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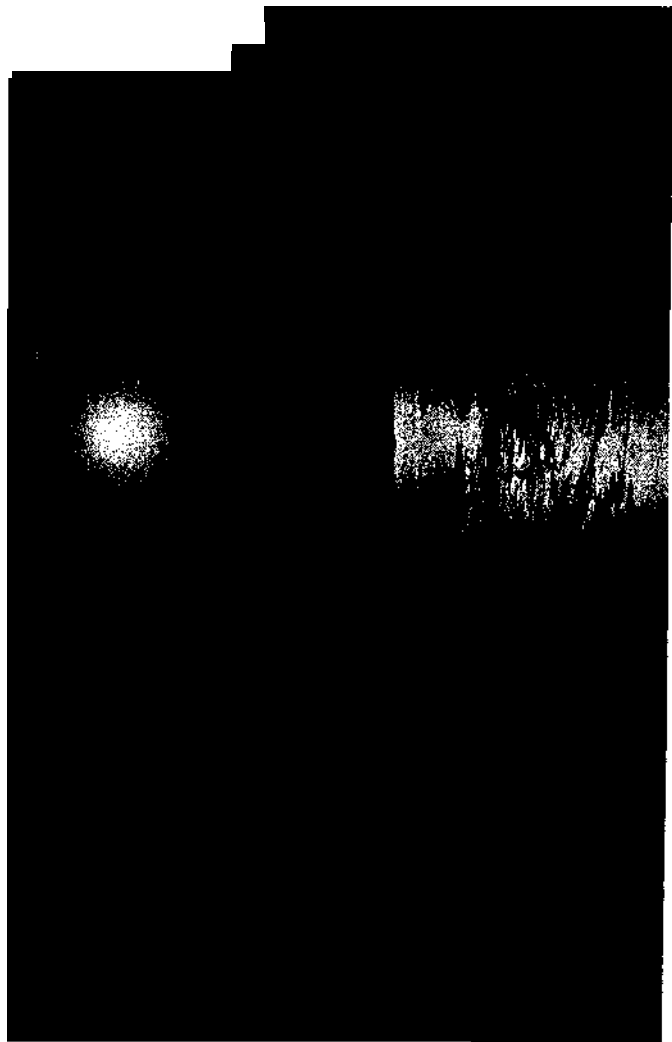


FIG. 1. SUNSET ON THE THAMES AT WESTMINSTER—THE HEART OF THE BRITISH EMPIRE
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THE BRITISH ISLES

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PREFACE

THE geographical fact that the British Isles constitute the land-centre OFthe world has a greater significance at the present day than ever before. Great Britain is looked to for a lead in affairs not only by the other countries of the British Commonwealth, but also by nations the world over. General Smuts, v^hose statesmanlike speeches command universal.attention-, said recently that "To Great Britain and our Commonwealth is entrusted the difficult but glorious task of being the peacemakers of,Europe. . . . Great Britain to-day is the one Power left in the Old""World with sufficient influence and moral prestige to undertake the task." And just because our international interests are so widespread there is a danger of paying too little attention to our own country. Yet the political conditions prevailing abroad make it as necessary now as during the War to take careful stock of our resources, for although our own trade has improved, the volume of international trade has declined, is declining, and may take long to recover. And when recovery comes the conditions surrounding it will be new, not those which existed before 1914.

This book aims at presenting a concise account of the relation between the land and the activities of the people. It is written to meet the needs of secondary school pupils taking the School Certificate Examination, which for the great majority marks the end of their scholastic studies. But I hope that it will achieve an object beyond that of furnishing the knowledge necessary to pass the examination. No country has a greater claim upon the affection of its people. We are justly proud of its wealth of natural beauty, but if this heritage is to be preserved amid the

THE BRITISH ISLES

rapidly changing conditions it is essential that sentiment should be supported by an understanding of the facts.

The first part of the book surveys in due sequence such aspects of the geography of the country as a whole as govern our national life and character—viz., position, structure and relief, climate, and natural resources. The second part describes on a uniform basis the natural regions of the British Isles. Repetition has been avoided by adequate cross-references. Limitation of space imposes a healthy discipline upon the selection and presentation of material, and appreciative passages in the cheerful manner of the modern guide-book have had to give place to simple description based upon the latest obtainable facts. Yet I hope that the book will be found interesting to read as well as informative, and that some readers at least will be prompted to pursue their study of the homeland, and find pleasure in making at their leisure further investigation of the countryside. I shall be grateful for notification of errors and suggestions for improvement.

I am particularly indebted to the editor of the series for his experienced guidance, and also to my colleague, Mr J. Corley, M.Sc., for providing the maps and for several helpful suggestions. Among the publications which have proved of special help are: *Great Britain: Essays in Regional Geography*, by twenty-six authors; *Industrial Britain: a Survey*, by Albert Wilmore, D.Sc., from which I have been privileged to take certain maps; *The British Isles*, by L. Dudley Stamp, D.Sc., and S. H. Beaver, M.A.; the *Journal of the Royal Geographical Society*; the publication of the Geographical Association entitled *Geography*; and the supplements of *The Times* and *The Manchester Guardian*. I greatly appreciate also the generous terms on which I have been allowed to use many of the photographs, and I am grateful to the publishers and to several friends for their assistance.

A. M. D.

June 1935

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THE BRITISH ISLES

PART I

GENERAL

CHAPTER I

WORLD-POSITION

LET US first be quite clear as to the real meaning of the various names commonly used in reference to the British Isles. A study of the map shows that there are between 5000 and 6000 islands grouped round the main islands of Great Britain and Ireland. By 'Great Britain'⁵ we mean the main island occupied by the three countries England, Scotland, and Wales, which since 1603 have been under one rule. The 'United Kingdom'⁵ used to mean Great Britain and Ireland. But since 1922 Ireland has been divided into Northern Ireland and the Irish Free State. Northern Ireland, although possessing a Parliament of its own, is closely associated in many matters with Great Britain. The United Kingdom now means, therefore, Great Britain and Northern Ireland. The Irish Free State has the status of a Dominion of the British Empire, and as such is independent of the United Kingdom. Neither the Isle of Man nor the Channel Islands are included in the United Kingdom. The Isle of Man has its own Parliament, called the Tynwald, and Bills which are passed by the Council and the elected House of Keys are promulgated after receiving the Royal Assent. The Channel Islands, which formed part of the dukedom of Normandy, have been attached to England since the Conquest, but have also their own form of government,

THE BRITISH ISLES

called the States. The laws of Great Britain are applied to the Channel Islands only in special cases which receive the approval of the States. This distinction between the various parts of the British Isles must be kept in mind throughout our survey of the land and its peoples.

Size. Much that is great in the history of these little islands can be traced to their fortunate position on the earth's surface. For we must remember that as regards area the British Isles are small compared with other leading countries. Thus, European Russia is sixteen times as large; France, Germany, and Spain are each about twice as large; while Italy, Norway, Sweden, Poland, and Rumania each occupy a larger area. The contrast in size is still more marked in the case of countries in other continents. Great Britain, with an area of 88,745 square miles, occupies only about a fortieth part of the area of either Canada, the United States, or China. India is twenty times and Australia thirty times as large. Yet in spite of this small area Great Britain supports a population of forty-five millions, a larger population than any other European country, except Russia and Germany. This population is more than four times that of Canada, and about seven times that of Australia. The United States, with forty times the area, have less than three times the population of Great Britain. That so small an area can carry so large a population calls for explanation, and one of the chief reasons is the advantage derived from its position on the globe.

Centre of Land Hemisphere. Until the time of the discoveries by Diaz, Da Gama, Columbus, and Magellan in the fifteenth and sixteenth centuries the British Isles were on the fringe of the civilized world, and the countries round the Mediterranean were the centre of culture and trade. The conquest of the oceans and the settlement of the other continents reversed the order of importance in favour of the British Isles. For the British Isles are at the centre of the land hemisphere, while the Mediterranean is a

WORLD-POSITION

secluded sea, almost landlocked. The globe shows best how most of the land of the world is ranged round the British Isles, while the Pacific Ocean occupies most of the opposite side of the world. But maps also show that in addition the greater part of the land hemisphere drains

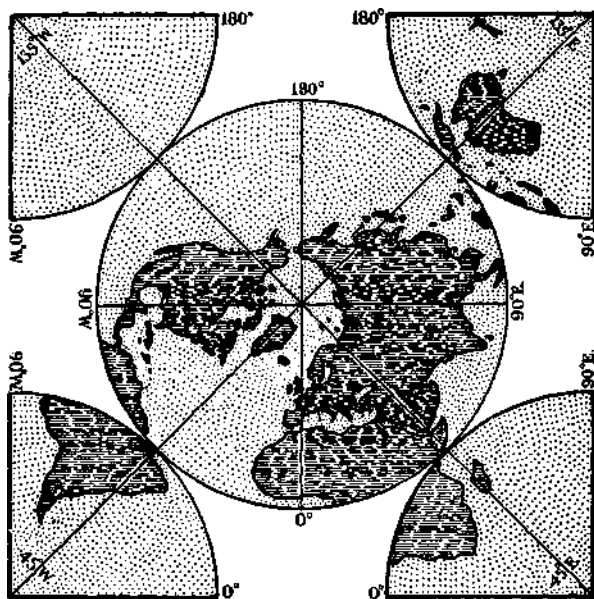


FIG. 2. DIAGRAMMATIC REPRESENTATION OF BRITAIN'S CENTRAL POSITION RELATIVE TO THE MAJOR LAND MASSES OF THE WORLD

into the Atlantic basin. If the lofty mountain-ranges which fringe the Pacific had instead skirted the shores of the Atlantic history would have had a very different tale to tell. As it is, however, communications lead naturally to the Atlantic, and the bulk of the trade of the world flows through the ports on its shores, so that most of the world's greatest ports are to be found there. On a world map there appear to be sea routes round the north of America and Asia, but they were found to be extremely difficult, on

THE BRITISH ISLES

account of ice, and useless for practical purposes as world routes. This ice-barrier to the north diminishes somewhat the value of Britain's central position, seeing that the British Isles are nearer to the Arctic Ocean than they are to the equator. And until the Suez Canal was opened in 1869 and the Panama Canal in 1914 communication with distant lands entailed long voyages to the south in order to get round South Africa or South America. The opening



FIG. 3. AN AIR-LINER AT CROYDON AERODROME

of these canals restored to the Mediterranean lands some of the advantages they had lost, but in no way diminished those of the British Isles. On the contrary, the shortening of the routes to Australia and the Far East was a source of additional profit.

Recent rapid developments of transport and communication by aircraft and radio have but served to enhance the value of Great Britain's world-position. The weekly air-service from London, through Africa, to Cape Town takes only nine days, and that from London, through India, to Singapore eight and a half days. The fact that aircraft can take short cuts and, on long-distance flights, follow 'great circle' routes will make the British Isles more than ever the junction for such routes between the capitals

THE BRITISH ISLES

of Europe and North America. This can best be tested with a piece of string on a globe. To avoid the risks attaching to long-distance flights over sea the possibility of using the Faroe Islands, Iceland, and Greenland as stepping-stones from Great Britain to Labrador has already been explored. In the same way, London is the world's exchange for cablegrams, radio-telegrams, and for the radio-telephone overseas or to ships at sea. Conversations between persons in the United Kingdom and the countries of Europe are carried by cables across the land and under the sea between Dover and the coasts of France and Belgium, and between the Suffolk coast and Holland. Other telephone cables cross the narrow seas from Northern Ireland to Scotland, the Isle of Man, and England; from Dartmouth to the Channel Islands; from the Nevin peninsula, in Northern Wales, to the Irish Free State; and from the mainland to some of the islands of Scotland. Telephone calls across the ocean or from one continent to another are effected by wireless. Messages are transmitted from Rugby, the most powerful radio station in the world. The replies come by a totally different route within the space of less than one-tenth of a second after they are spoken, and are received at Baldock, in Hertfordshire, if transmitted on short waves, or at Cupar, in Fifeshire, if on long waves. This wonderful system has been developed during the last eight years, and pamphlets issued by the Postmaster-General contain much interesting information about the service. So marked is this world importance of the British Isles that it is true to say that, as a nation, we are as closely concerned with the life and trade of the peoples of overseas dominions, America, and Asia as we are with those of European countries.

Continental Position. Nevertheless we must not minimize the advantages which accrue to these islands from their proximity to Europe. In the first place, they stand on a broad platform covered by shallow seas, called the continental shelf. Between the coast of Western Europe

WORLD-POSITION

and the 100-fathoms line the sea deepens very gradually, and the greater part of it is less than 50 fathoms deep. But to the west of the 100-fathoms line the sea-bed falls rapidly to a depth of over 1000 fathoms. It is well known how the tides pile up water over shallow ground, whereas the rise and fall in the oceans are but small. This strong flow and ebb of the tides is most marked where coasts converge, and these tides enable ships to reach ports far from the open sea, like London, Glasgow, Southampton, Cardiff, and Bristol. They also scour the estuaries, removing silt brought down by rivers, and cleanse the shores. The shallow waters enable the fish to spawn on the sea-floor, and great quantities of algae, or plant food, are available for food for the smaller fry on which the larger fish feed. The shallow seas therefore yield a rich harvest of fish. There are numerous harbours to which the catch can be taken rapidly, and the cool climate enables the catch to be kept fresh, under salt, in the ships' holds. Not less important is the training in seamanship which this industry provides. The work calls for courage, endurance, and skill, qualities upon which the efficiency of our naval and mercantile fleets so much depends.

These narrow seas, as they are often called, especially to the south and east, are also, perhaps, the busiest shipping highway to be found. The fact that the British Isles lie like a breakwater off the coast of Western Europe entails the necessity for the ships of these European countries to pass close to our ports. They naturally tend to call at these ports, and trade is thus stimulated. Just as it is true to say that British ships can be found in every important harbour in the world, it is no less true that in the chief ports of the British Isles ships of every maritime country may be seen at one time or another. It should be particularly noted that the estuary of the Thames faces that of the Scheldt and the delta of the Rhine, which, while causing competition, brings Britain into close relationship with densely populated areas of the Continent.

THE BRITISH ISLES

There is great competition between various countries for the shipping trade of the world. Before the Great War Great Britain had an established lead over other countries in ships carrying goods not only to and from our own ports, but between distant countries. Since the War the Governments of most countries have more and more tried to be as independent as possible of other countries, both as regards production of goods and the carrying of them. As a result international trade has gradually decreased, and with it the need for so many ships. But in the modern world no country can be entirely self-sufficing. Products needed from other countries must be paid for chiefly in goods, and thus exchange of goods is necessary. The United Kingdom needs not only every conceivable kind of raw material for her industries, but also the larger part of her food-supplies from overseas. Countries which supply these needs buy our manufactured goods in exchange. Many of them thus use our shipping. For convenience other goods destined for Continental countries are also sent in these ships. As a result, great markets of the world's trade have grown up in these islands. The splendid facilities for shipbuilding and the great experience of our seamen are other factors which give good reason to hope that when trade between countries flows more plentifully the British shipping industry will once more benefit.

Climate. The British Isles are ten degrees nearer to the North Pole than they are to the equator. They lie between the same lines of latitude as the coast of Labrador and the island of Karafuto (Sakhalin), off the east coast of Asia. In both these places life is very difficult, owing to extreme climatic conditions.

The other coast in these latitudes in the Northern Hemisphere is that of British Columbia, where the climate is much less severe than in the case of the other two, but, except along the coast and in Vancouver Island, is not nearly so equable as in the British Isles. The

WORLD-POSITION

explanation is, of course, that Britain lies in a belt where the winds come most frequently from lower, latitudes in

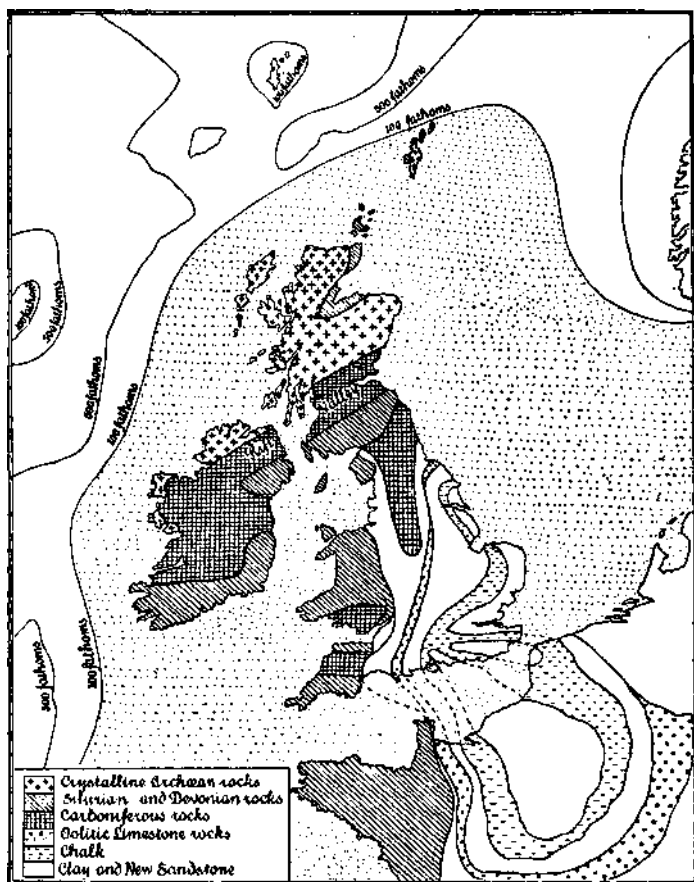


FIG. 5. CONTINENTAL SHELF AND RELATION BETWEEN
STRUCTURAL DIVISIONS

the south-west, and, moreover, have been warmed by the warm water of the North Atlantic Drift, which passes

THE BRITISH ISLES

our western coasts and exerts its genial influence far to the north. The whole country gets the benefit of this mild climate, for no part of Britain is much more than 80 miles from the coast. Note how estuaries on the east and west coasts approach one another, bringing London within 120 miles of Bristol, Hull within no miles of Liverpool, and Glasgow within 45 miles of Edinburgh (Leith). The winds usually bring rain at frequent intervals throughout the year, ensuring an adequate water-supply and normally no fear of drought.

The effects of this advantageous climate are far-reaching. Our ports and harbours are always free from ice and available for shipping and for fishing-fleets at all seasons. Agriculture is rarely seriously hindered by extreme conditions, and work on the land is nearly always possible. The changeableness and uncertainty of the weather have a beneficial effect on the character of the people, for they learn to be prepared for the unexpected, and so to be resourceful and adaptable. At the same time, the changes in the weather are never so violent or sudden as to discourage industry and foresight, which usually bring reward in due season.

The continental shelf, now covered by the narrow seas, at one time linked Great Britain to the Continent. The bed of the North Sea slopes northward, and is cut by a long, deep channel which no doubt was eroded by the united waters of the Rhine and the Thames, which drained what was then the plain. Similar indications are to be found in the English Channel and the Irish Sea, showing that Great Britain was formerly joined to France and to Ireland. Besides this evidence, we shall see in the next chapter that the rocks of the Thames basin reappear in the Paris basin, and that Scotland has many of the characteristics of Scandinavia. So that in structure Great Britain is part of the European continent. (See Fig. 5.)

CHAPTER II

STRUCTURE

THE British Isles possess an infinite variety of landscape. We have every reason to be proud of this characteristic, but if we are to appreciate it properly we need some knowledge of the way in which it was built by nature, and of the materials used in the making. The story of the building of these islands has been patiently pieced together by detailed study of the rocks. As in human history we speak of the Norman or the Tudor period, so in the history of the rocks the geologist has divided the infinitely longer time with which he has to deal into four or five periods. Each of these extends over millions of years. And just as the history of man has been marked by periodic revolutions, so the formation and arrangement of the rocks have been subjected at certain periods to great activity in the movements of the earth's crust.

In the earliest or oldest rocks little or no trace of life in the form of fossils can be found, and these rocks are said to belong to the *Pre-Cambrian era*. They are mostly crystalline, but some were formed of sediments deposited on the beds of lakes or seas, and are therefore called sedimentary. In many cases these have been changed, owing to great heat and pressure from volcanic intrusions. When so changed they are called metamorphic rocks. The Pre-Cambrian rocks are very hard, and have weathered extremely slowly. But owing to their immense age they are worn down to low hills. Most of them have been covered by later deposits, and occur at the surface mainly in the highlands of Great Britain.

Next comes the *Primary era*, during which the hard old sedimentary rocks were formed in areas then under

THE BRITISH ISLES

water, and subsequently uplifted by what are known as the Caledonian earth movements. Many volcanic rocks and lavas were thrown up at intervals, and now stand out

GEOLOGICAL FORMATIONS *{for reference}*

ERA	FORMATIONS	CHARACTERISTIC ROCKS	USEFUL MINERALS	GENERAL CONDITIONS
QUATERNARY	Recent Pleistocene and Ice Age	Gravels, drift, moraines, boulder-clay		} England part of Continent
TERTIARY	Pliocene Miocene Oligocene Eocene	Craggs and gravels of East Anglia Clay of London basin, Bagshot beds, Hampshire basin	Clay, sand, gravel, peat, granite	^ Alpine earth movements; volcanic activity in Scotland and Northern Ireland; England part of Continent
SECONDARY	Cretaceous Jurassic Triassic	Chalk of Chiltern Hills and the Downs, clay, greensand Oolitic Limestone. Cleveland and Cotswold Hills New Red Sandstone of Cheshire and Midlands, marls, conglomerates	Chalk Building-stone Sandstone	1 Part of England submerged
PRIMARY	Permian Carboniferous Devonian Silurian Cambrian	Magnesian Limestone, sandstones, and Red Marls Coal Measures of Pennines, South Wales, Ireland, and Central Scotland Old Red Sandstone of South Wales and Northern Scotland Slate, shales, and hard sedimentaries of Wales and Southern Uplands of Scotland	Millstone Grit, limestone Coal Sandstone, granite Roof-slate	Armorican earth movements v Caledonian earth movements; volcanic activity in Scotland, Wales, and Lake District; 1 parts of Britain submerged at times
1 Si; <		Crystalline schists, gneiss, and granite of Highlands of Scotland	Metallic ores, granite	Britain part of Continent; volcanic activity in Scotland

as hill masses in Wales, the Lake District, and Scotland. It is these Caledonian movements which gave the mountains of Scotland and North Wales their characteristic trend from south-west to north-east. While many of the

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mountains were slowly wrinkled into great folds, some broke under the stress, and in this way were formed the two large rift valleys of Scotland—that of Glen More,

^Jfex* *' •



FIG. 6. A STACK ON THE PEMBROKE COAST

The waves of the sea carry on a constant attack on the rocks, undermining them, forming natural arches, then stacks, and finally low islands and beaches.

which separates the Northern from the Central Highlands, and the rift valley of Central Scotland and North-eastern Ireland. From these mountains descended torrential streams, which deposited in seas to the south *debris* which consolidated into rocks known as Old Red Sandstone,

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found in Devon, Cornwall, and South Wales. Thus worn down, the former mountains were again invaded by the sea. In this sea conditions favoured organisms like coral, which flourished in vast numbers, and in time accumulated into great masses of limestone. This is the Carboniferous Limestone found so extensively in Ireland, in the Pennines, and in the Mendip Hills. Upon this limestone a great delta of sand and mud was deposited by a southward-flowing river, and this in the course of time hardened into the Millstone Grit which plays so important a part in the Pennines. Warm, moist climatic conditions then favoured the development upon this delta and elsewhere of swampy forest, which in countless years led to the formation of the Coal Measures. Then occurred a second great series of earth movements, known as Armorican, which folded the rocks anew. In Devon and Cornwall, South Wales, and Brittany these folds had an east-west trend, but in the north and west the pre-existing Caledonian folds were accentuated or added to, and in some parts of England, as in the case of the Pennines and Malvern Hills, the folds took a north-south trend.

Towards the end of the era of Primary rocks it is thought that a great inland sea extended over Great Britain from the direction of Germany, and that the land surrounding it was subjected to desert-like conditions, as most of the rocks laid down in this age are sandstones and are red. These are the New Red Sandstone and Red Marls. Magnesian Limestone is another well-known rock of this period.

In the *Secondary era* the most familiar rock formations are known as Triassic, Jurassic, and Cretaceous. It must be clearly understood that these major divisions of geological time are made purely for convenience of classification, and that one age changed imperceptibly into the next, and that all the changes and movements, which, indeed, are still going on, were very gradual and slow. So that in speaking of the sandstones and lime-

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stones of this age there is no marked change in the characteristics of the rocks. Clearly desert conditions still prevailed, beds of salt or gypsum marking the drying up of some shallow basin. In cases where these inland seas surrounded islands of Primary times the new rocks were



FIG. 7. A BOULDER OF FOLDED STRATA

deposited round their bases. Rocks so arranged are to be found round the Wrekin, the Lickey Ridge, south of Birmingham, and among the hills of Charnwood Forest. Later, in the sea of Jurassic times, deposits of clay and much limestone were laid down. In particular, mention must be made of the Oolitic Limestone, which was covered with further layers of alternate clays and sands. A similar sequence of deposits took place again, when the sea retreated towards the south-east of England, covering the

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Wealden area and extending across the present English Channel into France. These deposits account for the Weald Clay and Hastings Sands of the central Weald.

Then came the great Cretaceous sea, which is thought to have covered most of the British Isles and the Great European Plain, and perhaps explains the levelling off of the mountain-tops which is noticeable in some of the



FIG. 8. THE CHALK CLIFFS OF BEACHY HEAD
AND THE 'SEVEN SISTERS'

Beachy Head Lighthouse is at the foot of the cliffs.

Welsh mountains and the Mendip Hills. This deep sea of clear water abounded with tiny organisms whose remains formed that very pure white limestone we know as chalk.

We pass on to the *Tertiary era*. This is the era in which occurred the great earth movements which uplifted the Alpine mountain system of Europe and other great ranges of the world. In the British Isles these earth movements had comparatively little effect, because the greater part of the land was too old and hard to be folded. The stresses set up in the old hard rocks by the Alpine earth movements did, however, lead to much faulting

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and to lava-flows. The hills of Mull, Skye, Staffa, and Antrim were formed in this way. Such hills and others like the Castle Rock of Edinburgh are the plugs of volcanoes then active, from which the covering cones of volcanic ash have been weathered away. Folding did, however, occur in the south of England. The dome of the Weald and of Salisbury Plain and other folds, noticeable particularly in the Isle of Wight and the adjacent area, were formed at this time. By then most of Britain was land as we know it, except that the south-east was still sea-covered. During the Tertiary era the area covered by the sea varied, and the rivers drained south-eastward into this sea, carrying sands, clays, and muds, which were deposited round its shore among the marine fossils. These deposits partly account for the variety of soils¹ in the south-eastern area which are so valuable to agriculture.

