spain. No sooner did the French abandon a district than a local Junta sprang up, cutting off couriers, ambushing escorts, and imperilling communications.

In 1812 Napoleon was enmeshed in a Russian campaign and began to withdraw troops from Spain. Wellington, at an appalling cost, captured Ciudad Rodrigo and Badajoz and won, in July, a victory on the sunburnt plains of Salamanca. In 1813 Napoleon recalled much larger forces and Wellington was able to manœuvre the weakened French armies back towards the Pyrenees. After a victory at Vitoria (June 1813) he forced, in October, the passage of the Bidassoa river and began an invasion of south-western France. So ended what Napoleon himself had called 'the running sore'.

At the peace following Waterloo (1815) Spain and Portugal found themselves bankrupt and disorganized. The habit of guerrilla warfare engendered in the Spanish people was to reveal itself again in the two Carlist Wars of 1833-9 and 1868-74. The characteristic features of Spanish history continued to be poverty, civil war, and regional separatism.

CHAPTER VIII

THE PEOPLES OF SPAIN AND PORTUGAL

RACES

The Peninsula

THE Iberian Peninsula is the only large area of continental Europe whose living population belongs basically, and almost entirely, to the Mediterranean race. This race, one of the most important divisions of the white people of the world, extends from the Atlantic to India and, from there onward, mingles with other races in Oceania. Racially, the Peninsula is a colony of Africa, and to some extent of Near Eastern Asia, though its people have been somewhat modified in the past by invasions from the north.

The settlers of the Upper Palaeolithic period who drew the mural paintings found to-day in so many caves in Spain have left no trace in the physical make-up of the present population. Consequently, the racial history of Iberia begins when the Peninsula was colonized from Africa as the result of the drying of the Sahara, after the retreat of the last great glaciation of Europe. Hunters and gatherers of a small, rather primitive Mediterranean type arrived from North Africa during the Mesolithic, a period between the last glaciation and the time when men learned to domesticate plants and animals. Traces of their occupation are found in the shell-heaps at Muge, on the Tagus in Portugal.

In the third millennium before Christ, food-producing people migrated from North Africa, bringing with them cultivated barley and emmer, sheep, goats, and pigs. These Mediterranean people, who form the basic population of the Peninsula to-day, were short and slender, being about 161 cm., or 5 ft. 3½ in., tall. They had short, narrow, oval faces, with slender and narrow lower jaws, noses of narrow or medium width, and were dolichocephalic to mesocephalic, their cephalic indices running from 73 to 75.¹

About the second millennium B.C. there began other migrations by

¹ The cephalic index shows the proportion of the breadth to the length of the head as a percentage; adding 2 units for the difference between observations on the skeleton and those on the living, these indices run from 75 to 77. Indices below 75 represent a long narrow head, and its owner is said to be dolichocephalic. When the percentage is between 75 and 80, a head somewhat broader in proportion to its length is indicated, and the owner is mesocephalic. If the index is 80 or over, a round head is indicated, and such are brachycephalic.

sea from Africa of tall megalith-building Mediterraneans, sometimes called Atlanto-Mediterraneans. Though still using stone tools these people were of a more advanced culture than their predecessors. Their settlements were mainly on the east and north coast, and many of them went as far as the British Isles or Scandinavia. Their height was 167-171 cm., or between 5 ft. 6 in. and 5 ft. 7½ in. They were dolichocephalic, with medium to long faces more muscular in outline than those of the former invaders, with straight narrow noses.

They were followed by people of Mediterranean type from Asia Minor with prominent convex noses, and their brachycephalic compatriots with the same type of nose who brought the Dinaric racial type, a cross between Alpine and Mediterranean, to western Europe. Some settled on the east and north coasts, while others went on to more northern countries. The Phoenicians from Asia Minor were of the same racial type, and their settlements from about the eleventh century B.C. were also mainly on the coasts.

About 500 B.C. the northern part of the Peninsula was invaded by Celtic-speaking people from south-western Germany, who formed with the native population the group known to the Romans as Celtiberians. The Celts appear to have been a mixture of central European long-headed Nordics with brachycephalic Bronze Age Dinarics and round-headed Mesolithic survivors. They were restless wanderers and conquerors, who overran many countries, particularly to the west, and their racial composition differs somewhat according to the countries where they settled.

Neither the Carthaginians (242 B.C. onwards) nor the Romans, who finally conquered them in Caesar's Spanish campaign of 38 B.C., brought any new racial elements into the Iberian Peninsula, but the Romans gave their language, religion, law, and civilization.

The second Nordic invasion from the north began with the break-up of the Roman Empire, and Visigothic rule lasted from about A.D. 414 to 711. These tall people, with their high-vaulted skulls and long faces with broad jaws, very like Anglo-Saxons in appearance, had been under the influence of Roman civilization before they entered the Peninsula. Possibly the higher percentage of fair complexions in the north is due to them.

The last great movement of peoples into the Iberian Peninsula was again from North Africa, that of the Moors, who first began raiding in A.D. 711, and by the tenth century occupied the whole Peninsula south of a line from the mouth of the Douro to that of the Ebro. They included Arabs, of the same Mediterranean race as former invaders, of

brown or tawny-white complexion, as well as the fairer-skinned Berbers, who may have been a mixture of tall Mediterraneans with survivors of the Upper Palaeolithic Afalou people previously mentioned, or with the survivors of some early Nordic invasion of North Africa.

It might be supposed that the Christian reconquest (11th-15th centuries) and the reoccupation of the territory of the Moors would have altered the racial distribution of the Peninsula considerably. But many of the Moors preferred baptism to expulsion, and remained. Hence, we find to-day that Portugal and southern and south-eastern Spain are inhabited by people with brown eyes and hair and brunette complexion, while in the northern, north-eastern, and central parts of the Peninsula, although there is considerable percentage of light and light-mixed eyes and hair, and some fairer complexions, even here the Mediterranean complexion is more prevalent. In brief, all the earliest occupations were by Mediterranean races, except those by Nordics in the north. It would appear that even there the Visigothic nobility mingled relatively little with the earlier peoples who became their teachers in the art of civilization, and who outnumbered them to such an extent that the Nordic element became submerged rather than absorbed.

Hitherto, the Peninsula has been considered as a whole and certain general conclusions only have been made. A more detailed account will now be given of the Spanish and Portuguese peoples.

Spain: The Basques

The Basques include in their racial composition some of the very earliest people to move into the Peninsula. The fact that Basque names for sharp-edged or pointed implements are derived from the word *aitz*, which means 'stone', suggests an ancient or primitive language which may go back to the Stone Age.

There are four Basque provinces in northern Spain, Guipúzcoa, Vizcaya, Alava, and Navarre. Between A.D. 580 and 587 the Basques crossed the Pyrenees into France. They eventually occupied Labourd, Basse-Navarre, and Soule, which together form about a third of the modern department of Basses-Pyrénées. Although not all Basques speak Basque, all are intensely conscious that they are Basques, and if asked their nationality will call themselves Basques rather than Frenchmen or Spaniards. Their proud insularity, especially in the remoter districts, is like that of English people, and any Englishman who behaves in a quiet, reserved manner is likely to be treated with friendly hospitality and kindness. Although they are

devout Roman Catholics, there is very little of the cult of images which one observes farther south; their temperament is not Latin. The village priest, who is usually himself a Basque, plays a large part as a friend and counsellor, joining them in their games, such as *pelota*, the national game.

Pride of race is matched by pride in family, or in the house. The individual is of little importance compared with the family, which is autocratically ruled by the head of the house, although he consults all members of the family, even the servants, about matters affecting its welfare. When he dies his possessions and authority pass into the hands of the heir of the house, who may be any one of the children, boy or girl, carefully chosen. If the heir is a girl, her husband will be of no more importance than others in the household. It is the duty of the head of the house to see that all members are supported, and that dowries are provided for the daughters of the house. With few exceptions, patronymics are the names of houses, and if a house has to be sold and is occupied by people of different name, they will be known by the name of the house, except for legal purposes.

The ordinary Basque farm-house has a wide entrance into a great room which is used for housing carts, often made with solid wheels like those in Gower, Glamorgan, or in parts of western Ireland, and drawn by oxen. Other apartments are for oxen and fodder and implements, and the kitchen, which has a separate outside door. On the rafters by the great fire-place hang hams, onions, and peppers. On the great walnut dresser one may often see lustre-ware, brought back from Newfoundland by fishermen, for they have always been famous fishermen and whalers. The bedrooms are on the first floor, except when the heir to the house marries and lives with the parents, when there will be a kitchen and bedrooms on both floors. The attic is often used for drying maize, a staple crop. The side walls are often brought forward to form a sheltered porch in front, where threshing may be done.

In Navarre almost every house has the arms of the commune or valley carved in stone, which all born within the area are entitled to bear. Guipúzcoa has both whitewashed houses with long sloping roofs and houses with long balconies and carved lintels, inscribed with the names of the first occupants. In Vizcaya the portico reappears, and in Alava it runs the full length of the house, parallel with the ridge of the roof. In other farm-houses the second floor projects outwards, the middle part being higher than the sides to allow extra height for the room which occupies the centre of the first floor.

The Basques still perform many traditional dances and plays such as the *pastorales* and *mascarades*. The former are morality plays enacted by villagers, in which the heroes always wear blue and are Christians, while the villains are always Turks and wear red. Between acts there is the dance of the Satans, accompanied by the *ttun-ttun*, a long narrow dulcimer whose strings are struck by a little stick, and a *t'chirula*, a small three-holed flute, both played by the same man. Another interesting Basque instrument, still played in remote parts of the Spanish Basque provinces of Guipúzcoa and Vizcaya, is the *alboka*, which is made of two cane pipes, split to make single-beating reeds, one with five holes and the other with three, set on a small wooden frame and made fast at each end with wax to a hollow ram's horn, one end forming the resonating bell, and the other the air-chamber and mouthpiece. One pipe is the drone. This instrument is a primitive form of the bagpipes, and its distribution may be due to Celtic migrations.

After performances of *pastorales* it is customary to put up to auction the privilege of performing the first dance. Villages bid against each other for this honour and for subsequent dances; the *mascarades* are a sort of combination of mumming plays and ballets.

The Basques are of moderate stature, averaging 164 cm., or about 5 ft. 4½ in., in Spain, and 166 cm., or about 5 ft. 5½ in., in France. Generally they are slender with broad shoulders, narrow hips, and a conical thorax. Their foreheads are straight, or slightly sloping, the depression at the root of the nose absent or slight, the forehead broad, the mid-face narrow, and the nose thin and often convex in outline. The lower jaw is very slender and narrow. French Basques are mainly brachycephalic with an index of 82, while the Spanish are mesocephalic, with an average of 78. Among French Basques about 22 per cent. have blue eyes, 44 per cent. medium, and only 34 dark. In 16 per cent. the hair is light brown to blond, brown in 77 per cent., and black in only 7 per cent. While there are not so many blond people on the Spanish side, they are still fair when compared with other areas in Spain.

Remainder of Spain

In Galicia and the Asturias the tall Atlanto-Mediterraneans and their round-headed Dinaric compatriots came looking for metals, and they and the Celts from the north have added their blood to the earliest Mediterranean stock. This is the only part of Spain where there is a concentration of brachycephalic people, the indices of Lugo

and Oviedo averaging as high as 80. The nose is sharp and the eye orbits low but wide; the eyes are often clear hazel. Their stature is slightly less than that of the Basques, being 162-3 cm., or about 5 ft. 4 in. The Galicians have a reputation for being very hard workers and are to be found all over Spain and Portugal, wherever energetic labour is needed. They and the Asturians are the only Spaniards among whom red hair is often noticeable, and both have a great reputation for courage. During the Riff war the Arabs warned their soldiers to watch out for the red-headed men who knew no fear. Asturians are a proud people who in character and language belong to Old Castile rather than to Galicia.

The civilization which the world regards as peculiar to Spain arose on the arid table-land of the Castiles and the dry uplands of Aragon. Here independent municipal organizations developed and overthrew the one-time superior civilization of the Moors, whose administration lacked such local organization. Characteristic of their independent attitude is the Aragonese oath to their king: 'We who are as good as you swear to you who are no better than we, to accept you as our king and sovereign lord, provided you observe all our statutes and laws; and if not, no.'

Catalonia has all the pride and independence of the Castiles, but is differently oriented. The country through which Greek and Roman civilization came to Spain has always remained most receptive to Italian and French influences. Though poor in both agricultural and mineral products, the love of hard work and will to succeed have developed a great manufacturing region, whose outlook is as European as that of the Castiles is Spanish.

Andalusia and Valencia are the provinces where the Moorish influence is most evident. Here seven centuries of Moorish occupation, together with a kindlier climate, have made the people more exuberant, cheerful, and easy-going than their northern neighbours.

The population of all parts of Spain, outside the north and north-west, is again almost wholly Mediterranean, though a greater incidence (c. 25 to 35 per cent.) of lighter-coloured hair and of light and light-mixed eyes in the north-east shows some admixture of Nordic blood. Regional stature varies from an average of 161 to 168 cm., or from 5 ft. 3½ in. in some of the central parts to 5 ft. 6 in. in coastal areas, indicating that more than one Mediterranean strain is involved. The form of the head is almost everywhere mesocephalic, an index of 78-9 being the most widespread, with patches of 76-7, brachycephaly being nowhere important in Spain except in Galicia and the Asturias.

The fact that the cephalic index rises with the stature indicates the presence both of Dinaric and Atlanto-Mediterranean elements. Straight noses and dark brown hair distinguish the Spaniards in bulk from living Arabs and North Africans with their prevalence of convex noses and black hair, and indicate that the present Spanish people are mainly derived from the earlier Mediterranean invasions of Mesolithic and Neolithic times. Even the Andalusians owe far more racially to the ancient Mediterranean immigrations than to later invasions. The general Mediterranean type, mesocephalic with oval face and straight narrow to medium nose, the upper face long in comparison with shallowness of lower jaw, brunette-white skin, brown hair and eyes, is the commonest type. The Andalusian generally has a light-brown skin with dark hair and eyes and a broader jaw than other Spaniards. Occasionally one sees the hook-nosed Dinaric type, larger and fleshier, and the small golden-blond Nordic. But essentially, in spite of her complex political history, Spain is a Mediterranean country.

Portugal

Nowhere do the old and new mingle more obviously than in Portugal. In Oporto one can see motor lorries carrying wine, and beside them the long-horned oxen with elaborately carved and painted tall olive-wood yokes dragging carts with wine barrels. In Lisbon can be seen modern liners and flying-boats hard by double-ended sardine boats, with eyes painted on them to look for fish and to ward off the evil eye. Here fishwives in brilliant costume carry their fish in baskets on their heads, and also sometimes their shoes, for the police require them to have shoes and, when they obey, they carry them on their heads and go about with bare feet as they always have done. The life of the countryside is more evident in the towns than in other parts of western Europe, and in the rural districts old beliefs and customs linger on with unusual virility.

About three-fifths of the inhabitants of Portugal are engaged in agriculture. On the whole, the northern provinces are the homes of small-holders, and the south has considerably larger estates worked by labourers rather than by owners. In the province of Alemtejo many farmers still wear 'cowboy' trousers with sheepskin chaps and a long tail coat. Locally hired labourers go from farm to farm to prune the cork-trees and split the bark, their dinners or suppers being kept hot in home-made Thermos containers of cork. For the corn and olive harvest, bands of labourers are recruited locally or from Beira. The midday meal is served in a huge cauldron. A common meal is a hot

vegetable stew, varied with beans, macaroni, sausage, olives, fruit, dried cod-fish mainly from Newfoundland, and sardines, with occasional pork or chicken. A familiar sight in Alemtejo and in the Serra da Estrêla in Beira are the shepherds dressed in brown fleeces with huge blue umbrellas. At Estremoz much pottery is made in the homes of the peasants, who use the simple potter's wheel with the foot-pedal. Red-brown ware is made here; in Trás-os-Montes and Beira Alta is made black pottery which looks like gun-metal or pewter, and from Coimbra to Caldas da Rainha attractive pottery with a cream-coloured glaze on which are floral designs in colour. Mafra ware in Estremadura in green, brown, or buff is also made in human and animal forms, the human forms giving a suggestion of Minoan designs.

On the coast of Estremadura are seen many evidences of the sardine fisheries and packing, with the picturesque double-ended boats brilliantly decorated and the Arab-style dhows with bright coloured lateen sails. Inland near Torres Vedras are many country houses built with Brazilian wealth in the eighteenth century. Their pleasant baroque style is copied by the peasants' houses, two-storied north of the Tagus. In this province are the extensive pastures of the Ribatejo, whose people are cattle-breeders and have a great admiration for their bulls, which are used for fighting. The Portuguese bull-fight differs in some respects from the Spanish as the bull's horns are sheathed. The bull-fighter wears the satin coat and three-cornered hat of the eighteenth century, and is mounted with a light lance, ornamented with coloured paper. When the bull charges, the horseman is supposed to plant his lance in the bull's neck, and get out of the way. When this has gone on long enough to satisfy honour, a trumpet sounds, and some cows are driven in. The bull follows them out, and another trial of skill begins. The herdsmen are called *campinos*, and live in the saddle. They wear the stocking-caps—usually red or green—common to the peasantry of the province, white shirts, scarlet waistcoats, black knee-breeches, and white knitted stockings. They carry long staves as they ride to guide the bulls, and their stirrups are big box-like affairs inlaid with brass. Not only they, but most of the young bloods of the cattle-breeding areas enjoy testing their mettle against the young bulls at holiday times when the bulls are brought in for sale or branding.

Far more popular with the people as a whole are the many *romarias*, *festas*, and market-days. *Romarias* are pilgrimages to Catholic shrines, in which religious duties are combined with the secular pleasures of an outdoor holiday, and compare with old-fashioned English country

fairs. On such occasions, and at the *festas* of numerous saints, a great variety of brilliantly coloured local costumes are worn, and on the saints' days those interested in folk-lore can observe more ancient customs than, perhaps, anywhere else in western Europe. Market-days, too, are combined with open-air restaurants and many amusing side-shows.

In Minho the peasants' homes are like small country houses, and the fields are very small; there are no great landlords or landless farmers. About half the maize grown in Portugal is found in this province and in Trás-os-Montes, and the long slender corncribs, raised on pillars with mushroom tops to stop climbing rats, and tall stacks of the stems, used as cattle-fodder, are seen everywhere. A sharp-tasting and refreshing wine, *vinho verde*, is drunk locally in the open-air cafés and taverns, which are also general shops. There is a richer variety of local custom and costume here than elsewhere in Portugal. In the mountains of Suajo and Gerez are still to be found many old-time survivals. The few men of the former still wear their traditional costume of white woollen cloth. In some villages of the Gerez, roads, bridges, and sheepfolds are built and maintained by the community. All the cattle are pastured by a single householder in turn, his term of duty varying according to the number of cattle he owns. Each head of a family in turn acts as head of the village with a council of five other householders to decide on such matters as wood-cutting, irrigation, times of sowing, harvesting, turning cattle to pasture, or settling disputes. On the west coast at Apulia and Espo-sende, men in sou'westers and belted tunics plunge into the big Atlantic rollers with long rakes, and pull out seaweed, which the women carry ashore on light frames to dry as fertilizer for the vineyards. The houses with their pictured tiles within and without are well worth attention.

In the valley of the river Douro raincoats and leggings are made of reeds, and are most practical garments. It is in this part of Portugal, about a hundred miles up the river from its mouth, that port wine is made. Early in October, for two or three weeks, men and women pick the grapes and bring them down the narrow paths in tall heavy baskets supported by tump-lines. They are carried by ox-carts and on the backs of mules to the pressing-sheds, where they are sometimes crushed by mechanical means, but often by barefooted men or women to the music of accordions or of Portuguese guitars, instruments with a nearly circular sound-box and six double strings of wire, having a more brilliant tone than the ordinary type.

The differences in character between the people of northern and southern Portugal are a reflection of their different geographical circumstances. If northerners are more energetic, more independent, and more conservative in outlook than southerners, the difference can perhaps be largely attributed to a cooler climate and to their system of small-holdings.

Racially the Portuguese are the most Mediterranean people in Europe. They are almost uniformly brunette in complexion, and there are no districts where brachycephaly is prominent, as it is in Galicia and the Asturias. There was a little Celtic influence in the north of Portugal, and a good deal of Arab and Berber in the south, where relations between Moor and Christian were never bitter as they were in Spain. The skin colour is light brown in 45 per cent., brunette-white in 45 per cent., and about 10 per cent. only have pinkish-white skins. Sixty-eight per cent. have dark brown hair, only 2 per cent. have blond or red. Blue eyes run to 13 per cent. in the north, and only about 2 per cent. in the south. Stature varies, with concentrations from 158-60 cm. to 164 cm., or about 5 ft. 2 in. to 5 ft. 4½ in., the latter peak in the curve of distribution being much greater, and probably showing that a short Mediterranean type has been absorbed by one of taller stature. The shortest people are in the Tagus valley; those to the north and south are taller. Heads are large for the statures of the people, and an index of 76.4 as an average shows them to be just mesocephalic, while in Trás-os-Montes there is a dolichocephalic group with an index of 73.3. There are few non-Mediterranean elements, though traces of Nordic and Dinaric blood are found. The average picture is of a slender man of medium height, with wavy dark brown hair and brown eyes with a brunette-white to light brown complexion, a longish comparatively narrow head, oval and fairly narrow face with a slightly broader jaw than most Mediterraneans, and a straight nose of narrow to medium width.