There followed the most recent or *Quaternary era*, which extends down to our own times and, more important still, includes the Ice Age, which profoundly changed the face of Britain. During this glacial period the whole of the British Isles as far south as the Thames valley was covered either by glaciers which originated in our own mountains or by an ice-sheet reaching across the North Sea from Scandinavia. The slow but powerful movement of this ice, either outward from the mountain-ridges or southward as along the east coast of England, removed the soil from extensive highland areas, smoothed and rounded the old hard rocks, scooped out existing valleys into U-shaped valleys, and extensively altered the system of drainage. More than that, great quantities of rock fragments and stiff boulder-clay were transported and deposited over the low-lying areas as the ice-sheet gradually withdrew under warmer climatic conditions. The floodwaters of the melting ice carved out the valleys afresh, and deposited in many places beds of gravel and sand. Late in the south of England, wind carried quantities of fine particles

¹ For further notes on soils see pp. 100-102/

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and formed drifts of soil not altogether unlike the loess of China, deposits which are known as brick-earths. These surface deposits of the Ice Age differ so much in character

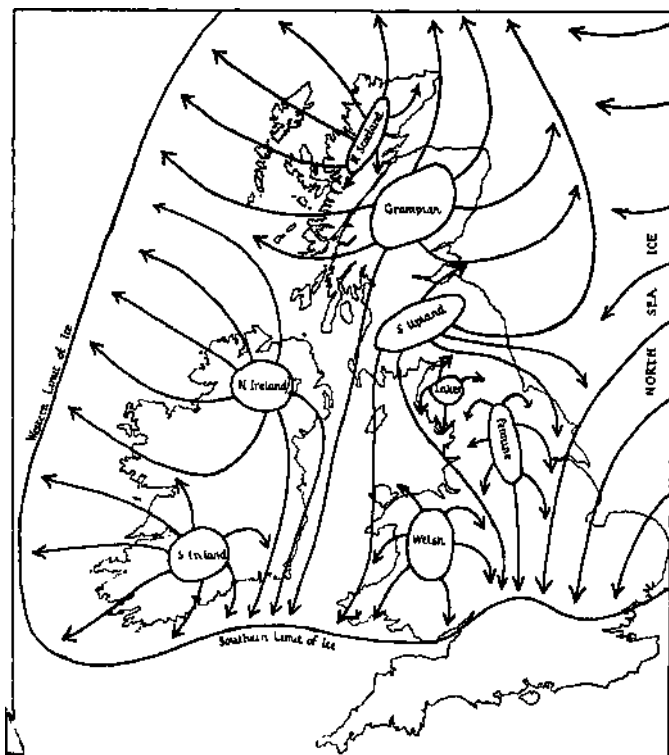
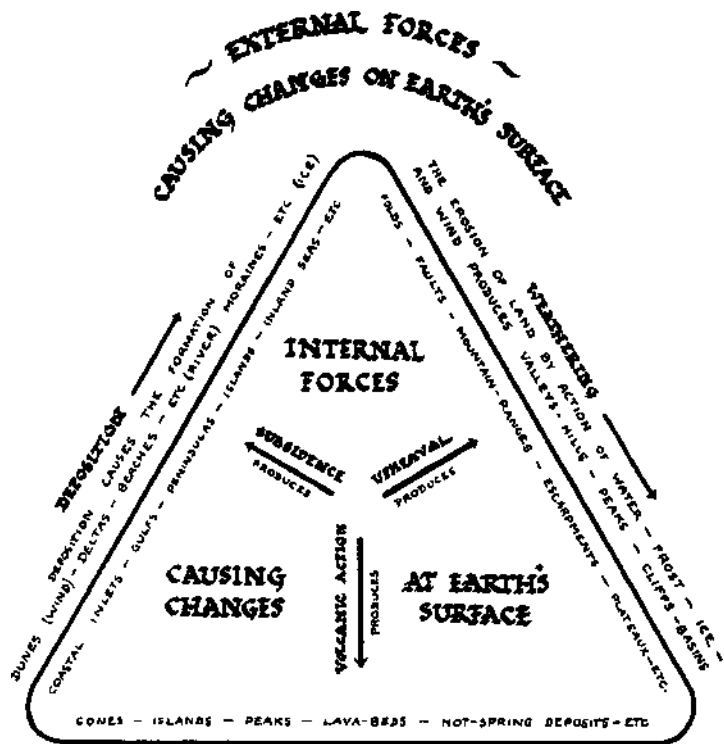


FIG. 9. THE MOVEMENT OF ICE FROM THE ICE-SHEET OF THE BRITISH ISLES DURING THE ICE AGE

from the underlying solid rock that special 'drift' maps have to be made for the areas affected.

And so we arrive at the present-day *relief*, with its main features depending upon the cycle of changes in the distribution of land and sea which has been outlined, but

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TRANSPORTATION OF MATERIALS BY RIVER.S, ICE AND WIND, PRODUCING
EVER-CHANGING LAND FORMS, SUCH AS TERRACE.*. MIWSHES, PLAINS, 6XC

4

TftAiwyoxjanoi*

FIG. 10. THE CYCLE OF NATURE'S WORK ON LAND FORMS

Newly deposited rocks are at once subjected to weathering, and the material so produced is constantly being transported and deposited afresh. At any and every stage of this cycle of change on the earth's surface one or other of the internal forces may operate, causing subsidence, upheaval, or volcanic activity. The part of the diagram representing these internal forces should therefore be regarded as capable of being turned to face any of the three positions

with the details carved by weathering—the result of exposure to sun and air, to changes of temperature, particularly frost, to the work of running water, of wind and wind-blown sand, and, round the coasts, of the sea.

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So that the land as we know it is partly the work of internal forces of the earth and partly the work of forces exterior to the surface of the earth. The internal forces have caused upheavals or subsidences often combined with volcanic activity; and the external forces have worn down the uplifted land, and running water, ice, and wind have carried the material to be deposited on lower levels or in the sea. Tennyson expresses this great truth of the cycle of Nature's forces very graphically in the following lines:

**There rolls the deep where grew the tree.
O earth, what changes hast thou seen!
There where the long street rears, hath been
The stillness of the central sea.**

**The hills are shadows, and they flow
From form to form, and nothing stands;
They melt like mist, the solid lands,
Like clouds they shape themselves and go.**

The terms applied to the natural features of the land at the several stages of this cycle are numerous. Many, such as gulfs, peninsulas, faults, dikes, canyons, basins, alluvial plains, moraines, and so on, are quite familiar and need no explanation. Some others which are in frequent use are not so well known. For convenience a few of the more important are explained briefly below:

Anticline. An upfold of rock-strata in the form of an arch. Similarly, a downfold in the form of a trough is called a *syncline*.

Drumlin. A rounded or elliptical-shaped hill of boulder-clay formed under the ice during the Ice Age.

Escarpment, or Scarp. A steep face or cliff formed by the erosion of the end of gently tilted strata.

Esker. Long, winding ridges of gravel which often extend for miles across hills and valleys in the direction of the ice movement. They are accumulations formed in the crevasses or in the tunnels of sub-glacial streams.

Mesa {Spanish for 'table'}. An isolated block of rock with a flat top, steep and sometimes vertical sides, left upstanding

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amid surrounding country, owing to the wearing away of the underlying layers of rock by streams or blown sand.

Moraine. A mass of rock fragments and earth carried by a glacier and piled in long ridges along the side of it, or deposited in a confused heap at its lower end.

Scree, or Talus. A mass of rock fragments which have fallen from precipitous mountain-sides and settled down to form a slope, the steepness of which is usually about 35° . These slopes are called 'glyders' in North Wales.

There are terms in common use also relating to the erosion of river valleys which it is well to note:

'Longitudinal' and 'Transverse' Valleys.

In some highland regions the ranges run in parallel lines. The valleys between them are said to be therefore *longitudinal*, and rivers fre-

quently flow along them. But later they often turn at right angles and pass through gaps cut by the rivers themselves. They are then known as *transverse* valleys. South-western Ireland has several examples of both such valleys. The Thames Gap through the Chiltern Hills is a

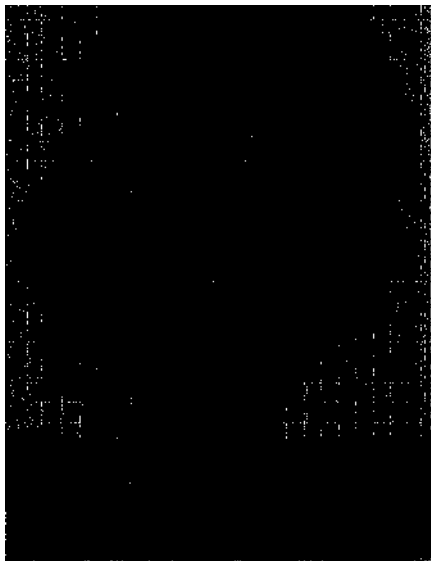
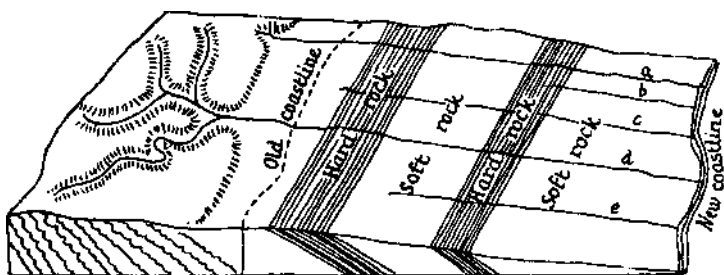


FIG. 11. A 'MESA' ON THE YORKSHIRE MOORS, BETWEEN WHITBY AND PICKERING

The surrounding rock has been **weathered away**, and the remaining block has been **carved by rain, frost, and blown sand**. This is an example of sub-aerial erosion.

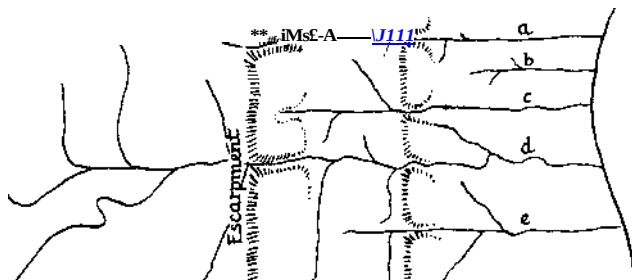
Photo Central Prt'ss



An old land surface reduced to low relief by weathering and river erosion.

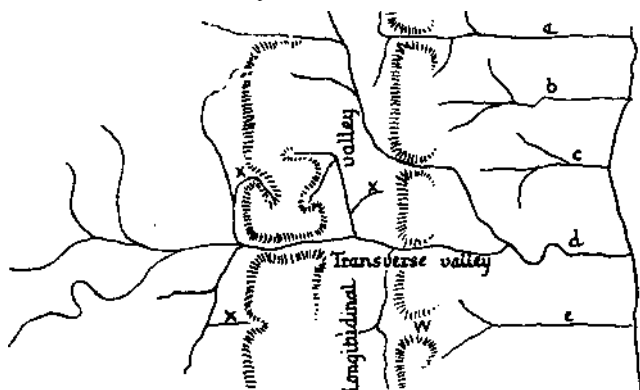
A new land surface which has been slowly uplifted from beneath the former sea.

Consequent Drainage



Subsequent Drainage

The subsequent streams erode the softer rocks. Note the gaps and escarpments of hard rocks.



Later Development

Showing the capture of the head-waters of adjacent streams by the river (d) and the resulting wind-gap at W. Obsequent streams are marked X.

FIG. 12. THE DEVELOPMENT OF A DRAINAGE SYSTEM

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transverse valley. The Wealden area contains an excellent example of the development of river-drainage systems.

When land is slowly uplifted from the sea rainfall upon it at first runs down the slope to the sea. Valleys are thus formed as a consequence of the slope of the ground, and these are named *consequent*. In their course they are likely to pass over rock-strata of varying hardness. As the consequent streams cut down their beds tributaries develop more or less at right angles to the main stream. Since they developed subsequently to the first they are so named—viz., *subsequent* rivers. These subsequent streams wear away the softer strata more rapidly than the harder, which are therefore left upstanding and appear as a line of hills. From these hills other tributaries gradually develop, draining into the subsequent streams. Some of these thus naturally flow in a direction opposite to that of the original river, and so are called *obsequent*.

CHAPTER III

PHYSICAL FEATURES

A GLANCE at the physical map of Great Britain suggests at once two main regions, one consisting of the north and west and the other of the south and east. The boundary is the familiar line between the mouths of the rivers Exe and Tees, excepting the Cheshire plain and its extensions,

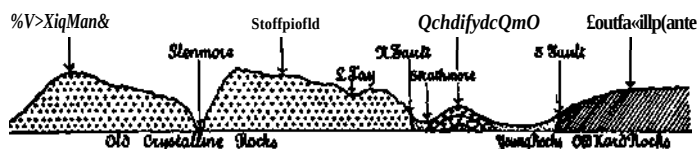


FIG. 13. SECTION ACROSS SCOTLAND FROM NORTH-WEST TO SOUTH-EAST

which lie to the west of the boundary, but belong to the south-east region. On the one side there stand the remnants of the mighty mountains composed of Primary rocks. On the other side are the plains and low hills of lifted strata, or scarplands, composed of Secondary, Tertiary, and other rocks formed in recent times. But here and there among these younger rocks small 'islands' of the ancient platform underlying them come through to the surface. Let us call the one the upland region and the other the lowland region.

THE UPLAND REGION

(a) The Highlands of Scotland. The grain of the mountains runs from north-east to south-west, and they are composed of metamorphic and crystalline rocks, of which the most familiar are named gneiss, schist, quartzite,

THE UPLAND REGION

and granite. On account of long-continued denudation the highest points are only a little over 4000 feet. Ben Nevis, the highest mountain in the British Isles, is 4400 feet high. For the most part they are the remains of a platform sloping south-eastward from roughly 3000 to 2000 feet high. The great rift of Glen More,



FIG. 14. GLEN MORE

This is a view of the rift valley looking up Loch Ness. Note the rounded outlines of the Highland mountains.

Photo Sport and General

containing Loch Ness, Loch Oich, and Loch Lochy, separates the North-west Highlands from the Central Highlands, or Grampians. The mountains of the north-west rise in rugged peaks, and abound with steep-sided glens, often containing lochs, or lakes, in fault valleys or glacier-cut basins. The coast is cut into long peninsulas separated by sea-lochs like fjords and fringed with rocky islands. The Central Highlands, the most imposing of which are the Cairn Gorms, present a smoother skyline, and are more rounded. There are far

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fewer long, narrow lochs, and the coast is smooth in outline, though still rocky. At intervals firths run far inland, but, unlike the fjords of the western coast, are drowned river-mouths, such as Dornoch Firth and Moray Firth, with its offshoots Beaully and Cromarty Firths. The soils of the Highlands are poor and thin, large



FIG. 15. LOCH EIL

Loch Eil runs east-west. Fort William is situated opposite its eastern end.

Photo Sport and General

quantities having been removed by the ice-sheet; what remains is acid and often marshy. The mountain-sides are heather-clad, and woodlands or forests occur only in the lower portions of the valleys. The eastern margins of the Highlands in Caithness and North-east Aberdeenshire consist of a low plateau of Old Red Sandstone and other ancient rocks, but the soil is not very fertile. Note that the Orkney Islands are similar in character to this north-east region, while the Shetland Islands farther north are more like the Central Highlands. The whole

THE UPLAND REGION

region is bounded on the south by a clear-cut fault-line running from the mouth of the Clyde to Stonehaven.

(b) The Central Lowlands, or Midland Valley, lie between the fault just mentioned and another running parallel to it some fifty or sixty miles to the south. Formed



FIG. 16. L.LbIN C^biiAKii-k

A glen in the Eastern Highlands near Kirriemuir. Note the rounded, smooth slopes of the hills.

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in the first instance by the Caledonian earth movements, the lines of faults must once have presented a series of scarps facing one another. But erosion has somewhat reduced the steepness of their slopes, though on the northern side especially the Highlands present a bold edge to the plain. The floor of the valley contains crumpled sedimentary rocks, chiefly of the Old Red Sandstone and Carboniferous periods; but volcanic rocks stand up boldly and form conspicuous features, both as interbedded

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strata and as sills, dikes, or necks, having resisted weathering better than the sedimentaries. On the northern side, separated from the Highlands by the Vale of Strathmore, occurs a line of volcanic hills named successively the Renfrew, Campsie, Ochil, and Sidlaw Hills. The rocks which form the central node, or the watershed between the Clyde and the Firth of Forth, are also volcanic, and volcanic dikes and plugs occur among the disturbed sedimentary rocks, as Edinburgh Castle Rock or Dumbarton or Stirling Laws.

A study of the place-names reveals that in the earliest times following the Ice Age the valley was covered with forest, mainly of such deciduous trees as oak, birch, and hazel, indicating a fairly rich damp soil. But the forests have been cleared and the lakes drained, and now peat covers large tracts of the higher part of the lowland, while the glacial soils in the agricultural land have lost some of their valuable constituents, which have been dissolved or washed away by excessive rain-water, particularly in the wetter west. Notice that the Carse o' Gowrie, the fertile lowland north of the Firth of Tay, is in the drier east.

(c) The Southern Uplands. The mountains here are the remnants of the lofty ranges which trended, like the Highlands, from north-east to south-west; but, unlike the Highlands, they are composed of much folded old sedimentaries of Primary age. In Galloway, the Nith valley, and elsewhere there are some volcanic intrusions, but as a rule the rocks are hard and of even texture, like slate, often presenting their edge to the ground surface, but smoothed by ice-erosion. The whole plateau has been deeply dissected by the rivers which flow through the dales from north-west to south-east.

The Uplands are highest (over 2000 feet) in the centre, and are drained by the head-waters of the Clyde and Tweed. This central portion is bounded by the Nithsdale-Cumnock Gap in the west and the Moffat Gap in the

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east. It has a lowland margin along the Solway coast and Liddesdale, and this lowland has fertile soils, though somewhat stony from glacial deposits.

The western portion of the Uplands is very rugged, deeply cut by river-valleys, and the landscape rather gloomy. This is Galloway, with its irregular coastal plain



Kie. 17. THE SITE OF STIRLING CASTLE

Only portions of the castle remain standing.

Photo Valentine and Sons, Ltd.

to the south, the soil of which has a dry surface, in spite of a considerable rainfall, particularly in the curiously shaped Rhinns peninsula. The valleys have mixed soils derived from New Red Sandstone, limestone, and boulder-clays, which make good dairy and mixed farming possible. The hill-slopes are covered mainly with sheep pastures and some heather, as elsewhere in the Uplands.

The eastern portion consists of Tweeddale, between the Lammermuir and Cheviot Hills. Here Carboniferous and Old Red Sandstone rocks intermingled with volcanic

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rocks form the basis of the soils, though many drumlins of glacial deposits occur. Hence, although the higher ground is devoted to sheep pastures, all the lower ground is capable of being used for arable farming.

(d) **The Lake District.** The existing mountain mass resembles a great dome, with its axis running almost due east-west. No doubt the mountain system was once united with the Isle of Man. The mountains are composed mainly of old sedimentary rocks, with many igneous rocks exposed. Folding apparently commenced in early geological times. The old rocks were thus worn down and covered, at any rate round their margins, with Carboniferous deposits, and again uplifted, faulted, and folded, probably during the Alpine earth movements. The forces of erosion, especially running water and ice-action in past ages, have carved out a series of spurs and valleys which radiate in remarkable fashion from the central hub, or axis. The variety of rocks gives rise to striking contrasts of scenery. The mountain-slopes are smooth and rounded where grits and shales occur, rugged and wild where volcanic rocks are exposed, of the tableland type on the dry limestone of the outer ring, and of a rolling type on the Coal Measures. The dome is cut into eastern and western masses by fault valleys, which are now followed by the road linking Kendal and Keswick. The highest points are Scafell Pike (3210 feet), in the west, and Helvellyn (3118 feet), in the east. In the north, separated from the Helvellyn group by another fault valley, stands Skiddaw (3054 feet). The steep-sided mountains, with high passes between them, the wooded lower slopes, and the many glacial lakes make the region most attractive. The chief lakes emphasize the radial character of the drainage. To the north Derwent Water and Bassenthwaite, now separated by the delta which the river Derwent built across the lake, occupy the central position. To the west lie Crummock **Water and Buttermere**, also separated by a delta, and **Ennerdale**.

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To the east lie Ullswater and Hawes Water. On the south side Windermere occupies the central position, with Coniston Water and Wast Water to the west. Lake Thirlmere, which supplies water to Manchester, lies in the central rift valley at the foot of Helvellyn. Numerous tarns occupy rock-basins, and cascades tumble down from tributary valleys to the main valley below. Ice-action has stripped the valley-sides bare to the rock, and numerous screes lie along them. But in the valley-bottoms are alluvial meadows fenced by loose stone walls. Drumlins of glacial deposits are to be found arranged parallel to the circumference of the dome. The thin, poor soil, deficient of lime, on the flatter parts of the mountains provides only rough pasture for sheep. Afforestation is being carried out in many places. The range of colour in the scenery is remarkable. In summer green is the predominant colour, both on the meadows of the valleys and on the mountain-slopes, where the varying tints of the bracken, the oak, and larch-trees please the eye. From October to the following June the sienna tints of the dead bracken and the brown oak-leaves serve to enhance the greyish-green of the lichen-covered rocks and of the hazel- and birch-trees.

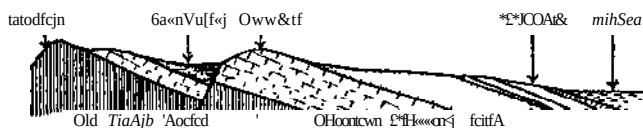
The Carlisle plain and the Eden lowland, where the sandstones and conglomerates of the red Permian and Triassic rocks occur, are distinct regions. The soils from these rocks combined with glacial and alluvial deposits provide good arable land. The Lake District is linked with the Pennines only on the south-east by the hill-mass of Shap Fell.

(e) The Pennines. The fold in this upland is a gentle one, and resembles a wave with its crest breaking towards the west. In the centre the strata lie almost horizontally, and dip to the east gently under more recent rocks. The Northern Pennines are much more faulted than folded. These faults give rise to important transverse valleys, which divide the Pennines into four blocks—the Cheviot

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Hills, the North Pennines, the Central Massif, and the South Pennines, the central one lying between the Stainmore Faults and the Craven Faults of the Aire Gap. The North and Central Pennines are broader and higher than the South Pennines.

The whole area is formed of rocks of Carboniferous age, except where they are broken by igneous rocks, as in the Cheviots and the faulted areas. These basaltic sills and dikes are small in extent. The North Pennines overlook fault-line depressions in the north, west, and south, and



Figs. 18. NORTHERN PENNINES, EAST TO WEST SECTION

the highest summit, Cross Fell (2892 feet), is found on the western fault, the scarped face of which rises from the Eden valley to a height of 1500-2000 feet above sea-level. The Central Pennines are not only bounded by faults, but much broken by a series of intricate faults across their mass; for they were subjected to both the strain of the folding movement which raised the Lake District, the axis of which ran east-west, and the folding of the Pennines along the north-south axis. The flat-topped summits of Whernside, Ingleborough, and Penyghent in this section are all over 2000 feet, and are remnants which have been protected from erosion by a capping of Millstone Grit. The South Pennines are distinctly a folded section which may be subdivided into areas north and south of the Peak (Kinder Scout). For south of the Peak the limestone underlying the Millstone Grit has been laid bare. Another exposed limestone area lies between Clitheroe and Skipton. In these two areas there is much bare rock, and valleys are devoid of surface streams, water finding its way underground; in this way swallow-holes, gorges, and

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caves occur. These areas have only a thin covering of turf, which, however, provides good sheep pasture. Over most of the rest of the Pennine surface Millstone Grit predominates, and the slopes are covered by peat bogs and moorland of heather, bilberry, and cotton-grass, which alone can flourish on the ill-drained soil. There are but few glacial deposits on the upland, but many such are to be found on the lower slopes and in the valleys.

It should be carefully noted that important coalfields are found on the flanks of the Northern and Southern

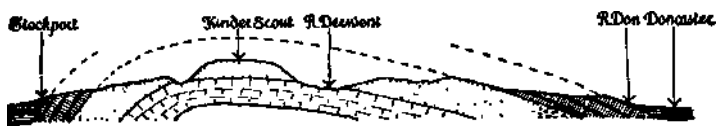


FIG. 19. EAST TO WEST SECTION SHOWING UPFOLDED PENNINES
DENUED

Pennines, but no coalfield borders the central section. These coalfields have been preserved from denudation by a covering of younger rocks.

The drainage of this upland area is naturally east and west, except in the south, where the upland dies down into the English plain in a series of finger-like projections. Elsewhere the eastern slopes have been carved out by rivers into spurs separated by broad dales. In the south rivers like the Derwent flow from north to south, and are collected by the Trent. The soft water which drains from the peat bogs and heather moors plays an important part in the textile industries of Lancashire and Yorkshire.

(/) The Welsh Massif. The whole of Wales, excepting, possibly, the plain of Gwent in South Glamorgan, which belongs in character to the English plain, is an area of ancient crystalline sedimentary and volcanic rocks. It was at one time connected with Eastern Ireland, and formed what has been named St George's Land. The oldest part is in the north-west, and the flat, uninteresting landscape of Anglesey conceals a most interesting geological

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history, for its crystalline rocks of gneiss and schist were folded in Pre-Cambrian times, and, after many other phases, have been planed down to a low plateau. On the mainland the grain of the mountains follows the trend of the Caledonian movements previously mentioned, but in the south the folds are east and west, and belong to a later Armorican period of earth-folding. The rocks are mostly of Primary age, and consist of grits, slates, and sandstones, with Carboniferous Limestone in the south and round the north-eastern fringe. But many of the most rugged heights are masses of igneous rock, particularly in the north.

The general character of the whole massif is a plateau, highest in the west, formed by ancient foldings which have been weathered down and then again uplifted. Four main mountain-blocks may be distinguished:

(i) The greatest heights are in the Snowdon Range, Snowdon itself being 3560 feet high. The summit of this peak shows clearly rocks in synclinal formation, indicating that at one time it formed the floor of a valley between much loftier mountains. Other notable peaks in the Snowdon group are Carnedd Llewelyn (3484 feet) and Carnedd Dafydd (3430 feet). The upper Dee valley separates this block from—

(ii) The Bcrwyn Range, which contains the volcanic masses of Cadair Idris (2927 feet), Aran Mawddwy (2970 feet), and Arenig (2800 feet). The valleys of the upper Severn and the Dovey (or Dyfi) separate the block from—

(iii) The mass of Central Wales, which includes the Plynlimmon group (2469 feet), its south-western outliers, the Mynydd Bach, and its eastern buttresses, Clun Forest and Radnor Forest (2166 feet).

(iv) The Brecon Beacons (2900 feet) and the Black Mountains (2624 feet) lie south of the Wye-Towy valleys. This mass is composed of Old Red Sandstone, with the grain running east and west. Where the hard sandstones



FIG. 20. BEDDGELERT AND SNOWDON: SPRINGTIME SNOW

Photo G. P. Abraham, Keswick

THE BRITISH ISLES

and conglomerates occur the high moorland is extremely wild and bleak. On the lower ground, where the softer Red Marls occur, the land is fertile, as in the plain of Hereford. The Carboniferous rocks which were deposited



FIG. 21. THE RHEIDOL GORGE
The Glen and Falls from the Devil's Bridge.
Photo Sport and General

to the south of this block have been folded into a syncline which has preserved the valuable coal of South Wales. The Millstone Grit and Limestone come to the surface to form an oval ring to the basin.

As in the Scottish Highlands and the Lake District, ice-sheets and running water have carved out the relief. Rounded rocks, U-shaped valleys, striations, erratic

THE UPLAND REGION

blocks, and numerous areas of boulder-clay are to be found. In addition, great faults developed, which in many cases have been invaded by the sea, as in the case of Menai Strait, or deepened by rivers, as in the Bala valley. Practically the whole surface of the plateau is impervious to water, owing to the character of the rocks and the beds of boulder-clay, so that rain runs quickly off the mountains. Some of the streams which drain the plateau westward have cut impressive gorges, particularly that of the Rheidol at Devil's Bridge. But there are large basin areas of moorland, where lie deep mossy bogs. There are also areas of boggy moorland along the coastal lowland, the largest lying south of the Dyfi estuary. The chief drainage is to the east, and the two longest rivers, the Severn and the Wye, rise close to each other on the boggy slopes of Plynlimmon. The Dee makes use of a rift valley, and the Usk, in the south, skirts the boundary between the old plateau and the coalfield.

(g) The South-west of England. The last of our upland regions, although containing in the Lizard area and the small plateau near Start Point remnants of a Pre-Cambrian land, differs in many ways from the regions described above. The old rocks here consist largely of Devonian shales and limestones and Carboniferous grits, shales, and limestones, known as Culm Measures. These were folded by Armorican earth movements into two or three folds running east and west. The intrusion of igneous rocks has complicated the structure, and the great bosses of granite now uncovered by weathering constitute dominant features of the relief. The chief are Dartmoor, Bodmin Moor, and St Austell; two others occur in the extreme west. They decrease in height and grandeur as one moves westward. The Scilly Isles are also low remnants of granite hills. Across the neck of the peninsula occur rocks of Secondary age. The Vale of Taunton is floored with Red Marls, which give to the scenery

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a pleasing character, in contrast to the sterner type of country to the west.

This upland region, then, contains no rugged mountain system, but is rather a land of rounded hills cut by deep, narrow valleys. The heights of Mid-Devon and North Cornwall are bare, windswept, and often boggy. The

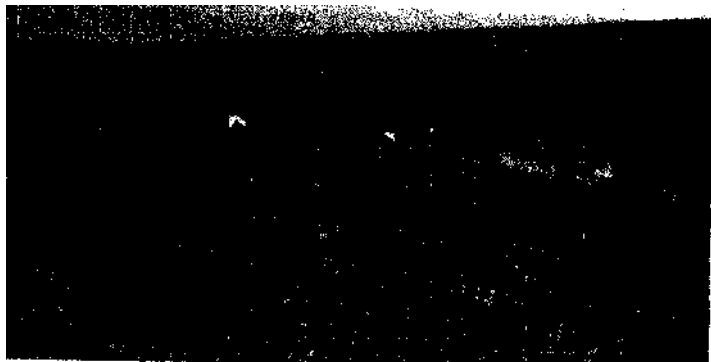


FIG. 22. DARTMOOR: PEAT-CUTTING AND -CARTING

The view gives a good idea of the monotonous relief of granite moors. There is no definite landmark. The valley-bottoms are swampy, and the peat accumulates. Note the complete absence of trees, due to the thinness of the soil and exposure to strong winds.

Photo Sport and General

peninsula receives abundant rain, and the drainage radiates from the moorland areas, but it is clear that many changes have occurred here, as elsewhere, during the infinitely long geological history of these ancient highlands.

IRELAND

Although Ireland is not part of the island of Great Britain, which we are considering, and will be dealt with separately, it has a structure closely connected, of which

THE UPLAND REGION

the main points must be noted. For instance, the crystalline Archaean rocks of the Highlands of Scotland are continued in the mountains of Donegal, and the ancient sedimentaries of the Southern Uplands in County Down of North-eastern Ireland. But the Mourne Mountains are a mass of granite which has thrust its way in and has been exposed by the erosion of the overlying rocks. The rift valley of the Central Lowlands of Scotland is obscured in Ireland by the lava-flow which has weathered into the basalt plateau of Antrim. But the underlying structure of most of the central plain of Ireland is similar, being composed of Carboniferous Limestone through which upfolds of older sedimentaries appear and form isolated hills. Lough Neagh occupies the centre of this rift valley, the line of which runs from Lame to Armagh. It must be remembered that although Carboniferous Limestone looms largest on the geological map of Ireland it is seldom visible. It lies flat, and has been covered with a deep deposit of glacial clays and sands left after the Ice Age; the coal has been almost entirely eroded away, and the peat which accumulates on the surface from time to time slides to lower levels, and bogs cover a large proportion of the country. Lough Foyle may be said to be the Irish counterpart of Loch Fyne, and the West Donegal coast that of the rift of the Caledonian Canal. In the same way, the Giant's Causeway, with its well-known formation of hexagonal pillars of basalt, reveals a rock-structure like that of Fingal's Cave, in Staffa Island.

In South-eastern Ireland Wexford and the country west of it have mountains with a clearly marked trend practically east-west, like the Brecon Beacons of South Wales or the North Devon upfolds.

Like them also, these Irish mountains are composed of Old Red Sandstones intermingled with Carboniferous Limestone which were folded by Armorican movements. The longitudinal valleys between the parallel ranges of the Knockmealdown, Galtee, and Kerry Mountains are

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drained eastward by rivers which all turn sharply southward to their estuaries. It is probable that these sharp bends are due to tributary or subsequent streams cutting their valleys back along the softer rocks, beheading the original or consequent streams. (See Fig. 12.) On the south-west the longitudinal valleys have become submerged, forming rias which shelve gently seaward. The chief arc Dingle, Kenmare, and Bantry Bays.

The Wicklow Mountains, on the south-east coast, also belong to this area, but are formed of granite.

CHAPTER IV

PHYSICAL FEATURES—«wi/imi«f

THE LOWLAND REGION

BEFORE attempting to divide the area which lies to the south and east of the Exe-Tees line into its physical regions let us first gain a general impression of the relief. If we start from the London area and travel westward or northward we cross in succession rock formations of the geological periods outlined above. Beginning with recent alluvial deposits, little above sea-level, we cross the clays of the London basin, to ascend hills rising gently to 600 or

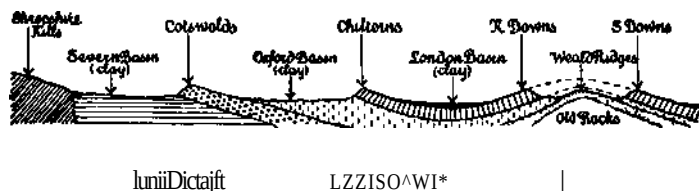
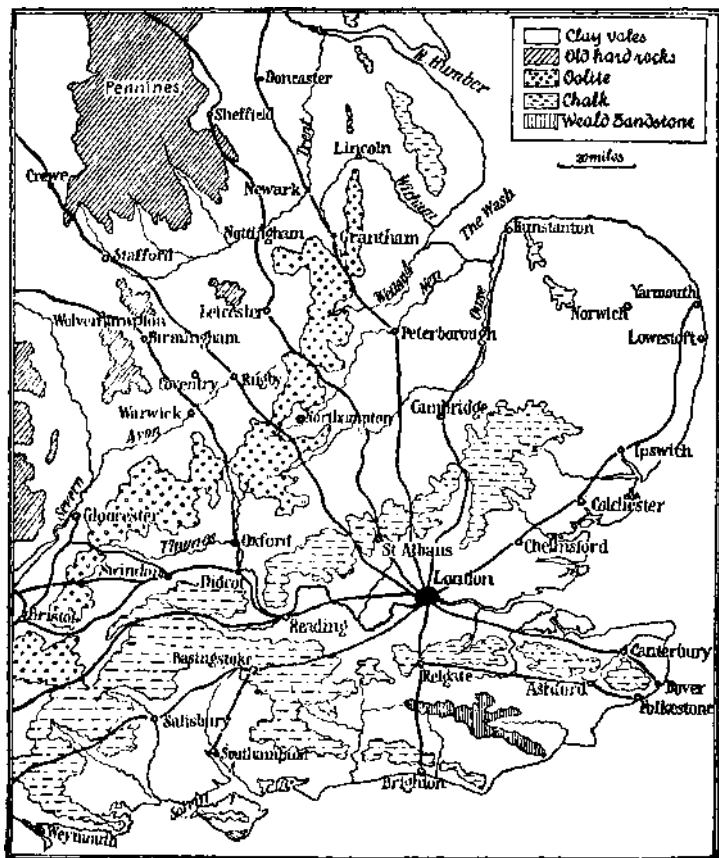


FIG. 23. SECTION ACROSS SOUTH-EASTERN ENGLAND FROM NORTH WALES TO BEACH HEAD

even 800 feet high. This line of hills stretching across England runs first in a north-easterly direction, and then, in detached portions, northward. The hills are formed of Cretaceous rocks, of which the chalk is the most conspicuous. They present a steep, well-defined escarpment towards the north-west. With their rounded contours, rolling grassy downs, and dimpled hollows, in which soil has accumulated, and occupied in sheltered positions by beech woodlands, they have a beauty of their own. After descending, the diagram shows how we cross the sands and clays of the plain, the chalk has several minor escarpments

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Fin. 24. THE MIDLANDS AND SCARPLANDS

as successive strata crop out. Rising steadily, we come to the Jurassic formation stretching across England from the south-west on a line nearly parallel to that of the chalk. This formation also rises to a steep escarpment north-westward, and rises to a high plateau. But the line of these hills is not continuous, and the cause the face

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has been deeply cut back in places by rivers draining westward. The escarpment is steeper than that of the chalk. Descending this, we begin to cross the plain of the Severn or the Avon. The soils in this plain are lighter than clay, and are greenish where weathered from some strata and red over the wider tract of Triassic strata, extending through the gate of Cheshire.



FIG. 25. A VALLEY IN THE CHALK DOWNS OF DORSET

A similar sequence is found on a journey from the London area southward or south-westward, but with a difference. Let us take South-east England as our first region.

(a) The South-east. We have seen that the whole of South-east England was originally covered with chalk, and that this was arched into a dome during the Alpine earth movements. Weathering has removed the crown of the arch, so that the chalk remains only on the North and South Downs, which present escarpments facing each other. The region between these two escarpments is the Weald proper, and occupies nearly half the area. The diagram (Fig. 26) shows how the sandstones and clays underlying the chalk have weathered unequally, the clay

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forming broad valleys running east and west and the sandstones upstanding as ridges.

The drainage of the area has particular interest, for it was to this river system that the terms now universally used were first applied. When the dome was more complete the rivers flowed either to the north or south as a consequence of the slope of the ground. Such are consequent streams. As these rivers cut down their beds other subsequents developed, and several of them became more important than the original streams. (See p. 39.)

The axis of the Wealden upfold extends from the borders of Hampshire eastward to the Strait of Dover and

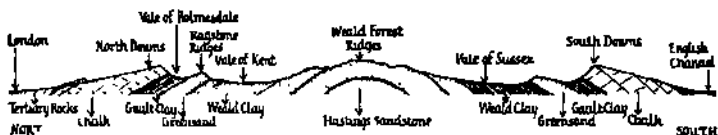


FIG. 26. NORTH TO SOUTH SECTION ACROSS THE WEALDEN AREA

into France, a distance of over a hundred miles. Passing across the Weald from the chalk escarpment in the north to that in the south, the following belts are traversed:

- (i) The Vale of Holmesdale, which is covered with moisture-holding' clay. But near the foot of the escarpment rich mixed soils occur.
- (ii) The Greensand Ridge, much of which is heathland, because the soil is poor and dry; but some parts are capable of cultivation. Numerous springs occur along the base of the ridge.
- (iii) The Vale of Kent, another wet clay vale much broader than (i). This belt was once covered with oak forest, but is now chiefly pasture, and there are few villages.
- (iv) The Weald Forest Ridges, also once forested, and at that time important for the preparation of charcoal for the early iron industry.
- (v) The Vale of Sussex, similar to the Vale of Kent.

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Outside the Weald proper lie the North and South Downs, rising to an average height of 600 feet and dipping away towards London or to the south coast with gentle slopes, except where the sea has cut across the chalk, forming vertical white cliffs. The steep drop of over 400 feet from the top of the escarpment to the clay vales raises difficulties of communication. The gaps cut by the conse-

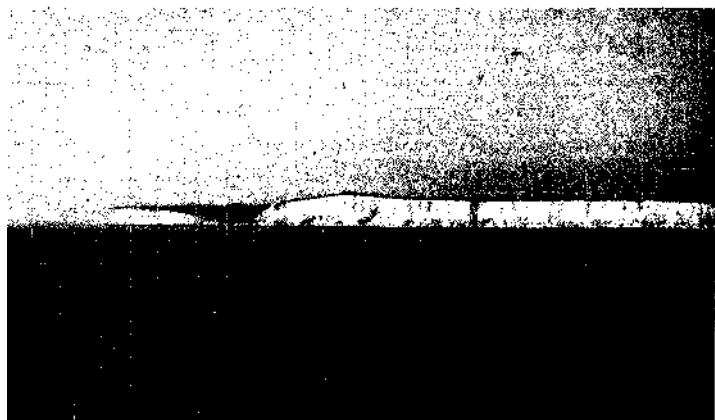


FIG. 27. THE SOUTH FORELAND

The exposed end of the chalk upfold cut by the sea at the Strait of Dover. The break in the chalk cliffs is the valley at the mouth of which Dover is situated.

quent rivers are important both for routes and town sites. (See Fig. 82.)

(b) The Hampshire Basin. In this region will be included the chalk downs which surround the basin proper. The area is that approximately included within the part of a circle of a radius of 45 miles, with the Needles as the centre. The chalk here has been arched into a broad upfold in the north and a narrower upfold in the south (the Purbeck Downs and the hills of the Isle of Wight), with a downfold between them. As in the case of the Weald, the sea has cut the rim of the basin, but differently. The southern chalk ridge no doubt once ran

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continuously parallel to the coast; but the sea has cut through it at each end of the Isle of Wight. The Solent and Spithead are as much carved out by the sea as they are drowned river valleys. There are other minor folds, as, for instance, that which formed the hills overlooking

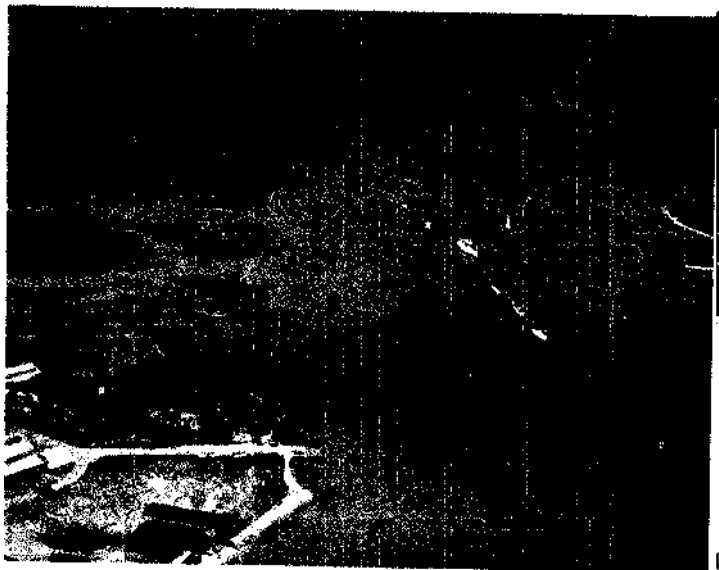


FIG. 28. THE HAMBLE ESTUARY

A drowned valley on the east shore of Southampton Water—a yachting centre.
"Flight" copyright

Portsmouth Harbour. The chalk downfold across the centre of the basin has been covered and preserved by deposits of Tertiary age. They consist largely of mixed sands which intermingle with areas of loamy soil, give variety to the landscape, and are valuable for farming. The New Forest marks one such area of sands. In the north erosion of the chalk is going on apace by streams draining on all sides. The result is that the wide uplands are being cut into tabular blocks, or 'cuestas,' with vales

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between them. In the south the sea is not only cutting further gaps, as at Lulworth Cove, and carving the softer rocks into smooth bays, leaving the harder ones standing out as 'bills,' but in other parts is actively depositing pebbles and sand, as at Chesil Beach, near Weymouth.

The original consequent drainage of the area has become considerably changed. It seems to have followed the line of the river Frome from the west into Poole Harbour, the Solent and Spithead collecting the drainage from the north. The sinking of the land below sea-level has submerged the lower valleys and left the tributary streams as separate rivers.

(c) The Plains of Somerset and the Lower Severn Basin. This region is a boundary area between the old hard rocks and those that are younger and softer, and partakes of the character of both. For instance, in the Mendip Hills we have an 'island' example of a Carboniferous Limestone upfold which has the characteristics of parts of the Pennines. The Mendips consist of an anticline which after being eroded to a plain was uplifted, so that it is now a plateau. On the surface of this plateau are a number of swallow-holes, into which surface water disappears. Underground caves are formed, and ultimately the caves become open combs and gorges. Cheddar Gorge is famous. The plain of Gwent is formed of Old Red Sandstone, while much of the rest of the region forms part of the great area of New Red Sandstone of the Midlands. Then, beginning on the Dorset coast west of Weymouth and extending north-eastward is the Oolitic Limestone escarpment of Jurassic times, most conspicuous in the Cotswold Hills. The region, therefore, may be subdivided into (a) the plain of Somerset, bounded by the Mendips in the north and the Quantocks in the south; (b) the plain north of the Mendips, including that of the lower Severn; (c) the plain of Gwent, on the Welsh coast; (d) the plain of Hereford, between the Malvern Hills and the Welsh Massif.

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Much of the plain of Somerset is almost at sea-level, and the peaty moorland is very subject to flooding, but the Polden and other low hills stand up like islands. Sedge-



FIG. 29. CHEDDAR GORGE, IN THE MENDIP HILLS

Note the road winding through the gorge, following the old watercourse. The height of the cliffs in the foreground is 450 feet. But note that the surface of the Mendip Hills is flat, and was probably planed down by the sea in past ages.

" *Flight* " copyright

moor is a well-known part of the plain, and the whole region reminds us of the Fens. The higher levels of Somerset and the other plains are covered with soil of a deep red colour, consisting of marl and clay mixed with lime constituents. In the plain of Hereford parts are covered

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with glacial drift. The whole region is essentially suited to pastoral farming. The course of the Bristol Avon should be noted. It rises on the eastern slopes of the Cotswolds, and flows eastward as a consequent river, as though to join the Thames; but, turning first southward and then westward, it cuts its way through the Oolite at Bath, and finally flows northward through a second gorge in the Clifton Downs near Bristol.

(d) The Thames Basin, (i) *The Upper or Oxford Basin*. This area lies between the Jurassic scarpland of the Cotswold Hills and the chalk escarpment of the Chilterns. In the south-west the vale narrows, rises in level, and is formed of clays, sands, and limestones, which have weathered unequally, the last two forming minor hills in the plain. Much of the difference in the rate of erosion is due to the porous nature of the rocks, which does not favour the development of streams. And it is the action of the streams which has made the relief of this basin. Valleys are steep-sided and narrow on the limestones, and become broad, open vales on the clays.

The rocks of the Cotswolds dip so gently south-eastward that the country has the appearance of a tableland dissected into blocks by the rivers. Three sections of tableland should be noted—the Cotswolds, Edge Hill, and the Northampton Uplands. The two latter lie to the east of the line of the first, and each is separated by a broad valley. They rise to heights of 1000, 700, and 600 feet respectively. The main valleys of the Cotswolds are explained as due either to solution by underground water or to the fact that during the Ice Age freezing of the subsoil prevented percolation. In either case there are certainly a number of gaps now devoid of streams, and these are called wind gaps.

The fact that the Thames flows transversely across the grain of the land, cutting a wide gap—the Goring Gap—between the White Horse Downs and the Chiltern Hills, suggests that it was the original consequent river, and

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that it probably carried the head-waters of the Severn. When the subsequent streams had removed the protective covering of the underlying sands and clays the valley was planed down; but the river Thames was able to maintain its course, deepening its bed through the chalk.



FIG. 30. ON THE THAMES AT LECHLADE

Lechlade is situated at the foot of the Cotswold tableland, where three head-streams of the Thames converge.

"The Times" copyright

Its volume and, as a result, its power of erosion were increased by capturing a number of other consequent streams. The subsequent streams would do this as they cut back their valleys in the soft strata. One such stream, the Cherwell, or Cher, which drains into the Thames from the Northampton Uplands, follows the axis of a slight downfold in the rocks of the plateau. The Kennet still more markedly follows a downfold of the chalk between the White Horse Hills and the downs north of the Hamp-
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shire basin, which contain the highest point of the English chalk hills.

(ii) *The London basin* is contained between the North Downs and the Chiltern Hills, with their extension in the East Anglian Heights. The plan of the chalk formation



FIG. 31. THE RIVER MOLE, NEAR MICKLEHAM, SURREY
Mickleham is situated in the Mole Gap between Dorking and Leatherhead.
"The Times" copyright

is V-shaped, and the valley between the arms of the V is due to a syncline of the chalk. Thus, the physical divisions of the basin are: the Chiltern Hills, the Kennet valley, the Thames valley, the North Downs, and the sloping plain of Essex. The basin extends into Essex, where the chalk hills descend to form a low plateau, and are drained partly into the Thames by the rivers Lea and Roding and partly direct to the North Sea by the Chelmer, the Colne, and the Stour. London is in every sense the

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centre of this basin. Underlying the chalk in this syncline is a continuous layer of Gault clay, and overlying the chalk are beds of sands, gravels, and clays. This structure favours a good artesian water-supply, though London takes most of its water from rivers. But London clay forms the surface of aver half the basin. It is easily eroded, and where beds of sands or glacial gravels protect it from erosion low hills like Hampstead, Harrow, Bushey Heath, or Elstree are left upstanding. Sands also pre-dominate between Windsor and Guildford, forming dry, unfertile soil. In the Lea valley and the Essex part of the basin are patches of boulder-clay and gravels. Gravels also abound along both sides of the river, and in places form distinct terraces.

The streams draining into the London basin can be grouped as follows: (i) Those, like the Medway, Wey, Mole, and Darent, which rise outside the basin in the sandstones of the central Weald and make their way through gaps in the North Downs; (ii) streams which rise in the Chilterns whose valleys have been cut back nearly t[^] the escarpment, like the Colne; (hi) smaller streams which come from springs at the junction of clay and chalk or from gravels resting on clay.

(e) East Anglia. This region covers the counties of Norfolk and Suffolk and North-eastern Essex. Although this is a land of low relief and, excluding the Fens, the youngest part of England, the glacial deposits which bury the chalk over so much of the area provide a wide variety of soils, and hence of agricultural towns and villages. Chalk, however, covers more than half the area rising on the borders of Cambridge and Suffolk to a height of 300 feet. It forms gently rolling uplands, with typical combes and dry valleys. The ridge dies down near Bury St Edmunds, but reappears in Norfolk Edge, which runs in a northerly direction until cut by the Wash, and reappears as the Lincoln Wolds. Of the glacial deposits the most noteworthy is the morainic ridge extending westward from

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Cromer. This ridge forms a watershed for several streams. East of a line between Cromer and Norwich lies a region of glacial loams, light but fertile, and easily worked. The area behind the Yarmouth-Lowestoft coast is the well-known land of the Broads, which contains valuable alluvial soils and provides rich pastures. Farther south along the coast, extending into Suffolk, is a belt of light



FIG. 32. HICKLING BROAD

Clearing weeds which impede the sailing of yachts and wherries in the holiday season.

Photo Sport and General

soils, loams, sands, and gravels, with some fertile tracts, but chiefly heathland. Inland on the higher ground of Norfolk and Suffolk the soils are frequently heavy and tenacious, but are interspersed with gravels and drifts of brick-earth. Here there is much common land and mixed arable farming. Along the north coast of Norfolk is an alluvial plain, with soils similar to those in Broadland. To the south and west sandy soils cover a wide area and give rise to large farms and to the cultivation of barley and roots. Where these sands overlie the chalk but thinly there is much uncultivated heathland, and agriculture depends a great deal on the seasonal rainfall.

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(/) The Basin of The Wash. The Fenlands formed by the lower valleys of the Witham, the Nen, and the Ouse form a separate region. They cover an area 70 miles long and 30 miles broad. Formerly this was a vast swamp, "a labyrinth of black wandering streams, broad lagoons, morasses submerged every spring tide, vast beds of reed and sedge and fern, vast copses of willow and alder and grey poplar, rooted in the floating peat." The muds and gravels were deposited partly by the sea, which is still rapidly filling the Wash, and partly by the sluggish rivers. Marsh plants grew in profusion, and formed deposits of peat fifteen feet thick in some places. The area is so flat that there is practically no drainage. The average height above sea-level of the Fens is only about 15 feet. The 50-foot contour may be taken as marking the limit of Fenland, and most of the houses and villages are built on 'islands' above this contour. But by means of pumps, embankments, and cut channels, such as Fleam Dike and Devil's Dike, the land has been reclaimed. The dark soils, now drained, are wonderfully fertile. Three-quarters of the area are now under the plough, and successions of such crops as potatoes, sugar-beet, wheat, and other grains are obtained without risk of exhausting the soil.

The basin of the Witham forms the northern part of the basin of the Wash, and includes most of Lincolnshire, the county next in size to Yorkshire. Of this county the physical subdivisions should be noted. Along the northern coast of the Wash is a belt of fens some ten miles wide. Marshes also occur along the east-coast plain. The chalk upland of the Wolds, rising to 500 feet, extends parallel to the east coast for 45 miles, and varies in width from five to eight miles. West of it is a broad lowland of soft clay and glacial deposits of boulder-clay and gravel. Flanking this lowland on the west is Lincoln Edge, a northward extension of the Jurassic limestone scarp. Through this ridge the Witham has cut a gap wide

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FIG.

A view looking along Wenlock Edge showing the distance to the Wellington.

"The Times" copyright

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enough to suggest that the Trent formerly flowed through it. North of the gap the Edge stands up boldly between the plains on either side. It runs due north, straight and narrow, and is devoid of villages. South of the gap the Edge broadens out into the Kesteven plateau, with stone-built houses and stone fences. West of the Edge is a low plateau of bluish clay fringing the Trent. The marshlands known as the Isle of Axholme, though in Lincolnshire, belong to the Trent basin.

(g) The Midland Plateau. This triangular area in the heart of England includes the basin of the Trent, the middle valley of the Severn, the Vale of Evesham, and the plateau between them. The boundary of the area on the south-east is the limestone escarpment of Edge Hill and the Northampton Uplands. The plateau is formed for the most part of Triassic marls, which weather into a rich red soil, similar to that of the Old Red marls of the Hereford basin. This broad plateau is far from flat, for the rivers have carved out a varied relief. In addition, there are several conspicuous hill districts composed of old hard rocks. These are Charnwood Forest, in the north-east, Cannock Chase, in the north-west, and the Clent Hills, in the south-west. Another detached ridge of ancient rock in the south-west is named the Lickey Hills. Finally, there is the upland of Wyre Forest, through which the Severn has cut a gorge, and the Wrekin of North Shropshire. The Pre-Cambrian rocks of Charnwood Forest are quarried for road-metal. But there are many attractive steep-sided valleys among the hills, some of which are dammed to provide reservoirs for the industrial cities. Coal Measures are associated with these old rocks. The Leicestershire Coalfield adjoins Charnwood Forest on the west, the Warwickshire Coalfield marks another old-rock area near Nuneaton, and the South Staffordshire Coalfield lies between Cannock Chase and the Clent Hills.

(h) Lancastria. This region is a continuation of the

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plain just described, and is joined to it by the Midland Gap, or Gate, between the Pennines and Wales. It is an undulating lowland, the outcrops of sandstones forming low hills and the marls the lowland. The latter rocks contain important salt deposits.

(i) The North-eastern Lowlands. This is the eastern counterpart of the Cheshire plain. As the rocks of the

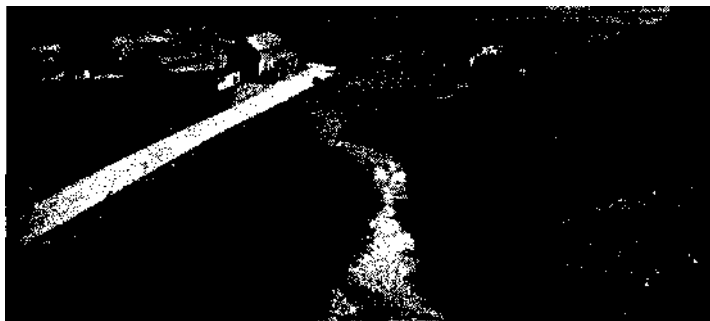


FIG. 34. SALTERSGATE, YORKSHIRE
The road across the moors to Whitby from Pickering.
Photo Will F. Taylor

Pennines dip eastward they are covered by Magnesian Limestone, sandstones, and marls successively, each producing a different type of scenery. The limestone forms a distinct scarp facing west, the sandstones an unfertile tract chiefly covered with woods, such as Sherwood Forest, and the marls a lowland relieved here and there by morainic deposits, particularly in the Vale of York. This important valley, which is the very heart of Yorkshire, is some 60 miles long from north to south. The southern part is 30 miles wide. But the plain narrows

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to 10 miles in the Northallerton Gate before merging into the valley of the Tees.