LANGUAGES

THE languages of the Peninsula can be divided into two groups of very unequal size. Basque, the only language of the first group, is spoken over a very small area, but is quite distinct from the three languages of the second group. The latter can all be described as Romance tongues, and represent the different forms taken by Latin in different parts of the Peninsula. These Romance languages are (a) Castilian or standard Spanish and its numerous dialects; (b) Catalan and its dialects; and (c) Portuguese and the associated dialect of

Gallego, which is spoken in Galicia. All four languages have been affected by the Moorish conquests and by the great discoveries made by Iberian navigators and explorers. The Basque language received a considerable amount of Romanization, while the three Romance tongues all contain a strong Arabic element. The linguistic boundaries cannot be marked with precision on a map, because there are

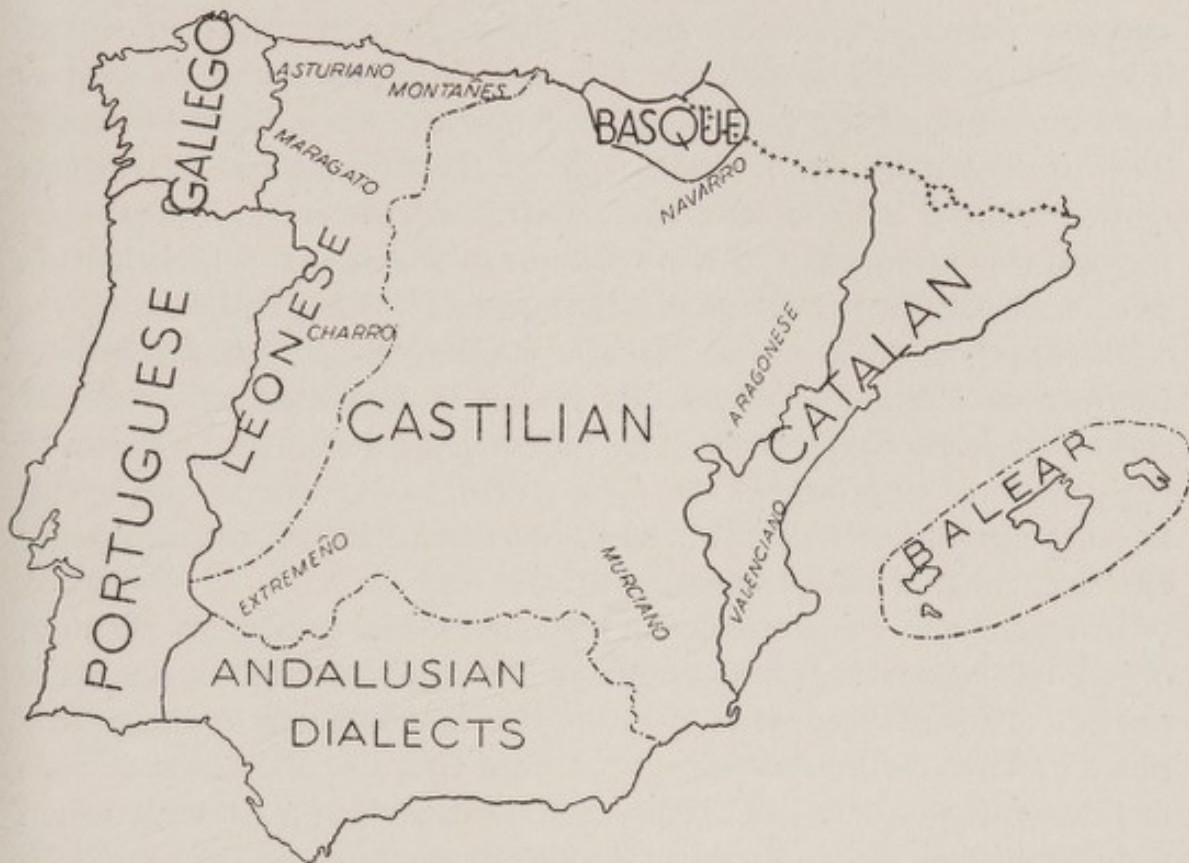


FIG. 43. THE DISTRIBUTION OF LANGUAGES AND PRINCIPAL DIALECTS IN IBERIA

intermediate zones through which one dialect changes into another. The map (Fig. 43) merely gives a very general picture of the distribution of the languages and dialects.

Basque

The ancient language of Basque or Euskera is a survival from the pre-Roman period and may possibly represent a widespread Iberian tongue. The language has no affinities with French or Spanish. Authorities differ, but some suggest that the language resembles those of North Africa, while others think that it is connected with certain Indian tongues. When the Romans first entered Spain they found the Vascones in the western and central Pyrenees, and these people have given their name to Biscay, the Basque provinces, and to Gascony.

From a philological point of view Basque is a language of great complexity. Moreover, there are numerous dialects of the language such as Biscayan, Guipúzcoan, Lower and Upper Navarrese, and there are at least twenty-five sub-dialects.

Basque is at present spoken in the province of Guipúzcoa, in the east of Vizcaya, the north of Alava, and in parts of Navarre as well as in the Basque country in France. It is estimated that about 550,000 persons speak it, and of these 450,000 reside in Spain. The Basque-speaking region was at one time much wider and may have included all the foothills of the western and central Pyrenees. The present southern boundary passes through Salinas (north-east of Estella) and Tafalla, and thence runs north-east to Pic d'Anie. Beyond this line there are many Basque place-names, which help to demarcate the former limits of the Basque-speaking region.

During the last sixty years bilingual speakers have increased and the number of Basque speakers has gradually decreased by a number estimated at about 70,000. The industrialization of the towns and the growth of communications have tended to decrease its use, and it has been replaced by Castilian. The port of Bilbao can no longer be regarded as a Basque-speaking town.

In recent years an intellectual movement has grown up with the object of preserving the language and maintaining its linguistic purity. This movement is very similar in character to the efforts made in Eire to stimulate the use of Erse and, like the latter, is connected with politics. The Basque movement has met with much success, especially with regard to the production of books, newspapers, and plays, but it has sometimes defeated its own ends by going to extremes. Numerous words of Latin origin which had crept into the language have been replaced by Basque words and all 'international' words such as 'electricity', 'telephone', and 'radio' have been eliminated. This tended to make the language incomprehensible, even to intellectuals.

To the traveller in the Basque lands the bilingual character of the region is very evident.¹ Street names and notices on church doors are written in both languages. The official language for public documents has been Spanish since the Middle Ages, but religious instruction in the Church is given in Basque. Religious literature in the language is extensive. Ignatius Loyola, the founder of the Jesuits, was himself a Basque and is the patron saint of the people, although he wrote in

¹ The Basque names for the towns known in Castilian as Fuenterrabía, San Sebastián, and Pamplona are Ondarrabia, Donostía, and Iruña respectively.

Castilian. An exhibition held at Bilbao in 1935 was able to display 1,500 books written in Basque or about the Basque language. There is a strong Basque theatre, and many popular songs are composed in the language. The cultural movement for sustaining and strengthening the language has been a powerful factor in the political Regionalist movement for home rule in the Basque lands.

Castilian

In the greater part of Spain the prevailing speech is Castilian, which has been the official language used in public documents since 1230. It is the principal literary language of Spain as a whole and is used by about 16½ million Spanish subjects in Spain. The remainder, Basques, Catalans, and Galicians, also use Castilian for official purposes, and there are very few Spaniards who are completely ignorant of the dominant speech. It must be remembered that the language is one of the most important forms of speech in the world because it prevails in vast parts of South America and elsewhere.

The Castilian language was formed in the north, in the mountains near Santander, and gradually spread southwards as Spain was re-conquered from the Moors. It contains a considerable admixture of Arabic words, and this fact also reveals itself in the place-names of Spain. For example, the Arabic *wādī*, 'river', appears in Guadalquivir, 'the big river', and in Guadalajara, 'the river of the stony place'. The Arabic word *medīna*, 'castle', is frequent, as in Medina Sidonia and in Medina del Campo. The Albufera of Valencia is based on the Arabic *Al-Buhair*.

Pure Castilian is spoken from the Atlantic coast at Santander, southwards as far as Andalusia, and may be described as the language of the greater part of the Meseta. In the western part of the Meseta certain dialects of Castilian prevail; these are known as Leonese and extend into the Cantabrian mountains. Leonese was formerly spoken in the whole of the kingdom of León (outside Galicia and Portugal) and had a considerable primitive literature. The ancient language has now been largely absorbed by Castilian, but it survives in various dialects such as Maragato, the dialect of Zamora, and Charro in Salamanca. The dialects of the central parts of the Cantabrian mountains are known as Asturiano or Bable and Montañés, and these are also associated with Leonese.

In Andalusia important dialects of Castilian are spoken and have exerted considerable influence on the colloquial speech of Spain. In

these dialects and in Extremeño, vocal sounds predominate and the pronunciation of consonants is weak. In Murcia the dialect can also be claimed as a branch of Castilian. The dialect of Aragon, although formerly very distinct from Castilian, is now almost entirely Castilian and only survives in comparative purity in the high valleys of the Pyrenees (Hecho, Ansó, Gistain). Navarro is an Aragonese dialect and has been much influenced by French and Basque because of its proximity to peoples using those languages.

Catalan

Catalan is the most important of the regional languages of Spain, and must be regarded as a separate language and not as a mere dialect of Spanish. This language is a transition between Spanish on the one hand and Italian and Provençal on the other. The distribution of Catalan and its associated dialects covers the whole of Catalonia, the Balearic Islands, the coastal lowlands of Valencia, part of Roussillon in France and, very curiously, the town of Alghero in Sardinia. Formerly the language must have been widely used in Sardinia and Sicily. About 5½ million persons speak it, including 10,000 Algherese and about 100,000 persons in America. This language flourished and possessed a considerable literature in medieval times, but steadily declined before the advance of Castilian and became a mere *patois*, the speech of peasants, although it continued to be used by priests in churches. A great revival of Catalan took place, however, in the nineteenth century and can be dated from the publication of a Catalan grammar in 1814. This revival of Catalan has powerfully aided the Regionalist political movement of Catalonia. The language can be divided into three groups, Catalan, Valencian, and Balear. In the Balearic Islands themselves dialects exist in each island.

Gallego

Gallego, the language of Galicia, is closely connected with Portuguese and is virtually the same language. About 2,100,000 persons speak Gallego; the area of the speech is not confined to the four provinces of the region, but penetrates into Asturias and also into parts of León and Zamora, in the regions of El Bierzo and Sanabria. Gallego became a mere dialect during the period between 1500 and 1800, and very little literature was written in the language. Interest in the language (largely antiquarian in nature) was revived in the eighteenth century. Castilian has invaded the region, especially the towns, and Gallego has nothing like the hold possessed by Catalan in

Catalonia. There is an interesting modern regional literature, but the whole revival is somewhat artificial. Within Gallego there are at least four dialects corresponding to the language as spoken in Corunna, Lugo, Orense, and Pontevedra.

Portuguese

Portuguese is spoken by over 7 million persons in Portugal, Madeira, and the Azores. This language enjoyed its greatest literary period in the years succeeding the great discoveries of Portuguese explorers. The famous Portuguese poet Camões wrote the *Lusiads* in 1572, and Portuguese has been described as being 'to a unique extent the language of one inspired man'. The language is not only spoken throughout Portugal but also in some towns and villages in the west of the Spanish provinces of Salamanca, Cáceres, and Badajoz. In the same way some Spanish-speaking areas exist in Portugal, a form of Leonese being spoken at the Portuguese town of Miranda do Douro. Portuguese can be divided into three groups: (1) As far south as the Douro, for long a boundary between Christendom and Islam, local dialects which are the most archaic forms of Portuguese are found. One dialect spoken in Trás-os-Montes is somewhat akin to Leonese, while the other, spoken in the more western province of Entre-Douro-e-Minho, is called Minhoto. (2) To the south of the Douro lies the hilly country of Beira, in which the dialect is known as Beirão. Here Portuguese loses the northern peculiarities of the language and approximates more closely to the Portuguese of Lisbon. (3) In the southern provinces of Estremadura, Alemtejo, and Algarve the standard language is spoken, but in the extreme south a few distinctive features of speech occur.

RELIGION

Spain

Spain is essentially a Roman Catholic country, and the Church has always taken a very important place in Spanish politics and in Spanish life generally. Religion has been the central element in Spanish culture and civilization. At the present time the Government of General Franco is favourable to the Roman Catholic Church, although it has proposed its disestablishment. In June 1941 a preliminary agreement for a new Concordat was concluded by the Government of General Franco and the Vatican. This agreement fixed the procedure for the regulation and appointment of Spanish archbishops, bishops, apostolical administrators, and auxiliary bishops. Nineteen vacant

bishoprics are to be filled, including those of Barcelona, Almería, Ciudad-Real, Cuenca, Jaén, Sigüenza, and Teruel, whose bishops were killed during the Civil War. This agreement will hold good until a new Concordat has been finally elaborated. Meanwhile the Spanish Government has promised to observe the first four articles of the Concordat of 1851, which state *inter alia* that Roman Catholicism is the State religion of Spain, to the exclusion of all other creeds. Dis-establishment will not affect the spiritual welfare of the Church. A leading supporter of General Franco pointed out that 'though the Church is to remain separate from the State, since it is in the interests of both, it must be understood that this separation does not imply divorce, but rather the outward form of a close spiritual partnership'.

There were, in 1930, nine ecclesiastical provinces, namely, Burgos, Granada, Santiago, Saragossa, Seville, Tarragona, Toledo, Valencia, and Valladolid. These archdioceses are each divided into about six to eight dioceses, the total number of which is sixty, the chief being Toledo, the residence of the Primate. Besides these nine provinces there is the diocese-priorate of the four Military Orders. Military chaplains are under the jurisdiction of a Vicar-General of the Army and Navy. In 1930 there were 66 cathedrals, 22 collegiate churches, 20,612 parish churches, and 17,157 chapels and sanctuaries. It is impossible to obtain statistics of the number of persons in religious communities, which were on the increase in the decade 1920-30; their number must still be very large, in spite of persecution and civil war. The orders with the greatest numbers include Jesuits, Franciscans, Capuchins, Augustinians, Piarists, missionaries of the Heart of Mary, Brothers of Christ, Marist brothers, and Lazarists.

The Roman Catholic Church in Spain is the Church of the people, who are profoundly religious. The nation as a whole is divided into two clear-cut groups, Roman Catholics on the one hand, and unbelievers and atheists on the other. A hundred years ago George Borrow remarked that 'the whole nation is divided into two classes, bigoted Romans or Infidels', and this is still true to-day.

Church services are well attended and the people are devout. Simple forms of worship are preferred, low mass being more popular than high mass. The Spaniard is mystical and individualistic, and his worship is affected by those characteristics. The unpleasing features of the Church in Spain, which are obvious to any British observer, such as uncleanness, lack of sound learning, and intolerance, must be regarded as failings characteristic of Spain, rather than as faults of the Church. The country clergy are badly educated, as are the vast

majority of Spanish people. The general level of knowledge possessed by the clergy might be raised if theology was studied as critically as any other branch of learning. The clergy do not receive large enough salaries to enable them to buy books. This partly accounts for the obscurantist tendencies of the Roman Catholic Church in Spain, which still lives in the atmosphere of the seventeenth century, and has been accused of consistently opposing the invasion of Spain by any breath of the modern western spirit.

It should be noted that certain regions of the country are particularly clerical in sympathy, especially the higher parts of the Spanish Pyrenees, including Navarre, the mountainous parts of Catalonia, and the Basque provinces. In the latter the Church encouraged the movement for regional self-government.

Protestant Churches. The Reformation never gained a foothold in Spain, and Protestantism is almost a negligible factor; in 1933, out of a population of over 23 millions, the total evangelical community numbered only 21,900, of whom 6,259 were communicants. These were divided into twenty-five societies which included missions organized by foreign Protestant bodies. Of 265 workers in the 166 local churches, only 142 were Spanish. The strongest centres of Protestantism appear to be in Catalonia and in Andalusia. The Protestant forms of religion do not appeal to the Spanish mentality, to which they appear as cold and unemotional. At the present time the Protestant churches are being persecuted by the Government of General Franco.

Portugal

There is complete freedom of worship in Portugal, but the predominant religion is Roman Catholicism. The number of Protestants is insignificant (4,500 in 1910). Roman Catholicism was the official religion until 1911, when the Church was disestablished and persecuted. Although still disestablished, the Roman Catholic Church continues to play a very important part in the life of the nation. Dr. Salazar, the President of the Council of Ministers, is a devout Catholic, and Cardinal Cerejeira, the Patriarch of Lisbon and one of the youngest cardinals, is zealous and energetic.

A Concordat between the Vatican and the Portuguese Government was signed on 7 May 1940. The agreement consisted of thirty-one articles, the chief of which provided for (1) the indissolubility of Church marriage; (2) the restitution of Church property alienated by the law of 1911; (3) the designation of bishops by the Pope, formal

nomination only pertaining to the Head of the State; (4) religious instruction in the schools and the right of the Church to found schools. The separation of Church and State remained.

The Portuguese Church is very alive, and its religion very real, probably because the persecution of 1911 weeded out time-servers and persons with no vocation in the priesthood. The worship and customs of the Portuguese Church do not differ from those of other Roman Catholic Churches in south Europe. The traveller will notice, however, that the priests wear frock coats and not cassocks in everyday life.

Portugal, including the Azores and Madeira, is divided into three ecclesiastical provinces with their sees at Lisbon, Braga, and Évora. The Archbishop of Lisbon (Patriarch since 1716) has seven suffragan bishops, of whom only two, Guarda and Portalegre, are on the European mainland, while the Archbishop of Braga (the oldest see in the country) has five at Bragança, Lamego, Coimbra, Oporto, and Vizeu, and the Archbishop of Évora two, at Beja and Faro. The Azores, Madeira, and the Portuguese colonial possessions of West Africa, continental and insular, with five episcopal sees, constitute part of the ecclesiastical province of Lisbon.