To the east lie two upland areas separated by the Vale of Pickering. The northern upland, the North York Moors, extends nearly 40 miles from east to west, and is nearly 20 miles broad. This is the last representative of the Oolitic Limestone escarpment, and terminates at the coast in bold cliffs. To the south the limestone dips under the clays and alluvium of the Vale of Pickering.

This wide vale was originally drained eastward to Filey Bay; but the valley became dammed by a glacial moraine, so that a lake was formed, which overflowed in the south-west, where the river Derwent has cut a gorge. The alluvial deposits are fertile but flat, and subject to winter floods.

To the south of the Vale the Yorkshire Wolds are the termination of the chalk escarpment cut by the Humber. After gaining a height of 800 feet they swing to the east in a crescent-shaped curve, ending in the well-known Flamborough Head. On the south-east the chalk dips gently to the plain of Holderness, which is covered by irregular glacial deposits overlain in places with alluvial soils. Many of the meres which originally filled the hollows of this monotonous plain have now been drained and their beds brought under cultivation.

CHAPTER V

CLIMATE

THE weather of the British Isles is so changeable that it is of constant interest, and, indeed, almost a national topic. This aspect of our climatic conditions makes it extremely difficult to give any general description which is really satisfactory. It is much easier to consider the conditions on any particular day or succession of days, as is shown in the map prepared daily by the Air Ministry and issued to the newspapers with the forecast for the succeeding twenty-four hours. This we must do later in order to understand the details of a weather map when we wish; but we must also know not only something of the main forces at work over these islands, but also the chief factors affecting any climate.

The most powerful influence is the sun, which is the source of all energy. If the sun alone had to be considered the problem of climate would be easy, for the area of greatest heat would clearly be in equatorial regions, where the sun's rays are most concentrated, and the greatest cold would be at the Poles, where the sun is never high above the horizon. Temperature would decrease gradually and regularly from the one area to the other. The climate of a place would depend upon its *latitude*. We know that this is only partly true, and that the *distribution of land and water* plays a great part. For land absorbs and loses heat more rapidly than the sea. We know too that even the land does not absorb heat equally, and that great differences may exist between two places east and west of each other. This is not surprising, seeing that in some parts bare rock is exposed, in others soils are of widely varying character, and in many places the soil

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itself is protected from the sun's rays by vegetation, sometimes dense, sometimes sparse. Then, again, the land is not everywhere level. Mountain-slopes which face the sun get more concentrated heat. So that both the *surface conditions* and *aspect* are important factors of climate.

If the air were dry and free from dust the sun's rays would pass through without warming it. On mountains, where the air is always purer than in the valleys and plains, it is often comfortably warm in the sun, although the air temperature may be below freezing-point. The more *water-vapour* or *dust* contained in the air the more the air absorbs and retains heat. So that such air has the effect of reducing the heating of the land by day and also of reducing its cooling by radiation at night. In fact, the air of the British Isles is warmed or cooled chiefly by the land surface beneath it.

Prevailing Winds. Further, the air is rarely still. Differences of temperature cause it to circulate. Thus, over the North Atlantic there is a tendency for cold dense air to flow from the polar area towards the south-west and for a current of warm air from the Atlantic to flow to the north-east—*i.e.*, towards Europe. These air-currents can move much more freely in all directions than the currents of the sea. In this way movements of the air in a vertical direction rapidly modify its temperature. When air rises pressure on it decreases, and expansion takes place, which has the effect of lowering its temperature about 3° F. for every 1000 feet of ascent. Such movements in a vertical direction may be set up by a mountainous relief. But they occur also over lowland areas whenever the air in one part has become warmer, and therefore lighter, than the cooler air around, which then flows underneath it. The latter are convectional air-currents. Upon the temperature of the air depends the amount of invisible water-vapour it can hold. Moist air that is forced to rise from any cause tends to condense this water-vapour, forming clouds,

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which act as a screen to heat-rays, either from the sun or from surface radiation. It is important, therefore, in considering any climate to bear in mind the source of the usual air-currents, for if they have been for some time in contact with the sea both the temperature and the amount of moisture carried will differ from that of air coming from a land area.

The chief facts to remember concerning the air conditions over the British Isles are:

- (i) That the islands lie between latitudes 50° and 60° N. In these latitudes the sun rises to a summer altitude of sixty-three degrees above the horizon in the south and fifty-three degrees in the Orkneys, and in winter sixteen degrees and six degrees respectively. Note that these are not temperatures, but *the angles of the sun's rays*.
- (ii) That in these latitudes the differences between the seasons are much more marked than they are in either polar or tropical lands. In polar lands the summer and winter seasons are longest, and the change from one to the other is quick and severe, while in tropical lands the seasons are marked more by rainfall than by temperature. In Britain and other temperate lands the change is gradual, producing definite seasons of autumn and spring, and each season has a character of its own.
- (iii) That the islands lie on the west of a great land mass, yet close to it. As the winds come mainly from the south-west the climate varies between oceanic conditions, with equable temperatures and abundant rain, and continental conditions, with extremes of temperature both between summer and winter and between day and night.

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- (iv) That because they are islands and small in extent no part is shut off from these influences.
- (v) That the highest land is in the west, and that for the most part the land slopes eastward or south-eastward.
- (vi) That there is a wide variety of surface conditions which have marked local effects. Thus, the flat clay vales of the English plain hold moisture and keep the air damp and cool, while the low hills of porous rock are drier and are both warmed and cooled more rapidly.

Atmospheric Pressure and Winds. The state of the weather is carefully noted at some forty stations in the British Isles, and the facts recorded by the various instruments are communicated to the Air Ministry in London at six-hour intervals. From this information a map is made, and from this map weather forecasts are drawn up. Among the most useful of these facts are the atmospheric pressures recorded by the barometer. When allowance has been made for the altitude of the recording station the pressure at sea-level is inserted in the map, and lines called isobars are drawn through places which have the same pressure. These isobars show pressures at intervals of $\frac{1}{4}$ inch, or two millibars in the height of mercury in the barometer. The result is that certain areas are seen to have high pressure and others low pressure. And the recorded direction of the wind shows that air is flowing from high to low pressure, not in a straight line, but circulating, and moving inward towards the centre of the 'low.' The recorded strength of the winds also shows that the nearer a high area is to a low one the stronger is the wind. The winds are usually strongest in the winter half of the year.

The distribution of pressure is always changing, but as a rule pressure is low near Iceland during most of the year. In winter the pressure over the cold Continent is

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high, and there is also high pressure in the neighbourhood of the Azores islands. Sometimes these two high-pressure systems unite to form one, but more frequently there is a shallow trough of low pressure between them. As a result the winds are mainly from the south-west over the British Isles. In summer the low-pressure area near Iceland is less deep, but pressure is then less also over the heated continental area, while the high-pressure area near the Azores persists and stretches farther north. So that again, though less strongly, air-currents tend to be drawn across the British Isles from the Atlantic.

Thus, the outstanding feature of our climate is the frequent flow of warm, moist air from the south-west. This stream of air is warmed in passing over the North-east Atlantic Drift, and benefits the whole island. Records show that wind is from a westerly quarter during nearly half the days of the year, from an easterly quarter on a quarter of the days of the year, from the north for a tenth of the time, and from the south for the same number of days, the remainder of the days being calm. But surface relief causes local variation in the direction and force of the wind.

These winter low-pressure systems which form over the warm waters of the North Atlantic arc vast eddies in the current of air moving towards the Icelandic low-pressure area. They form in rapid succession, some crossing the British Isles, but more frequently passing along the west coast in a north-easterly direction. These disturbances seem to be due to a stream of warm, moist air from the south-west coming into contact with a stream of cold polar air, the two flowing side by side in opposite directions. Where the two streams touch, the eddy begins to form, caused by a gulf of warm air entering the path of the cold air. The dense cold air flows underneath the lighter warm air, which is lifted up and cooled, its moisture condensing into cloud. This eddy or cyclone, shaped like a shallow cone, as it were, floating on the heavier air

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beneath, may measure several hundred miles across, and it moves forward in the same direction as the warm current. (See Fig. 37.)

The first sign high in the sky of such a disturbance approaching is a layer of thin clouds. The sky becomes more and more overcast, and rain begins to fall, becoming heavier as the centre of the cone or trough approaches. After it has passed the sky gets clearer, the air cooler, the rain dies away, and fine weather returns. Places which lie in the direct path of a cyclone moving in an easterly direction experience winds first from a south-easterly direction, then a calm as the centre passes, and then winds from the reverse—viz., north-westerly—direction. (See Fig. 36.) Those over which the southern side of the depression passed would get south-westerly winds, veering or changing direction first to south and then to west; those on the northern side of it north-easterly winds, veering first to north and then to west.

The larger cyclones or disturbances are frequently followed by secondaries. They are smaller, but usually more violent. The cyclones come on an average once every ten days, but more frequently in winter than in summer. The majority move in from the Atlantic, and pass close to our western coasts. But they not infrequently cross the islands, and may come from other directions. The Severn estuary seems to form a convenient gateway for them to cross the midland plains. Other frequent routes are up the English Channel and across the north of England. Cyclones are thus associated with cloud, rain, and strong winds, the secondaries, especially in summer-time, often being responsible for thunderstorms.

Sometimes, however, the pressure system of the Continent extends over our islands. In winter the extension of the high-pressure system may displace the warm, rainy weather brought by the westerly winds by a spell of fine, dry, frosty weather, with easterly winds or calm conditions. The air flowing outward and downward towards the

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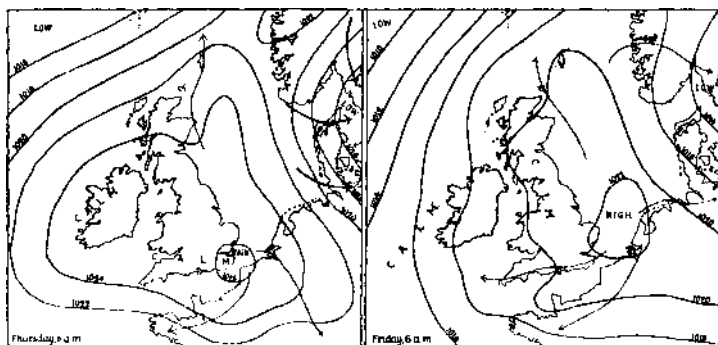


FIG. 35. DIAGRAMS SHOWING TYPICAL PRESSURE CONDITIONS:
ANTICYCLONES

A large anticyclone over the British Isles is tending to decrease in intensity and drift eastward. Note the gentle winds blowing outward from the anticyclone and areas of calm weather; also complete absence of rain. In twenty-four hours the anticyclone has moved only a few miles. (Cf. Fig. 36.)

Figures are in millibars.

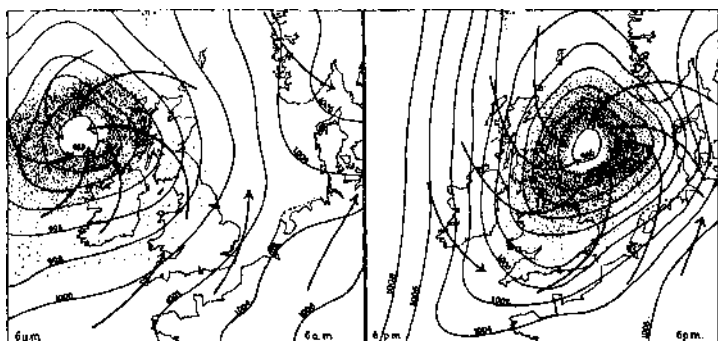


FIG. 36. DIAGRAMS SHOWING TYPICAL PRESSURE CONDITIONS:
CYCLONES

A depression centred to the north-west of Ireland (6 A.M.) has moved eastward across Scotland, and by 6 P.M. is centred over the North Sea. It has brought heavy rains to Northern Ireland and Scotland; light rainfall elsewhere. Note the winds blowing towards the centre and the absence of rain in the central part of the depression.

Figures are in millibars.

low-pressure areas is warmed by compression, and tends to pick up moisture. But if winds are absent and the air

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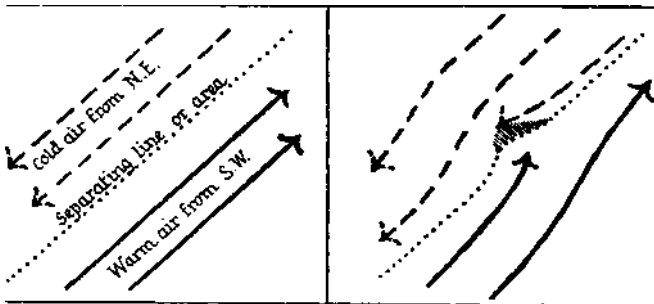
is calm, persistent fog may develop. In summer the continental low-pressure area increases the tendency of the air-currents to be drawn across the British Isles from the Atlantic, bringing cool, rainy weather. But sometimes in summer the high-pressure area of the Azores extends northward over these islands. This happened for considerable periods in the summers of 1921, 1929, 1931, and 1933. The effect is to produce a spell of fine, sunny weather, with clear sky, but tempered by light winds.

Clouds and Rainfall. When water-vapour in the air condenses into minute particles near the ground fog is produced; at higher altitudes, cloud. These minute particles of liquid water or of ice tend to fall slowly unless carried up by a rising air-current. Whenever they pass into air that is not saturated the particles evaporate again and become invisible. Clouds being carried along horizontally sometimes evaporate and disappear, only to re-form farther on. This is particularly true in mountainous districts. The saturated air, chilled by ascent, condenses to form a cloud, streaming out like a banner on the leeward side. Such a cloud is constantly being renewed by condensation and destroyed by evaporation. It is this which gives to clouds their ever-changing form. It is well to know the main types of cloud, though the gradations between them are infinite.

The large, billowy snow-white clouds rising like a dome with a flat base are called cumulus clouds. They are generally formed by rising air, the base marking the level where saturation is reached. They are characteristic of summer afternoons and fine weather conditions, but may result in heavy showers or thunderstorms. The average height of cumulus clouds is about half a mile.

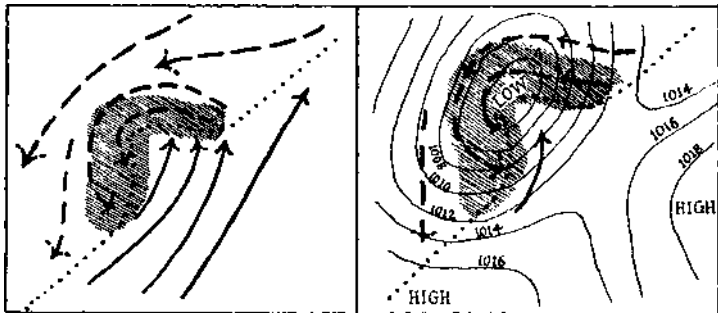
The light, feathery clouds, looking like brush-marks on the sky, are usually formed of minute ice crystals at a height of five miles or more, and are called cirrus clouds.

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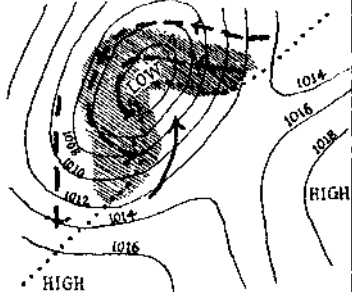


1. Movement of air over the Atlantic Ocean before warm air invades the stream of cold air.

2. Gulf of warm air in cold-air stream. This represents the beginning of a cyclone (disturbance or depression) which moves north-eastward towards the British Isles along the separating line.



3. The cyclone develops, causing winds to blow into the centre, there to rise, resulting in low pressure and heavy rainfall (shaded area).



4. Similar to 3, but isobars have been inserted. Note the lowest pressure in the centre, towards which the winds blow; also heavy rainfall in front of and behind the centre.

FIG. 37. DIAGRAMS SHOWING HOW A CYCLONE (DISTURBANCE OR DEPRESSION) IS FORMED

Based on diagrams appearing in "A Short Course in Elementary Meteorology," by permission of the Controller of M.M. Stationery Office

If such a cloud changes into a thin horizontal layer known as stratus, it may herald the approach of a disturbance. Stratus clouds may vary in height from 1000 feet to some three miles, and often extend in long bands across the

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sky. They account for much gloom and loss of sunshine.

Nimbus clouds are those which often form from stratus or cumulus clouds at the time when snow or rain is falling. The most familiar intermediate forms are cirro-stratus, cirro-cumulus, and strato-cumulus.

Taking the British Isles as a whole, clouds exclude direct sunshine on the average for two days out of three. The most favoured parts for sunshine are the south and east coasts, which get a daily average of four and a half hours, and to a less extent the eastern part of the midland plain. The parts which suffer most from loss of sunshine are the industrial areas, owing to the smoke pall, and mountainous districts of the north-west, from cloud, the average there being three and a quarter hours daily. Fog is frequent in still weather. It may result from cold air moving over a warm, wet surface in summer and autumn or from warm, moist air moving slowly over a cold surface in winter and spring. In large cities the heat from the houses sometimes keeps the streets clear of fog, and yet a 'high fog' may form, so dense as to turn day into night. But in spite of the bad reputation for fog which our islands have abroad, records show that even in the areas most liable to sea-mists 85 per cent, of the days are clear. Over most of the country not more than 2 per cent, of the days are foggy.

In considering rainfall the number of rainy days is no less important than the amount of rain. For instance, the east gets most of its rain in sharp showers, with fine intervals, while the west, particularly Ireland, often gets many days in succession of gentle drizzle. In this respect geographical position is important, the records showing that 'the number of rainy days increases steadily from 150 days in the east of Essex to an average of 250 days in the north-west of Scotland.

The rain brought by the stream of moisture-laden air from the west generally falls steadily, varying in quantity

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with the relief of the land. The heaviest rain occurs where the air-current meets high ground, just beyond the highest

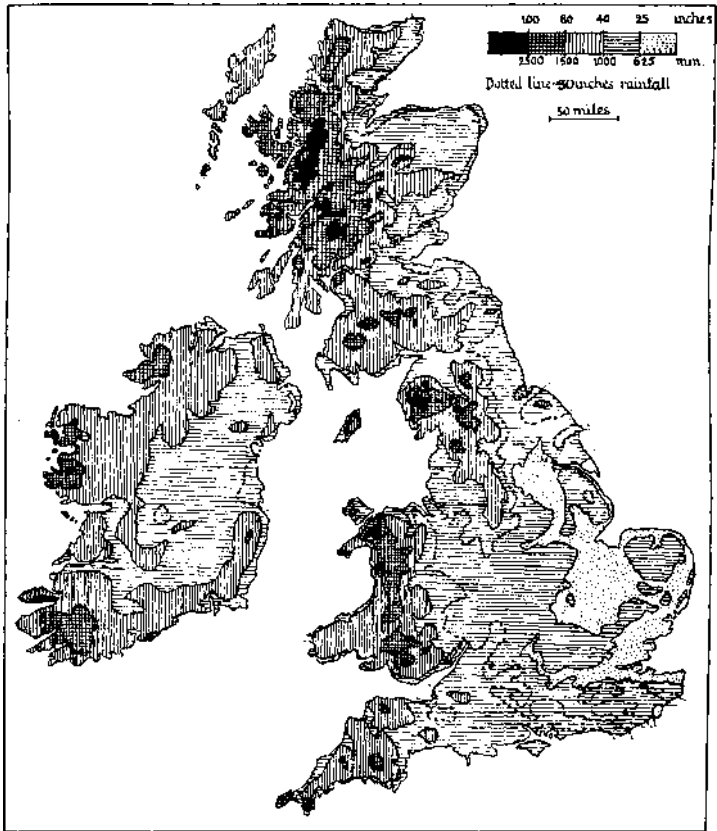


FIG. 38. AVERAGE ANNUAL RAINFALL

Based on Plate I of the "Rainfall Atlas of the British Isles," published by the Royal Meteorological Society

point, as the air begins to descend to lower levels. This is sometimes called the rain shadow. For rising air is cooled not only by ascent, but by expansion. In summer,

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however, a comparatively small district may become warmer than adjacent areas, and the air rising forms first cumulus and then nimbus clouds, which drop rain in heavy showers on hill and dale alike. The lowlands of the British Isles depend for most of their rain on convectional rainfall of this type.

In spite of the uncertainty of our rainfall from year to year and from place to place, certain definite characteristics can be stated. First, rain falls at all seasons in these islands, and the average for the whole country is about 40 inches, which is plentiful, seeing that the loss by evaporation is small, possibly about 15 inches a year. Secondly, the west receives the major part of its rainfall in winter; but rain in the east comes mainly in the form of thundery showers in summer. Thus, in the west and south-west, October is the wettest month and March the driest, although in Wales and West Scotland December and January are the wettest months. But in East Anglia July and August are the wettest months, though there are many fine days. The rest of the country usually receives its maximum rainfall in the autumn. Thirdly, the annual rainfall in any year may vary from as little as two-thirds of the average to as much as one and a half times the average.

It is not surprising, therefore, to find that the rainfall map shows a striking similarity to the relief map. Even the low hills of the minor escarpments are shown by a slightly greater rainfall than the adjacent lowland. Over most of the upland region the amount exceeds 60 inches, while the lowland area gets only 30 inches or less. These are average figures, for areas like the Thames estuary get as little as 20 inches, and in parts of the upland area, as the Snowdon massif, the Lake District, or the North-west Highlands of Scotland, the total rainfall may be as much as 200 inches. In Ireland a similar distribution over the west and east is to be found. Snowfall, which is included in rainfall figures (reckoning 12 inches snow

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= 1 inch rainfall), is commonest on high ground in the north, where it falls on fifteen to fifty days a year. On low ground in the south snow seldom falls on more than a few days, and rarely lies long.

The rainfall of the western areas is as a rule more than is needed for agriculture, which becomes impossible in the wettest parts. Even the south-east lowlands would be waterlogged but for the systems of drainage, particularly that of the Fenlands, which has gone on continuously since it was begun with the help of Dutch engineers in the seventeenth century. But the land in the wet areas often yields excellent pastures, and the value of heavy rainfall in the mountains, which enables many large towns to get a good water-supply by gravitation, is very considerable. In some mountainous parts also, water-power is utilized and may be developed.

The shortage of water occasionally experienced in some localities in a dry year is due, not to the insufficiency of rainfall over the country as a whole, but to insufficient means of storing it. At present each locality makes its own arrangements for water-supply. The result is that the collecting area is often small and limited to a relatively dry district. The large cities go far afield and compete with one another to store water in the natural or artificial lakes of Wales, Cumbria, and the Pennines. But many parts of Eastern England have access to no such natural reserve of water, and have to rely upon small reservoirs or wells. The quantity to be obtained from wells tends to diminish owing to the increase in the number of wells. Besides shortage, there is often a risk of pollution in water obtained from shallow wells.

Suggestions have been made for pooling the national resources of water, by establishing a grid water-system, with mains running from the mountainous districts to Eastern England, the Midlands, and the South. Some such scheme will certainly be necessary if the population increases, if not before.

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Temperature. The actual temperatures experienced in any place depend not only upon the angle of the sun's rays, but also upon the elevation and aspect. In making isotherm maps it is convenient for the sake of comparison to reduce the actual temperatures to sea-level by adding 1°F. for every 300 feet of altitude. In reading these isotherm maps the relief map needs to be kept constantly in mind. In mountainous districts the isotherms of actual temperatures look something like contour-lines, but, of course, slopes facing south get much higher temperatures than those facing north. The screening effect of mountains or even low hills from the cold north or east winds is also marked, as in the case of Aberystwyth and the south coast of Sussex or the Isle of Wight.

The angle of the sun is ten degrees lower in the north of the British Isles than it is in the south all the year through; but the summer day in the Orkneys lasts two hours longer than it does in Cornwall. This extra time does not, however, altogether compensate for the lower heating-power of the sun in the northern latitude. Conversely, in winter the northern day is two hours shorter than the southern. In summer, therefore, when winds are light and the sun is strong, the temperature of the air is chiefly affected by radiation from the heated land surface. The higher the sun is, the hotter the land surface and the warmer the air; so that in summer the south is warmer than the north. The hottest part is the London area, where the mean July temperature is 64°F. Speaking generally, temperatures fall steadily northward to 55°F. along the north coast of Scotland. The cooling effect of the sea is not felt far inland unless strong westerly winds occur, and this is unusual in the summer. Around the south-east coasts the seas are narrow and have little effect inland. The west and south-west coasts, facing a deep, open sea, are, however, decidedly cooler. The isotherm of 60°F. , which swings rapidly northward over the land and far to the south over the Irish Sea, indicates

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the marked difference of air temperature over land and sea of any two points east and west of each other. Another effect of the sea to be noted is that the influence of oceanic conditions in the climate of these islands results in the hottest month being August, rather than July, in many places. Also, February, rather than January, is the coldest month.

At mid-winter the sun reaches an altitude of only six degrees in the north of Scotland and sixteen degrees in the south of England. The sun, then, has little effect on the temperature of the air. The chief factor in winter is the stream of warm air brought in from the Atlantic by the winds. The isotherm of 40° F. takes a very striking course, and should be carefully considered. It practically follows the north and west coasts, swinging south-eastward from the Bristol Channel to the Isle of Wight. But remember that its path in many parts of Scotland and Wales lies along high mountains. The actual temperature may therefore be over 10° F. lower, owing to altitude. Even so, however, it brings out clearly the fact that at sea-level in winter the west is warm and the east cold. Even in Ireland the north-east, which to some extent is sheltered from the south-west winds, is cooler than the south-west. Thus, Valentia Island has a mean average temperature for January of 45° F., while that of Belfast is 40° F. A further proof that the winds are the winter source of warmth is that occasionally the maximum temperature for the twenty-four hours occurs during the night in winter. In summer, however, the night is usually 10° or 12° F. cooler than the day. The coldest areas of Scotland are along the east coast between Aberdeen and Dundee, and of England along the east coast between the Humber and the Thames estuaries.

Snow and frost furnish a good index of winter temperatures. The only parts of the British Isles which occasionally pass through winter without a fall of snow are the south and west coasts. Elsewhere snow invariably falls

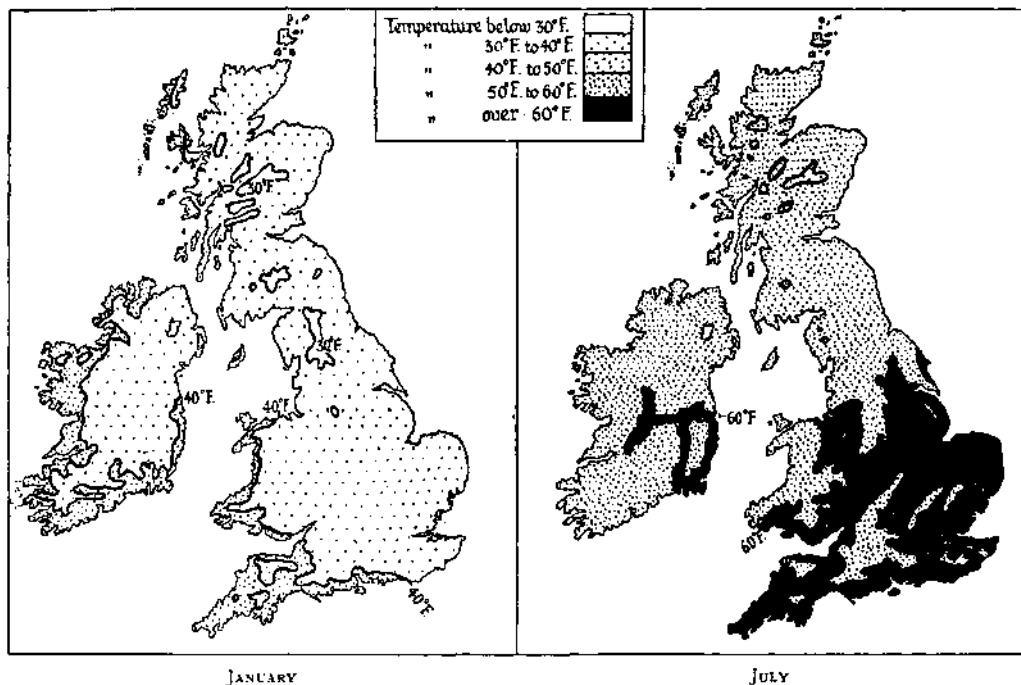
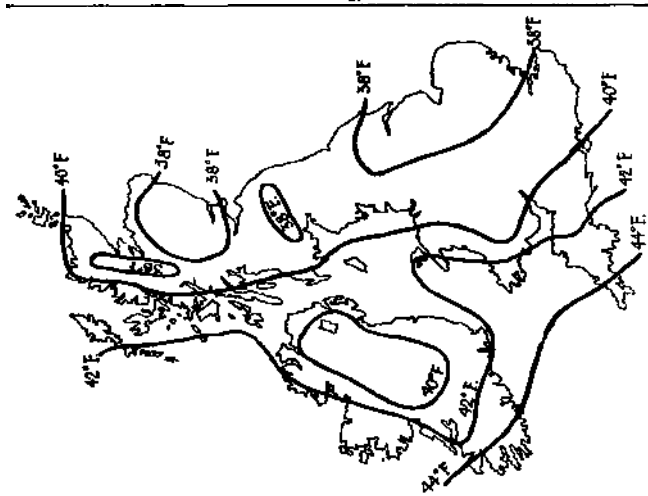
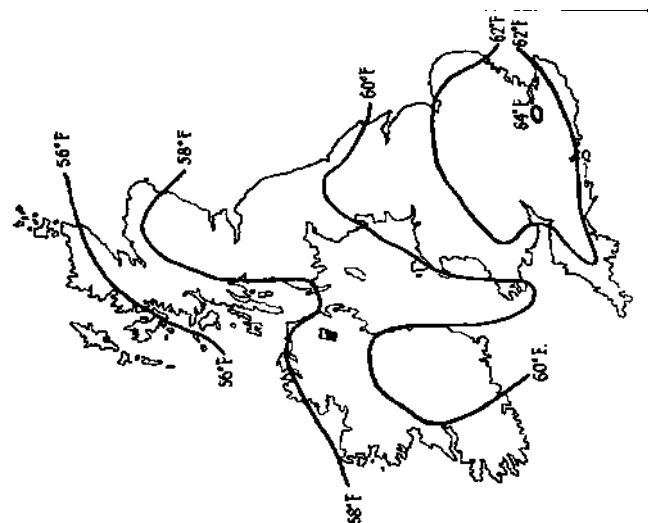


FIG. 39. DIAGRAM MAPS SHOWING ACTUAL TEMPERATURES



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in winter on one or more days. The interior highlands naturally experience snow more frequently, and snow occasionally lies throughout the year in northward-facing gullies of the highest mountains. Balmoral, for instance, experiences ground frost on 151 days of the year, and snow for 50 days. For Glasgow the figures are 79 and 16 respectively. London has 101 days of frost, and 13 days with snow, while for Liverpool the figures are only 79 and 11 respectively.

The intersection of the two typical isotherms of 40° F. for the winter and 60° F. for the summer indicates that four climatic divisions may be distinguished regarding the climate of the British Isles:

(i) The south-east area, including most of the English plain, which has hot summers and cold winters, with a range of temperature at London of 25° , and a low rainfall of 20-30 inches, falling chiefly in summer. The slight continental influence on the climate of Eastern England is shown by the number of thunderstorms per year, being on the average between fifteen and twenty, whereas in Western Ireland the yearly average is only seven. This is the chief legion for arable land, especially in the east, but with extensive areas of permanent pasture in the Midlands.

(ii) The north-east area, covering the remaining part of Great Britain, excluding the west coast. Here the summers are cool and the winters cold; the rainfall is more abundant than in (i), particularly in the west of the area; the eastern coastal areas get from 25-30 inches, with a maximum either in summer or autumn. The range of temperature varies from 18° to 21° F., the latter being the figure for Aberdeen. The north-eastern part of this area is devoted chiefly to arable land, and the south-western part to permanent pasture.

(iii) The north-west area, consisting of the west coast of Scotland and the north and west of Ireland. This is a region of cool summers and mild winters, with a range of

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temperature at Fort William of 18°F. and at Valentia Island of less than 15°F. Rainfall exceeds 40 inches,

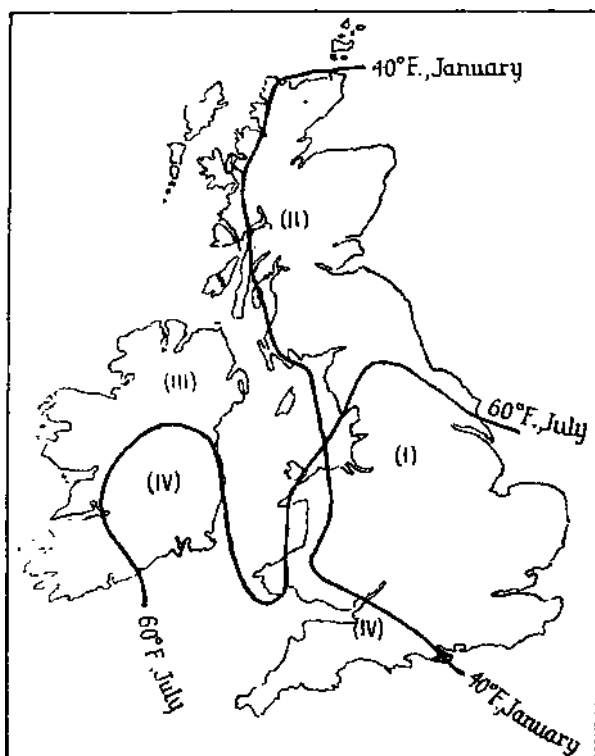


FIG. 41. CLIMATIC REGIONS OF THE BRITISH ISLES

- (I) S.E. Climatic Region: Hot summers; cold winters. Range of temperature $20-25$ degrees. Rainfall $20-30$ inches, chiefly in summer.
- (II) N.E. Climatic Region: Cool summers; cold winters. Range of temperature $18-21$ degrees. Abundant rain in west; $25-30$ inches along east coast.
- (iii) N.W. Climatic Region: Cool summers; mild winters. Range of temperature $15-18$ degrees. Copious rainfall at all seasons.
- (IV) S.W. Climatic Region: Warm summers, mild winters. Range of temperature $15-21$ degrees. Copious rainfall at all seasons.

except in Western Galloway and North-eastern Ireland, where it is between 30 and 40 inches, and falls throughout

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the year, with a winter maximum. Relatively few days are free from rain. This is essentially an area of permanent pasture.

(iv) The south-western area, which includes the west and south of Wales, the west of England, and Central and South-eastern Ireland. This is a region of warm summers and mild winters. The range of temperature varies from 15° F. in the Scilly Isles to over 18° F. at Dublin and 21° F. at Shaftesbury, Dorset. Rainfall exceeds 40 inches, except along the south-eastern coast of Ireland, portions of the Welsh coast, and the south-west coast of England, where it exceeds 30 inches. It falls throughout the year, with an autumn and winter maximum. This too is chiefly devoted to permanent pasture, except in Cornwall, where there is more arable land than pasture.

CHAPTER VI

VEGETATION, SOILS, AND AGRICULTURE

NATURAL VEGETATION

WHEN the British Isles emerged from the ice-cap, it is probable that conditions for some time resembled those of the tundra to-day, with comparatively few plant species, and those chiefly of low berry-bearing bushes and herbaceous plants. Gradually, however, as climatic and soil conditions improved, there would be an increase in the number of pine- and birch-trees, and later of oak, elm, and other deciduous trees, with alder and willow abundant on the wetter ground. Extensive marshes no doubt existed. On the chalk and limestone hills and on the sandy areas the natural vegetation was even then grassland, and this was probably used from very early times for sheep pasture. On alluvial soils better grassland of the meadow type would develop in the woodland clearings, but this type is largely the result of long cultivation.

Every plant has some combination of climatic and soil conditions under which it attains perfection, while with less congenial conditions it will have only stunted growth, or fail to survive. And there is always competition for ground-space between plants of similar requirements. So that land left to itself comes to be clothed with a family of plant species which botanists call plant associations. Lists of such associations have been compiled for certain well-known areas like the Peak District, Somerset, and many others. These studies show that natural vegetation can be classified into three or four groups—(i) forest and woodland, (ii) heathland and moorland, (iii) grassland, (iv) fenland and marshland.

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Forest and Woodland. The characteristic tree of British woodlands is the oak, which flourishes on the clay and loams of the English lowlands. The timber from these oak forests was much used for shipbuilding in the early days and for the charcoal industry. These oak forests



FIG. 42. ANEMONES IN A SUSSEX COPPICE

The term copse, or coppice, is applied to a wood in which there are relatively few standard trees per acre, the intervening space being occupied by small trees of some other type.

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have now dwindled to numerous coppice-woods, and the oaks are much interspersed with hazel and the Spanish chestnut, both of which provide good wood for fencing and garden purposes. Such woodlands are popular for their attractive ground plants, like the primrose, bluebell, and anemone.

In the Pennines, the Lake District, and in Wales, where

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the soils are thin, lacking lime, and rather acid, a smaller type of oak woodland occurs, often interspersed with bracken and bilberry. In the Highlands of Scotland birch-trees, which can stand exposed positions, form the chief woodlands far up the mountain-slopes. In the glens



FIG. 43. THE SEVERN PLAIN BETWEEN GLOUCESTER AND
CHELTENHAM

The aerodrome in the foreground is at Brockworth, situated at the foot of the Oolitic escarpment. The hill in the distance is Churchdown, near Cheltenham. Note the distribution of trees.

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and broad vales of Scotland and on the sandy soils of the Pennines and the south of England pine-woods are common. These too are interspersed with heath, 'bilberry, and bracken. In sheltered hollows on the chalk and limestone hills beech-woods play an important part, furnishing timber for chair-making and so on. As the ground beneath them is usually bare of shrubs and carpeted deep with rich brown leaves they form a very

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picturesque feature of the landscape. On the Carboniferous Limestone of the Mendips and Derbyshire the characteristic trees are the ash and the elm. The hazel too is very fond of limestone soils. Where the clayey marl overlaps the limestone the oak joins this association of ash, elm, and hazel to form typical woods. And on damp lowland soils alders and willows are usually found.



FIG. 44. A REED HARVEST IN NORFOLK
"The Times" copyright

It should be noted that although large forests are now rare in Great Britain, there are still, in most parts a great many trees along roads, around fields, and in valley-bottoms. Many of these have been planted for shelter and for timber. Modern planting, however, is confined mainly to soft-wood trees—*e.g.*, pine, larch, etc. Considerable areas are now being afforested with such trees.

Heath and Moorland. On the broad Millstone Grit moors of the Pennines, in the Lake District, and in Wales there are wide tracts of moorland clad chiefly with heather, bilberry, and cotton-grass. Trees cannot grow

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in any profusion, because their roots cannot penetrate the hard subsoil, and the position is exposed to strong winds. Rough, tufty grass also covers large areas. Other moorlands of a different type are to be found in the sandy soils of East Anglia, the Bagshot sands of the London basin, or those in the Hampshire basin and the Weald. Heath occurs also on the granite and sandstones of Somerset and Devon. Many moorlands in the south of England have areas on which gorse forms a conspicuous feature. On peaty soils, such as are found in parts of East Anglia or on the low plain of Somerset or the 'mosses' of Lancashire, mosses and reeds abound.

Grassland. The varieties of natural grassland to be found in Britain depend mainly upon the varieties of soil. The moist, mild climate is ideal for grass which left to itself would gradually become covered with trees. So certain varieties of grass are often found together in association with one particular type of oak-tree or another. Perhaps the most typical of English grasslands is that of the chalk down. The springy turf, with its tough, wiry grasses, dotted with numerous flowering herbs, close-grazed by sheep and rabbits, makes an excellent training-ground for racehorses and for Army manoeuvres. On sandy soils grassland tends to be mixed with heath plants, but the turf remains thick. On the siliceous (coarse sandy) soils of the Pennines and other old rocks the rough mat-grass and moor-grass predominate, but bracken and gorse invade them. One of the best types of grassland is found where the soil is said to be neutral—that is, neither too acid nor too rich in lime. Such grassland makes splendid pasture, because plants, such as the heaths, which prefer an acid soil avoid it.

Fenland, Marsh, and Sea-coast Vegetation. These areas, which suffer from being waterlogged with fresh water, or are periodically invaded by salt water, grow hard grasses which help to bind the sand in the dunes, but are of no pastoral value.

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SOILS

Before proceeding to consider cultivated crops it may be well to give a brief note on the subject of soils.

Soil is formed in the first instance by the weathering of surface rock, which becomes broken up gradually into finer and finer particles. The kind of rock determines the kind of soil. Thus, clay comes from shales, a siliceous or sandy soil from sandstones, and a calcareous soil from limestone. Igneous rock produces soils with a wide variety of constituents.

In Britain, however, almost all the soils contain constituents other than those of the underlying rocks. Mention has already been made of the deep deposits of glacial material, particularly in Eastern England. Other soils have been carried by running water, and are called alluvial; others again by wind. Then, again, soils subjected to excessive rainfall tend to lose valuable salts, which are carried away in solution. Such soils are said to be 'leached.' In Britain, where rainfall increases from east to west, the soils tend to become more acid in the west. Thus, in time soils have less and less of the characteristics of the rocks from which they are derived.

The fertility of a soil depends not only upon the quantity of plant food it contains, but also upon its character: whether the particles are fine or coarse, whether they lie closely packed or loose, and, as a consequence, whether air can penetrate them easily or not, and water be retained or quickly lost. A considerable part of all fertile soils consists of decayed vegetable matter called *humus*. But if this deposit is kept too wet and insufficiently aerated, then humic acid is formed instead of humus. Thus, peat is a kind of black mud formed by the decay of vegetable matter under water.

The best soils are those containing a mixture of sand, clay, and humus. *Loam* consists of a mixture of sand and clay, with the latter predominating. *Marl* is either a

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SOILS

mixture of clay and lime products (calcium carbonate and calcium phosphate) or loam mixed with lime. These characteristics make it convenient to group the soils of Britain as heavy, loamy, or light. The heavy soils include the boulder-clays, which are usually stiff and difficult to work, but where mixed with chalk, as in Eastern England, are lighter and more fertile. Heavy clay soils are also found overlying the Jurassic rocks, the Cretaceous rocks of the Weald, and the Tertiary rocks of the London basin. On the chalk downs in many places the lime has been washed out of the soil, which then forms a stiff brownish clay mixed with flints. These heavy soils have always been difficult to cultivate, and so are often occupied by woodlands or laid down to grass for dairying. Villages are few, widely scattered, and usually unattractive in appearance.

In the Fens an area of about a million acres is covered with black earth, containing in the better drained parts much humus; it is often quite friable, not sticky, like clay. This is perhaps the most fertile soil in England. But the wetter and more compact soils in this area are acid.

The loamy soils readily admit both water and air, are fertile, and are suitable for all kinds of crops. They are therefore widely used for market-gardening, for potato crops (especially in Lincolnshire), for fruit in Kent, East Anglia, and elsewhere, as well as for root and cereal crops grown on farms. Loamy soils are specially well suited for the wheat crop.

The light soils are those which consist largely of sand particles, which may be coarse or fine, containing only a small percentage of clay. They include also gravelly soils found in terraces in the river valleys, particularly the Thames valley, or in beds deposited by glacial streams. The calcareous soils of the Oolitic Limestone and the chalk are also light soils. The lightest sandy soils cannot usefully be cultivated, but are valued for sport and as residential areas, particularly because the natural vegetation

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Chiefly heath and pine-trees. But where mixed with iudm they are suitable for the plough, although liable to lose moisture rapidly. The need to guard against this calls for good farming. The top soil is kept fine by harrowing, which reduces evaporation, and farmyard manure is plentifully used. This necessitates the keeping of bullocks through the winter, and this in turn to village settlements for the labourers who tend them. On the chalk and limestone soils sheep play an important part in the agricultural scheme by both pulverizing and manuring the soil. A careful rotation of crops is kept to provide food for the sheep, and special breeds of sheep are developed to meet the particular conditions of the locality.

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In England and Wales about two-thirds of the total land area is either arable or pasture land. Only one-ninth of the total area is occupied by towns, roads, and railways. In Scotland the proportions are a quarter and less than a ninth respectively. In Northern Ireland and the Irish Free State the proportions of the total area used for arable or pasture are over a half and about two-thirds respectively. The remainder in each case is either rough grazing land or waste. As to arable land, the percentage of the total area in England is 25, in Wales 12, in Scotland 17, in Northern Ireland 17, and in the Irish Free State 9.

The principal crops grown on the arable land, taking the average of the last ten years, both in order of acreage and total produce in tons, are oats, wheat, and barley. Other crops, used mainly for feeding livestock, are turnips, swedes, and mangolds. The acreage planted with potatoes is increasing, and now amounts to about 5 per cent, of the arable area. Peas too are more widely grown, but beans are becoming less important. Another crop which has become very important since the War is sugar-beet. In 1900 only 51 acres in these islands

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were planted with sugar-beet. In 1933 there were over 360,000 acres, which is more than double the average for the last ten years.

On the whole the acreage of arable land in England and Wales tends to decline. Even in 1933, a good year for farming, arable acreage decreased nearly 10 per cent, on the ten-year average. This is partly because in countries like Canada, Australia, or Argentina, wheat can be grown on the 'extensive' plan. That is to say, although the yield per acre is much less than in England, the aggregate output is high and the cost of production low. In Britain the farmer must obtain a high yield from a small area, and to do this he pays great attention to manures and rotation of crops.

The *rotation of crops* is an essential feature of good farming. In medieval times the land under the manorial system was divided into arable, pasture, and waste; and the arable land was divided into three open fields, one of which was left fallow and the other two used respectively for growing a winter crop of wheat and a spring crop of some other kind of grain, or perhaps beans. The three fields were tilled in rotation. The growth of population and the need for increased food-supply led to the adoption of less wasteful methods. First, a four-field method was tried. This has been replaced by varying sequences of crops over a period of five years, such as follows—wheat, a root crop, oats or beans, barley, clover or rye-grass. In this way the farmer gets regular supplies of fodder for his livestock and grain to sell to the miller or the brewer. Thus, there is always about a fifth of the arable land sown with rotation grass or clover. In the wetter west grass of this kind may be left for two or three years. This must be distinguished from permanent grassland, which will be considered later. Other fodder crops grown in various rotations include peas and beans, vetches, rape, lucerne, and field cabbages, the last of which are extensively grown in the Irish Free State.

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This 'intensive' farming leads to a great variety of crops. Such variety calls for careful organization in marketing. This is being met by co-operative methods, so successfully used in Denmark, Holland, and other countries. At present this type of organization is chiefly applied to the products of pastoral farming, but its application to arable products and to market-gardening becomes the more necessary, since the overseas markets for our manufactured goods have declined.

Wheat. The best conditions for wheat are a long winter, with adequate rain and little frost, followed by a cool, rather wet spring, changing gradually to a warm summer, becoming drier as the summer heat increases. It likes a firm soil, but not too stiff and heavy. Rolling country which provides natural drainage also facilitates the use of machinery for ploughing, sowing, and reaping. The total production of wheat in the United Kingdom in 1933 was 1,672,000 tons. This was the best crop within living memory, and nearly the best recorded. It represents an increase of 42 per cent, on that of 1932. Of this total Scotland produced 93,000 tons, Wales 16,000, and Northern Ireland 6000. In England wheat cultivation is most concentrated in the eastern counties, extending from the East Riding of Yorkshire, through Lincolnshire, to the Fens and East Anglia. Both climate and soils conform closely to the conditions stated above, including plentiful sunshine. Wheat is also grown widely over most of the English plain south of the 60° July isotherm. In Scotland the coastal areas of the Forth and Tay are the chief centres of production, though some is grown as far north as the plain of Caithness. The wheat grown in the British Isles is a soft wheat of high quality, and the yield per acre is much higher than in other countries. These factors help the growers to meet the competition of wheat grown more cheaply overseas, the import of which amounts to six times the home production.

Oats. The reason this crop exceeds on the average that

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of wheat and barley is that it will thrive in much damper conditions and on poorer soils than the other two. The areas of greatest production, therefore, are those where wheat cannot compete. But still it is chiefly grown along

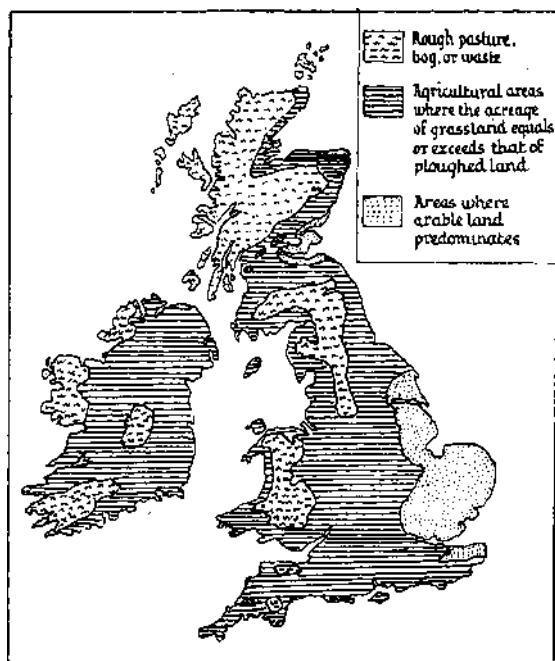


FIG. 45. AGRICULTURE IN THE BRITISH ISLES

the eastern plains of both Ireland and Great Britain, where drier conditions are found. In Ireland nearly half the arable land, and in Scotland more than half, is devoted to the oat crop, for oats play a very important part in feeding livestock, as well as providing the familiar diet of porridge and oat-cakes. In England and Wales oats are grown in every county; and in Cheshire, Lancashire, and Cumberland a third of the

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arable land is used for the crop. But the English oat acreage is only about equal to that of wheat, and in 1933 was actually less.

Barley. This is the hardiest of the cereals, and can be grown farther north than the Arctic Circle, whereas the northern limit for wheat is reached in the north of Scotland. It seems to ripen with the longer summer days of the north where wheat will not. But it prefers a warm, and particularly a dry, climate, drier than that for wheat. For the same reason it is often grown on lighter soils than those planted with wheat. It competes, therefore, with wheat in the eastern counties, and attains greatest importance on the eastern side of the areas producing the heaviest wheat crops. Thus, Norfolk and Rutland have the highest proportion of arable land given to barley. This is true also for Scotland, while in Ireland the production is almost confined to the south-east and valleys protected from heavy rainfall. The total British acreage is not half that of either wheat or oats. Most of the crop is used for brewing beer, and in Scotland and Ireland also for distilling whisky.

Small quantities of rye, which will grow on the poorer soils and stand severer climatic conditions, are grown in Britain and in Ireland. The production in 1933 fell to less than half the average. Some is cut green for use as fodder, and some is used for distilling.

Potatoes. The potato crop is in some respects more important than the cereal crops. For, unlike the latter, the British Isles are much more dependent upon home supply than upon imports. This is partly because transport costs are heavy in relation to their value and partly because potatoes suffer damage from much handling and fluctuating temperatures. They also form a very important part of the national diet, particularly in Ireland. The total production amounts to some eight million tons.

This crop is less dependent upon climate and soils than the cereals, and can be grown almost everywhere in these

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islands. But the potatoes must be protected from frost when stored and the store well ventilated. In the Irish Free State, which raises about a quarter of the total production, they are grown everywhere, except on the mountains and boglands, and particularly on land unsuited for other crops. This wide distribution is to be found also in Scotland, where the production is about one-eighth of the total. But in England and Wales, although grown on almost every allotment, production on a large scale is confined to a few well-known areas. The controlling factors are specially suitable soils—deep loams free from stones—and proximity to large markets. Thus, in the Holland district of Lincolnshire more than a quarter of the arable land is under potatoes. The market for this area is London, which draws supplies also from Middlesex, Kent, and Surrey. Similarly, the plains of Cheshire and Lancashire supply the industrial towns west of the Pennines. South Durham supplies the industrial areas of the north-east, and there are important productions in the West Riding of Yorkshire and in Staffordshire. In Scotland the eastern lowlands are an area of special production, and Ayrshire specializes in early crops. In England there is also an eager market for early potatoes, which come chiefly from Jersey and the other Channel Islands and from Cornwall.

In Ireland, although nearly a quarter of the tilled land is planted with potatoes, and the production amounts to about fourteen hundredweight per person, only about 1 per cent, is exported. More than half is fed to pigs and other livestock or kept for seed.

Root Crops. Turnips, swedes, and mangolds are grown chiefly to provide winter food for sheep, and to a less extent for cattle. They also constitute a valuable rotation crop. Turnips and swedes are, of course, also produced as vegetables for human consumption. All such root crops like a deep, fairly friable soil, free as possible from stones, to enable the roots to form well. For the reasons

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given above cultivation of these crops is widely spread. In England the production of roots fluctuates, often with a rise or fall in the number of sheep, and on the whole has declined. The largest areas devoted to them are in the eastern counties, but the heaviest yield per acre is to be found in the damper west. Most of the Welsh counties secure good crops, but it is in Ireland that they attain chief place, for although they occupy less acreage than potatoes the yield is about twice as much. Practically the whole output is used by the grower. Mangolds are more susceptible to frost than the other roots, and so do best in the warmer south of England and Ireland. The highest yields are, however, obtained on the rich Fen soils.

Sugar-beet. In Britain this crop is an outcome of the Great War, just as the industry arose on the Continent during the Napoleonic wars, when the supply of cane sugar was cut off. For shipping could not be spared during the War to bring the normal supplies of sugar, which was therefore rationed. The Government accordingly stimulated by subsidies the cultivation of beet-sugar in this country, particularly since 1925, and these subsidies are still maintained. The roots of the sugar-beet resemble parsnips in appearance, and require a limey, loamy soil and dry conditions when reaching maturity. If rains occur at this time the sugar content is reduced. In view of their bulk and weight, transport is an important factor. To reduce this cost some fifteen factories are distributed about the eastern counties, extending from Essex to Southern Yorkshire, two on the Welsh border, and one at Cupar, in Fife. The roots are carefully cleaned before delivery to the factory, where they are sliced into warm water. After boiling, the heavier syrup or molasses is separated from the purer sugar crystals which form. The pulp is useful for cattle food. As the factories are called upon to deal with large deliveries within a short time the industry requires much careful organization. The crop

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makes heavy demands on the soil, and has to be grown in rotation, and the sugar content varies with the season. The Government is carefully examining the future requirements of the sugar-beet industry.

Mention must be made of two crops of a special kind—flax and hops. The first is grown mainly in Northern Ireland, though a little is raised in Somerset, Norfolk, and Yorkshire. It requires a heavy though well-drained soil, and is grown for the fibres in the stem or for the seeds. The plain of the river Bann and the west of Lough Neagh are the most productive areas. Hops are used to flavour beer. They are grown on the slopes of the Kent Downs, and in the Hereford neighbourhood. The plant grows high, and needs support. Numerous pickers are required for the harvest, and special houses for drying and storing the crop.