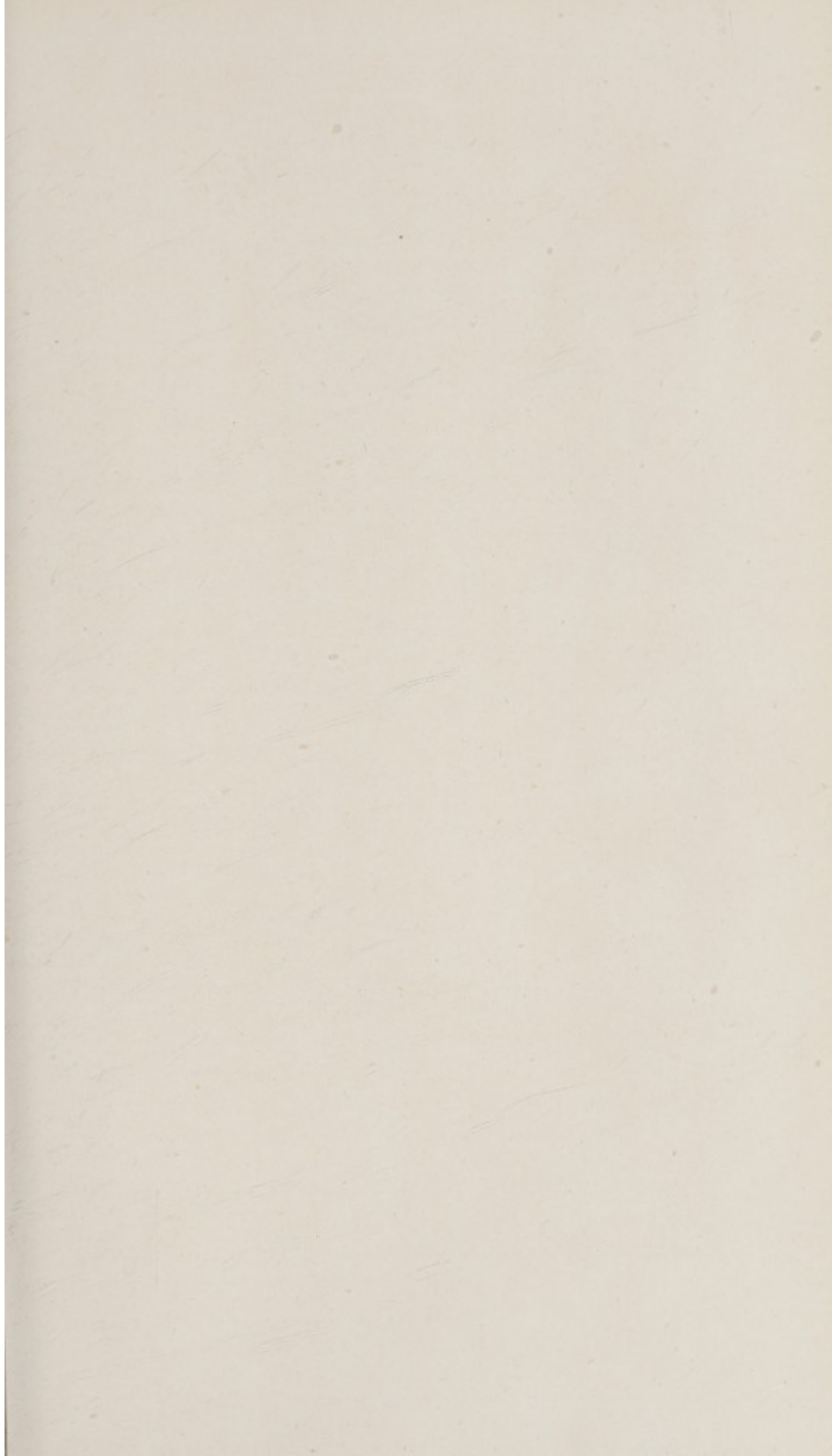
SOME ASPECTS OF SPANISH AND PORTUGUESE CULTURE

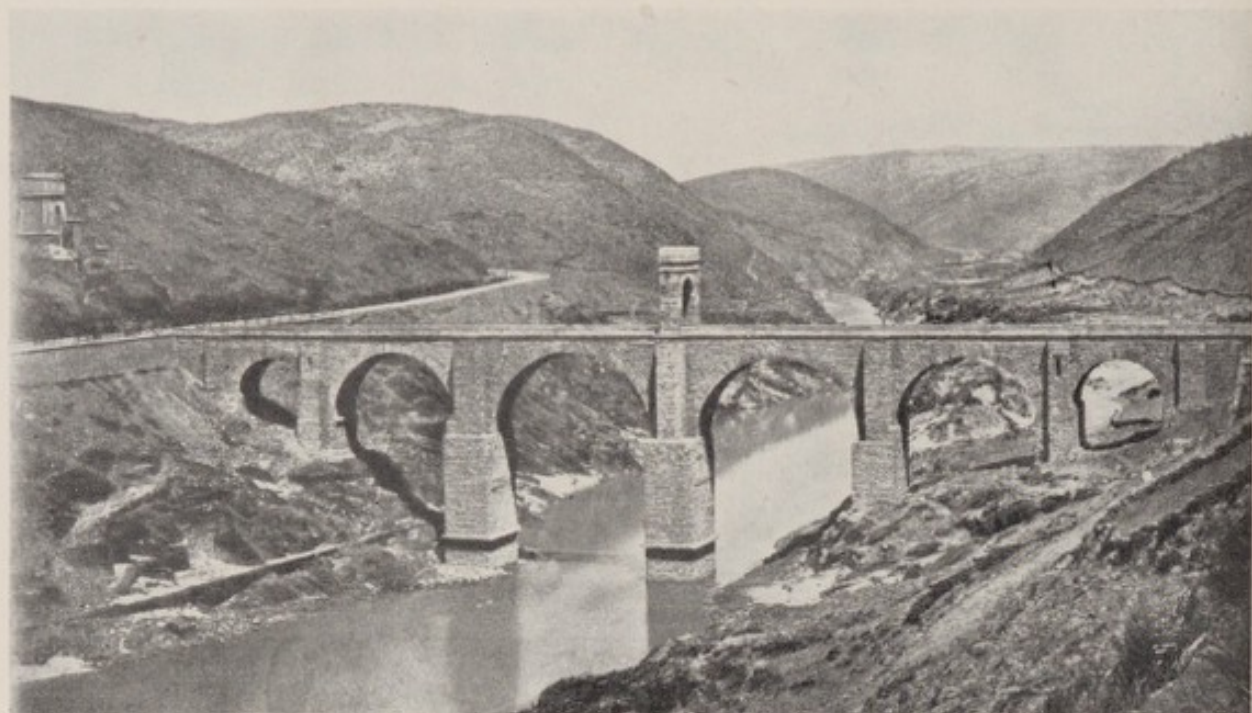
(a) THE ARTS

THE visitor to Iberia is continually confronted with evidence of its former greatness. Indeed, in Spain and Portugal the glorious achievements of the past occasionally appear in stark contrast with the efforts of the present. The growth of civilization in Iberia was, however, so complex and so much affected by foreign influences that it cannot be adequately summarized. All that can be done in a few pages is to indicate the general trends in architecture, literature, and art, and to recount the names of some of the main contributors to these branches of civilization.

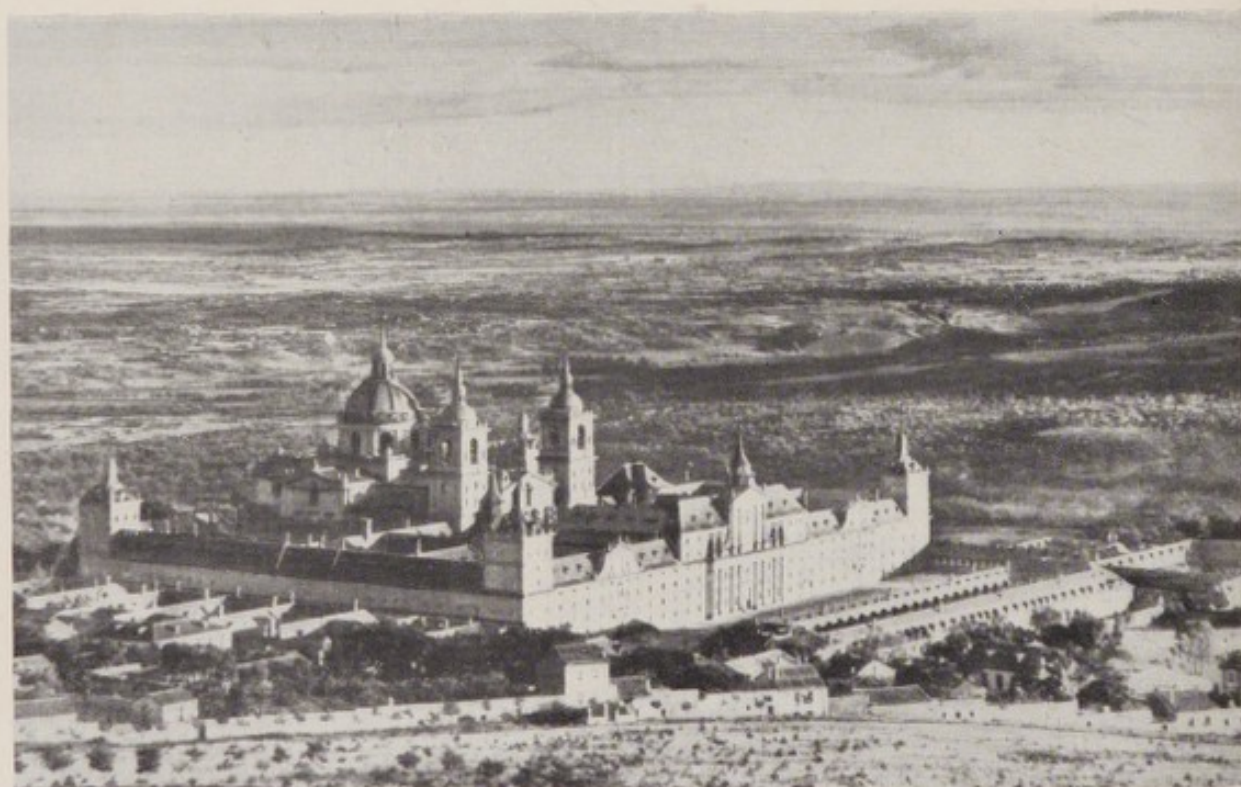
Roman Influence (3rd century B.C.—5th century A.D.)

The earliest important architecture of Iberia is Roman. The remains of this period are chiefly engineering works such as the aqueduct at Segovia, a granite structure 2,700 feet long and 132 feet high, that still provides the city with water. There are aqueducts also at Tarragona and at Mérida, amphitheatres at Tarragona, Ronda, and Sagunto,





65. *The Roman bridge at Alcántara. Note the deep valley of the Tagus*



66. *The Escorial*

and city walls at Tarragona and Lugo. Near Toledo, at Alcántara, a six-arch bridge, 600 feet long and 180 feet high, spans the river Tagus (Photo. 65).

Sagunto and Mérida (*Augusta Emerita*, the capital of the province of Lusitania) have yielded an endless variety of Roman remains. The Spaniards absorbed Roman culture to a remarkable degree and many distinguished themselves in science and literature. Among these were Seneca, the moral philosopher, and Lucan, the poet, both of Córdoba; Quintilian of Calahorra; Martial, the satiric poet, of Calatayud; and Columella, an agriculturalist, and Mela, a cosmographer, both of Andalusia.

The Moorish Occupation (8th–15th centuries)

Upon the Roman civilization there was imposed, from A.D. 711 onwards, that of the Moors, who retained control of some part of Spain until 1492. The chief buildings of Arab or Moslem architecture are the mosques, of which the finest and earliest example in Spain is at Córdoba (A.D. 786–987). Here may be seen the characteristics of Moorish art—the horseshoe arch, the many columns, the cupola over a square base, and the glass mosaics and glazed tiles in relief that adorn the walls. The building is really a square, nearly 400 feet each way, flanked by colonnades and originally covered with a flat roof to shelter the worshippers. The prayer-niche is at the end facing Mecca. The decorative designs on the walls consist of geometrical patterns and written inscriptions, the representation of the human form being banned by the Koran. Other examples of early Moorish architecture in Spain occur at Saragossa and Toledo, while in the south fortifications remain at Seville, Córdoba, Almería, Jaén, and Ronda. Moorish civilization continued to flourish in Andalusia until at least the thirteenth century (*see* p. 167). When, in the fourteenth century, the Moors had been pushed back by the Christian kings to the kingdom of Granada, they erected there the Alhambra, the most famous Moorish building in Spain. This royal palace, which is almost Moroccan in type, is characterized by its wealth of decorative detail.

The Moslems brought the learning of the ancient Greek world back to western Europe. Paper was introduced, paper-making encouraged, and books became cheap and numerous; sugar, rice, and other useful plants were cultivated, and irrigation was greatly extended; stock-breeding and mining, wool- and silk-weaving, glass-blowing, and a variety of other industries were developed. Henceforward, Iberian

civilization has a veneer of Moslem culture which, at least, differentiates it from that of western Europe and, at most, closely links it with that of northern Africa.

The Expansion of the Christian Kingdoms (11th–15th centuries)

During the gradual reconquest of Iberia from the Moors (A.D. 718–1492) the Christian kingdoms became the meeting-place of Oriental (Moslem and Jewish) and of European currents of civilization. As the Christian States advanced southwards, many Moslems remained behind under Christian rule and were known as 'Mudéjares' from the Arabic *mudajjan*, 'left behind'. At the same time, many Spaniards who had previously submitted to Moslem rule were reincorporated into the Christian kingdoms. These, the Mozárabes ('almost Arabs'), and the Mudéjares and Jews helped to spread Moslem influence in the north of Iberia. There was, in addition, much interchange of ideas between the Moslems of the south and the Christians of the north. The peoples mingled freely during the peaceful periods between the spasmodic attempts at reconquest by the Christians. Alfonso VI of León made Toledo (c. A.D. 1100) a centre for the translation of Oriental books. Alfonso X (c. A.D. 1260) founded academies in Murcia and Seville that attracted the best Christian, Moslem, and Jewish scholars of the day. The most obvious sign of this intercourse is the Mudéjar style of architecture which combines Moorish and Christian ideas. The largest example is the Alcázar at Seville, but equally typical are the belfries that form so striking a feature of the landscape of Aragon. These Mudéjar towers, with their brick patterning and inset tiles, overlook, for example, the houses of Teruel, Calatayud, Saragossa, Tarazona, Tauste, and Ateca.

The Christian kingdoms were also influenced by French ideas, which were introduced by the monks of Cluny, from A.D. 1100 onwards, as well as by Italian fashions which most affected north-eastern Spain and the Balears. During the eleventh and twelfth centuries a highly decorative Roman style of architecture known as Romanesque flourished in northern Spain. Examples of these richly carved exteriors may be seen at the cathedrals of Lérida, Tarragona, and, above all, at the great pilgrimage centre of Santiago de Compostela, which was the reputed burial-place of St. James the Apostle. In the thirteenth century the Gothic style, with its pointed arches and groined vaulting, was imposed on the Romanesque. Many of the greatest cathedrals and religious buildings in Iberia—at León, Burgos, Toledo, Barcelona, Cuenca, Gerona, Palma (Majorca), and Batalha

(Portugal)—are in this style. Several are over 100 yards long and 70 yards wide. Palma Cathedral is, at its maximum measurements, 380 feet long and 230 feet wide, while the central nave is 140 feet high. Among civil buildings in this style are the ducal palaces at Guadalajara and Burgos, the *casas* (town houses) in Segovia and Salamanca, the *lonjas* (exchanges) at Palma, Barcelona, and Valencia, and the *ayuntamiento* (town hall) at Barcelona. The magnificent *casas* of the gentry usually possess a central court (*patio*) that may be seen from the street through the narrow exterior windows and deeply inset doorways. Military architecture of the Gothic period is seen to perfection in the town walls of Ávila, which are $1\frac{1}{2}$ miles long and are guarded by eighty-six towers. Lugo, León, and Astorga have less perfect examples of town walls.

Among the intellectual aspects of the reconquest is the rise of the Iberian universities. Palencia, the oldest, was founded in 1214, Salamanca, Valladolid, and Lérida were founded by 1300, and Coimbra by 1308. At the beginning of this period most literary work was still in Latin. The earliest great Spanish poem, an account of the exploits of the Cid, a hero of Castile, was composed in Castilian about 1140.

Political Unity and Cultural Progress (1480-1520)

During the late fifteenth and early sixteenth centuries silver became so important in Iberia that it influenced architecture. Following ideas prevalent in Italy, buildings were decorated with a wealth of carving in the style known as Plateresque, from the word *platero*, a silver-smith. Salamanca is a museum of this exuberant style, as seen in the façade of the university. In the same city the Casa de las Conchas, with its shaded *patio*, carved balconies, wrought-iron window screens, and its decorative scheme of shells and escutcheons, is a typical ancestral home of the Spanish grandee of this period. In Portugal the so-called Manueline style, as seen at the monastery of Belem, closely resembles the Plateresque.

The advent of political unity was accompanied by a growth of scientific and literary culture. Especially notable was *La Celestina*, a novel in dialogue, written by Fernando de Rojas about 1499. In painting, Italian and Flemish influence predominated, but a national school of music began to form itself.

The Golden Age of Culture in Iberia (1520-1680)

The majority of the best writers, artists, and scientists which Spain has yet produced belong to the sixteenth and seventeenth centuries.

The wealth acquired from a world-wide empire brought a period of prosperity that lasted to about 1600 and only enriched a relatively small number of people. Yet the stimulus given to the intellectual life of Iberia persisted well into the late seventeenth century. Hence the climax of Spanish cultural achievements actually corresponds with a time of political and economic decline. Throughout this period much store was set on learning, and thirty-four universities flourished in Spain alone. 'In all the fields of culture and polite society, Spain was then the leader and model, and Spanish was a language which no man or woman of good birth could afford to disregard. The printing-presses of Spain, Italy, France, the Netherlands, and Germany turned out Spanish books to satisfy a world demand, and Spanish intellectuals spread over all Europe' (*S. de Madariaga*).

Almost all branches of physical and natural science flourished. The invention of a compass and of metal bilge-pumps, the construction of telescopes and of spectacles, and the many successful scientific expeditions give some idea of the varied fields in which progress was achieved.

In literature the novel developed mainly on Picaresque lines under the leadership of Francisco de Quevedo and others, but the greatest literary achievement was Miguel de Cervantes's (1547-1616) *Don Quixote*, a satirical and idealistic narrative. This, the story of Don Quixote and his servant Sancho Panza, representing the struggle between the real and the ideal, forms 'the most important single contribution by the Spanish Peninsula to world-literature' (*W. J. Entwistle*). It is significant that the most popular of Spanish novels should be written by a Castilian and be set in the plains of La Mancha.

The stage, following the early experiments of Juan del Encina in Spain and of Gil Vicente in Portugal, was transformed by Lope de Vega (1562-1635), whose *comedias*, a mixture of comedy and tragedy, make him the Shakespeare of Iberia. His extant plays alone are ten times as numerous as those of Shakespeare, and titles to over 700 of his works are known. Among Lope's contemporaries were Pedro Calderón (1600-81), Tirso de Molina, and Juan de Alarcón. Calderón rivals Lope in greatness; Tirso is remembered for his clever satires on human weaknesses and for his creation of the character of Don Juan, which ranks alongside the Cid and Don Quixote as being supremely 'Spanish'.

In poetry there appeared in 1572 the *Lusiads* of Luiz de Camões, a Portuguese, who incorporated his own wide travelling experience into a kind of Virgilian epic which deals with Portuguese expansion

overseas, and especially with the discoveries of Vasco da Gama. Camões wrote brilliantly both in his native Portuguese and in Castilian, which at this time was becoming the standard Spanish form.

In architecture the highly decorated Plateresque style prevailed to about 1550, when a Romanesque reaction set in and buildings became more severe and massive. Philip II led the change in building the Escorial, a palace of grey granite about 7 acres in extent, set in the bleak Guadarrama (Photo. 66). This austere phase was followed by the Baroque (c. 1650–1750), when buildings were overburdened with intricate carvings, gilding and plastering, marble and bronze. At its worst the style became a wild chaos of ornamentation; at its best it was amply decorative.

In painting, during the sixteenth century, the chief national painters were overwhelmed by the influence of Florence and Rome. Charles I chose Titian as his Court painter and Philip II chose a Flemish artist. But to this period belongs El Greco (c. 1548–1614), a Greek (Domenico Theotocopouli) by birth, who spent most of his later life at Toledo. El Greco marks the beginning of the great age of Spanish painting. Soon after 1623 Velázquez (1599–1660) became the Court painter of Philip IV and produced the famous series of portraits of royal personages. On Velázquez's death the excellence of Spanish art was maintained by Esteban Murillo (1617–82), who became famous for his many paintings of the Immaculate Conception, but is equally, if not more, admired for his studies of the street and market-place characters of his native Seville. These artists, together with Zurbarán, Ribera, and others of lesser repute, produced a great number of masterpieces which have attracted visitors to Spanish galleries from all over the world. During the recent Civil War many famous pictures were sent out of the country for safety and were afterwards exhibited at Geneva.

The Eighteenth Century (c. 1680–1808)

During the eighteenth century there were signs of an economic revival in Spain and a corresponding growth of interest in cultural problems. Yet, as regards actual achievements the period does not compare with the previous age. Painting was largely dominated by French and Italian influences except in the case of Francisco Goya (born 1746). Goya, whose character included much that was brutal, painted both sides of Spanish civilization, showing in his numerous works a vigour, simplicity, and cruelty 'unmatched in the history of painting'. Of the four giants of Spanish painting—El Greco, Velázquez,

Murillo, and Goya—only Goya allows the morbid and pessimistic to prevail over the more admirable traits of the Spanish character.

In architecture the Baroque style remained fashionable, although a neo-classic type came in under Philip V (c. 1735) and was used for many public buildings in Madrid.

In literature, although French influence predominated, this period, at least until 1750, was characterized by its sterility. On the other hand, tanning, mining, pottery, and various handicrafts, such as the weaving of embroideries and tapestries, were revived and stimulated by royal patronage.

'Experts, foremen, and workmen were brought from Germany, England, and other countries, and workshops and technical schools were set up. . . . The roads were improved (339 leagues of high road and 605 bridges were built between 1749 and 1800). Rivers were improved by the digging of canals (Castile canal, Huescar canal, and the Imperial or Pignatelli canal); reservoirs were made (Val del Infierno, Puentes); dockyards for the building of ships were inaugurated; arsenals for the making of arms (Oviedo, Trubia, Ferrol, &c.); and the first official bank was founded—the San Fernando' (*Rafael Altamira*).

Yet the main interest of these years, apart from the works of Goya, lies in the efforts made to increase the general standard of culture. New institutions, such as the Hydrographic Museum and the Ordnance Survey, were created outside the field of the universities. These new bodies produced a spate of historians and scientific writers. The Royal Court and private citizens, stimulated by the teachings of Rousseau, took an increasing interest in public education, and the State subsidized elementary schools. The stimulus, however, was neither adequate nor sustained, and at the end of the eighteenth century there was still in Iberia a small cultured minority and a vast illiterate majority.

The Nineteenth and Early Twentieth Centuries

Spain and Portugal made no very outstanding contribution to the rapid progress of science in the world at large during the nineteenth century. This period, however, especially after 1850, was one of great literary activity and notable works were produced in most types of literature. The strong influence of Sir Walter Scott and of Byron is of special interest to British readers. Modern Spanish literature has seen the restoration of regional works in Catalan, Valencian, and Galician and an increase in the number of works written in Basque.

Painting has produced no exceptional artists since the death of Goya (1828); of living Spanish painters Pablo Picasso (born 1881) enjoys the widest celebrity. In music, the Italian opera predominated in Spain throughout the early nineteenth century. Some works of Carnicer, a Catalan, were introduced into Rossini's *Barbier de Séville* and the dance (*habanera*) in Bizet's *Carmen* was written by Yradier, a Spaniard. About 1850 the *zarzuela*, a mixed opera and drama, reappeared and spread rapidly throughout Spain. In Catalonia the formation of local choral societies did much to popularize music in that province. More recently Debussy (died 1918) and other French composers wrote much music on Spanish themes and under their influence a modern school of Spanish music arose, led by Manuel de Falla, Albéniz, Granados, and Joaquín Turina.

The architecture of modern Spain has made use of many styles. Moorish and Plateresque have been used at Toledo and Seville, Romanesque in Madrid, while skyscrapers may be seen in the largest cities.

(b) EDUCATION

Spain

The cultural progress of present-day Spain is reflected to some extent in the general level of education. When educational reforms were taking place in Britain, constant turmoil prevented the establishment of a satisfactory system of education in Spain. Periods of liberalism alternated with periods of repression, the *Ateneo* of Madrid (founded in 1820) being a notable centre of free discussion. Ferdinand VII in 1830 closed the universities, but these were reopened under Isabella II (1833-68), who also brought back many liberals from exile. After 1833, political journals increased in number and various literary and encyclopaedic reviews were begun. In 1834 a Normal School for teachers was founded and in the year following, when the regular religious orders were suppressed, those dedicated to teaching were spared. Ten years later the State assumed control of the universities. General education was set on a sounder footing in 1857 to 1859, when elementary, normal, and special schools and places for secondary education were either established or confirmed. Higher education was to be financed by the State, secondary education by the provinces, and primary education by the municipalities.

Other reforms followed, and the State eventually made itself responsible for the salaries of teachers, and endeavoured to improve both their financial and social status. Many of its schemes failed

because of lack of public support. After the revolution of 1868, when Isabella was dethroned, journalism increased rapidly, but from the first seems to have been associated with political propaganda. At this time university accommodation was ample, whereas the provision for elementary education remained totally inadequate. As a result, three-quarters of the Spanish population could neither read nor write. By 1910 the proportion had decreased to about 64 per cent., which, after deducting the number of children below school age, corresponds to some 55 per cent. of the population. In other words, about 10 million Spaniards, above 6 years old, were illiterate, although there were nearly 25,000 Government schools in existence at this time. By 1930, 47 per cent. of the Spanish population could read and write, of which 1 per cent. could read only; thus, including the infant population (7 per cent. total), 52 per cent. of the people were illiterate. Illiteracy is highest in south and south-eastern Spain, the following ten provinces being the most illiterate in recent censuses: Málaga, Almería, Jaén, Albacete, Murcia, Granada, Ciudad-Real, Córdoba, Castellón, Alicante. In these provinces, on an average, 5 or 6 persons in every 10 can neither read nor write.

The general standard of education is highest in the Basque lands, the Asturias, Old Castile, Madrid, and Barcelona. Recent censuses show that illiteracy is lowest in the provinces of Santander, Alava, Madrid, Palencia, Burgos, Segovia, Guipúzcoa, Vizcaya, Barcelona, Soria, Navarre, and Oviedo. Here, on an average, only 2 or 3 persons in 10 can neither read nor write. The Basque lands have received much cultural influence from their trade with western Europe; in Navarre education has been compulsory since 1780.

To-day, elementary education is compulsory and free. The country is divided into eleven educational areas, each based on a university. In 1935 there were some 43,000 public elementary schools in Spain which served a school population of over 4,700,000. In 1933 there were 53,000 National teachers, or an average of 1 trained teacher to every 90 of the child population. In those provinces where the educational standard is highest the proportion of children to trained teachers is occasionally 1 in 50, whereas in the most illiterate areas 1 teacher to 150 children is not unknown. Most national schools have 1 or occasionally 2 teachers; Valladolid had 88 national schools with only 88 teachers, but Madrid had 344 national schools with 809 teachers. There were in addition some 1900 complementary institutions for elementary education and a few hundred complementary classes. In practice, the number of children per teacher is not so

excessive as would appear from the statistics, as the attendance is low and very irregular. Since 1912, literacy among both teachers and pupils has been encouraged by the establishment of libraries, and in 1933 there were 2,000 fixed and over 1,000 circulating libraries in the country.

Facilities for secondary education, besides the 54 normal schools for primary teachers, are provided in 113 schools in which, in 1933, there were 2,500 teachers and 123,000 registered pupils, mainly youths. These secondary institutions prepare for the universities which exist at Madrid, Barcelona, Saragossa, Valladolid, Granada, Santiago, Salamanca, Seville, Valencia, Murcia, and Oviedo. In 1932-3, of the 32,000 students attending these universities, 10,000 were at Madrid and nearly 5,000 at Barcelona. University education was largely restricted to males, men students outnumbering women by 14 to 1. In Murcia University (1,200 students) there were only 28 women following courses. The ancient university of Salamanca is organized on a collegiate system somewhat similar to that of Oxford and Cambridge.

In addition to the universities, there are numerous special colleges and centres for higher education including the medical and science branches of Seville University, which are at Cádiz.

Portugal

Compulsory education has been in force in Portugal since 1911. In that year some 75 per cent. of the people of Portugal were illiterate. The growth of educational facilities had, by 1930, diminished the proportion of illiteracy to about 68 per cent. which meant that 60 per cent. of the population above school age could neither read nor write. In the provinces of Beja and Castelo Branco about 8 persons in 10 were illiterate, and even in the most progressive provinces of Lisbon (52 per cent. literate) and Oporto (40 per cent. literate), with their large city populations, nearly 1 person in 2 was illiterate.

In 1935-7 there were 43 infant schools with 76 teachers and 3,000 children. The provision for public elementary education consisted in 1937-8 of 7,940 schools with some 10,100 teachers, and an attendance of nearly 460,000 pupils. Some of these schools had complementary classes which, in 1937-8, were attended by 22,000 pupils and 600 teachers. In the many small country villages, where the population is too small for a school, the Government appoints a local teacher to provide instruction. In these study centres (*postos de ensino*) some 50,000 pupils were being taught by 2,100 teachers. Therefore, in

1934-8, a total of 531,000 children were receiving an elementary education and there was, on an average, 1 teacher to every 40 pupils.

Secondary education is carried on in 43 schools where 960 teachers instruct 19,000 scholars, but there are in addition 5 small 'normal' schools. From these schools the pupils can pass on to the three universities of Lisbon, Coimbra, and Oporto. Of these Lisbon, with over 3,000 students and 200 lecturers, is by far the largest. Oporto, however, also has a university now largely technical, which is attended by 1,600 students; its Faculty of Arts has recently been suppressed. The ancient University of Coimbra is the traditional training-ground of Portuguese men of affairs. The country possesses numerous specialized centres of higher learning apart from the universities.

The remarkably high percentage of illiteracy in Portugal is partly explained by the irregularity of attendance at the elementary schools. Here, as in many provinces of Spain, an attendance of 60 to 70 per cent. is average, and this may drop to a very low figure when the children are needed to help at home. The seasonal migration of a proportion of the adult population also militates against the regular school attendance of their offspring. The fact remains that in 1930 about 50 per cent. of the children in Portugal between 10 and 14 years old could neither read nor write.

(c) THE PRESS AND BROADCASTING

Spain

In Spain, the Press is strictly, if indirectly, censored and controlled by the Falangist Party. The seven important newspapers published in Madrid are all, in varying degrees, pro-Axis. *A.B.C.* gives more space to society news, uses titles more frequently, and retains a higher standard of writing than most Spanish newspapers. It is monarchist rather than Falangist in sympathy and has a circulation of about 300,000.

The official organ of the Falangist Party is *Arriba* (circulation c. 30,000 in Madrid), which is pro-Axis in sympathy. *Ya*, also a morning paper, is strongly religious and pro-Italian and occasionally indulges in subtle monarchist propaganda. The remaining daily newspapers of the Madrid press comprise *Alcázar*, *Informaciones*, and *Pueblo*, all evening papers, and *Madrid*, a new morning paper with a small circulation.

Of the twelve important provincial dailies, the majority are likewise pro-Axis in sympathy. Two are published at Barcelona, *Vanguardia* being the more influential. This paper gives much space to foreign

news, to which it also devotes a number of features and comments. Although decidedly pro-Axis, it does publish the British point of view. Two provincial newspapers are printed at Valladolid, and one each at Vigo, Bilbao, Saragossa, Badajoz, Granada, Valencia, Pamplona, and San Sebastián.

Faro de Vigo and *Ideal* (Granada) seem to some extent independent, while the *Pensamiento Navarro* (Pamplona) is the most outspokenly Carlist, as becomes the former stronghold of Carlism.

Portugal

The more important Portuguese newspapers are published at either Lisbon or Oporto.

The Lisbon press includes eight daily newspapers. *Jornal do Comércio e das Colónias* (founded in 1853) is the oldest paper in the country and has a daily circulation of about 10,000. Its interests are primarily economic, but it carries one or two pages of foreign political and war news. Although its editorial comment is limited to economic matters, it is strongly pro-British.

Probably the most influential and wealthy paper in Portugal is *Diário de Notícias* (founded 1864), which has a circulation of 140,000. It gives detailed reports of important events, but, as is usual in Portuguese newspapers, it seldom has an editorial column.

O Seculo (founded 1880) shows a keen sense of publicity. It has a circulation of 50,000 and in 1940 produced a magnificent special number to celebrate the double centenary of 'the foundation and restoration of Portugal'.

Voz is a strongly Catholic paper which shows a particular interest in education, agriculture, and in the welfare of the peasants.

Diário da Manhã (founded 1931) is the Government journal and organ of the 'União Nacional'. It has a circulation of about 22,000 and is the one daily newspaper in Portugal that may be accounted open to German influence.

Novidades (circulation 30,000) is the official Roman Catholic organ and confines its interest mainly to the Church and social and agricultural problems.

Diário de Lisboa and *República* are the two leading evening newspapers. The former is excellently produced and is well informed on foreign affairs; the latter is more popular and domestic in tone.

The Oporto press is dominated by three chief newspapers. *Primeiro de Janeiro* (founded 1868) has the reputation of being the most independent and outspoken paper in Portugal. It is the only

daily with a regular picture page that has done very good service to the Allied cause.

Comércio do Porto (founded 1854) is similar to *Primeiro de Janeiro* in interests, excellence of presentation, and in circulation (c. 35,000). It carries, however, a fuller news service and more regular leading articles. It is independent of party politics, and is the organ of the wine industry.

Jornal de Notícias (circulation 45,000) is more popular in character than either of the above and is especially interested in local topics, such as agriculture and social conditions in northern Portugal.

Broadcasting in Spain

The evidence available suggests that the number of efficient wireless receiving sets in Spain is small. During 1941 efforts were made by the Spanish Government to increase the use of radio for purposes of 'national propaganda and culture'. As the existing Spanish stations had a strength of between 5 and 15 kilowatts only, work was begun on two new transmitting stations near Arganda on the Madrid-Valencia road. These, with a strength of 40 and 120 kilowatts, will allow programmes to be received all over Spain even with sets of one or two valves. In addition a special station, under the control of the University Students' Syndicate at Madrid, and three provincial stations have been recently opened.

Little is known of the use, if any, made by broadcasting in education. The programmes are published officially in *Radio Nacional*, a kind of combination of *The Listener* and the *Radio Times*. There are some programmes for children usually at 19.00 or even as late as 20.30 hours, and some talks for women, but these occupy a relatively unimportant place in the programme as a whole. The provincial programmes consist almost entirely of popular music. In March 1941 the Spanish Home Office made serious attempts to improve the tone of the programmes by restricting commercial announcements. Advertisements were not to take more than 5 minutes in each hour of broadcasting time, and were not to be relayed just before or just after official programmes, national anthems, and official ceremonies. In general, the announcements were to be decorous in tone and not to include personal jokes or observations.

(d) SPORT

The national sport of Spain and Portugal is the bull-fight (*corrida*), which is attended equally by both sexes. Every important town has its

bull-ring (*plaza de toros*), but the great fights take place at Madrid and Seville. The season begins with the Easter corrida at Seville and lasts until November, there being no bull-fights in winter. There is usually a break at the height of summer and many of the corridas in the hotter weather are for young bulls and less experienced *toreros* (bull-fighters). The fixtures are arranged to take place on feast-days (*fiestas*), public holidays, and Sundays, usually in the afternoon—*si el tiempo lo permite*. Some of the chief fixtures are attended by 10,000 or more people, including ladies who wear their most fashionable clothes; the whole presents a colourful spectacle.

The bull-ring is an open amphitheatre, the arena being separated from the tiers of seats by a barrier over which the torero jumps when hard pressed. Occasionally there are small refuges round the ring and always, in a commanding position, there is the president's box. The seats may be of stone or of wood, but small straw mats may be hired for a small fee. Tickets should be taken for the shady side of the ring (*boletín de sombra*) as the cramped seating, the heat, dust, and glare can be most oppressive.

The bull-fighting team, or *cuadrilla*, consists of a *matador*, *banderilleros*, *picadores*, and *peones* in order of rank. The matador, or chief torero, kills the bull; he is the idol of the crowd and may become almost a national hero. The banderilleros stick darts in the shoulders of the bull; the picadores are mounted lancers; the peones tire and irritate the bull with their cloaks.

At the start of the corrida the toreros enter the arena, in the above order, behind two quaintly dressed horsemen. The procession is ended by a gaily caparisoned mule-team whose duty it is to drag out the carcasses of slaughtered beasts. After all the toreros have made their obeisance, the president of the fight tosses a key to the leading horseman, who lets out the bull. The peones tease the beast with their cloaks and goad him into some degree of ferocity. One object of this part of the fight is to find out what sort of a bull it is. Some matadors like the famous Belmonte can tell this almost at a glance. The bull may run about all over the ring. If he follows the cloak and not the man he is probably a steady 'brave' bull and likely to give infinite trouble. A second object of the peones is to get the bull into position for the picadores. The whole performance by the men on foot is a matter of correct timing and rhythm and taking care not to be caught on the wrong foot. Then, after a few minutes of this agile cloak play, the president orders the bugle to sound for the final killing of the bull. The slaughter takes place in three acts. In the first act, the *Suerte de*

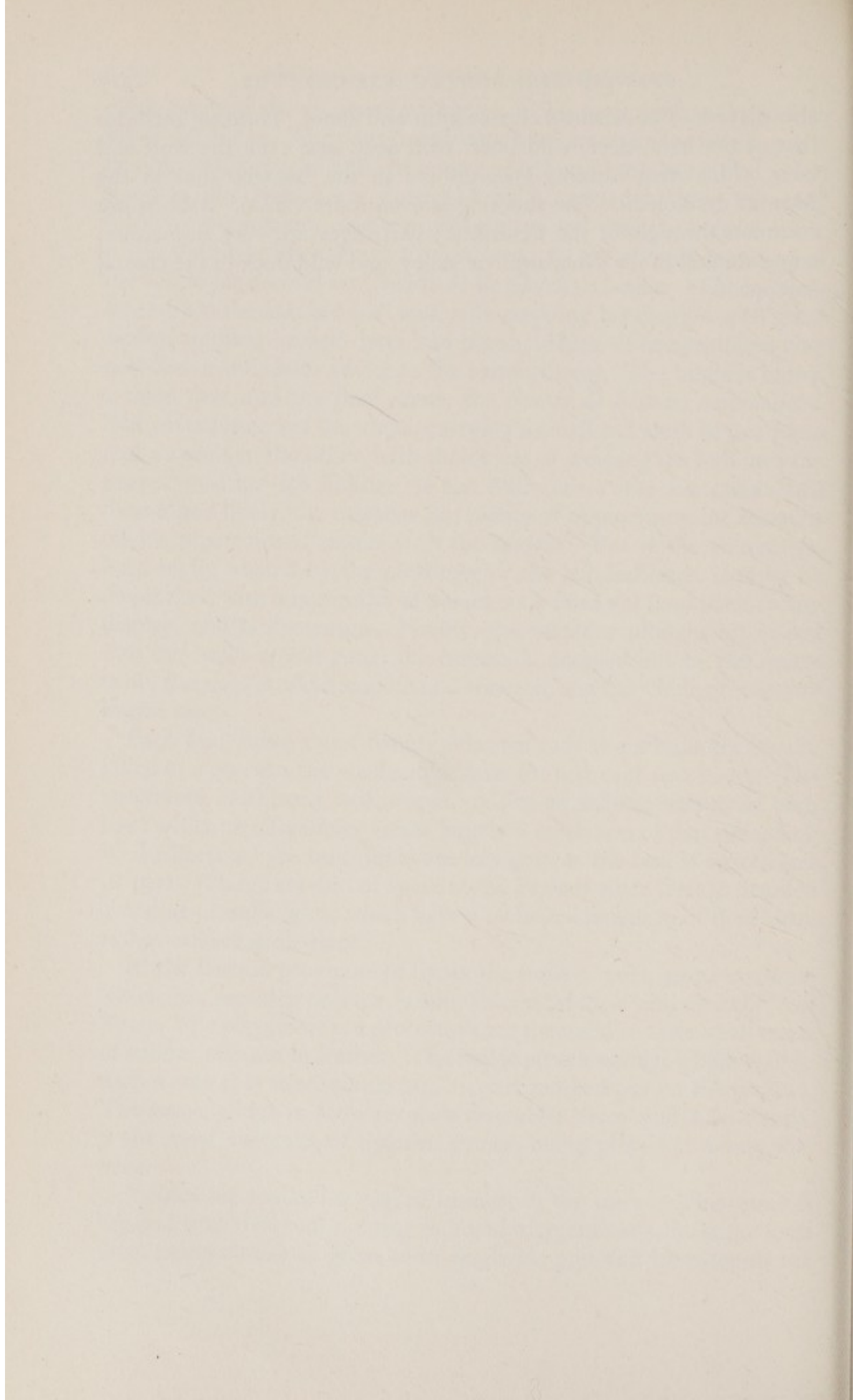
Picar, each of the mounted picadores, in his turn, incites the bull to attack his horse. The poor brute, which has its right eye bandaged, is usually gored by the bull, who may overthrow both horse and rider. To-day, the horses are protected by a padded cuirass, but they seldom escape injury, and it must be admitted that the painful scene is distasteful to the average Englishman. At the second sounding of the bugle the second act (*Suerte de Banderillas*) begins. The banderilleros face the enraged bull and, side-stepping his charges with great agility, implant barbed darts into his shoulders. The spectators clap each move and shout advice to the banderilleros. The bugle is blown a third time and the final scene, the *Suerte de Matar*, commences. The matador enters the arena, carrying a small red cloth in one hand and a sword in the other, with the object of working the bull into the proper position for killing. If the bull comes into his hands still 'brave' and lively, the matador has plenty of opportunity for showing off his repertoire of passes with the muleta. But if the animal has been badly treated by the picadores or the banderilleros, it must be dispatched with a minimum of passes, as it does not lend itself to any display, and is dangerous. Finally, the matador plunges his sword into the bull's spinal cord; the carcass is dragged out by the mule-team, the sand is raked smooth and watered, and the whole proceeding begins anew.

Each bout takes about twenty minutes and, as six bulls are usually killed at a corrida, the whole affair lasts for just over two hours. The spectators, both men and women, notice an infinite variety in each bout which to a foreigner seems largely a repetition of that preceding it. In Portugal the bull-fights are less gory as the bull is spared (*see p. 192*). A large amount of space in the Press is given over to detailed accounts of bull-fights, which have a technical language of their own, as has cricket in England.

In the Basque provinces of Spain the most popular game is *pelota*, which has recently become fashionable in Madrid and elsewhere in Spain. The players wear a protector over the hand and use a ball made of rubber encased in leather. The ball is struck against a high wall in such a way that it rebounds into a court marked out on the ground. The game, which in some respects resembles 'fives' and lawn-tennis, is the most energetic of Spanish games, being played at a very fast pace.

Association football is played in most of the towns. This game is beginning to rival bull-fighting in popularity, enthusiasm for the local team being almost as great as in England; golf and lawn-tennis are

also played. The leisured classes hunt and shoot. Hunting includes that of the hare, deer, wild boar, wild goat, and even the wolf and bear. The great hunting-grounds are in the Asturias and in the Montes de Toledo. The shooting is even more varied. Rabbits are common throughout the Peninsula; partridges are very numerous; snipe abound in the Guadalquivir valley, and wild duck in the coastal lagoons.