Fruit-farming. *Orchards.* The chief fruit-trees are apple and plum, in the proportion of two to one. Pear- and cherry-trees are far fewer in number. England is the only country in the British Isles which grows these fruits in any quantity, and the orchards are found in three main areas—Kent; Gloucester, Hereford, and Worcester; and Somerset and Devon. A large part of the apples and pears is used for cider and perry, but more trees are being planted to produce dessert fruit, notably in Essex.

Small fruits, such as strawberries, gooseberries, and currants, are also grown, chiefly in the three areas mentioned above and in the counties round the Wash. Kent and the adjoining counties have the largest acreage for small fruits. The second in importance is the Fen area, with Wisbech as the centre. In Scotland the Carse o⁵ Gowrie, between Perth and Dundee, is famous as a fruit area.

Market-gardening. Nearly a quarter of a million acres in England and Wales are utilized for the cultivation of vegetables and flowers for table use. These gardening areas are particularly dependent on good, deep soils, for

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cultivation is intensive. They no less depend on proximity to large markets like London and the industrial centres. The value also of climatic advantages in securing early crops is great. The business calls for quick and efficient transport. In this connexion the Fen counties are important. Kent, Bedford, Cornwall, and the East and West Ridings of Yorkshire are other outstanding areas. The Scilly Isles and Cornwall also furnish valuable early crops of flowers and vegetables.

INDUSTRIES CONNECTED WITH AGRICULTURE

Mention has already been made of the beet-sugar industry. Another industry that has leapt into importance is that of canning fruits and vegetables. It is estimated that the output has increased tenfold in the last five years. This is partly due to the development of automatic machinery for the work and to the good summers which have produced abundant supplies. The difficulties are similar to those of the beet-sugar industry—viz., the rush of products to be dealt with in the short period of the year, June-September; the necessity of having factories close to the producing areas; and the need of selecting and grading the supplies. Proximity to a port or to sugar supplies is also desirable. In these respects East Anglia is singularly favoured. The possibility of utilizing the machinery for other products, such as fish or poultry, available at the other seasons of the year has not been overlooked.

The chief factories which produce preserved meats, smoked and dried fish, and other potted commodities are found chiefly at the great ports—London, Liverpool, Glasgow, Aberdeen, Hull, and Grimsby—but also at Birmingham and some other inland centres. The bottling of fruit and the canning of fruit-salads are also centred in these places; but Manchester, Leeds, Dundee, and Paisley are specially important for this branch of the

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trade, as they are also for jam-making and fruit preserves. In connexion with this industry the refining of imported

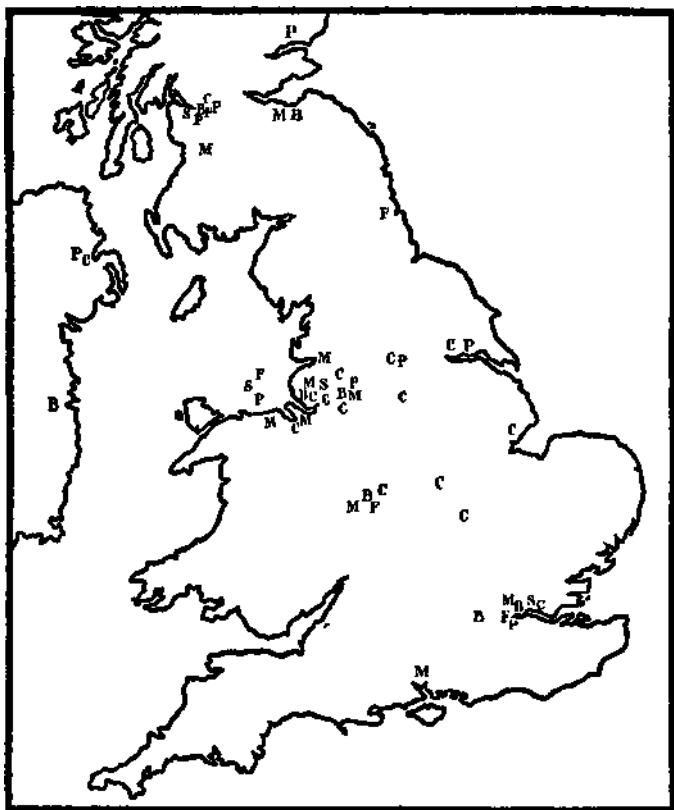


FIG. 46. SOME OF THE MORE IMPORTANT LOCALITIES FOR
FOOD MANUFACTURES

C, corn-milling (flour), B, biscuit-making; S, sugar-refining, M, margarine manufacturing; P, preserves and jam-making, F, preserved canned goods

sugar, which used to be carried on in most towns, is now mainly concentrated in three great centres—London, Liverpool, and Greenock.

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Another such industry is flour-milling. Flour-mills are found in most towns of any size well served by railways, particularly in the east of England. The two greatest inland centres for flour are Birmingham and Leeds. But the ports are even more important, and the Liverpool area is the second largest flour-milling centre in the world. The London area comes next, and practically all the ports have a considerable flour industry. The making of bread, cakes, and biscuits is a widespread industry, but the last is carried on in a few great centres, such as Liverpool, Glasgow, Dublin, Manchester, Reading, and Edinburgh.

The brewing industry utilizes much of the barley crop and, of course, the hops. The barley is slightly fermented to form malt, which is mixed with warm water, and the other processes are then completed. Much depends upon the quality of the water, a hard water, such as comes from Carboniferous Limestone areas, being the best. Brewing is more and more being confined to the largest breweries, which have suitable water-supply, and are to be found at Burton and Dublin especially. Vinegar is a by-product of brewing. Barley is also the chief raw material used in the distillation of Scotch whisky, though in Ireland other grains are used as well.

Other industries connected with agriculture, such as tanning, starch, and mustard, will be referred to in the regional chapters.

PASTURE AND LIVESTOCK

The best cattle pastures are naturally found where lowlands are watered with abundant rains. The proportion of permanent pasture to arable land is constantly changing. But in practically all the counties of Ireland, Wales, Central and Western England, and South-west Scotland more than half the area is pasture land. In some parts, as in Ireland, Somerset, Westmorland, North-

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umberland, and the Midland counties of England, the proportion is much higher.

But it must not be forgotten that the upland areas contain extensive tracts of grassland classified as rough grazing. The following table shows what percentage of the total area in the separate divisions of the British Isles is permanent pasture or rough grazing land:

--	ENGLAND	WALES	SCOTLAND	N. IRELAND	IRISH FREE STATE
Permanent pasture	40	41	8	38	50
Rough grazing land	11	32	50	16	12

In England the rough grazing land is chiefly on the Pennines and on the moors of the south-west peninsula. In Scotland the great extent of the Highlands and Southern Uplands accounts for the high proportion of rough grazing. These rough pasture lands are used almost entirely for sheep, and only during the summer months. Even in the Highlands of Scotland there are very few cattle.

Cattle. Half the total of 12,650,000 cattle in the British Isles are to be found in England and Wales, about 1,300,000 in Scotland, and the remainder in Ireland (Irish Free State 4,100,000 and Northern Ireland 714,000). Approximately half the total are dairy cows, the others being bred for beef and veal. Although the number tends to increase as the population grows, it does not keep pace with it. Close attention is paid to breeding and feeding, in order to increase the yield of milk or beef. For dairy herds many factors have to be considered besides good pasture. The fields must be within easy reach of the farm-hands for regular milking. For the sale of milk as such, quick transport to the towns is, necessary. If the milk is to be made into butter or cheese the co-operation of farmers over particular areas is economically necessary. As a rule a factory is established in a convenient centre which can deal with the

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whole supply. Thus, whereas in England only about a sixth is made into butter and cheese, in Ireland only about the same proportion is consumed as milk. Notice also that in England and Wales it is the counties remote from populous areas which are famous for cream and butter, like Cornwall or Pembroke or Wigtownshire. These products are more profitable than milk in bulk, as the cost of transport is less. They go to populous centres outside the respective counties. The demand in large towns for milk explains also why counties like Essex are paying increasing attention to dairy cows. But on the whole the eastern counties use cattle mainly in connexion with arable farming. The best dairy-cattle areas are Somerset and Cheshire in England, Ayrshire and Wigtownshire in Scotland, and the counties of Limerick and Southern Cork in Ireland. It must be remembered that a considerable quantity of milk is used for feeding young livestock.

Cattle bred for beef can utilize pastures more remote from farmhouses and transport facilities. The distribution of such cattle is therefore much more widespread, but most marked in such areas as Cornwall and Devon, Hereford, Eastern and South-western Wales, Yorkshire, Cumberland; in Scotland, the north-east coastal plain; in Ireland, Meath and Limerick. The central plain of Ireland supports a large number of cattle bred for beef, but relatively few dairy cows.

Sheep. The number of sheep bred in the British Isles fluctuates considerably, as seasonal conditions vary so much from year to year, and affect both the lambs and the pasture. On the whole the number tends to increase, and it is a little surprising to find that there are more sheep in these islands than in New Zealand, where mutton and wool are staple products. It shows that although sheep flourish in warm, dry conditions and upon short, wiry grasses they can be bred successfully where conditions are moist. The main thing to avoid is badly

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drained ground, which soon gives rise to disease. Thus, Ireland has as many as 4,250,000 sheep, Scotland nearly twice as many, and England and Wales together nearly twice the combined total of the other two countries. This wide distribution is partly due to the number of breeds which have been developed to meet varying local conditions. In most of the great wool-producing countries of the world the flocks have descended from British-bred sheep. But partly it is due also to highly skilled farming which makes use of sheep in fertilizing and pulverizing the soil. For although the largest numbers are grazed on the mountain-slopes and moorlands, and on the crisp herbage of the limestone and chalk hills, a considerable number are reared in arable districts. The mountain pastures are available usually only in the summer months; in the winter the sheep are brought down to the best-drained lower pastures. Approximately a third of the total number of sheep are killed annually for mutton or lamb.

Most of the British breeds also grow heavy fleeces of long-staple wool; but the Welsh breeds are reared chiefly for mutton. The average weight of wool per fleece is about ten pounds.

The most important areas of sheep-rearing are the Tweed basin and the western isles of Scotland, Northern and Central Wales, the Pennine and Cumberland highlands of England, and the mountains of Galway and Wicklow, in Ireland.

Horses. In spite of the development of tractors and motor-ploughs, the number of horses in the British Isles in 1934 was 1,263,507. This represents a decrease of over 600,000 in the last ten years. The heaviest decrease was in trade, draught, and van horses, but the number used in agriculture also declined by 13 percent. The number used on farms varies naturally with the style of farming. Although the majority of the horses are used for agricultural work, horse-drawn vans are still numerous, and a

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considerable sum of money is expended on the breeding of horses for hunting and racing, as well as bloodstock for export. The number of riding horses and hunters has not declined, and the number of thoroughbreds has actually increased. The chief areas used for training horses for pleasure or sport are the Downs of England, near such centres as Newmarket and Epsom, and the Curragh district, south-west of Dublin.

Pigs. The establishment of a national marketing scheme is likely to increase the number of pigs reared in England, which at present is nearly 3,000,000. Ireland has about a third of this number, and Scotland relatively few. As pigs are usually fed on waste food or skimmed milk they are kept chiefly on smallholdings near large towns or in regions of dairy-farming. To produce a steady supply of bacon of standard quality skilful organization is required. In the past large quantities of bacon were imported from Denmark, and more recently from Poland. The quantity, still large, is now regulated by trade agreements with these countries.

Poultry. A similar increase has taken place of recent years in the keeping of poultry. This too is chiefly managed by smallholders, for although every farm has a certain number, they usually receive less attention than on a holding specially planned for the purpose. The largest numbers are to be seen in the eastern counties or near the large towns. In addition to fowls, reared both for egg-laying and for table use, ducks, geese, and turkeys are raised in considerable numbers, particularly in Essex, Suffolk, and Norfolk. Ireland too, both the Free State and Northern Ireland, has rapidly increased the annual production of poultry and eggs. But the import of these commodities from abroad remains large.

CHAPTER VII

MINERAL WEALTH

THE term 'mineral' is generally taken to mean all materials obtained from mines and quarries. Far and away the most important mineral in the British Isles is coal, the value of which constitutes nearly 90 per cent, of the total mineral output of these islands. Iron ore, which comes next in importance, represents barely 2 per cent, of the total value. The numerous other minerals which make up the total will be referred to later.

Coal. British coal occurs in several forms. *Anthracite* is hard and shiny, and does not soil the fingers when handled. It does not burn readily, but burned under suitable conditions it gives out great heat, is smokeless, and leaves very little ash. The western part of the South Wales Coalfield is the chief source of supply. The coal used in houses, factories, gas- and coke-works, burns readily, and is called *bituminous*. Another well-known variety is *cannel* coal, which is dull black and gives off much smoke. 'Cannel' is a corruption of candle, and the coal is so called because when lit it burns with a flame like a candle. There are several grades of coal between anthracite and bituminous, which are often called *steam coals*, and these are much used in ships, locomotives, and other engines. The soft brownish-black substance called *lignite*, though of considerable importance in some countries, figures very little in British production, and is found chiefly near Newton Abbot, in Devon. *Peat*, on the other hand, occurs widely in these islands. It consists of accumulations of plant remains, and forms on high moorlands or on low-lying, badly drained fens. When cut near the surface it is brown in colour and breaks easily

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in the fingers. But at deeper levels, where it has been compressed and partly carbonized, it is blacker and harder.

In other parts of the world coal occurs in various geological formations, from Carboniferous upward, but in Britain practically all is found in the system of Carboniferous rocks. The coal is distributed in layers, which vary in thickness from a few inches to several feet. Many of the best seams in Britain are from three to nine feet thick. But the actual coal-seams form only a small fraction of the total depth of the Coal Measures. Thus, for instance, in the Burnley Coalfield, where the Coal Measures reach down to nearly 2400 feet, the twelve workable coal-seams are little more than thirty feet when added together. Much depends upon the nature of the rock underlying and overlying the coal. The floor is often a greyish clay, useful for making bricks which have to stand high temperatures; the 'roof is generally a shale or sandstone, but sometimes is also clay, and this adds to the difficulty of working the seam. The coal is worked mainly on one of two systems. Either pillars of coal are left to support the roof at intervals, or the whole seam is removed and the roof supported by pit-props. The first plan, although it involves a loss of available coal, is often the more economical in the long run, owing to the saving on pit-props. And it is necessary near town areas to avoid the subsidence which eventually takes place when the props collapse.

The ordinary geological map shows the Coal Measures only where they are exposed at the surface. Actually the most productive coalfields at the present time are those which are concealed underneath layers of younger rocks. In the case of the East Kent Coalfield about a thousand feet of newer rocks cover the coal. And in most of the coalfields of Northern and Central England important developments have taken place in extending the workings of the concealed parts. In the Cumberland and the

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Durham Coalfields the workings extend beneath the sea three to four miles from the coast. The maximum depth at which coal can be mined at present is about 4000 feet. Although on the exposed coalfields the coal is found much nearer to the surface, there is often danger of flooding by cutting into old mines long since abandoned.

The production of coal in the United Kingdom may be reckoned at 4,200,000 tons a week. It is estimated that at this rate of consumption there is still enough coal in Britain to last for five, or perhaps seven, centuries. Of this annual production of approximately 220,000,000 tons some 140,000,000 tons are burned as coal, about 40,000,000 tons are used in the production of gas and coke, and the remainder shipped overseas.

Important developments are taking place in the utilization of coal. It is no doubt wasteful to burn it in its natural state in an ordinary fireplace. Even when used for steam-heating or engines to produce electricity many valuable by-products are lost. Many of these products, such as tar, ammonia, benzine, and sulphur, are obtained when coal is distilled or carbonized in gas-works or coke-ovens, where coke is produced for steel furnaces and foundries. More recently experiments have been made in using coal to form a liquid fuel which can be used in oil-burning mechanism.

At Billingham, on Tees-side, a large factory has been erected at great cost for producing petrol from coal. The process is a close secret, but is thought to consist of crushing the coal, mixing it with oil and treating the liquid so formed with hydrogen, and then refining the converted oil. A very large annual output is expected, and extensive plant has been erected for filling sea-going tankers, as well as railway and road carriers.

The coalfields of Britain, which will be considered in more detail in the next chapter, are distributed in five main groups as follows—the coalfields on the flanks of the Pennines, those of Central England and North Wales,

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those of South Wales and Southern England, those of Central Scotland, and the coalfields of Ireland.

Iron Ore. The next mineral in importance in the British Isles is iron ore. As already mentioned, the value of the output of iron ore is a mere fraction in comparison to coal. Yet the part played by this mineral in assisting the mining of coal is so great that it is difficult to decide which helped the other most—the coal in the iron industry or the iron in the coal industry.

Iron ores in Britain are obtained from rocks belonging to three geological formations. The Carboniferous Limestone of Cumberland, Westmorland, and North Lancashire yields a kidney ore, or haematite, deposited irregularly in pockets or basins. A carbonate of iron known as blackband or clay-band ironstone is often found in the shales of the Coal Measures, and used to be worked in North Staffordshire. When other iron and steel industries began, local iron ore was used. But 85 per cent, of British iron ore is now obtained from the rocks of the Jurassic ^{hi}1 Is which extend across Central England. In these rocks the ore occurs in irregular beds. It is a brown ore, called limonite, containing carbonate of iron, not found pure, but mixed with other minerals. This ore is not very rich in iron, but it lies in fairly thick beds near the surface. The four main areas where it is being worked are the Cleveland Hills of Yorkshire, where the ore is rich, but the output rapidly declining; Lincolnshire, round Scunthorpe, in the north, and near Grantham, in the south; Northamptonshire, in the neighbourhood of Kettering and Northampton; and Oxfordshire, north of Banbury.

For some time the ore was carried to the coalfields for smelting, but now coke is sent to the ironfields, and more than half the pig-iron produced in Great Britain comes from blast-furnaces not on coalfields. Thus, in Lincolnshire round Frodingham and Scunthorpe there are twenty-five furnaces, and a similar number round

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Kettering and Wellingborough. There is, of course, a large number of blast-furnaces on the coalfields, particu-

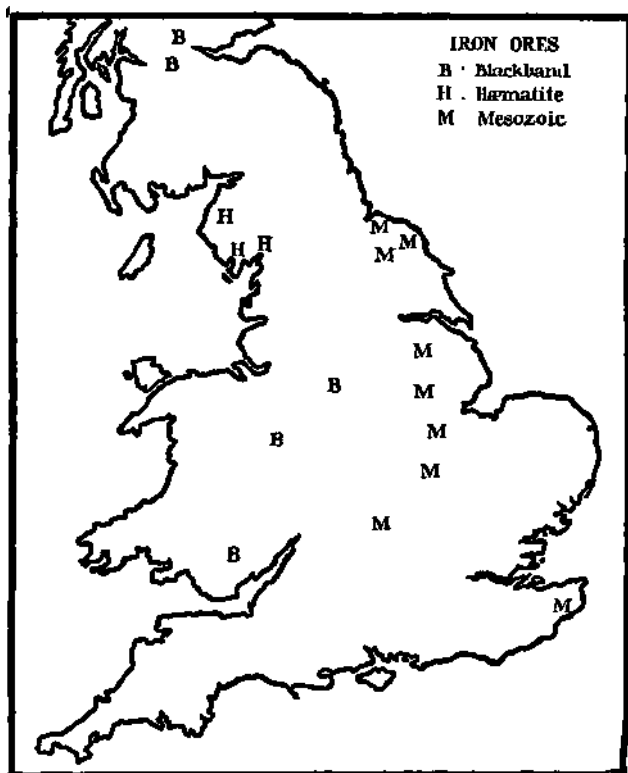


FIG. 47. IRON ORES OF THE PRESENT DAY

B, the blackband ores of the Coal Measures, H, the haematite ores of the Carboniferous Limestone, M, the varied ores of the Secondary rocks.

larly of North-east England, South Wales, and Central Scotland.

Limestone follows closely on iron ore in the total value of output, and plays a fundamental part in the production of pig-iron. It is used as a flux in the blast-furnaces.

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Limestones occur in many geological formations. Carboniferous Limestone rocks of considerable thickness are found in many parts of the British Isles, and always give rise to bold and impressive scenery, as in the Yorkshire and Derbyshire dales, the Great Orme, the Vale of Llangollen, in Wales, the lower Wye valley, and Clifton and Cheddar Gorges. Another important use made of this limestone is for the production of lime, which is so valuable for fertilizing some soils, and for cement and building purposes. In the limestone areas mentioned, stone walls take the place of hedges.

But limestones are found also among the older rocks in South Devon, Shropshire, and Staffordshire, and have helped the industries of the adjacent coalfields. The Magnesian Limestone belt extending from Nottingham to the river Tyne is much valued as building-stone. The Houses of Parliament and York Minster are built of it. It is also used for lining iron furnaces. The softer Oolitic Limestone of the Jurassic formation is another useful building-stone, as it can be sawn in any direction, and so is often called freestone. Portland Stone, Bath stone, and other brands of this limestone are well known. Most of the cathedrals of South-west England are built of it. It is also ground up and used for making cement and artificial stone.

Chalk is a rock of similar composition. It is widely quarried for making lime and cement. Kent heads the list of counties where chalk is quarried. Other counties where this production is important are Essex, Yorkshire, and Bedfordshire. The materials used in the making of the famous Portland cement, which is produced near Dartford, are chalk, mud from the Medway, and clay from the foot of the Downs.

Igneous rocks are widely used for important public buildings, monumental purposes, paving-stones, and kerbstones, but the demand for the latter purpose is decreasing. Leicestershire leads in production of kerbstones, the

MINERAL WEALTH

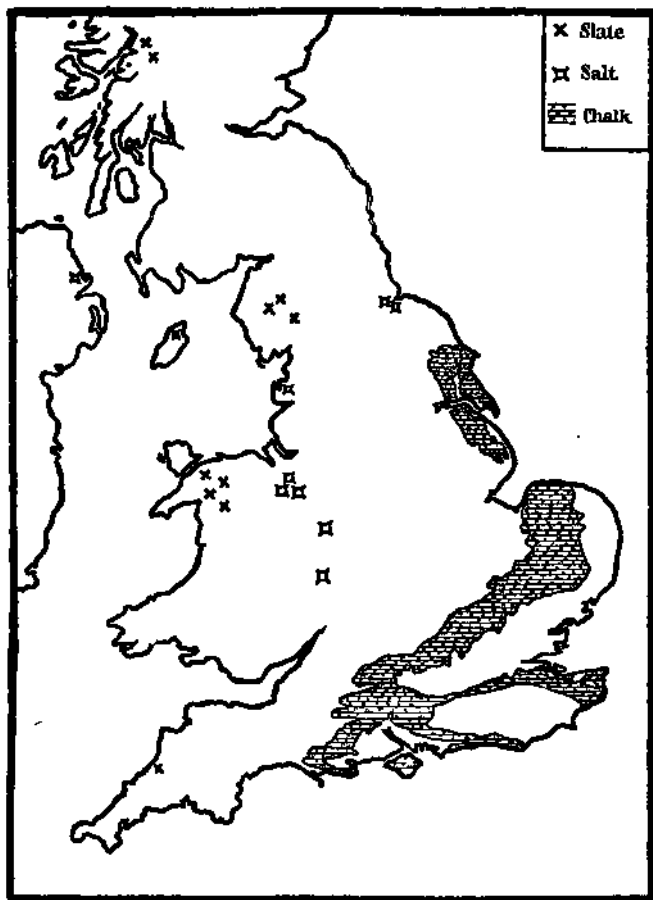


FIG. 48. THE CHIEF LOCALITIES FOR SLATE, SALT, AND CHALK
(FOR CEMENT MANUFACTURE)

stone for which is quarried in the Charnwood Forest area. The granite of Aberdeen is famous; granite is quarried for building-stone also in Cornwall, Devon, and other areas. It is much used too for metalling roads, the largest

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quarries for this purpose being at Penmaenmawr, in North Wales, and near Penryn, in Cornwall. In Northern Ireland the Mourne Mountains, and in the Irish Free State the Wicklow Mountains, have many large quarries of this stone.

Slate. As is well known, slate is used chiefly for roofs of buildings. Its production is limited to three or four districts in the United Kingdom, where some of the oldest rocks occur. The slate quarries of Penrhyn and Llanberis are famous, and their output exceeds that of all the other areas of production. These are Festiniog, in Merioneth, Cornwall, Westmorland and Cumberland, and Argyll, in Scotland. In some counties—Oxfordshire and Northamptonshire, for instance—many houses are roofed with thin stone slabs. These are not slates, but thin slabs of sandstone or similar rock.

Sandstone. This important mineral is obtained from many districts and geological formations. Reference has been made to the Old Red Sandstone, of which many historic buildings are constructed. Millstone Grit is a coarse kind of sandstone much used for grindstones and millstones. This and other sandstones of the Carboniferous formation are quarried in Yorkshire, Lancashire, and the Southern Pennines, South Wales, and near Edinburgh. The New Red Sandstone is softer and more easily worked. It is quarried particularly near Liverpool, Penrith, and Dumfries.

Salt. This was formerly obtained by evaporating seawater, but in modern times a much purer salt is secured by evaporating the brine pumped up from the rock-salt underlying the plain of South-east Cheshire. Supplies in much smaller quantities are also obtained from North Lancashire, Carrickfergus, in Antrim, and one or two other places. Apart from domestic use, salt plays a very important part in chemical industries. Rock-salt is also quarried, though the bulk of the supply of salt comes from the saturated solution or brine.

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Clay and Shale. Clay is a very useful mineral, and is found chiefly among the Coal Measures and Jurassic formations. London clay, Oxford clay, and Gault clay are well known. The older clays are worked in Yorkshire and Lancashire, and the younger clays notably near Peterborough, in Kent, and in numerous other counties. Many Lancashire towns make bricks, tiles, and other stoneware. The clay often found underlying a coal-seam is called fireclay, because it will stand heat better than ordinary clay. Many colliery companies make fire-bricks and fireproof earthenware as a by-industry. China-clay, or kaolin, is formed by the decomposition of granite. It is obtained in Cornwall and Devon, and shipped from several harbours to the Mersey, and thence to Staffordshire for the pottery industry. It is also used in Lancashire in the cotton and paper industries and for other purposes in Kent and elsewhere.

Oil-shales. Between certain sandstones of the lower Carboniferous rocks are shales which yield oil by distillation. These oils are like paraffin, and are useful for light and fuel. A yield of forty gallons from a ton of shale is exceptional, most of the shales yielding much less. The production of oil from this source is relatively small, and is carried on chiefly in the Scottish coalfields.

Oil. Various attempts have been made to find oil by boring in the Carboniferous rocks of Yorkshire and Derbyshire. The Hardstoft well yields oil, but not in any quantity. Steps have recently been taken with a view to continuing the search under Government control.

The British production of the ores of tin, copper, lead, and other valuable metals usually found as veins in igneous and old fractured rocks has dwindled to very small dimensions, and needs no special reference here, though Derbyshire lead shows signs of again increasing in importance, and Cornwall still produces tin.

CHAPTER VIII

GOAL AND POWER

COAL

IN early geological times coal deposits probably extended unbroken from Central Scotland to the south of England. But earth movements by uplifting some parts, like the Pennines, and downfolding others, as in South Wales, caused much loss of coal by denudation in the one case and its preservation in the other. Faulting has further complicated matters, so that the existing coalfields are separated.

The Pennine Coalfields. Five coalfields may be said to belong to this group—viz., those in Cumberland, Northumberland and Durham, Yorkshire - Derbyshire - Nottinghamshire^ Lancashire and Cheshire, and North Staffordshire.