APPENDIX A

CLIMATOLOGICAL STATISTICS

SECTION I. *Meteorological Tables*

<i>Name of station</i>	<i>Regional position</i>
1. Bilbao	Basque Lands
2. Corunna	} Galicia
3. Pontevedra	
4. Oporto	} Portuguese Coastal Lands
5. Lisbon	
6. Cádiz	Plain of Andalusia
7. Gibraltar	Strait of Gibraltar
8. Cartagena	} Levantine Lowlands
9. Valencia	
10. Barcelona	Coastal Zone of Catalonia
11. Palma	} Balearic Islands
12. Mahón	
13. Guarda	Portuguese Central Ridge
14. Burgos	Northern Tableland
15. Madrid	} Southern Tableland
16. Badajoz	
17. Saragossa	Ebro Trough
18. Teruel	Iberic Mountains
19. Seville	Plain of Andalusia
20. Granada and Jaén	Andalusian Mountains

SECTION II

Seasonal Wind Direction and Speed in the Upper Air at Almería.

SECTION III

Sea in Relation to Wind Direction at Almería, Barcelona, and Mahón.

SECTION I. METEOROLOGICAL TABLES

Region: BASQUE LANDS

Station I. BILBAO

Lat. $43^{\circ} 16' N.$, Long. $2^{\circ} 55' W.$ Height 56 ft.

Month	Pressure at mean sea-level, reduced to 32° F. and Lat. 45°		Air temperature								Relative humidity	Cloud amount Scale 0 to 10†	Rain			Mean velocity knots	Wind								No. of days					
	Mean		Average *		Mean daily		Mean monthly		Extreme				Aver- age fall in.	No. of days‡	Max. fall in 24 hrs.§		Percentage of observations, from								Gales*	Fogs	Snow	Frost	Thunder	
	For month	Daily ampli- tude	Max.		Min.		Max.		Min.								N.	NE.	E.	SE.	S.	SW.	W.	NW.						Calm
			°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.																				
January.	mb.	—	48	55	40	66	28	77	19	77	6.3	4.7	15	1.5	4	16	5	2	23	12	9	6	27	—	4	3	1.8	—	0.6	
February.	1019	—	51	59	42	70	31	80	23	73	5.9	3.5	13	1.8	4	11	10	2	17	6	12	12	30	—	4	4	0.7	—	0.4	
March.	1018	—	52	61	43	76	32	87	25	72	6.5	4.4	15	1.9	4	17	15	2	6	6	13	12	29	—	4	3	0.9	—	1.0	
April.	1015	—	56	66	46	79	37	97	31	71	6.6	4.4	16	2.3	4	15	17	1	2	1	3	7	54	—	2	5	0	—	1.1	
May.	1014	—	60	71	50	87	40	103	37	69	6.2	3.1	14	2.8	3	7	22	4	8	3	3	12	41	—	1	5	0	—	1.6	
June.	1015	—	66	77	55	92	47	102	42	69	6.2	3.3	12	3.4	3	18	31	0	3	0	4	4	40	—	0.5	6	0	—	2.8	
July.	1017	—	69	80	59	96	50	111	46	69	5.5	2.5	10	3.4	3	12	47	1	0	0	2	4	34	—	0.7	5	0	—	2.2	
August.	1018	—	70	82	59	98	51	108	47	70	5.2	2.2	11	4.8	3	10	50	1	2	0	2	6	29	—	0.5	4	0	—	1.9	
September.	1017	—	67	78	57	94	46	109	41	70	5.3	3.5	12	4.3	3	7	20	3	6	3	5	19	37	—	0.6	4	0	—	1.7	
October.	1016	—	60	70	51	83	40	101	31	74	6.0	5.5	16	2.3	3	12	20	4	5	2	2	18	37	—	2	3	0	—	0.9	
November.	1017	—	53	61	46	73	33	82	20	78	6.5	5.6	15	2.2	3	10	12	7	15	7	3	12	34	—	4	5	0.2	—	1.2	
December.	1018	—	48	55	41	67	30	77	18	78	6.6	5.6	15	3.3	3	13	5	3	15	5	19	14	26	—	4	4	0.9	—	0.9	
Means	1017	—	58	68	49	101||	25||	—	—	72	6.1	—	—	—	3	12	21	2	9	4	6	11	35	—	—	—	—	4.6	16.3	
Totals	—	—	—	—	—	—	—	—	—	—	—	48.3	164	—	—	—	—	—	—	—	—	—	—	—	—	27	50	—	—	—
Extreme values	—	—	—	—	—	—	—	111	18	—	—	—	—	4.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	35	—	35	35	35	35	35	50	50	—	35	35	—	40	35	—	—	—	—	10	—	—	—	—	25	42	—	—	—	—

* $\frac{1}{2}$ (maximum + minimum).

† Probably mean of day. Hours of observation 8 h., 16 h.

‡ Day with trace (0.1 mm.) or more rain.

§ Maximum fall during the 24 hours from one morning observation to the next. || Mean of highest each year and lowest each year.

Region: GALICIA

Station 2. CORUNNA

Lat. 43° 23' N., Long. 8° 23' W. Height 82 ft.

Compiled from observations, 1861-1920

Month	Pressure at mean sea-level		Air temperature								Rain			Wind	No. of days											
	Mean		Mean daily		Mean monthly		Extreme		Average	No. of days†	Max. fall in 24 hrs. s	Mean velocity knots	Percentage of observations, from													
	For month	Daily amplitude	Max.	Min.	Max.	Min.	Max.	Min.					N.		NE.	E.	SE.	S.	SW.	W.	NW.	Calm				
January	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	in.	in.	—	7	19	13	6	16	13	19	7	—	3	7	0.1	—	0.9
February	1020	—	49	55	42	63	32	68	22	81	6.8	3.2	13	18	7	7	11	14	14	11	—	4	6	0.0	—	0.5
March	1018	—	50	57	42	65	33	77	25	80	6.6	3.1	11	16	26	3	10	16	16	10	—	3	6	0.2	—	0.7
April	1016	—	51	58	44	68	35	77	28	79	6.6	3.2	13	17	37	2	7	7	13	17	—	3	5	0	—	0.8
May	1016	—	53	60	47	72	39	81	34	79	6.5	2.5	12	13	26	3	0	10	26	12	—	2	6	0	—	1.1
June	1016	—	57	64	51	77	43	95	38	79	6.2	2.2	9	13	40	3	0	3	7	23	11	2	8	0	—	1.0
July	1018	—	61	68	55	81	48	97	42	81	5.7	1.4	7	20	32	6	0	6	10	16	10	1	9	0	—	0.9
August	1019	—	64	71	57	82	51	95	46	81	5.1	0.9	5	1.7	16	28	6	3	10	23	11	1	10	0	—	0.7
September	1018	—	65	72	57	83	50	94	46	81	5.0	1.2	6	1.6	13	30	13	0	10	7	20	1	9	0	—	1.3
October	1018	—	63	70	55	81	47	92	39	82	5.5	2.2	8	2.2	19	16	6	4	16	10	19	2	6	0	—	0.3
November	1016	—	58	65	51	75	42	90	36	81	6.4	3.5	13	2.2	12	29	5	3	19	2	23	2	6	0.1	—	0.4
December	1017	—	53	60	46	69	35	83	28	81	6.7	4.2	13	2.2	9	17	6	3	13	32	7	4	6	0.0	—	0.3
December	1019	—	51	57	45	64	34	69	29	82	6.8	4.4	15	2.2	15	27	6	2	10	20	10	—	—	—	—	—
Means	1018	—	56	63	49	87	30	—	—	81	6.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Totals	—	—	—	—	—	—	—	—	—	—	—	32.0	125	—	—	—	—	—	—	—	—	28	84	0.4	—	8.9
Extreme values	—	—	—	—	—	—	—	97	22	—	—	—	—	3.2	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	40	—	34	40	34	30	24	40	34	40	35	60	55	40	—	—	—	—	—	—	—	—	40	40	—	—

* $\frac{1}{2}$ (max. + min.). Hours of observation 0800 and 1600.

† Day with trace or more rain.

§ Maximum fall during the 24 hours from one morning observation to the next.

† Mean of highest each year and lowest each year.
‡ Probably mean of day.

Region: GALICIA
Station 3. PONTEVEDRA
 Lat. 42° 26' N., Long. 8° 39' W. Height 79 ft.
 Compiled from observations, 1861-1920

Month	Pressure at mean sea-level		Air temperature										Relative humidity		Rain			Wind								No. of days gales	No. of days fogs
	Mean		Mean daily		Mean monthly		Extreme		Relative humidity		No. of days		Max. fall		Mean velocity		Percentage of observations, from										
	For month	Daily amplitude	Max.		Min.		Max.		Min.		Average fall	in 24 hrs.	knots	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm					
			°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.													in.	in.			
January .	mb.	mb.	47	57	38	29	69	20	°F.	82	6.3	14	3.7	—	26	10	3	13	26	6	6	10	—	1	1		
February .	1022	—	49	59	40	31	77	25	°F.	78	5.9	13	2.4	—	32	14	4	11	21	7	4	7	—	0.8	0.8		
March .	1020	—	52	62	41	34	88	22	°F.	75	6.4	16	3.4	—	28	17	0	6	17	10	6	16	—	1	0.4		
April .	1017	—	55	66	45	37	88	27	°F.	69	6.5	13	2.5	—	42	17	0	3	8	12	6	12	—	0.6	0.1		
May .	1017	—	60	72	49	40	95	36	°F.	67	5.3	13	2.5	—	30	10	0	3	26	10	6	15	—	0.9	0.4		
June .	1018	—	65	76	54	47	99	41	°F.	68	5.0	9	2.3	—	44	17	0	3	10	3	3	20	—	0.5	0.7		
July .	1019	—	68	80	56	49	104	38	°F.	68	4.8	7	2.0	—	36	19	0	0	16	13	6	10	—	0.9	1		
August .	1018	—	68	80	56	48	100	44	°F.	70	4.0	7	2.6	—	49	14	0	3	19	6	3	6	—	0.3	2		
September .	1018	—	66	78	54	45	101	37	°F.	74	5.5	10	2.7	—	40	20	3	0	17	10	3	7	—	0.4	1		
October .	1018	—	58	69	48	39	89	31	°F.	79	5.6	15	3.5	—	39	23	3	6	13	3	3	10	—	0.5	1		
November .	1018	—	52	63	41	33	78	23	°F.	84	6.6	15	2.9	—	27	26	0	7	13	3	7	17	—	0.3	0.8		
December .	1020	—	49	58	39	30	69	24	°F.	84	5.9	17	3.1	—	23	23	3	3	26	6	3	13	—	1	1		
Means .	1018	—	58	68	47	27	—	—	°F.	75	5.6	—	—	—	35	17	1	5	18	7	5	12	—	—	—		
Totals .	—	—	—	—	—	—	—	—	°F.	—	59.1	149	—	—	—	—	—	—	—	—	—	—	—	8	10		
Extreme values	—	—	—	—	—	—	104	20	°F.	—	—	—	3.7	—	—	—	—	—	—	—	—	—	—	—	—	—	
No. of years' observations	33	—	33	33	33	23	33	33	°F.	8	60	33	—	—	—	—	—	—	—	—	—	—	—	—	—	33	

* $\frac{1}{2}$ (max. + min.). Hours of observation 0800 and 1600.

† Day with trace or more rain.

‡ Maximum fall during 24 hours from one morning observation to the next.

§ Mean of highest each year and lowest each year.

|| Probably mean of day.

Region: PORTUGUESE COASTAL LANDS

Station 4. OPORTO

Lat. 41° 9' N., Long. 8° 28' W. Height 328 ft.

Month	Air temperature				Relative humidity	Cloud amount Scale 0 to 10	Rain		No. of days				Wind									
	Average	Mean monthly		Abs. yearly			Average fall	No. of days	Snow	Hail	Frost	Thunder	Percentage of observations, from									
		° F.	Min.	Max.									° F.	Min.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
January	49	63	—	—	78	5	in.	0.3	0.6	1.7	0.5	7	6	13	19	16	16	10	13			
February	50	66	—	—	75	5	5.0	0.4	0.6	0.2	0.2	11	7	14	18	11	14	14	11			
March	52	71	—	—	71	5	5.0	1.1	0.7	0.1	0.5	19	13	11	6	6	16	10	19			
April	57	76	—	—	73	5	5.0	0.4	0.4	0	0.8	13	3	11	10	7	13	20	23			
May	61	82	—	—	72	5	3.5	0	0.5	0	1.4	10	3	4	3	6	23	32	19			
June	67	88	—	—	71	5	1.6	0	0	0	1.0	20	7	7	6	3	10	30	17			
July	68	91	—	—	72	4	0.9	0	0	0	0.8	13	4	6	0	3	16	29	19			
August	69	91	—	—	71	3	0.8	0	0	0	0.5	16	6	6	4	4	16	29	19			
September	66	87	—	—	71	5	2.8	0	0	0	1.4	10	3	10	7	6	20	27	17			
October	61	78	—	—	74	5	5.0	0	0	0	1.2	16	6	10	10	13	16	16	13			
November	54	69	—	—	77	6	6.5	0	0.3	0.1	0.6	10	3	20	23	10	17	10	7			
December	48	63	—	—	76	6	5.0	0.4	0.5	0.7	0.8	10	6	20	26	13	13	6	6			
Means	59	—	—	—	73	5	46.5	—	—	—	—	—	—	—	—	—	—	—	—			
Totals	—	—	—	—	—	—	78.5	2.6	3.6	2.8	9.7	—	—	—	—	—	—	—	—			
Extreme values	—	93	101	24	—	—	31.0	—	—	—	—	—	—	—	—	—	—	—	—			
No. of years' observations	38				30				6													

Region: PORTUGUESE COASTAL LANDS

Station 5. LISBON

Lat. 38° 43' N., Long. 9° 09' W. Height 321 ft.

Month	Pressure at mean sea-level		Air temperature								Relative humidity Scale 0 to 10	Rain		Mean velocity knots	Wind									No. of days											
	Mean		Mean daily		Mean monthly		Extreme		Average*	No. of days		Max. fall in 24 hrs.	Percentage of observations, from									Gales§	Fogs	Snow	Hail	Thunder									
	For month*	Daily amplitude	Max.	Min.	Max.	Min.	Max.	Min.					N.		NE.	E.	SE.	S.	SW.	W.	NW.						Calm								
January .	mb. 1022	mb. —	° F. 51	° F. 56	° F. 46	° F. 61	° F. 37	° F. 66	° F. 30	79	5.3	in. 3.3	13	3.2	in. —	33	20	4	3	7	11	9	12	1	0.4	0.1	0	0	0.6						
February .	1020	—	52	58	47	64	40	73	29	75	5.2	3.2	12	2.0	—	30	16	4	3	8	14	10	14	1	0.5	3	0	0	0.6						
March .	1017	—	55	61	49	70	42	83	34	72	5.2	2.4	13	2.4	—	30	13	4	3	7	14	11	17	1	0.4	2	0	0	0.9						
April .	1016	—	58	64	52	75	46	87	40	70	5.0	2.4	11	2.1	—	27	9	2	2	6	15	14	24	1	0.2	0.7	0	0	1.1						
May .	1016	—	62	69	56	83	50	94	42	68	4.5	1.7	9	1.7	—	29	7	2	1	7	16	12	25	1	0	0.3	0	0	0.6						
June .	1018	—	67	75	60	90	55	99	49	65	3.5	0.7	5	1.4	—	34	5	1	1	5	14	11	28	1	0	0.3	0	0	0.4						
July .	1018	—	70	79	63	93	58	103	52	62	2.1	0.2	2	1.5	—	41	5	1	1	3	11	9	28	1	0.2	0.3	0	0	0						
August .	1017	—	71	80	64	94	59	100	55	61	2.0	0.2	2	1.8	—	42	6	1	1	3	11	8	27	1	0	0.5	0	0	0.2						
September	1017	—	68	76	62	89	57	99	51	66	3.7	1.4	7	3.0	—	32	9	2	2	7	16	10	21	1	0.1	1	0	0	0.9						
October .	1017	—	63	69	57	79	50	89	43	72	4.8	3.1	11	2.2	—	30	12	3	3	9	16	9	16	2	0.2	2	0	0	0.6						
November	1018	—	56	62	52	69	43	77	14	77	5.3	4.2	13	3.6	—	30	18	4	3	8	12	9	14	2	0.2	4	0	0	0.6						
December	1021	—	52	57	47	66	38	66	31	79	5.4	3.6	13	4.4	—	33	20	4	3	7	12	8	12	1	0.4	5	0	0	0.5						
Means .	1018	—	60	67	55	—	—	—	—	71	4.4	—	—	—	—	33	12	3	2	6	13	10	20	1	—	—	—	—	—						
Totals .	—	—	—	—	—	—	—	—	—	—	—	27.1	111	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—						
Extreme values	—	—	—	—	—	—	—	103	29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—						
No. of years' observations .	75	—	75						65	75												69	75	—	—	—	—	—	—	—	—	—	—	—	—

* Mean of 24 hours. Hours of observation 0900, 1500, 1800, 2100.

† Day with trace or more rain.

§ Maximum fall during the 24 hours from one morning observation to the next.

† Wind velocity 32 knots or over.

Region: PLAIN OF ANDALUSIA

Station 6. CÁDIZ

Lat. $36^{\circ} 31' N.$, Long. $6^{\circ} 17' W.$ Height 46 ft.
Compiled from observations, 1881-96; 1911-17

Month	Pressure at mean sea- level		Air temperature										Relative humidity	Cloud amount		Rain			Wind Percentage of observations, from	No. of days gales	No. of days fogs						
	Mean		Mean daily		Mean monthly		Extreme		Scale 0 to 10†	Aver- age of fall	No. of days†	Max. fall in 24 hrs.‡	Mean velocity knots	N.	NE.	E.	SE.	S.				SW.	W.	NW.	Calm		
	For month	Daily ampli- tude	Max.	Min.	Max.	Min.	Max.	Min.																			
																										Average*	° F.
January .	mb.	—	mb.	—	° F.	60	48	° F.	67	39	° F.	76	29	%	4.0	9	in.	3.8	—	—	—	—	—	—	0.5	1	
February .	—	1021	—	—	° F.	54	60	° F.	67	39	° F.	76	29	75	4.0	9	in.	3.8	—	—	—	—	—	—	0.5	0.8	
March .	—	1020	—	—	° F.	52	62	° F.	69	42	° F.	74	34	73	4.2	9	in.	1.9	—	—	—	—	—	—	1	1	
April .	—	1017	—	—	° F.	58	64	° F.	72	44	° F.	81	36	72	4.8	10	in.	2.6	—	—	—	—	—	—	0.4	0.3	
May .	—	1016	—	—	° F.	61	67	° F.	77	48	° F.	88	41	71	4.1	8	in.	1.8	—	—	—	—	—	—	0.6	0.3	
June .	—	1016	—	—	° F.	66	72	° F.	84	53	° F.	89	50	68	3.1	5	in.	2.2	—	—	—	—	—	—	0.4	0.5	
July .	—	1017	—	—	° F.	71	77	° F.	88	59	° F.	99	55	65	1.9	2	in.	0.7	—	—	—	—	—	—	0.5	1	
August .	—	1017	—	—	° F.	75	81	° F.	91	64	° F.	101	59	66	1.1	0.4	in.	0.3	—	—	—	—	—	—	0.6	0.3	
September .	—	1016	—	—	° F.	76	83	° F.	92	64	° F.	103	61	64	1.3	0.2	in.	1.2	—	—	—	—	—	—	0.5	1	
October .	—	1017	—	—	° F.	73	80	° F.	89	60	° F.	96	55	69	2.9	3	in.	2.3	—	—	—	—	—	—	0.2	0.5	
November .	—	1017	—	—	° F.	67	73	° F.	82	52	° F.	89	44	71	3.9	7	in.	3.7	—	—	—	—	—	—	0.5	1	
December .	—	1019	—	—	° F.	61	67	° F.	75	46	° F.	81	35	74	3.7	7	in.	2.2	—	—	—	—	—	—	0.5	1	
Means .	—	1021	—	—	° F.	55	61	° F.	68	41	° F.	75	36	76	4.1	9	in.	3.6	—	—	—	—	—	—	0.5	2	
Totals .	—	1018	—	—	° F.	64	71	° F.	94||	37||	° F.	—	—	70	3.3	—	in.	—	—	—	—	—	—	—	—	—	
Extreme values	—	—	—	—	—	—	—	—	—	—	—	103	29	—	—	70	23.9	3.8	—	—	—	—	—	—	6	10	
No. of years' observations.	35	—	22										16	16	23			—	—	—	—	—	—	—	—	13	21

* ‡ (max. + min.). Hours of observation 0900, 1500.

† Day with trace or more rain.

|| Mean of highest each year and lowest each year.

† Probably mean of day.

§ Maximum fall during the 24 hours from one morning observation to the next.

Region: STRAIT OF GIBRALTAR

Station 7. GIBRALTAR

Lat. 36° 06' N., Long. 5° 21' W. Height 90 ft.