The Cumberland Coalfield has an area of about 180 square miles, half of it exposed and the other half concealed under newer rocks. The exposed portion extends from Whitehaven, through Workington and Maryport. The concealed portion continues beneath the sea and northward, perhaps as far as Carlisle. It produces about 2,000,000 tons of bituminous coal a year, which is used in blast-furnaces, and some is exported to Belfast.

The Northumberland and Durham Coalfield has been worked since the thirteenth century, and has less remaining coal than other British coalfields. Its area can be roughly judged on the map by a triangle, with Hartlepool, Alnwick, and Barnard Castle at its points. The portion east of the Bishop Auckland-Sunderland line is concealed, and it extends also beneath the sea. Both this coalfield and the preceding one have the great advantage of being

GOAL

on the coast, and the Tyne and other ports, including Blyth and Sunderland, are well equipped for efficient and

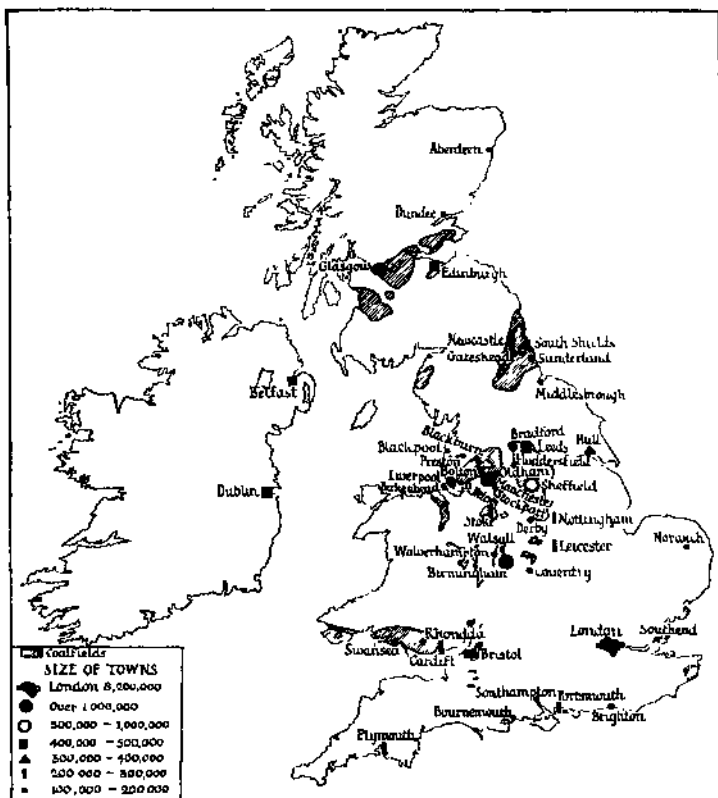


FIG. 49. THE CHIEF TOWNS OF THE BRITISH ISLES IN RELATION TO COALFIELDS

N.B. The Kent Coalfield is entirely concealed, and there are no manufacturing centres on it at present.

rapid transport of the coal from collieries to ships. The coal is of high quality, that coming from the Durham part

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being particularly suitable for producing hard coke for furnaces. A good deal of this goes to Barrow-in-Furness, for the Cumberland coal does not make such good coke. This coalfield produces about a fifth of the annual total

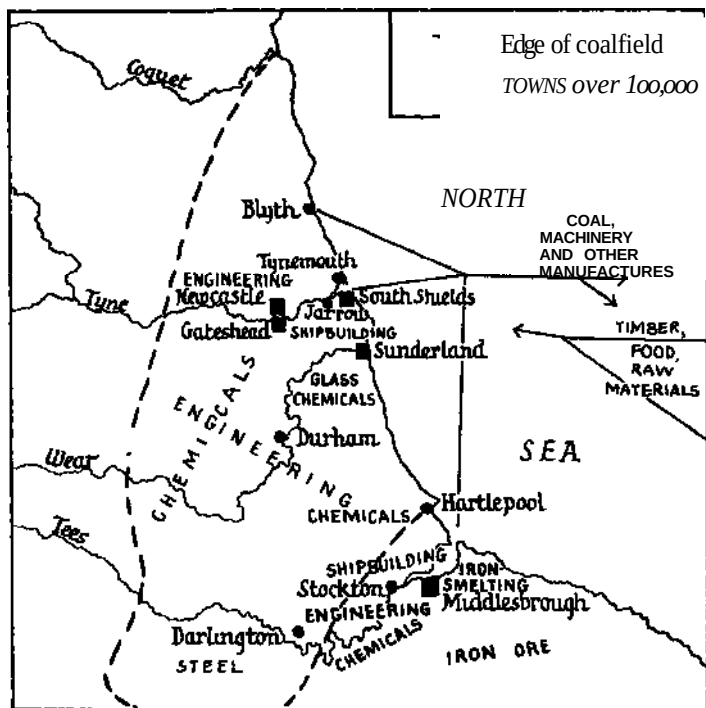


FIG. 50. THE CHIEF INDUSTRIES ON THE NORTH-EASTERN COALFIELD

for the British Isles. A good deal is exported. Manufactures are varied, but the chief are metallurgical, including steel and shipbuilding.

The Yorkshire, Derbyshire, and Nottinghamshire Coalfield. This is all one coalfield, and the largest in Britain, its total area being over 2000 square miles. Leeds marks approximately its northern limit, and Nottingham the southern,

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with Sheffield midway between them. The northern half is the widest, and here the exposed part is some twenty-five miles across. The portion concealed under new rocks to the east extends probably to the neighbourhood of Hull, or at least to the Trent. In the west, where the Goale

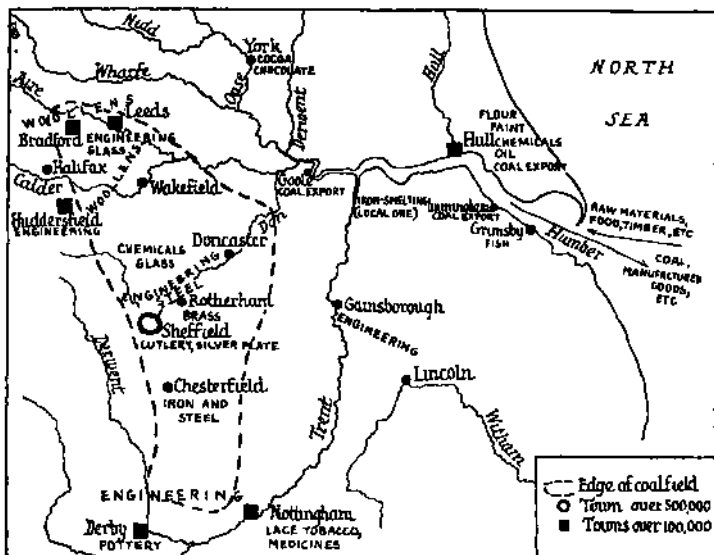


FIG. 51. THE CHIEF INDUSTRIES ON AND AROUND THE YORKSHIRE, DERBYSHIRE, AND NOTTINGHAMSHIRE COALFIELD

Measures are exposed on the flank of the Pennines, the coal-seams dip sharply down, but farther east they flatten out and lie more horizontally, though at a depth of some 3000 feet. The exposed part of the southern half narrows to about ten miles. But, as in the north, the concealed coal covers a much larger area. Doncaster has become the centre of these deep mines in the hidden field, for there the coal is relatively high, and the most easterly colliery at present is at Thorne, north-east of Doncaster. Mansfield plays a similar part in the southern portion.

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Other important mining centres are Wakefield, Barnsley, and Chesterfield.

The coal is of high and uniform quality throughout the coalfield, and the sequence of strata above it is also uniform, and but little disturbed by faulting. The mining engineer's task is therefore easier than in other coalfields, and its rich seams can be worked through more readily. Some of these, like the Barnsley seam, are famous. For the most part this seam is between five and ten feet thick. Another well-known seam is called the Silks tone Hard. The coal is excellent for household and manufacturing purposes and for making gas and coke. The newer collieries are larger and better equipped than the older ones, and the tendency is for the area of greatest output to move eastward. Many by-products are obtained from the coal, such as sulphate of ammonia, benzol, naphtha, tars, creosote, and others. Manufactures include coke of all kinds, pig-iron and steel, and metal goods, as well as textiles—woollen, cotton, and silk.

The total output of this large coalfield reaches nearly a third of that for Great Britain. But it is an inland coalfield, and although considerable quantities are exported through the Humber ports of Goole, Hull, Immingham, and Grimsby, the volume handled is less than a third of what is exported from the Bristol Channel ports or those on the north-east coast.

The Lancashire and Cheshire Coalfield. This coalfield possesses many characteristics of the Yorkshire Coalfield, of which it was once a part. But it is smaller, and in shape resembles an irregular triangle, with Burnley at the apex, St Helens and Wigan at one angle, and Manchester at the other. But between the northern and southern portions is an anticline of Millstone Grit, which practically separates the whole field into three parts—the Burnley area, South Lancashire, and that part extending from Manchester into East Cheshire. As Millstone Grit bounds the coalfield on the north and east there is little

COAL

likelihood of any concealed coal there. And on the west and south the seams dip so sharply that they probably pass out of reach within a short distance.

The varieties of coal obtained are all of good quality for the various commercial needs. The coke produced in

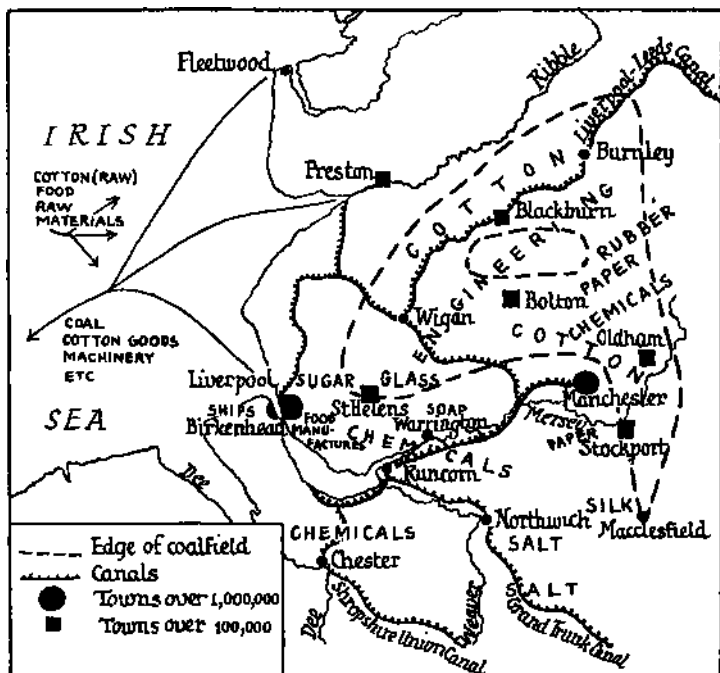


FIG. 52. THE CHIEF INDUSTRIES ON THE LANCASHIRE COALFIELD

the Burnley area is widely used. The cotton-mills and chemical industries use the bulk of the production, including large quantities of slack or small coal. Little coal is sent to other parts, excepting Belfast; in fact, considerable quantities are brought in from across the Pennines. The chief mining towns in the south are Wigan, Bolton, and Oldham. Manchester is the main

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coal exchange. The annual output approaches 20,000,000 tons, but has declined, and many of the best seams have been worked out in some areas.

The North Staffordshire Coalfield. This triangular coalfield at the south-western end of the Pennines is of great interest, for it contains preserved in a downfold, although much faulted, a complete sequence of the lower, middle, and upper Coal Measures, the maximum thickness of which amounts to some 7000 feet. The total thickness of coal, however, is only about 140 feet, and this is distributed over some thirty workable seams among the 4000 feet of strata. These numerous seams are of good quality and useful for gas and coke. One brand of hard coal obtained in the eastern part is much valued for use in blast-furnaces, because it contains little sulphur and leaves little ash. The fireclays and shales are useful in the pottery industry. Blackband ironstone also occurs, so that iron- and engineering-works are important, and these industries, in fact, employ more men than the pottery-works. The chief collieries lie along the belt of pottery towns—Burslem, Hanley, Stoke, and Longton. The whole coalfield covers about a hundred square miles, but there are some outlying portions.

The Midland Coalfields. The North Wales Coalfield. This coalfield lies along the south-western shore of the Dee estuary, and continues southward across the Dee to the neighbourhood of Oswestry, a distance of forty miles. The exposed coalfield covers about eighty square miles. The concealed part lies to the east and north, and may connect with those last considered. The coal is good for all purposes. The annual output is about 3,000,000 tons. The chief collieries are round Wrexham and Ruabon. As limestone is near at hand throughout the coalfield, smelting has always been important here, though now the ore has to be imported.

The Shropshire or Severn Coalfields. The total annual yield from these coalfields is only about 500,000 tons. The

GOAL

Wyre Forest and Coalbrookdale Coalfields lie along the Severn valley, and extend southward into Worcestershire. The main interest in these small fields arises from the earliest experiments which were made here in the use of coke for smelting iron, and the first iron bridge may still be seen at Ironbridge. Most of the mines in these coalfields are small and have only local importance.

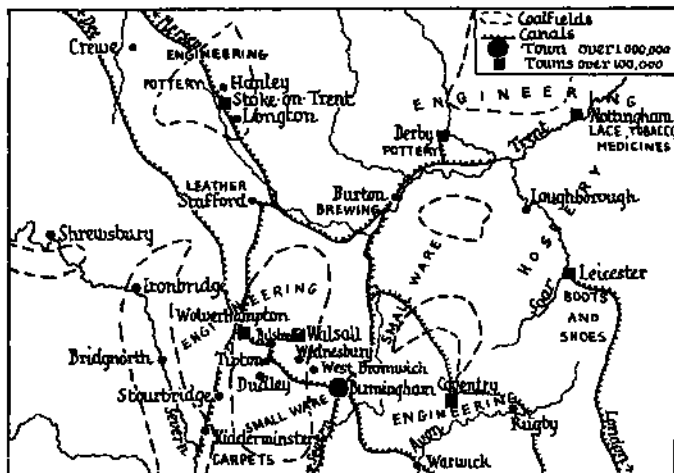


FIG. 53. THE CHIEF INDUSTRIES ON THE MIDLAND COALFIELDS

The South Staffordshire Coalfield. Although the visible coalfield is only about 150 square miles in area and the output about 6,000,000 tons, it is important, because of the number of metal industries carried on in the many large towns on it or round it. The coalfield extends southward from Rugeley some twenty-five miles. Bilston, Wednesbury, and Dudley mark its direction. Birmingham, on the east, and Wolverhampton, on the west, are just outside it. Walsall and West Bromwich overlap it. The hidden coalfield extends away on the east, north, and west, and is worked at Cannock Chase, in the north,

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towards Lichfield, in the north-east, and near Birmingham and Wolverhampton. In structure the coalfield is an anticline, with basins to the east and west. The coal is bituminous, and rests on ancient rocks, some of which are limestones. In the north the seams are of moderate thickness, but in the south near Dudley they seem to unite to form the famous Ten Yard seam, which occasionally reaches thirty-six feet in thickness. But complicated faults interrupt the seams. The existence of iron ore, coal, and limestone in close proximity gave rise to numerous furnaces, which in the early days belched forth dense clouds of lurid smoke, and gave the region the name of the Black Country. As the local ore diminished and coal became more difficult to get, the number of furnaces declined, the cost of transport proving a great handicap. But metal industries of great variety and value continue, and the region is exceptionally well served by railways and canals.

The Leicestershire and East Warwickshire Coalfields. Situated in North-west Leicestershire round the mining centres of Ashby-de-la-Zouch and Coalville is an area of some twenty-four square miles which has rich seams of good steam and house coal. Similarly, in the Warwickshire Coalfield, which lies between Tamworth and Coventry, the seams combine to form one over twenty feet thick. This coalfield is long in shape and measures about 150 square miles. The two coalfields have a combined output of 8,000,000 tons, and are therefore the most productive of all the coalfields in the Midlands of England.

The Southern Coalfields. These coalfields form part of the great system of folds caused by the earth movements which followed the Carboniferous era. The folds run east-west across South Wales to Kent and into Belgium. It was owing to the tracing of these folds that the concealed Kent Coalfield was predicted and proved.

The South Wales Coalfield. This coalfield, the third

COAL

largest in the British Isles both in area and output, occupies an oval-shaped dish, with the Coal Measures occupying most of the surface and the underlying Millstone Grit and Carboniferous Limestone curving up to form the rim around it. The whole basin is tilted towards the south. In the centre, where the coal-seams would have been at their greatest depth, there is a gentle arching of the strata, making it easily accessible. Further, the

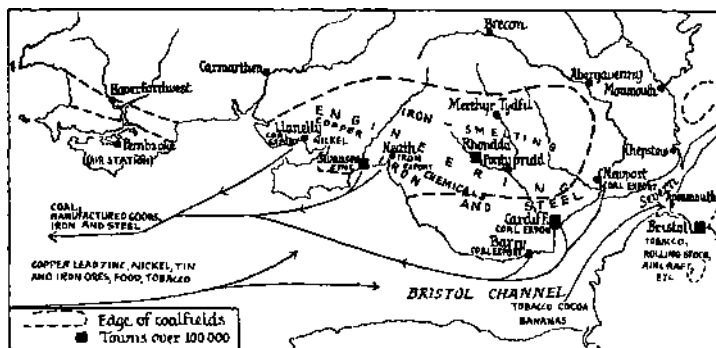


FIG. 54. THE CHIEF INDUSTRIES ON AND AROUND THE SOUTH WALES COALFIELD

rivers flowing southward in parallel courses have cut deep valleys and gorges through the southern rim of the basin. Two great advantages follow from this formation. The coal can be got at in many places by cutting horizontal tunnels into the mountain-sides, although most of the mines sink deep shafts through the plateaux between the valleys. Secondly, there is a down-gradient from the collieries to the ports for the trains carrying the heavy loads of coal and steel. On the upward journey the loads of pit-props and food-supplies are lighter.

The coal is of the very best quality, and ranges from rich bituminous coal in the east of the basin, through hard steam coal, to anthracite in the west. Thus, supplies for domestic use, manufacture, and gas-making come

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from the eastern mines; steam coal and anthracite for ships and locomotives from the centre and west. The coalfield occupies the greater part of Glamorgan, excluding the plain of Gwent. Most of the anthracite is contained in the western extension into Carmarthen. The sea has cut deeply into this part of the coalfield, so that the ports of Swansea and Llanelly are actually on the coalfield, while Barry, Cardiff, and Newport are not. The sea has also separated from the main field the coalfield in Pembroke. But the coal-seams in this part are thin and much contorted, so that only a few thousand tons are produced annually. Compared with the total annual output of the whole South Wales Coalfield—viz., nearly 50,000,000 tons—the Pembroke contribution is trivial. In the main coalfield there are many good seams from four to twelve feet thick.

Glamorgan also produces some 200,000 tons of iron ore annually. Formerly this was smelted along the northern margin of the coalfield, and the towns of Merthyr, Dowlais, Tredegar, and Ebbw Vale constituted a Welsh Black Country. Soon, however, South Wales became dependent more upon imported ores than local ores. The cost of hauling these heavy ores from the coast proved a considerable handicap, and many of the furnaces have been dismantled. The ports have become the chief centres of the metallurgical industries. But the industry also continues in the northern towns mentioned above.

The Forest of Dean Coalfield. Although this is a small field with an area of just over forty square miles the coal is good for domestic and industrial purposes. The mining centres are Coleford and Cinderford, and the output is about 1,500,000 tons.

The Somerset and Gloucestershire Coalfields. East of the Severn along the Mendip Hills are six detached areas of coalfield, measuring in all about fifty square miles, but with a larger area of hidden coal. The coal-seams are thin, and much of the coal is of poor quality. The chief

COAL

mining centre is Radstock, but the total output is less than 1,000,000 tons.

The East Kent Coalfield. The area of this coalfield, which is entirely concealed, is about 200 square miles. It lies south of the line joining Ramsgate and Canterbury, and Dover forms a convenient port. There are three mines, and the output exceeds 1,000,000 tons. So far there are no manufactures.

The Scottish Coalfields. The coal in the Scottish coalfields occurs not only in the rocks of Coal Measure age, as in England, but also in the older Carboniferous rocks. The coalfields occupy basins in these rocks which were let down and folded between the parallel lines of faults which bound the Central Lowlands. Actually the coalfields are between the line of volcanic hills—the Sidlaws, Ochils, and Campsie Fells—and a similar but more irregular line to the south. Three areas are to be noted.

The Lanarkshire Coalfield. This central coalfield, extending from the Clyde to the Forth and including, besides Lanarkshire, parts of Stirling, Linlithgow, and three other counties, produces half the total output of coal for Scotland. The chief mining centres, which should be found on the map, are Glasgow, Coatbridge, Motherwell, Wishaw, Airdrie, Falkirk, Kilsyth, and Alloa. Some of the best seams average three to five feet in thickness, and some are considerably thicker. The coal is mostly bituminous, although there is some anthracite. As blackband ironstone and limestone are also found, smelting is carried on. The ore is phosphoric, and formerly was not suitable for steel, but with modern processes it can be used. The bulk of the ore for the steel industry is, however, imported.

The Ayrshire Coalfield. This is the second in area, but not in output. The rocks in this coalfield have been much disturbed by the intrusion of igneous rocks, and much coal thereby destroyed. The coal is mostly bituminous, but there are some steam coals and a little

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anthracite. Kilmarnock and Irvine mark the chief mining districts; Ardrossan, Troon, and Ayr the coal ports.

The Forth Coalfield comprises both the Fifeshire and Midlothian areas, the two parts probably being connected under the sea. Of the two Fifeshire is the more important, and has developed rapidly of recent years. Methil is the chief coal port of Scotland. Burntisland serves the western part of the field. Good bituminous coals are available for

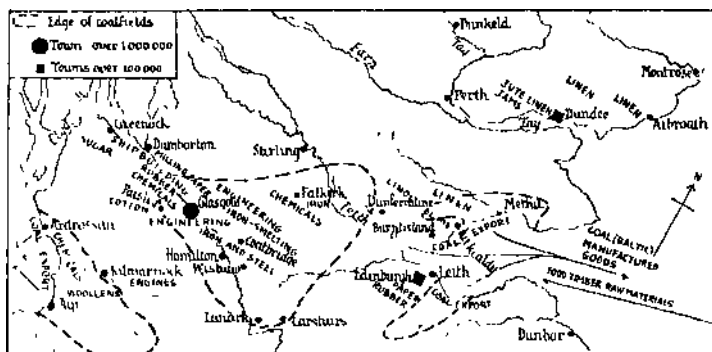


FIG. 55. THE CHIEF INDUSTRIES ON AND AROUND THE SCOTTISH COALFIELDS

all uses, and the steam coals approach the quality of anthracite. In the Lothian Coalfield, which has no port of its own, there are house, gas, and steam coals.

In addition to the coalfields mentioned there are two or three small outlying areas. The total output for the Scottish coalfields is about 35,000,000 tons, less than half that of the Yorkshire-Nottinghamshire Coalfield.

Northern Ireland. Although coal occurs round the south-west shores of Lough Neagh and several seams of coal have been proved, it has not yet been exploited to any appreciable extent.

The Irish Free State. In the same way, although the patches of coal in the Irish Free State are larger and more numerous, the coal-seams are thin and much distorted.

POWER

The largest patches are in Kilkenny and where the counties of Cork, Limerick, and Kerry meet, but the output is less than 100,000 tons, which, compared with an import of 2,500,000 tons, is negligible.

POWER^x

Water-power and oil are closely connected with coal as a source of power. From each of these electricity can also be generated. Practically all the petroleum oils used in these islands have to be imported, and are too expensive for use with electrical plant on a large scale. The electricity generated by water-power is also relatively negligible. In fact, it has been calculated that if all available resources of falling water were developed they would supply only 10 per cent, of the annual output. Over 97 per cent, of electricity in Great Britain is, in fact, generated by means of steam, involving the use of coal.

Every one is now familiar with the lines of electrical cables carried on pylons in all parts of the country. They represent a national scheme for supplying electricity on a uniform basis. Previously there was great diversity of voltage, and both alternating and direct current were in use even within small areas. This complexity hindered progress. The erection of the National Grid enables electricity to be generated at selected economical stations, and transmitted at high tension for long distances for distribution. It is not surprising to find, as the map indicates, that the chief generating stations are either on the coalfields or near the coast where sea-borne coal is available. The few exceptions are found near inland centres of population with a considerable consumption of electricity.

In planning this national supply Great Britain was divided into ten areas—three in Scotland (North,

¹ With acknowledgments to *The Times Electricity Supply Number*, of December 5, 1933.

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Central, and South) and the remainder in England and Wales. The boundaries are shown on the map. The area served in North-east England is about 5000 square miles, and contains about 2,750,000 people. As the great industries of shipbuilding, engineering, iron and steel manufacture, and coal-mining are concentrated on Tyneside and Tees-side, only about 180 miles of transmission lines were required.

The adjacent area of North-west England (including North Wales) covers some 9000 square miles, and contains over 7,000,000 people. The industrial parts of this area are similarly concentrated chiefly in Lancashire and Cheshire, where the great textile, cotton, and chemical manufactures are carried on. There are over 500 miles of transmission lines which connect with the hydro-electric power-stations of North Wales, with similar stations in South Scotland, through Lancaster, Penrith, and Carlisle, and with Central England, through Crewe.

The Central England area comprises over 7000 square miles, lying between Stoke-upon-Trent and Mansfield, in the north, and Worcester and Northampton, in the south. The population of this area exceeds 5,500,000. The industries carried on in the large manufacturing centres are very varied, and include steel and cutlery, pottery, motor-cars, lace, hosiery, boots and shoes, and confectionery. The distribution of current necessitates over 400 miles of transmission lines.

The area of mid-east England is similar in size and population. It includes the East and West Ridings of Yorkshire, the counties of Lincoln and Rutland, and parts of Nottingham and Derby. The manufacturing industries are mainly iron and steel, engineering, and textiles. But there is also coal-mining and important canal, dock, and harbour undertakings. But electricity is also increasingly used, particularly in Lincolnshire, for farming operations and domestic activities. The area is served by over 500 miles of transmission lines.



FIG. 56. TRANSMISSION LINES OF THE NATIONAL ELECTRICITY GRID
Based on a map appearing in "The Times Electricity Supply Number," of
December 5, 1933, by permission of the Central Electricity Board

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East and South-east England, though separate areas under the scheme, may be considered together. As it embraces London and the Home Counties it is a very important area. The population exceeds 13,000,000 and the area 12,000 square miles. The current is used for a wide range of miscellaneous manufactures, for Tube and railway transport, and more widely for domestic purposes. During the last few years the consumption of electricity in this area has increased more than 100 per cent. The main transmission system extends over 1000 miles. The area contains at Barking the largest power-station in the country, and at Northfleet the biggest switching-station. The crossing of the Thames at Dagenham involves spectacular pylons 487 feet high and a span of over 3000 feet.

The area of South-west England and South Wales covers over 17,000 square miles, or nearly a fifth of Great Britain. The population exceeds 6,000,000. The current is needed for the dense industrial area of South Wales, the china-clay and tin-mining districts of Cornwall, and important seaports extending from Portsmouth westward on the south coast, and on the shores of the Severn estuary. But it also includes wide areas of agricultural land, so that over 700 miles of transmission lines were necessary.

In Scotland the most important area is naturally the central one, for this comprises the great belt of industries—shipbuilding, engineering, coal-mining, steel, and textiles. It covers 5000 square miles, and has a population approaching 4,000,000. The transmission lines extend for 250 miles, and have to cross many rivers, notably the Forth.