Compiled from observations, 1852-1932

Month	Pressure at mean sea- level		Air temperature								Relative humidity	Rain			Wind										No. of days gales	No. of days fogs
	Mean		Mean daily		Mean monthly		Extreme		Average†	Scale 0 to 10	Aver- age fall	No. of days ‡	Max. fall in 24 hrs. §	Mean velocity knots	Percentage of observations, from											
	For month*	mb.	Max.	Min.	Max.	Min.	Max.	Min.							N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm			
January .	1021	—	55	61	49	67	42	75	33	°F.	4.7	4.6	10	in.	7.8	1	2	28	7	1	7	25	24	5	1	0.2
February .	1020	—	56	62	50	69	43	81	33	°F.	5.0	4.5	11	4.3	—	1	2	28	10	1	8	26	20	4	1	0.1
March .	1017	—	57	64	51	71	45	78	37	°F.	5.2	4.7	12	7.8	—	1	1	27	8	2	11	29	18	3	1	0.3
April .	1016	—	60	68	54	76	48	87	43	°F.	4.1	2.7	9	6.5	—	1	2	22	9	2	12	28	20	4	0.3	0.1
May .	1016	—	65	73	58	81	52	90	45	°F.	3.7	1.6	6	2.2	—	0	1	27	8	3	12	30	14	5	0.2	0.1
June .	1017	—	69	78	63	87	57	97	49	°F.	3.0	0.5	2	2.1	—	0	2	31	11	3	14	22	13	4	0.1	0.1
July .	1017	—	73	83	67	90	62	100	55	°F.	2.4	0.0	0.4	0.4	—	0	2	37	9	3	11	21	11	6	0	0.5
August .	1017	—	75	84	69	91	63	100	57	°F.	2.9	0.1	0.8	1.7	—	0	2	41	9	3	11	19	9	6	0	0.4
September .	1017	—	72	79	66	87	59	95	50	°F.	4.1	1.3	4	5.7	—	0	1	43	7	2	10	21	8	8	0.1	0.2
October .	1017	—	66	73	60	81	52	95	44	°F.	4.6	3.3	8	5.4	—	1	2	34	7	2	12	21	14	7	0.2	0.3
November .	1018	—	60	66	54	73	47	79	35	°F.	5.0	6.4	11	6.5	—	1	1	29	6	1	10	27	19	6	1	0.2
December .	1020	—	56	62	50	61	42	77	30	°F.	4.6	5.4	11	6.9	—	2	2	24	6	1	9	26	24	6	1	0.1
Means .	1018	—	64	71	58	93||	32||	—	—	°F.	4.1	—	—	—	—	1	2	31	8	2	11	24	16	5	—	—
Totals .	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Extreme values	—	—	—	—	—	—	—	100	30	—	—	35.1	85	—	—	—	—	—	—	—	—	—	—	—	6	—
No. of years' observations	76	—	78	98	98	98	98	98	98	24.5	24.5	79	79	77	—	—	—	—	—	—	—	—	—	—	45	51

* Reduced to mean of 24 hours.

† Day with 0.1 in. or more rain.

|| Maximum fall during the 24 hours from one morning observation to the next.

‡ † (0700 + 1300 + 2 × 2100). Hours of observation 0700, 1300, 2100.

§ Mean of highest each year and lowest each year.

Region: LEVANTINE LOWLANDS

Station 8. CARTAGENA

Lat. 37° 36' N., Long. 0° 47' W. Height 43 ft.

Compiled from observations, 1870-1900

Month	Pressure at mean sea-level			Air temperature				Relative humidity	Cloud amount Scale 0 to 10	Rain			Wind †								No. of days with gale	No. of days with fog	
	Extreme		Mean (of)	Extreme		Average	No. of days*			Max. fall in 24 hrs. †	Percentage of observations, from												
	Mean for month	Max.		Min.	Highest recorded						Lowest recorded	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm			
January	mb.	mb.	mb.	°F.	°F.	°F.	°F.	°F.	in.	5	in.	32	10	—	—	3	6	26	13	10	—	0.5	1.2
February	1019	1045	987	52	59	43	80	28	1.8	5	2.8	22	14	—	—	4	4	36	14	7	—	0.3	2.0
March	1018	1039	991	54	61	45	84	31	1.4	4	2.5	23	16	6	—	6	6	29	6	6	—	0.4	1.0
April	1016	1033	990	56	63	47	83	31	1.6	6	1.6	13	3	3	3	3	13	40	13	10	—	0.3	0.3
May	1014	1028	988	62	67	52	95	39	1.1	4	2.0	13	3	3	3	3	16	26	3	10	—	0.3	0.3
June	1014	1028	996	65	71	56	96	41	1.0	3	2.7	13	23	6	3	3	10	27	3	7	—	0.2	0.2
July	1016	1025	1003	72	78	62	99	51	.8	2	3.3	10	27	7	10	10	27	3	7	—	0.2	0.2	
August	1016	1026	998	77	83	68	104	57	.1	1	.4	3	39	16	6	10	23	—	3	—	0.3	—	
September	1016	1027	1002	78	84	68	104	57	.2	1	.9	10	23	16	13	19	19	—	—	—	0.2	0.2	
October	1017	1029	1002	74	80	65	101	48	1.4	3	4.2	17	33	20	3	7	13	3	3	—	0.3	0.2	
November	1016	1031	993	67	73	58	94	40	1.7	4	3.8	26	23	6	6	3	29	3	3	—	0.3	0.3	
December	1017	1034	995	60	66	51	85	32	1.9	5	2.7	27	20	3	3	3	30	7	7	—	0.3	0.5	
	1019	1035	995	53	61	44	79	30	2.0	5	2.6	32	19	3	—	3	32	6	6	3	—	0.4	0.8
Means	1016	—	—	64	71	55	—	—	—	—	—	19	21	7	5	8	27	6	6	—	—	—	—
Totals	—	—	—	—	—	—	—	—	15.0	43	—	—	—	—	—	—	—	—	—	—	—	7	7
Extreme values	—	1045	987	—	—	—	104	28	—	—	4.17	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	31	24		31	20		24		20		1877-80								24				

* Day with 0.1 mm. or more rain.

† Maximum fall during the 24 hours from one morning observation to the next.

‡ The times of observation of wind are not known, but are probably 0900, 1500 G.M.T.

Region: LEVANTINE LOWLANDS

Station 9. VALENCIA

Lat. $39^{\circ} 28' N.$, Long. $0^{\circ} 30' W.$ Height 59 ft.

Month	Air temperature					Relative humidity	Cloud amount Scale 0 to 10	Rain	
	Average	Mean monthly		Absolute yearly				Average fall	No. of days
		Max.	Min.	Max.	Min.				
January	° F. 50	° F. 69	° F. 30	° F. —	° F. —	69	4	in. 1.3	6
February	52	73	34	—	—	68	4	1.6	5
March	55	77	36	—	—	66	4	1.7	5
April	59	81	41	—	—	65	3	1.2	4
May	64	84	46	—	—	66	2	1.4	5
June	70	90	53	—	—	64	3	0.8	3
July	75	95	59	—	—	64	4	0.5	3
August	77	94	59	—	—	65	4	0.4	3
September	72	90	54	—	—	67	4	3.5	5
October	65	85	44	—	—	67	4	2.6	6
November	58	76	38	—	—	69	4	2.2	5
December.	51	70	34	—	—	70	4	1.7	6
Means	62	—	—	—	—	67	4	—	—
Totals	—	—	—	—	—	—	—	18.9	56
Extreme values	—	98	28	109	18	—	—	(28.0) (7.0)	—
No. of years' observations	20					30			

Region: COASTAL ZONE OF CATALONIA

Station 10. BARCELONA

Lat. 41° 23' N., Long. 2° 08' E. Height 136 ft.

Compiled from observations, 1851-1925

Month	Pressure at mean sea-level, reduced to 32° F. and Lat. 45°		Air temperature										Relative humidity Scale 0 to 10*	Rain			Wind									No. of days of			
	Mean		Mean (of)		Mean (of)		Extreme		Percentage of observations, from						No. of days of	Gales§	Fogs	Snow	Thunder										
	For month	Daily ampli- tude	Daily max.		Daily min.		Lowest in each month		Highest in each month		N.	NE.		E.						SE.	S.	SW.	W.	NW.	Calm				
			°F.	°F.	°F.	°F.	°F.	°F.	in.	No. of days†																Max. fall in 24 hrs.†			
January .	mb.	—	47	55	40	63	31	15	70	5	2.3	in.	5	—	15	9	2	1	2	9	21	30	11	1	5	1.6	0.0		
February .	1017	—	49	57	42	65	35	25	69	4.5	2.0	1.4	5	—	10	10	7	1	6	16	23	14	13	2	3	0.3	0.1		
March .	1016	—	51	60	44	69	37	25	69	5	1.9	1.5	5	—	9	10	7	2	6	20	23	13	10	2	2	0.5	0.5		
April .	1013	—	56	64	48	73	42	29	69	5	2.0	1.8	6	—	8	17	11	2	9	16	16	11	10	2	1	0	1.0		
May .	1013	—	62	70	54	79	48	39	68	5	2.6	1.9	8	—	4	17	10	3	13	15	12	7	19	0.8	0.9	0	1.9		
June .	1015	—	69	78	60	85	54	46	67	4.5	2.0	1.6	7	—	4	14	8	2	16	17	11	7	21	1	0.7	0	1.3		
July .	1015	—	74	82	65	90	60	48	66	3	3.9	1.4	6	—	2	12	9	3	19	19	14	6	16	1	0.8	0	2.2		
August .	1015	—	75	83	62	89	61	48	68	4.5	2.7	1.0	3	—	3	10	9	4	17	19	10	4	24	0.4	0.8	0	3.1		
September .	1015	—	69	78	62	85	54	41	70	4	4.5	1.4	4	—	6	13	10	3	12	17	13	8	18	0.2	1	0	3.6		
October .	1014	—	62	71	54	78	46	33	70	5	5.3	3.0	8	—	9	11	8	3	8	13	22	14	12	0.9	2	0	1.8		
November .	1014	—	54	62	48	70	39	23	71	5.5	2.8	3.2	6	—	15	15	7	1	2	10	21	21	8	2	3	0.1	0.9		
December .	1016	—	49	57	43	65	34	25	70	4.5	2.8	1.7	5	—	17	7	1	1	3	11	28	27	5	1.5	4	0.6	0.1		
Means .	1015	—	60	68	52	91||	29||	—	69	4.5	—	—	—	—	9	12	7	2	9	15	18	14	14	—	—	—	—		
Totals .	—	—	—	—	—	—	—	—	—	—	—	21.8	70	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
Extreme values .	—	—	—	—	—	—	—	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
No. of years' observations .	67	—	70	39-40	55	55	55	15	—	—	—	65	49-50	—	—	—	—	—	—	—	—	—	—	16-17	49-50	—	—		

Hours of observation, 0800 and 1600.

† Maximum fall during the 24 hours from one morning observation to the next.

|| Mean of highest each year and lowest each year.

* Interpolated from Cloud Charts.

† Day with trace or more rain.

‡ 29 knots or over.

Region: BALEARIC ISLANDS (MAJORCA)

Station 11. PALMA

Lat. 39° 34' N., Long. 2° 37' E. Height 75 ft.

Compiled from observations, 1865-1921

Month	Pressure at mean sea-level, reduced to 32° F. and Lat. 45°		Air temperature								Relative humidity	Cloud amount Scale 0 to 10	Rain		Wind								No. of days with gale†	No. of days with fog			
	Mean		Mean (of)		Mean (of)		Extreme		Average	No. of days			Max. fall in 24 hrs. †	Percentage of observations, from													
	For month	Daily amplitude	Average*	Daily max.	Daily min.	Highest in each month	Lowest in each month	Highest recorded			Lowest recorded	N.		NE.	E.	SE.	S.	SW.	W.	NW.	Calm						
January	mb.	mb.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	%	4.5	in.	8	in.	2.2	16	15	3	3	5	23	11	21	3	0	0.7	
February	1019	—	51	58	44	64	37	72	26	75	4.5	1.6	7	2.2	2.2	12	14	3	5	13	27	11	13	1	0	0.8	
March	1015	—	53	60	45	66	38	74	28	74	4.2	1.4	7	1.3	2.4	8	18	4	5	17	30	7	10	0	0.1	1	
April	1015	—	55	63	48	71	39	82	31	72	4.4	1.5	7	2.4	1.7	6	13	6	4	19	33	7	12	0	0.1	0.5	
May	1016	—	59	67	51	76	44	83	36	71	3.9	1.4	7	1.7	2.2	4	12	7	5	22	39	4	5	2	0	0.4	
June	1017	—	65	73	56	82	49	92	43	70	3.2	1.6	6	2.2	2.1	2	11	6	3	26	48	1	3	0	0	0.2	
July	1018	—	72	80	63	89	57	100	50	70	2.2	0.7	3	2.1	1.2	2	11	6	3	29	45	1	3	0	0	0.1	
August	1018	—	77	86	68	94	63	102	54	69	1.5	0.4	1.5	1.2	4.6	3	8	5	4	35	41	2	2	0	0	0	
September	1018	—	78	86	69	94	64	101	56	71	1.9	0.7	2	2.5	2.5	7	14	5	1	20	41	4	5	3	0	0	
October	1018	—	74	81	65	90	58	98	52	74	3.2	2.0	6	2.4	2.4	10	16	7	1	12	30	6	15	3	0.1	0.1	
November	1017	—	66	74	59	82	50	94	40	75	4.3	3.1	9	2.4	2.2	19	12	2	3	4	21	15	20	4	0.4	0.4	
December	1017	—	58	66	52	73	44	83	39	76	4.7	2.2	9	2.2	2.1	23	13	2	4	4	18	13	21	2	0.3	0.7	
December	1018	—	53	60	47	67	39	79	27	76	4.5	2.2	8	2.1	2.1	23	13	2	4	4	18	13	21	2	0.3	0.7	
Means	1017	—	63	71	56	95	35	—	—	73	3.5	—	—	—	—	9	13	5	3	17	33	7	11	2	—	—	
Totals	—	—	—	—	—	—	—	—	—	—	—	18.8	73	—	—	—	—	—	—	—	—	—	—	—	—	1.4	5
Extreme values	—	—	—	—	—	—	—	102	26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	56	—	56	—	—	—	—	42	—	—	35	56	42	36	—	—	—	—	—	—	—	—	—	—	—	14	39
																										16	41

Hours of observation, 0800 and 1600.

* $\frac{1}{2}$ (max. + min.).

† Maximum fall during the 24 hours from one morning observation to the next.

§ Mean of highest each year and lowest each year.

† Wind 29 knots or over.

Region: BALEARIC ISLANDS (MINORCA)

Station 12. MAHÓN

Lat. 39° 53' N., Long. 4° 21' E. Height 141 ft.

Compiled from observations, 1851-1917, 1926-32

Month	Pres- sure at mean sea- level	Air temperature								Relative humidity	Cloud amount Scale 0 to 10	Rain			Mean velocity§ knots	Wind								No. of days with fog	No. of days with gale||			
		Mean (of)				Extreme						Average fall mm.	No. of days†	Max. fall in 24 hrs.† mm.		Percentage of observations, from												
		Daily		in each month		in each month		recorded								N.	NE.	E.	SE.	S.	SW.	W.	NW.			Calm		
		max.	min.	Highest	Lowest	Highest	Lowest	° F.	° F.																		° F.	° F.
January .	mb.	50	55	46	63	36	71	28	77	4.4	61	9	69	8	29	6	1	4	4	6	10	11	18	15	4	0.7		
February .	1017	51	56	46	64	37	71	30	75	3.8	44	7	51	8	26	10	4	6	5	13	9	16	10	4	4	1		
March .	1013	53	59	48	68	39	75	33	73	3.7	54	8	81	8	17	10	8	8	6	19	9	14	9	3	3	1		
April .	1013	57	63	51	73	43	79	37	70	3.2	49	6	57	7	19	10	4	12	11	20	7	8	9	2	2	1		
May .	1014	62	69	56	79	48	90	42	68	2.9	36	7	65	6	19	12	5	13	13	20	5	7	7	1	1	2		
June .	1016	69	76	63	86	56	95	51	64	2.0	24	4	65	5	21	15	8	14	12	17	4	3	6	1	0.6	0.6		
July .	1017	75	81	68	90	61	97	56	61	1.3	14	2	86	5	21	19	8	14	11	11	3	3	8	0.7	1	0.6		
August .	1016	76	82	69	91	63	97	57	63	1.6	15	3	40	5	23	18	6	18	11	9	2	4	10	0.5	0.5	0.3		
September .	1016	72	77	66	86	58	93	50	67	3.1	55	5	125	6	23	14	8	10	12	11	3	6	12	1	0.4	0.4		
October .	1015	65	71	60	80	51	86	43	72	3.9	104	10	100	6	23	10	4	8	11	13	7	11	12	3	0.5	0.5		
November .	1015	58	63	54	71	44	77	39	75	4.3	97	11	81	7	21	7	3	5	8	21	9	15	11	4	0.8	0.8		
December .	1016	53	58	49	64	40	69	31	76	4.4	76	9	54	7	29	8	3	4	7	14	10	15	9	2	0.3	0.3		
Means .	1015	62	67	56	93¶	34**	—	—	70	3.2	—	—	—	6	23	12	5	10	9	15	7	10	10	—	—	—		
Totals .	—	—	—	—	—	—	97	28	—	—	628	80	125	—	—	—	—	—	—	—	—	—	—	—	27	10	—	
Extreme values	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
No. of years' observations	66-7	31	30-1	29-31	30-1	30-1	30-1	30-1	21-4	20	52-3	22-5	30-1	13-15	1926-32	12-14	27-30	—	—	—	—	—	—	—	—	—	—	

* ‡ (max. + min.).

† Maximum fall during the 24 hours from one morning observation to the next.

‡ Wind speed exceeds 29 knots.

§ Mean of 24 hours.

¶ Mean of highest each year.

** Mean of lowest each year.

Region: PORTUGUESE CENTRAL RIDGE

Station 13. GUARDA

Lat. 40° 32' N., Long. 7° 14' W. Height 3,409 ft.

Month	Air temperature						Relative humidity	Cloud amount Scale 0 to 10	Rain		No. of days of			
	Mean monthly		Absolute yearly		Average fall in.	No. of days			Frost	Snow	Hail	Thunder		
	Average	Max.	Min.	Max.									Min.	
	° F.													° F.
January	37	51	24	—	—	9	9.0	5.4	0	0.3				
February	39	55	27	—	—	10	4.6	3.8	0.1	0.2				
March	42	59	27	—	—	12	5.9	4.4	0.1	0.8				
April	47	66	31	—	—	11	2.6	2.3	0	1.6				
May	52	73	36	—	—	11	0	0.4	0	4.0				
June	60	81	42	—	—	7	0	0.2	0.2	4.0				
July	66	86	48	—	—	3	0	0.1	0	2.2				
August	66	86	48	—	—	2	0	0	0	2.2				
September	61	81	43	—	—	8	0	0.1	0	3.5				
October	51	69	35	—	—	11	0.1	0.5	0	1.1				
November	43	59	29	—	—	12	1.7	2.1	0	0.3				
December	39	53	25	—	—	12	7.4	5.8	0	0.2				
Means	50	—	—	—	—	—	—	—	—	—				
Totals	—	—	—	—	—	106	31.3	25.1	0.4	20.4				
Extreme values	—	88	21	16	94	—	—	—	—	—				
No. of years' observations	38				30				—					

Region: NORTHERN TABLELAND

Station 14. BURGOS

Lat. 42° 20' N., Long. 3° 42' W. Height 2,822 ft.

Month	Air temperature					Relative humidity	Cloud amount Scale 0 to 10	Rain		No. of days of			
	Mean monthly		Absolute yearly		Average fall			No. of days	Frost	Snow	Hail	Thunder	
	Average	Max.	Min.	Max.									Min.
January	° F. 36	° F. 54	° F. 17	° F. —	° F. —	84	5	9	4.3	—	—	0	
February	40	60	21	—	—	78	6	8	3.0	—	—	0	
March	43	66	22	—	—	73	5	10	4.1	—	—	0.3	
April	48	74	27	—	—	68	5	12	1.9	—	—	0.9	
May	53	80	32	—	—	67	5	11	0.2	—	—	2.0	
June	60	89	38	—	—	65	4	8	0	—	—	3.3	
July	65	93	42	—	—	61	3	4	0	—	—	2.6	
August	66	92	42	—	—	60	3	4	0	—	—	2.0	
September	60	87	37	—	—	67	4	7	0	—	—	1.5	
October	51	73	29	—	—	77	5	10	0.4	—	—	0.4	
November	43	62	23	—	—	81	6	10	1.5	—	—	0.1	
December	37	53	18	—	—	85	7	9	3.3	—	—	0	
Means	50	—	—	—	—	72	5	—	—	—	—	—	
Totals	—	—	—	—	—	—	—	103	18.7	—	—	13.1	
Extreme values	—	95	12	101	-4	—	—	—	—	—	—	—	
No. of years' observations	35		30		30		30		—	—	—	—	

Region: SOUTHERN TABLELAND

Station 16. BADAJOZ

Lat. 38° 54' N., Long. 6° 59' W. Height 623 ft.

Month	Air temperature				Relative humidity	Cloud amount Scale 0 to 10	Rain		No. of days of				
	Average	Mean monthly		Absolute yearly			Average fall	No. of days	Snow	Frost	Hail	Thunder	
		Max.	Min.	Max.									Min.
January . . .	° F. 45	° F. 66	° F. 25	° F. —	81	5	in. 1.7	7	—	*	—	—	0
February . . .	50	70	30	—	78	5	2.0	7	—	0	—	—	0.5
March . . .	54	79	34	—	74	5	1.6	8	—	0	—	—	0.6
April . . .	59	86	39	—	72	5	1.5	8	—	0	—	—	0.9
May . . .	64	92	42	—	68	4	1.3	7	—	0	—	—	1.6
June . . .	72	102	49	—	63	3	0.6	3	—	0	—	—	2.8
July . . .	79	107	54	—	59	2	0.1	1	—	0	—	—	0.8
August . . .	79	108	52	—	59	2	0.2	1	—	0	—	—	0.5
September . . .	72	100	49	—	65	4	0.9	3	—	0	—	—	1.2
October . . .	63	88	38	—	72	5	1.7	6	—	0	—	—	0.9
November . . .	54	76	32	—	76	5	1.7	7	—	0	—	—	0.2
December . . .	46	65	27	—	81	5	1.8	7	—	0.3	—	—	0.1
Means . . .	62	—	—	—	71	4	—	—	—	—	—	—	—
Totals . . .	—	—	—	—	—	—	15.1	65	0.4	1.9	—	—	10.1
Extreme values	—	109	23	—	—	—	{ 24.0 5.0 }	—	—	—	—	—	—
No. of years' observations	{ 19				—	—	{ 30		—	—	—	—	—

* At Campo Major at 945 ft. above mean sea-level.

Region: EBRO TROUGH
Station 17. SARAGOSSA

Lat. 41° 38' N., Long. 0° 54' W. Height 673 ft.

Month	Air temperature				Relative humidity	Cloud amount Scale 0 to 10	Rain		No. of days of				
	Average	Mean monthly		Absolute yearly			Average fall	No. of days	Snow	Frost	Hail	Thunder	
		Max.	Min.	Max.									Min.
January .	° F. 42	° F. 62	° F. 21	° F. —	82	* 5	in. 0.7	5	0.7	—	—	0	
February .	47	68	27	—	76	4	0.8	4	0.7	—	—	0	
March .	51	75	29	—	74	4	0.9	6	0.1	—	—	0.1	
April .	56	83	36	—	72	4	1.1	7	0	—	—	0.4	
May .	64	90	42	—	71	4	1.5	8	0	—	—	0.9	
June .	70	93	48	—	68	3	1.1	5	0	—	—	0.9	
July .	76	104	54	—	69	2	0.6	4	0	—	—	1.6	
August .	75	102	53	—	68	2	0.6	4	0	—	—	1.3	
September .	69	95	46	—	73	3	0.9	5	0	—	—	0.5	
October .	58	82	37	—	77	4	1.3	7	0	—	—	0.1	
November .	49	70	27	—	82	4	1.2	6	0.1	—	—	0	
December .	42	61	24	—	83	5	0.8	5	0.5	—	—	0	
Means .	58	—	—	—	75	4	—	—	—	—	—	—	
Totals .	—	—	—	—	—	—	11.5	66	2.1	—	—	5.8	
Extreme values	—	105	18	5	—	—	(22.0) 9.0	—	—	—	—	—	
No. of years' observations	—	34	34	—	—	—	—	—	—	—	—	—	

* Figures for Huesca (altitude 1,654 ft.).

Region: IBERIC MOUNTAINS

Station 18. TERUEL

Lat. 40° 21' N., Long. 1° 8' W. Height 3,015 ft.

Month	Air temperature					Relative humidity	Cloud amount Scale 0 to 10	Rain		No. of days of			
	Average	Mean monthly		Absolute yearly				Average fall	No. of days	Snow	Frost	Hail	Thunder
		Max.	Min.	Max.	Min.								
January .	° F. 37	° F. 61	° F. 12	° F. —	° F. —	82	4	in. 0.7	4	3.3	—	—	0.1
February .	42	68	17	—	—	78	5	0.7	4	3.0	—	—	0.1
March .	44	74	19	—	—	76	5	1.0	6	2.9	—	—	0.3
April .	50	79	26	—	—	75	5	1.6	9	1.4	—	—	0.2
May .	57	86	32	—	—	77	5	2.2	8	0.1	—	—	4.0
June .	65	96	39	—	—	75	4	1.9	7	0	—	—	5.1
July .	72	100	44	—	—	73	3	1.0	3	0	—	—	5.1
August .	72	101	44	—	—	74	3	0.9	4	0	—	—	4.3
September .	64	93	39	—	—	77	4	1.5	5	0	—	—	3.7
October .	54	81	28	—	—	78	4	1.4	6	0.1	—	—	0.9
November .	45	69	21	—	—	82	5	1.3	5	0.6	—	—	0.1
December .	39	61	16	—	—	83	5	0.8	4	2.1	—	—	0.1
Means .	53	—	—	—	—	78	4	—	—	—	—	—	—
Totals .	—	—	—	—	—	—	—	15.0	65	13.5	—	—	24.0
Extreme values	—	101	9	111	5	—	—	—	—	—	—	—	—
No. of years' observations	—	20	20	20	20	—	—	30		—	—	—	—

Region: PLAIN OF ANDALUSIA

Station 19. SEVILLE

Lat. 37° 23' N., Long. 6° 1' W. Height 66 ft.

Table compiled from 20-30 years' observations

Month	Air temperature					Relative humidity	Cloud amount Scale 0 to 10	Rain		No. of days of				
	Mean monthly		Absolute yearly		Average fall			No. of days	Fog	Snow	Frost	Hail	Thunder	
	Average	Max.	Min.	Max.										Min.
January .	°F. 52	°F. 72	°F. 31	°F. —	°F. —	% 85	4	in. 2.3	—	—	—	—	0.1	
February .	56	77	36	—	—	82	4	2.1	—	—	—	—	1.1	
March .	60	82	39	—	—	78	4	2.6	—	—	—	—	1.0	
April .	65	88	43	—	—	74	4	1.7	—	—	—	—	0.9	
May .	70	97	49	—	—	69	3	1.6	—	—	—	—	2.4	
June .	75	108	54	—	—	63	2	0.6	—	—	—	—	1.8	
July .	84	113	60	—	—	57	1	0.0	—	—	—	—	0.1	
August .	85	114	61	—	—	58	1	0.1	—	—	—	—	0.4	
September .	79	107	55	—	—	66	2	0.7	—	—	—	—	1.3	
October .	69	95	46	—	—	75	4	2.1	—	—	—	—	1.1	
November .	60	81	39	—	—	82	4	2.9	—	—	—	—	0.5	
December .	52	71	33	—	—	85	4	2.7	—	—	—	—	0.1	
Means .	66	—	—	—	—	73	3	—	—	—	—	—	—	
Totals .	—	—	—	—	—	—	—	19.4	—	—	—	—	10.8	
Extreme values	—	116	30	122	22	—	—	—	—	—	—	—	—	
No. of years' observations	20					20		32		—				

Region: ANDALUSIAN MOUNTAINS

Station 20. GRANADA

Lat. 37° 47' N., Long. 3° 48' W. Height 2,261 ft.

JAÉN

Lat. 37° 11' N., Long. 3° 45' W. Height 1,887 ft.

Month	Air temperature*				Relative humidity	Cloud amount Scale 0 to 10	Rain		No. of days of				
	Average	Mean monthly		Absolute yearly			Average fall	No. of days	Snow	Frost	Hail	Thunder	
		Max.	Min.	Max.									Min.
January .	°F. 46	°F. 64	°F. 28	°F. —	86	4	in. 2.0	9	0.2	—	—	0.1	
February .	50	70	33	—	79	5	1.7	8	0.6	—	—	0.4	
March .	53	76	34	—	75	5	2.2	11	1.2	—	—	0.6	
April .	58	79	39	—	70	5	2.1	10	0.2	—	—	0.5	
May .	63	87	44	—	69	4	1.8	10	0.1	—	—	2.2	
June .	72	97	50	—	63	3	0.8	4	0	—	—	2.5	
July .	80	103	57	—	56	2	0.1	1	0	—	—	1.8	
August .	80	103	59	—	59	2	0.2	2	0	—	—	1.3	
September .	72	96	52	—	65	4	1.1	5	0	—	—	2.4	
October .	62	83	41	—	67	4	1.8	8	0.6	—	—	1.1	
November .	53	73	36	—	83	5	1.9	8	0	—	—	0.2	
December .	47	64	31	—	86	5	1.9	8	0.4	—	—	0.1	
Means .	61	—	—	—	72	4	—	—	—	—	—	—	
Totals .	—	—	—	—	—	—	17.6	84	3.3	—	—	13.2	
Extreme values	—	104	26	112	17	—	$\left. \begin{array}{l} 17.6 \\ 48.0 \\ 12.0 \end{array} \right\} +$	—	—	—	—	—	
No. of years' observations	30	20	20	20	20	—	$\left. \begin{array}{l} 17.6 \\ 48.0 \\ 12.0 \end{array} \right\} +$	30	—	—	—	—	

* Temperatures refer to Jaén: other statistics to Granada. In average monthly temperature Granada is about 2° F. colder than Jaén.

† Yearly totals.

SECTION II

SEASONAL WIND DIRECTION AND SPEED IN THE UPPER AIR AT ALMERÍA

Lat. $36^{\circ} 52'$ N., Long. $2^{\circ} 30'$ W. Height 56 ft.

Compiled from observations 1923-34. Times of observation, forenoon

Number of days per 100 on which particular winds may be expected

Height (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV						
WINTER (December-February)																																		
Surface	4	0.9	0.4	—	9	3	—	—	10	1	—	—	1	—	—	—	0.4	—	—	13	3	—	—	9	4	0.9	—	3	4	0.4	—	31	116	
1,500	5	0.9	0.4	—	8	6	—	—	9	3	—	—	2	—	—	—	4	—	—	7	4	0.4	—	8	6	2	—	8	1	0.4	—	25	112	
3,000	8	3	2	0.5	7	2	1	—	2	3	—	—	3	—	—	—	1	—	—	4	2	2	—	12	5	6	—	12	7	3	0.5	16	97	
6,000	3	7	5	—	3	7	0.7	—	5	7	—	—	0.7	0.7	—	—	—	—	—	0.7	3	2	—	11	9	7	—	8	10	7	—	4	76	
10,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
SPRING (March-May)																																		
Surface	8	1	0.2	—	10	2	—	—	8	2	—	—	4	—	—	—	—	—	—	6	4	0.5	0.5	10	5	0.5	0.5	5	1	0.2	—	28	203	
1,500	4	0.7	—	0.5	7	2	—	—	10	5	—	—	4	0.2	—	—	4	—	—	9	5	0.7	—	7	7	1	—	5	3	—	—	24	205	
3,000	3	3	0.5	—	3	0.3	0.5	—	3	3	0.5	—	3	0.5	—	—	5	0.8	—	10	5	0.5	—	11	13	2	0.8	7	6	1	0.8	15	188	
6,000	4	6	2	1	0.9	0.9	—	0.3	2	2	—	—	0.9	0.3	—	—	2	0.3	0.3	4	6	0.6	0.9	9	18	7	1	8	13	2	1	6	161	
10,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
SUMMER (June-August)																																		
Surface	11	1	—	—	20	5	—	—	13	3	—	—	0.5	—	—	—	0.5	0.5	—	5	5	—	—	3	3	—	—	1	—	—	—	26	100	
1,500	2	—	—	—	6	6	0.5	—	15	9	1	—	6	1	—	—	2	—	—	8	5	—	—	7	7	—	—	1	—	—	—	21	101	
3,000	2	0.5	—	—	2	2	—	—	6	6	—	—	8	4	—	—	11	1	—	12	8	1	2	9	8	2	2	3	2	—	—	10	93	
6,000	2	4	—	—	1	0.6	—	—	5	—	—	—	5	1	—	—	5	2	1	10	13	4	4	10	21	2	1	2	4	—	—	1	82	
10,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
AUTUMN (September-November)																																		
Surface	9	0.6	—	—	28	5	—	—	11	2	—	—	2	—	—	—	2	—	—	11	2	—	—	10	2	—	—	2	0.6	—	—	13	88	
1,500	2	2	—	—	13	4	0.6	1	19	6	0.6	—	6	—	—	—	6	0.6	—	9	3	1	—	6	8	1	—	2	1	—	—	9	86	
3,000	3	2	—	—	4	0.7	—	—	9	1	—	—	7	0.7	—	—	5	—	—	16	5	2	4	13	8	0.7	2	7	3	—	—	7	76	
6,000	3	4	0.8	—	2	2	—	—	2	2	—	—	6	—	—	—	6	3	—	10	9	2	2	18	7	2	0.8	11	7	0.8	—	—	62	

SECTION III

SEA IN RELATION TO WIND DIRECTION AT ALMERÍA, BARCELONA, AND MAHÓN

Period: Mar. 1930-Feb. 1935 (Barcelona, Nov. 1934). Times of observation 0700, 1800 G.M.T. (Barcelona 0700 G.M.T. only)
Number of days per season (90 days approx.) of sea calm or slight, moderate, and rough

Season	Sea	Almería										Barcelona										Mahón									
		N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.	Total	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.	Total	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.	Total
WINTER (Dec.- Feb.)	Calm or slight Moderate Rough . . .	19 2 0.7	14 0.6 0.4	4 0.8 0.2	3 — —	3 0.6 —	9 2 2	6 1 1	6 1 1	13 — 0.1	77 8 5	6 5 12	0.7 0.7 6	0.5 0.5 1	— 0.7 0.5	0.3 0.5 0.5	2 0.7 1	9 5 4	7 8 11	3 3 3	29 24 39	10 3 14	6 0.6 2	0.9 0.3 0.9	2 0.2 0.6	2 0.4 0.3	8 3 2	6 1 1	11 3 1	9 0.8 0.1	55 12 22
SPRING (Mar.- May)	Calm or slight Moderate Rough . . .	10 0.9 0.1	8 0.1 —	3 2 0.2	2 0.4 0.3	10 1 0.4	12 5 6	3 1 3	3 1 0.4	17 0.3 —	68 12 10	3 4 4	2 0.6 1	2 0.8 0.8	0.4 0.8 0.4	2 0.8 0.8	5 2 0.8	7 6 2	7 6 3	13 3 2	43 28 18	8 3 5	3 1 2	0.7 0.7 0.7	7 0.7 0.6	6 1 0.9	14 2 2	5 1 0.8	7 1 1	8 — 0.1	66 10 13
SUMMER (June- Aug.)	Calm or slight Moderate Rough . . .	4 0.2 0.1	10 0.2 0.2	5 3 0.9	3 0.8 0.1	11 1 1	17 3 4	4 0.5 0.5	1 0.1 0.1	19 0.1 0.2	74 9 7	5 1 2	3 3 5	3 0.6 2	3 0.6 1	3 — —	9 2 0.6	9 2 1	5 3 0.6	12 5 0.2	57 22 12	10 4 5	7 1 0.5	10 2 0.4	6 2 0.1	8 2 0.7	2 2 0.1	4 1 0.2	7 0.1 —	64 17 8	
AUTUMN (Sept.- Nov.)	Calm or slight Moderate Rough . . .	13 0.8 0.1	12 0.2 0.3	4 1 0.3	2 0.1 0.1	8 0.3 —	11 4 3	3 1 0.6	4 0.3 0.2	19 0.1 0.4	76 8 5	7 6 5	3 0.4 0.6	0.5 0.4 0.6	0.2 0.5 0.2	1 0.5 0.4	2 0.9 0.4	6 5 2	7 8 5	13 4 2	40 28 19	10 2 5	6 1 2	5 2 0.9	6 0.8 0.5	9 3 1	5 0.7 0.5	10 2 1	12 0.1 0.1	65 12 11	

APPENDIX B

ALPHABETS OF THE SPANISH AND PORTUGUESE LANGUAGES

The following tables explain and illustrate, with English equivalents and examples, the pronunciation of place-names in Spain and Portugal.

SPANISH

<i>Spanish</i>	<i>English equivalent</i>	<i>Remarks on pronunciation, &c.</i>
a	a	As in <i>father</i> .
b	b, v	<i>b</i> after <i>m</i> and <i>n</i> and when absolute initial after a pause: Cambrils, Burgos; otherwise almost <i>v</i> : Bilbao, Ibiza.
c	th, s, k	<i>th</i> (nearly) before <i>e</i> and <i>i</i> , in Spain: Albacete, Ciudad, Valencia; <i>s</i> before <i>e</i> and <i>i</i> , out of Spain: La Concepción. Otherwise <i>k</i> : Alcalá, Cuevas.
ch	—	As in <i>church</i> .
d	d, dh	<i>d</i> after <i>l</i> and <i>n</i> and when absolute initial after pause: Novelda, Ronda, Denia; otherwise <i>dh</i> (nearly), though nearly mute when final or between two vowels: Madrid (pr. Madhrídh, nearly Madhrí), Toledo.
e	—	As in <i>eh</i> ?
f	—	As in English.
g	kh, g	<i>kh</i> (nearly) before <i>e</i> and <i>i</i> : Gerona, Orgiva; otherwise <i>g</i> : Málaga, Sagunto.
gu	gw, g	Before <i>a</i> and <i>o</i> = soft <i>gw</i> : Guadalquivir; before <i>e</i> and <i>i</i> = <i>g</i> : Figueras, Aguilar. When marked with <i>·</i> the <i>u</i> is pronounced separately: Sigüenza.
h	—	Almost mute: Alhambra, Calahorra, Híjar.
i	—	As in <i>marine</i> .
j	kh	Jérica, Trujillo, Badajoz (pr. Badhakhoth), Jumilla.
l	—	As in English.
ll	ly, l'	Almost <i>y</i> in common speech: Sevilla, Llerena.
m	—	As in English.

SPANISH (*cont.*)

<i>Spanish</i>	<i>English equivalent</i>	<i>Remarks on pronunciation, &c.</i>
ñ	ny, n'	La Coruña, Valdepeñas.
o	—	As in <i>both</i> .
p	—	As in English.
qu	k	Albuquerque, Quito.
r	—	Is sounded more than in English and is strongly rolled at the beginning of a word and after <i>l, n, s</i> .
s	th, z, s	Final <i>s</i> sometimes pr. <i>th</i> or <i>z</i> : Linares; otherwise always <i>s</i> , even when between two vowels: Pedroso.
t	—	As in English.
u	u	(<i>V.</i> also under <i>gu</i> and <i>qu.</i>) As in English.
v	—	As in English.
x	x, sh	<i>x</i> between two vowels and in prefix <i>ex-</i> : Vinaixa, Extremadura; otherwise <i>sh</i> : Guadix, Torrox. [The Arabic or Berber <i>sh</i> sound of N. Africa is consequently written by Spaniards as <i>x</i> : Xerif, Xexauen, for Sherif, Shishawen.] But <i>j</i> is now much used for it; e.g. the town lately written Xeres and pronounced Shereth (hence 'sherry') is now written Jerez and pronounced Khereth (nearly); Mexico is now written Méjico and pronounced Mekhiko (nearly) in Spain, but still written and pronounced with an <i>x</i> in Mexico.
y	y, i	<i>y</i> between two vowels or initial before a vowel; Ayamonte, Arroyo, Yecla; otherwise <i>i</i> : Alcoy.
z	th, z	<i>th</i> in Spain: Zaragoza, Cádiz; <i>z</i> out of Spain: Santa Cruz, Venezuela.

DIACRITICAL MARKS

The 'tilde' ~ and 'crema' '' are used respectively only over *n* and *u*; see *n* and *gu* (note).

The acute accent ' is used to indicate the stressed syllable, if it is not in accordance with the two rules that (1) a word ending in a vowel or in *n* or *s* has the stress on the penultimate, and (2) a word ending in a consonant (except *n* and *s*) has it on the last syllable: e.g. Málaga, León, Cortés, Cádiz.

DIPHTHONGS

The so-called diphthongs are pairs of vowels slurred in pronunciation; those beginning with *a*, *e*, and *o* have those vowels predominant. Exceptions of this rule are marked with the acute accent, e.g. Andalucía, Riofrío.

PORTUGUESE

<i>Portuguese</i>	<i>English equivalent</i>	<i>Remarks on pronunciation, &c.</i>
a	ai, a	ai (nearly) before <i>lh</i> and <i>ge</i> , <i>gi</i> : Alhandra Almocageme; otherwise <i>a</i> , though when unaccented it is almost the 'indeterminate vowel': Amarante, Tavira.
ã, ãe	—	French <i>in</i> (nearly, but more nasal): Gollegã, Guimarães.
ão	—	Nearly French <i>an+on</i> (dissyllabic), but more nasal: Fundão.
b	—	As in English.
c	s, k	<i>s</i> before <i>e</i> and <i>i</i> : S. Vicente; Cintra (sometimes spelt Sintra); otherwise <i>k</i> : Castello Branco.
ç, cc	s	Before <i>a</i> , <i>o</i> , and <i>u</i> : Bragança.
ch	sh, k	<i>sh</i> : Monchique, Coruche. In words derived from Greek it = <i>k</i> : S. Christovão.
d	—	As in English.
e	i, e	<i>i</i> (very short) in unaccented syllables and when final: Peniche, Soure; otherwise <i>e</i> : Evora, Lamego. Also when the final <i>e</i> is accented: Loulé.
eu	e-u	Vizeu.
f	—	As in English.
g	zh, g	<i>zh</i> (or French <i>j</i>) before <i>e</i> and <i>i</i> : Gerez, Vigia; otherwise <i>g</i> : Braga, Mondego.
gu	gw, g	<i>gw</i> before <i>a</i> and <i>o</i> : Guarda; <i>g</i> before <i>e</i> and <i>i</i> : Figueira, Guimarães.
h	(mute)	Bahia, Homem.
i	—	Long as in <i>marine</i> ; short as in <i>piano</i> .
j	zh, y, hy	<i>zh</i> (or French <i>j</i>): Beja, Tejo, Juncal; but = <i>y</i> in native names in Portuguese Possessions: Mucojo, Maganja; and when initial in ditto = <i>hy</i> : Jangamo, Jofane.
l	—	As in English.

PORTUGUESE (*cont.*)

<i>Portuguese</i>	<i>English equivalent</i>	<i>Remarks on pronunciation, &c.</i>
lh	ly, l'	Batalha, Covilhã.
ll	ll	<i>ll</i> is pronounced as such, and not as the Spanish <i>ll</i> (= <i>ly</i>): Gollegã.
m	—	A nasalized <i>n</i> at the end of a word or syllable, except before <i>b</i> and <i>p</i> : Belem, Alemquer; otherwise <i>m</i> : Almeida, Pombal, Pampilhosa.
n	—	A nasalized <i>n</i> (i.e. giving the French nasal sounds of <i>an</i> , <i>en</i> , <i>in</i> , <i>on</i>) at the end of a word or syllable except before <i>d</i> and <i>t</i> : Barrancos, Sinfães, Berlenga; otherwise <i>n</i> : Nine, Redondo, Belmonte.
nh	ny, n'	Pinhel, Minho.
o	u, w, o	<i>u</i> when final: Vianna do Castello; <i>w</i> between <i>c</i> or <i>g</i> and a vowel: Coimbra, Fragoas; otherwise <i>o</i> , when it sometimes bears the circumflex accent $\hat{}$: Lagôa, Penamocôr.
õe	—	French <i>on</i> (nearly, but more nasal and liquid): Pegões.
ou	o	Douro.
p	—	As in English.
ph	f	Sta. Sophia.
qu	k, kw	<i>k</i> before <i>e</i> and <i>i</i> : Queluz, Barquinha; <i>kw</i> when before <i>a</i> and <i>o</i> : Quarteira.
r	—	As in English; should be distinctly pronounced.
s	s, z, sh, zh	<i>s</i> at the beginning of a word or syllable: Santarem, Monsanto; <i>z</i> between two vowels: Vimioso, Casa Branca; <i>sh</i> before <i>c</i> , <i>f</i> , <i>p</i> , <i>ph</i> , <i>qu</i> , <i>t</i> , <i>x</i> : Cascaes, Espinho, Estrello; <i>zh</i> before <i>b</i> , <i>d</i> , <i>g</i> , <i>l</i> , <i>m</i> , <i>n</i> , <i>v</i> , and at the end of a word: Lisboa, Esmoriz, Elvas.
ss	s	Bussaco, Assumar.
t	—	As in English.
th	t	Thomar, S. Thiago.
u	-, u	Mute after <i>g</i> and <i>q</i> before <i>e</i> and <i>i</i> : Figueira, Quintã; otherwise = <i>u</i> : Setubal.
v	—	As in English.

PORTUGUESE (*cont.*)

<i>Portuguese</i>	<i>English equivalent</i>	<i>Remarks on pronunciation, &c.</i>
x	sh, z, s, x	<i>sh</i> when initial, and usually in the middle of a word: Xarrama, Cartaxo; <i>z</i> in the prefix <i>ex</i> before a vowel: Exalte; <i>s</i> in certain words; <i>x</i> in certain words.
y	i, y	<i>i</i> before a consonant or final: S. Thyrsó; <i>y</i> before a vowel: Alvayazere.
z	zh, z	<i>zh</i> at the end of a word: Aviz, Estremoz; otherwise <i>z</i> : Vizeu, Zezere.

Two accents are used in Portuguese: (1) the acute ', to show the stress, especially to distinguish different meanings of a word spelt alike; (2) the circumflex ^, to show that a vowel has an *i* or *u* sound combined with it, particularly to show that *o* is pronounced *o* and not *u*.

DIPHTHONGS

Each vowel is distinctly sounded; but see *ãe*, *ão*, *õe*, and *ou* (above).

APPENDIX C

BIBLIOGRAPHICAL NOTE AND SHORT LIST OF MAPS

No Geographical Handbook of Spain and Portugal was published by the Admiralty during the war of 1914-18. It must be admitted that geographical literature about the Iberian Peninsula is very scanty in the English language. Probably the most useful items are articles, which are widely scattered in periodicals. Full use was made of these and of numerous foreign articles in the preparation of this book. These articles are not listed here, but a short bibliography of the more useful general volumes and guide-books, and a list of maps are given below.

GENERAL

The fullest geographical account of the Iberian Peninsula in English is in M. I. Newbigin's *Southern Europe* (1932), of which chaps. x-xiii (pp. 229-329) are devoted to Spain and Portugal. Sound but brief descriptions will be found in *Encyclopaedia Britannica* (14th ed.) under 'Spain' and 'Portugal'. Although not primarily geographical, *Spain: A Companion to Spanish Studies* (ed. E. Allison Peers, 1930), and S. de Madariaga's *Spain* (1930) will be found useful.

Longer geographical descriptions of the Peninsula are contained in the Spanish, French, and German books named in the following list. Those containing full bibliographies are marked with a star *.

- *(1) *Enciclopedia Universal Ilustrada*, vol. xxi, 'España' (1923). The whole volume deals with Spain and is of great value.
- *(2) MARTIN-ECHEVERRÍA, L. *Geografía de España* (1928), 3 vols.
- (3) CERECEDA, J. DANTÍN. *Ensayo acerca de las regiones naturales de España*, vol. i only (1922). (An abstract in English, 'The Natural Regions of Spain', is in *Geog. Teacher*, xi (1922), 335-45, and xii (1923), 19-27, 82-90.)
- (4) HERNÁNDEZ-PACHECO, E. *Síntesis Fisiográfica y Geológica de España* (1932).
- *(5) SORRE, M. *Espagne-Portugal* (1934), being Tome VII, Première Partie, of *Géographie Universelle*.
- (6) GESCHER, B. H. and F. M. *L'Espagne dans le Monde* (1937).
- *(7) MAULL, O. *Länderkunde von Südeuropa* (1929), which treats the Iberian Peninsula on pp. 12-132.
- *(8) The most complete account of Portugal in any language is *Portugal auf Grund eigener Reisen und der Literatur* by H. Lautensach in *Petermann's Mitteilungen (Ergänzungsband)*, xlv (1932), No. 213, *Das Land als Ganzes*, and l (1937), No. 230, *Die Portugiesischen Landschaften*. The latter includes a bibliography of 577 items.

The older English books on the Peninsula should not be neglected, as they provide information about the life and spirit of the people that is still in many respects accurate. Particular mention should be made of two classics, George Borrow's *The Bible in Spain* (1843) and Richard Ford's *Gatherings from Spain* (1846); both are published in Everyman's Library. Murray's first guide-book on Spain, *The Handbook for Travellers in Spain* (2 vols., 1845), was also compiled by Richard Ford. This book has been justly described as 'one of the most entrancing itineraries ever written in the English tongue', and many of its descriptions are still valuable.

GUIDE-BOOKS

- (1) *Southern Spain and Portugal* (1929). Blue Guides.
- (2) *Northern Spain and the Balearic Isles* (1930). Blue Guides.
- (3) Cook's *Traveller's Handbook to Spain and Portugal* (1930), with good maps.
- (4) Baedeker's *Spain and Portugal* (latest edition in English 1913).
- (5) Baedeker's *Spanien und Portugal* (latest edition in German 1929).
- (6) *Michelin Guía, España y Portugal*, 11th ed. (1936-8).

SHORT LIST OF MAPS

The official topographic maps of the Iberian Peninsula do not display a high standard of accuracy; many of the sheets are old and out of date. For a large part of Spain maps do not exist on a larger scale than 1/200,000, and this series does not show relief. For these reasons too much reliance should not be placed in the maps of Spain and Portugal, nor in the various compilations made from them in other countries.

GENERAL

(1) 1/1,000,000 G.S.G.S. have published new editions of the 6 sheets, which cover Iberia, in 1939-40. These are K.29 Porto, K.30 Madrid, K.31 Marseilles, J.29 Lisboa, J.30 Gibraltar, N-J.31 Alger.

(2) 1/250,000 G.S.G.S. have a map of the Iberian Peninsula on this scale in course of publication in 1941.

SPAIN

(3) 1/500,000 *Mapa General de España*, published by Instituto Geográfico y Catastral in 9 sheets (including the Canaries) in 1926. The contours are much obscured by brown colouring, but this map is the most convenient and authoritative for all general purposes.

(4) 1/200,000 *Mapa Militar Itinerario de España*, published by Depósito de la Guerra in 69 sheets. A few sheets have not been issued and many are very old. The map shows rivers, roads, and railways, but relief is not represented. The map is badly printed and difficult to read.

(5) 1/100,000 *Mapa Militar de España*, published by Depósito de la Guerra. Only about 40 of the 345 sheets projected have been published.

Contours are shown at 50-metre intervals. Those which have appeared include parts of Galicia, parts of the province of Cádiz, and the whole of the Balearic Isles. In 1940 G.S.G.S. produced 3 sheets of Majorca and 1 sheet of Minorca on the same scale, and these were based on the Spanish maps.

(6) 1/100,000 *Mapa Topográfico de Catalunya*. Some of the 43 sheets planned have appeared, and are published by Mancomunitat de Catalunya at Barcelona; they are in the Catalan language.

(7) 1/50,000 *Mapa Topográfico Nacional*, published by Instituto Geográfico y Catastral of Madrid. The first sheet appeared in 1875, but of the 1,078 sheets planned, not more than half have yet been issued. Large blocks of Spain, including Galicia and Asturias, the provinces on the Portuguese frontier, and the Mediterranean provinces south of Catalonia as far as Malaga, are still unmapped on this scale.

The map has an unusually detailed system of conventional signs. It was one of the first national maps to show vegetation and cultivation symbols and has contours at 20-metre intervals.

Road Maps

(8) 1/1,600,000 *Contour Motoring Map of Spain and Portugal*, published by John Bartholomew (Edinburgh), is folded at the end of this volume.

(9) 1/1,000,000 *Michelin Mapa de Grandes Carreteras de España y Portugal*, published in 2 sheets in 1934-6, showing roads and rivers, but no relief.

(10) 1/500,000 *Mapa Turista de España y Portugal*, published by Blondel la Rougery (Paris) in 5 sheets with no date. Rivers and roads with kilometric distances are shown, but not relief.

(11) 1/400,000 *Michelin Mapa de España*, published in 11 sheets from 1928 onwards. The earlier editions were in 13 sheets. Roads and rivers are shown, and relief is indicated by a few spot heights only.

(12) 1/400,000 *Guía Internacional de las Carreteras de España y Portugal*, published in 14 sheets with no date. Roads and rivers but no relief are shown. This map has some useful information not always shown on Michelin's maps.

PORTUGAL

(13) 1/250,000 *Carta Itineraria de Portugal*, published by the Estado Maior do Exercito in 12 sheets from 1904 (?) onwards and revised in later editions. Towns, villages, roads, and rivers are marked, but there are no contours. Kilometric distances are marked along the roads.

(14) 1/100,000 *Carta Chorográfica de Portugal*, published by Direcção dos Trabalhos Geodésicos (now known as Instituto Geográfico e Catastral) in 37 sheets, 80×50 cm., during the period 1856-1904. Contours at 25-metre intervals are used without colours. A new edition of this map in 53 sheets and printed in five colours is in course of publication.

(15) 1/50,000 *Carta de Portugal*, published by Instituto Geográfico e Catastral from 1900 to the present. 175 sheets (64×40 cm.) are planned, but only about half of them have appeared. The map is usually printed in 5 colours and has contours at 25-metre intervals. There is a detailed system of conventional signs. Some of the sheets are in black only and are described as provisional.

Road Maps

(16) The road maps listed above under Spain also include Portugal.

(17) 1/600,000 *Carta Itineraria de Portugal* in 2 sheets, published by Foldex (London) for the Shell Co. of Portugal.

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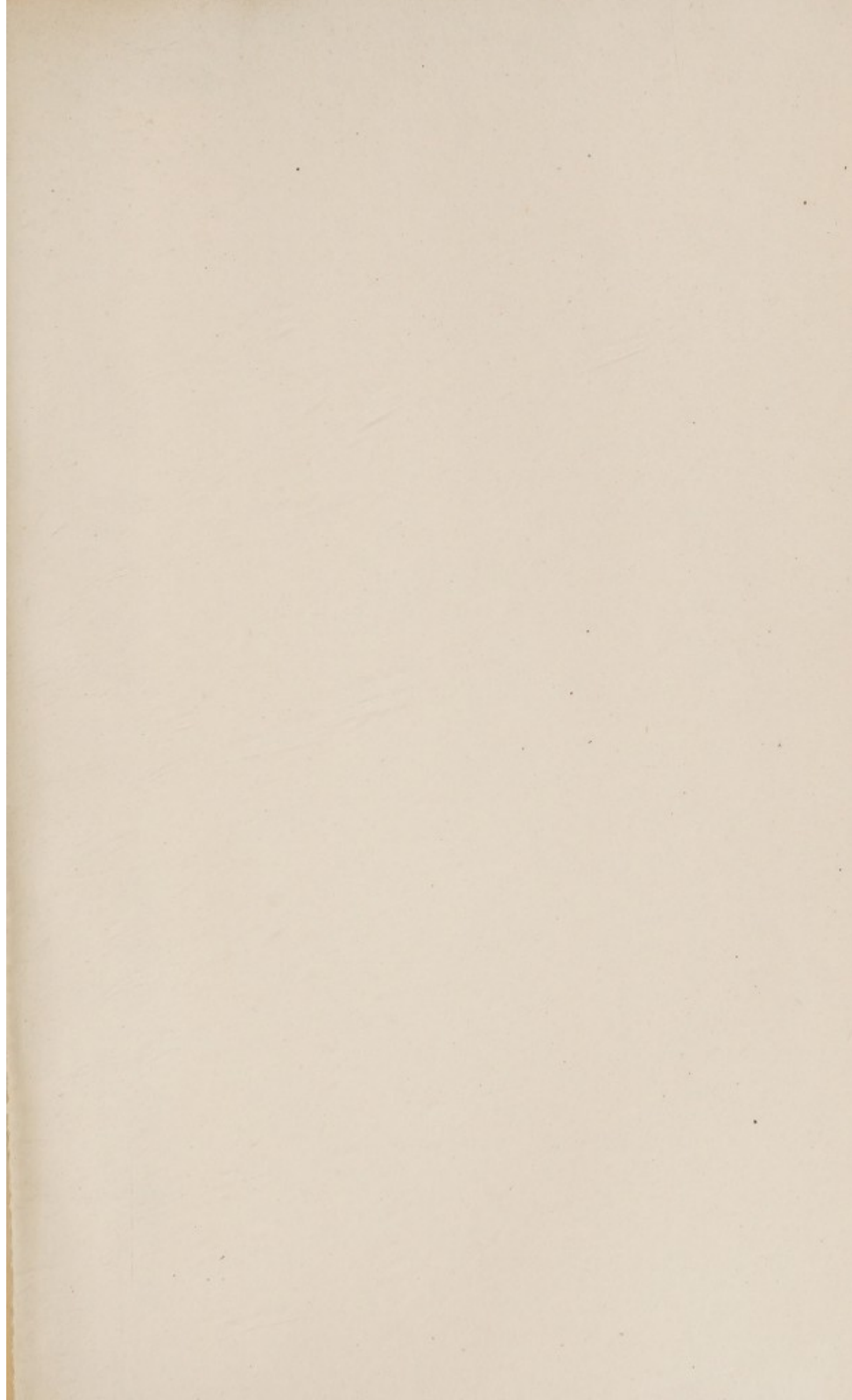
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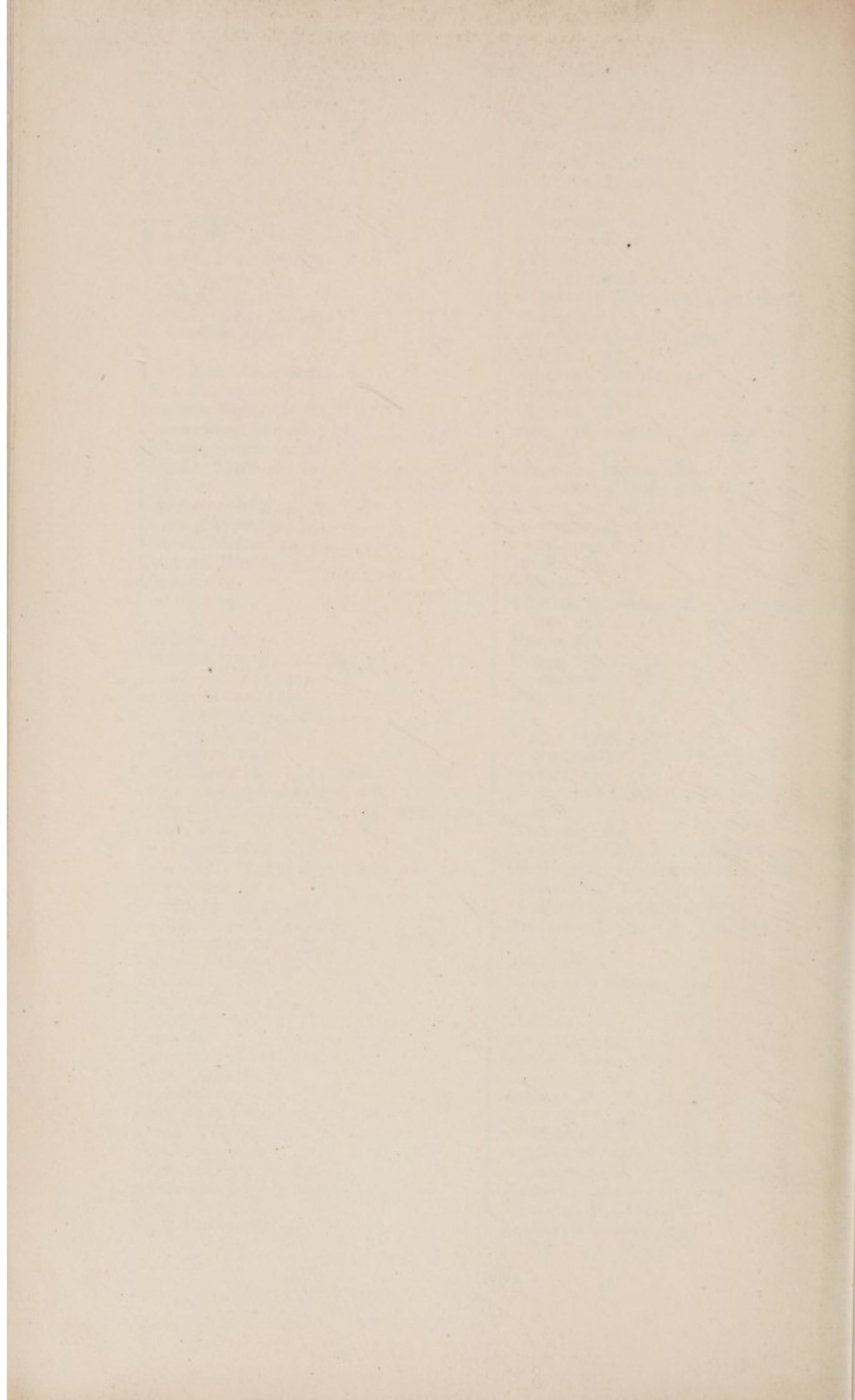
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BARTHOLOMEW'S
CONTOUR MOTURING MAP
OF
SPAIN & PORTUGAL

1:1,600,000

English Miles
Kilometres
Main Through Roads
Other Main Roads
Inland Waterways
Railways
In Portugal the limits of the administrative districts are indicated





BARTHOLOMEW'S
CONTOUR MOTORING MAP
OF
SPAIN & PORTUGAL

1:1,600,000

English Miles

French Miles

Portuguese Miles

Other Main Roads

Other Main Roads

Other Main Roads

Other Main Roads

Other Main Roads

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