The South Scotland area is similar in size, but as the country is almost entirely agricultural the population is only just over 250,000. There are nearly 400 miles of transmission lines. This area contains five hydro-electric stations in Galloway. It forms an important link between Scotland and England both in the east and west.

POWER

It is possible that a grid system for gas may ultimately be established in certain areas. A successful experiment was made by the Sheffield Gas Company of linking up the mains of the Sheffield plant with those of other companies over a considerable area of South-west Yorkshire. In this way the resources of all the plants concerned are available to meet any unexpected demand, and there is economy of production. Similar developments are taking place in other areas.

Gas must be produced near the area of consumption, and coal is the raw material of gasworks. In most cases, therefore, gasworks are established close to railway-stations or navigable waterways, to reduce the cost of transport of the coal.

Gas is as important in many ways as electricity, and there should be no need to regard the one as supplanting the other. When coal is burned in closed ovens or retorts the volatile gases are driven off and coke remains. For a long time much of this gas was wasted, because there was not sufficient demand for the numerous by-products (see p. 119). But the increasing use of tar in road-making and of the other chemicals in industry has gone far to end this waste. Most modern plants therefore now extract and purify these gases. In Sheffield, for instance, 97 per cent, of the gas produced is obtained from coke-ovens. The electric power-stations still consume coal in furnaces, and so lose all the by-products. Whether gas could be economically used to generate steam for electricity plant is a matter for consideration.

CHAPTER IX

MANUFACTURES

BRITAIN is essentially an industrial country. It is estimated that the home production of food would suffice to feed only a fifth of the population. For the remainder food must be purchased from abroad. The power to obtain not only the bulk, but the great variety of foods to which the people have become accustomed, is supplied by exports and by earning credits from foreign countries by carrying their goods, by insuring goods against loss, and by commissions in trading transactions. These credits and income derived from investments abroad are often called invisible exports. Coal is the most important commodity exported, not only for its value, but because it also assists shipping to get return cargoes. The other exports are almost entirely manufactured goods, for very little food or raw material is now sent abroad from Britain. Manufacturers depend upon the basic industries of coal and iron. The distribution of these and other important industries is largely controlled by geographical factors.

Shipbuilding. Besides coal and iron, shipbuilding is also of fundamental importance. As this is an island country shipping is essential for the supply of raw materials and food and for transporting overseas our manufactured goods. A successful shipping industry calls for long experience of the building of ships and of the seamen who navigate them. Great Britain has these and other advantages, such as first-rate ports and the natural facilities referred to in the first chapter.

In the latter part of the last century the Thames estuary was the chief shipbuilding district in the world, but now only minor shipbuilding and repairs are carried

MANUFACTURES

on there. All the great shipbuilding yards are in the north. North-east England (including the Tyne, Wear, and Tees) and the Clyde share between them 90 per cent, of the work on new ships. In 1934 the Clyde yards

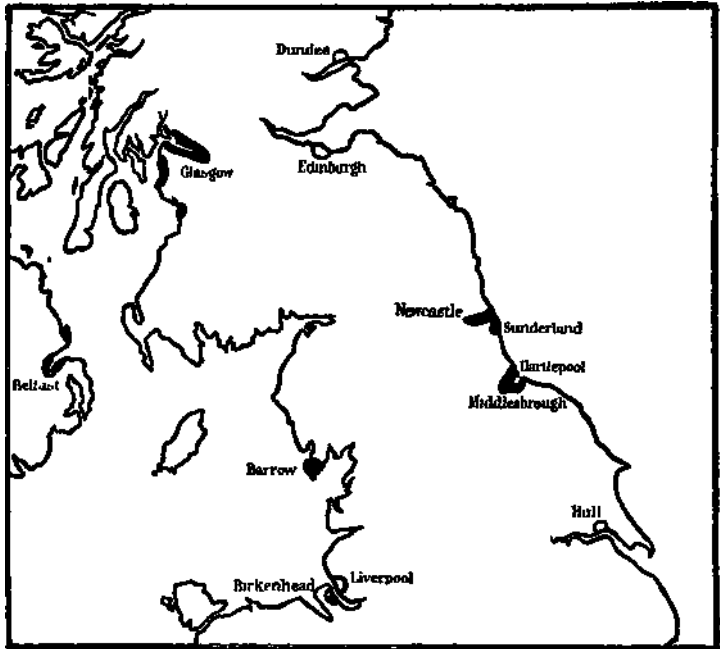


FIG. 57. THE CHIEF SHIPBUILDING CENTRES IN BRITAIN

produced nearly 50 per cent, of the new tonnage of Great Britain and nearly 25 per cent, of the world's output. Belfast, Birkenhead, and Barrow-in-Furness share the other 10 per cent. It is not difficult to find the natural facilities which explain this distribution. Good waterways capable of being deepened and widened; nearness to the great iron- and steel-works and to coal-mines; engineering-works capable of supplying the engines and every

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form of mechanical equipment required in a modern ship—these highly technical industries, each assisting the other, and above all the strong, skilled men who staff them, are the factors which account for the present distribution. The chief shipbuilding companies maintain large establishments for ship-repairing at Southampton, Liverpool, and other ports.

Steel and Engineering Industries. When iron ore is smelted with coke and limestone the product obtained is pig-iron. Most of the pig-iron is used for making steel, but some goes to foundries and some to be wrought at the forges. The steel-works produce girders, framework for machinery, and castings of many kinds. The foundry casts iron goods, which may vary from the smallest iron articles to stoves and huge tubes. The forge makes articles of a purer tough iron by heating, hammering, and bending. Almost every town has a foundry, but the great steel industries are established near the blast-furnaces in four areas of great importance—North-east England, South Wales, the Glasgow area, and the Sheffield district.

The engineering industry manufactures tools, implements, engines, and machines. In many cases the output is dominated by local needs. Thus, in the eastern counties agricultural implements and machinery predominate; in the Midlands motor-cars and cycles are important; round Sheffield small tools, as well as the famous cutlery and the larger armament products; in Lancashire and Yorkshire textile machines; and on the north-east coast and in Scotland mining machines and marine engines. The busiest and most comprehensive engineering areas are the Manchester province—as great as any to be found—the West Riding of Yorkshire, Tyneside and the north-east, the Clyde area, the Birmingham area, South Wales, and Greater London.

The Textile Industries. *Wool.* For many centuries the wool textile industry in England came next in importance to agriculture. It was carried on in every part of the



FIG. 58. DIAGRAM MAP OF THE CHIEF ENGINEERING REGIONS AND SOME OF THE MORE IMPORTANT ENGINEERING TOWNS IN GREAT BRITAIN

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country, but some parts, such as East Anglia, the West of England, the West Riding, East Lancashire, Central Wales, and the Scottish Border, were more important



FIG. 59. LOCATION OF THE WOOL INDUSTRY IN
THE BRITISH ISLES

Single or scattered mills are not indicated.

N.B. There is a far greater industry in the West Riding region
—shown black—than in all the other regions added together.

than others. Gradually the West Riding became supreme, and there it is now concentrated, practically in the area between Leeds and Bradford, in the north, and Huddersfield and Wakefield, in the south. The industry continue* on a smaller scale in other districts, to be noted later.

At first the chief factors were a plentiful supply of good

MANUFACTURES

raw material—in other words, the best sheep-rearing districts—and abundant soft water for washing the wool and turning the water-wheels. Later came the application of steam-power to the spinning- and weaving-machines and the necessity for coal. The dense population in the coalfield both supplied adequate skilled labour and a market for the goods. As the industry grew and wool was more and more imported easy transport from and to the ports had to be considered. Finally, great specialization in the processes of manufacture necessitated concentration. Now of the total amount of wool produced or imported into Britain about two-thirds is used in manufacture and a third is re-exported. This partly explains why London is the chief wool market, though far from the chief centre of the industry.

Cotton. Much the same explanation is applicable to the cotton textile industry, except that there was no home production of the raw material, and that the industry quickly became established in East Lancashire, instead of being widespread. Clearly the moist and equable climate and the coalfield were not the only important factors, for these can be found elsewhere and can be produced artificially. No doubt the good ports facing America and abundant soft water from the Pennine moors also helped, but perhaps the most important factor was the human one. As the industry developed and the processes became more and more specialized the skill and energy of the workers proved at least as valuable as the physical factors. The people of Lancashire were already familiar with the handling of wool when cotton was introduced. The pioneer inventors of textile machines—namely, Kay, Hargreaves, Arkwright, and Crompton—were all born in Lancashire. Chemical and mechanical operations too enter largely into the manufacture of cotton. The chief chemical-producing region in Great Britain is to be found in South Lancashire and North Cheshire, at the very doors of the cotton industry.

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Although Lancashire is essentially the home of the cotton industry, and Liverpool the greatest raw-cotton market in the world, the trade in this textile extends into Cheshire, Derbyshire, and the West Riding of Yorkshire. In Scotland, Glasgow is like a combination of Liverpool and Manchester, being the centre of an area where all the phases of the cotton industry are carried on. Certain

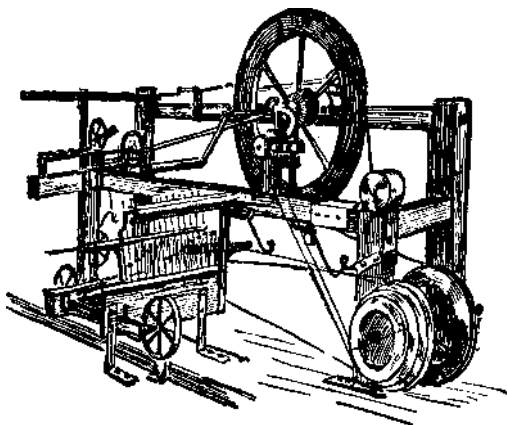


FIG. 60. CROMPTON'S SPINNING-MULE
The 'carrier' is seen on the left of the machine.

branches of the industry are established also at Belfast, Nottingham, and Leicester.

Artificial Silk. This industry has grown up during the present century, and is the result of the advance in chemical science. Fibres of different kinds are produced by dissolving nitro-cellulose and forcing the liquid through very small holes. Probably as much as four-fifths of the total production of artificial silk is made from wood-pulp, prepared from spruce- and pine-trees. The usual processes of spinning and weaving follow. A considerable amount of cotton is used with the artificial fibre. Threads of spun silk, wool, and flax are also used in the making of some artificial-silk fabrics. Many artificial-silk factories

MANUFACTURES

are to be found in the textile areas of Lancashire, Yorkshire, and Leicestershire; others have been erected in the old wool-making districts, as at Braintree and other towns of East Anglia; and some in unexpected places.

Natural or *spun silk* is older than the cotton industry, and is widely scattered. It is carried on in mills at Norwich and Braintree, in East Anglia; at Frome, Exeter, Barnstaple, and other places in the West Country; in Scotland and Ireland; and in many towns of the great textile areas previously mentioned.

Chemicals. Chemical products have become increasingly necessary not only in manufactures, but in agriculture and domestic life. The chemicals so much used by manufacturers are sulphuric, hydrochloric, and nitric acids, soda, potash, bleaching powders and liquids, and compounds of ammonia.

By far the most important chemical region is the Cheshire salt-field. This area has the advantage of being near a great port and manufacturing district. The region is also well served by canals. Widnes and Runcorn are typical centres. Other factories are placed near metal industries which require such products, as in the Birmingham area; or where fuel is cheap, as on Tyneside; or where powerful electric furnaces can be run cheaply, as at Loch Forbes and Fort William, in Scotland.

Coal-tar products are also of immense importance. Any gasworks can distil coal-tar. A wide variety of products can be obtained from it. So that the industry is carried on in many places. Nottingham is a famous centre for the preparation of medicines, essences, perfumes, and photographic chemicals. Disinfectants are also made there and at London, Bristol, Birmingham, and many other large centres. Coal-tar dyes are produced chiefly in the Manchester region and in the West Riding between Leeds and Huddersfield.

Other industries specially associated with chemicals include soap-making at the ports (particularly Liverpool),

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where animal and vegetable oils are available; glass-making, which requires sand, flint, alkalis, and great furnaces, found at St Helens, London, the Midlands, and the North; paper, which is made on a large scale in the London area, in North Kent, in Lancashire round the Rossendale Fells, and in the Eastern Scottish lowland; and leather, paints, and varnishes in towns to be mentioned in later chapters.

The distribution of other important industries, such as clothing, printing and publishing, the manufacture of food and drink, will also be found in the regional chapters which follow.

PART II

R E G I O N A L

CHAPTER X

NATURAL REGIONS OF THE BRITISH ISLES

IT is not easy to state precisely a definition of a natural region; yet the meaning of the term must not be shirked on that account, for the complex factors in the geography of any country, and particularly the British Isles, would be bewildering if some order and means of comparison were not found.

It is fairly easy to mark out regions which differ from one another in a particular aspect. We have already, for instance, discussed definite regions based upon rock formations, soils, and relief. We have divided the country into climatic regions; and, because plants depend so much upon climate and soils, we have considered some aspects of other regions based upon vegetation. But a natural region embraces all these aspects and others. It is a region in which these factors combine together, like the parts of a body, to produce a definite whole, full of life and activity.

So far only the physical factors have been mentioned, and there are regions like Antarctica where nature has sole control. But in most regions man too plays his part. In some he does little to alter the natural conditions of the land on which he lives: he takes what nature gives him, but does nothing to increase these resources, and in that sense is one of the animals. But in countries like our own he has profoundly altered the natural conditions by his coal-mines, his railways, his drainage of the land, his methods of tilling it, and in countless other ways. So that

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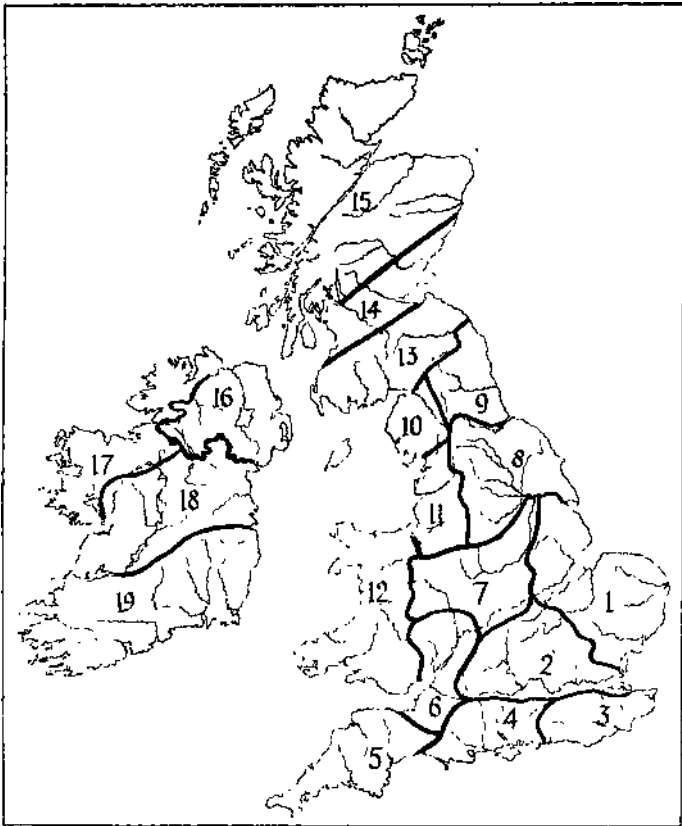


FIG. 61. NATURAL REGIONS OF THE BRITISH ISLES

The boundaries here shown are intended solely to indicate the arrangement of the natural regions as treated in this book. They are to be regarded only as a suggestion. Other divisions are possible. The boundaries mark no sudden change of conditions. For example, the conditions in Region 7 merge imperceptibly into those of Region 11, Region 2, and so on.

in the natural regions we are going to consider we shall be thinking chiefly of the association between man and the region round him. For that reason some people prefer to call such regions 'geographical,' rather than 'natural.

NATURAL REGIONS

But the underlying and permanent force at work is always the natural region itself. For, however much man tries to, and does, in fact, overcome natural obstacles, he is influenced by his natural environment; and he gets the most from the land not so much by conquering as by gaining knowledge of nature, and using her gifts to bring him return for his labours.

Looked at with these considerations in mind, the size of natural regions may vary considerably. If the world or a whole continent is being considered, then the separate units are of necessity large. They are the *major regions*. Each one can be analysed in further detail and minor regions noted. These too are capable of subdivision, until we get the smallest region which can usefully be regarded as a whole. Thus, we speak of the British islands as being part of the major natural region of temperate West Europe. Next, we have already noted natural differences of relief, climate, and human activities between the north-west and south-east regions of the British Isles as defined approximately by the Exe-Tees line. These two, then, are *minor regions*, the first belonging to the coastal region of West Europe and the other possessing more relationship to the lowland plains of West Europe. But obviously each of these two can, with advantage, be considered as made up of smaller divisions, or *sub-regions*, such as the Lake District or the Weald.

The following is a list of such regions in the order in which they are dealt with in this book (see Fig. 61):

- i. Eastern England.
2. The Oxford and London Basins.
3. The Wealden Region.
4. The Hampshire Region.
5. The Region of South-western England.
6. The Lower Severn-Somerset Region.
7. The Midland Region.
8. The Yorkshire Region.
9. The Region of North-eastern England.

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10. The Cumbrian Region.
11. The Lancastrian Region.
12. Wales.
13. Scotland: the Southern Upland Region
14. Scotland: the Central Lowland Region.
15. Scotland: the Highland Region.
16. Ireland: Northern Ireland.
17. The Irish Free State: the North-west Highlands.
18. The Irish Free State: the Central Plain.
19. The Irish Free State: the Southern Uplands.

Before considering each of these sub-regions in turn one word of warning is necessary. Natural regions rarely have precise boundaries. Though for convenience lines are drawn on maps marking off one region from another, there is seldom a sudden change from one set of conditions to another. It is impossible to say precisely where, for instance, Eastern England ends and the London basin begins. This is true equally of the vegetation, the climate, and the industrial aspects. There is always a transition zone, just as there is even between land and sea. The seashore is usually not a line, but a wide tract across which the sea ebbs and flows. In the same way, each of our regions merges into those surrounding it, and contributes to the life and development of the whole country.

The best way to learn the meaning of natural regions is to study your own area. Use the Ordnance map; trace various aspects separately, such as the contour-lines, the streams, the woods, the roads, the houses, and so on. Place one tracing on another, and note the connexion between them. Then go out and find the parts that interest you, and see what they are like in reality. Conditions are continually changing, so that there is always a need for fresh knowledge of a region. So get some one to help you to make a survey of your own area.

CHAPTER XI

THE REGION OF EASTERN ENGLAND

THE features common to this region are the backbone of chalk hills running from the East Anglian Ridge, through Norfolk Edge, reappearing north of the Wash in Lincoln Wolds, the clay vales which adjoin it, the similarity of the soils, of the climatic conditions, and of the occupations. The similarity, indeed, extends across the Humber into the East Riding of Yorkshire, but we shall not include this area in our region, because the Humber is much more a barrier than a link. Our region extends from the Humber to the Thames estuary. It consists of East Anglia, the basin of the Wash, and the remaining part of North Lincolnshire. Its boundary on the west follows approximately the Oolitic escarpment of Lincoln Edge and the western limit of the Fcnlands, finally crossing the chalk ridge to the Thames estuary. The whole of Essex might well be included but for the fact that the river-basins of a great part of this county belong to the London basin, and are better considered in relation to London. The region therefore includes the counties of Lincolnshire (which has three administrative divisions—Lindsey, Kesteven, and Holland), Norfolk, Suffolk, and parts of Cambridge and Essex.

This area is to a remarkable degree the most important one in the British Isles for arable farming. Not only is there a much higher percentage of arable land than elsewhere, but the yield per acre is the highest in the country, and perhaps of any country in the world. The chief factors are clear: the variety and suitability of the soils, which are described on pp. 100-101, the abundant supply of river-water, though rainfall is light, and the

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abundance of sunshine, particularly at the time of harvest. The open, rolling character of the country also assists in the tilling of the land, but undoubtedly the climate is the most powerful factor.

The country lies open to the North Sea and faces the Continent. It is relatively remote from the moderating influence of the westerly winds. So, though the winters are cold the summers are hot, and the range of temperature is greater than elsewhere in Britain. Although the westerly winds are nearly twice as frequent as those from an easterly direction, the latter winds are often strong, particularly in the spring. They naturally affect chiefly the coastal areas. But they tend to delay, over the whole area, the coming of spring, although as a compensation autumn is also usually later. The mean rainfall nowhere in this area exceeds 31 inches in the year, and is as low as 20 inches in some parts. It falls chiefly in the summer months, accompanied by more thunderstorms than in the west. With regard to sunshine, this region closely follows the south-eastern counties for the highest aggregate.

Let us begin our survey with the Fenlands, which are the most fertile part of all. They cover the whole Holland division and other parts of Lincolnshire, and extend far up the Witham valley. Along the north shore of the Wash they form a belt over ten miles wide; they include also the Isle of Ely division of Cambridge and part of Norfolk. The Fenlands thus embrace the lower basins of the Witham, Welland, Nen, and Ouse, an area of about 1500 square miles. The boulder-clays deposited during the Ice Age, the alluvium brought down by the rivers, and the muds and gravels washed in by the tides all contribute to make the land, now that it has been drained, so highly productive. The occupations of fishing, peat-cutting, and the hunting of wild birds only slowly gave place to farming. Now over three-quarters of the land is ploughed for crops. Indeed, the only districts where pasture land of any extent

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occurs are on the islands of boulder-clay near Ely, Wisbech, and March. More than a quarter of the arable land is devoted to the potato crop, and the average yield approaches eight tons per acre. The potatoes are dispatched chiefly to the London market. Mustard for the Norwich factory is also important. But no less rich are



FIG. 62. TULIPS AT SPALDING, LINCOLNSHIRE

The scene reminds us of Holland. Some Dutch firms have interests here.

"The Times" copyright

the crops of wheat, the acreage of which exceeds the total sown with oats and barley. Sugar-beet is another crop of commanding importance. Orchards and plantations of small fruits are numerous round the market town of Wisbech (12,000), which has a jam-making industry. Spalding (13,000), on the Welland, is the centre of a flourishing bulb industry. Over 2000 acres are planted with bulbs.- The other crops include roots (turnips, swedes, mangolds), peas, and beans.

There are relatively few sheep in the Fenlands, but many horses and pigs. Cattle too are fairly numerous,

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the reason being that they are useful in fertilizing the soil in the rotation of crops.

The chief market towns include Boston (17,000), at the mouth of the Witham, which in the Middle Ages was a more important port than Hull, but now, owing to the silting of the Wash, is accessible only to small vessels, which carry coal, coke, and iron to Scotland and the Continent. Peterborough (43,600), the bridge town of the river Nen, not only is a market centre and cathedral city, but also has manufacturing industries connected with agricultural tools, sugar, and bricks. The brickworks, with scores of tall chimneys, surround the great clay beds a few miles south of the city. Ely (8000) is another cathedral city, with an agricultural market and a sugar-beet factory. The hill on which Ely stands, although quite low, is conspicuous for many miles as an 'island' amid the surrounding fen. Sleaford and Stamford are two other towns of similar size built above the 50-foot contour on islands of boulder-clay. King's Lynn (21,000) is an ancient seaport and market town, with a sugar-beet factory; the town is now three miles from the mouth of the Ouse. Four miles from King's Lynn a new pumping-station, claimed to be the largest in the world, has recently been erected, to drain the heart of the Fens. An area of 175,000 acres, formerly peat, is now most fertile land. But the drainage causes the surface to subside, and the great pumps prevent flooding, especially when the tide is high. Cambridge (67,000), the university town famous since the twelfth century, is built on the banks of the river Cam, an Ouse tributary, on the edge of the Fenlands.

In the Kesteven area wheat and barley rival each other in acreage. Oats, potatoes, sugar-beet, and roots are other leading crops. On the river Witham, west of Lincoln Edge, is Grantham (20,000), an important railway centre. Its engineering industry produces agricultural machinery and railway materials. After flowing

THE REGION OF EASTERN ENGLAND

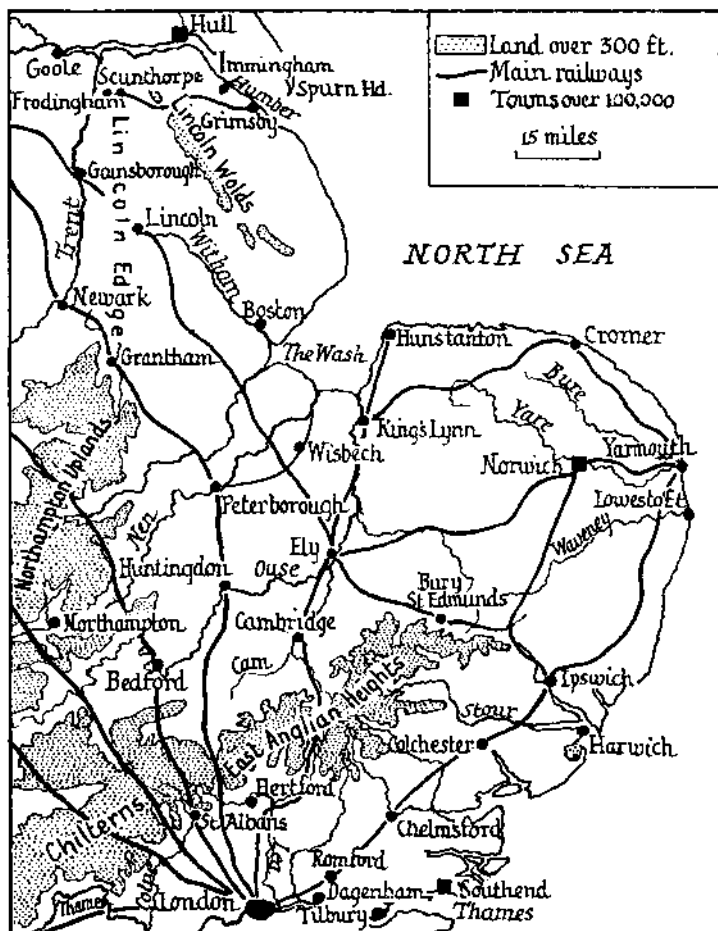


FIG. 63. EASTERN ENGLAND

northward and westward as though to join the Trent the Witham turns eastward through the gap it has cut in the Oolite ridge. At this gap is the historic city of Lincoln (66₅₀₀₀). Since the Romans established a colony there,

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and the castle and cathedral were built in medieval times, the city has continued to grow in importance, partly because of the rich agricultural area round it, partly because coal is near at hand in Nottinghamshire. The gap is wide enough to take roads and railways on both sides of the river without tunnelling. It is one of the important engineering centres, specializing in agricultural machines, particularly excavating machines, and all kinds of road locomotives. Some interest in woollens recalls an ancient industry.

Several streams which rise in the Wolds also drain into the Wash.

In the north of Lincolnshire the physical divisions become more clearly defined, running parallel to the coast from north to south. First the belt of marshlands along the east coast, then the Wolds, then a broad lowland of soft clay, then Lincoln Edge, and finally the plain of the lower Trent. The reclaimed marshlands are used as pasture for cattle and sheep, and the glacial clays at the foot of the Wolds for wheat and root-crops. The villages lie along this line. But cultivation extends practically to the top of the Wolds, and the parishes stretch from the Wolds to the sea, thus including each type of land. In Lindsey as a whole wheat, barley, and oats together occupy nearly half the arable land. Turnips, potatoes, and sugar-beet come next in importance. Stock-raising is also important here, particularly the Lincoln breed of sheep, which is famous all over the world. This area contains more cattle and horses than the rest of the county. The number of poultry in this part is about three times that in either of the other parts. This is true of ducks, geese, and turkeys, as well as fowls. There are sugar-beet factories at Brigg, in the north, at Bardney, on the Witham, and at Spalding, in the south.

North Lincolnshire has two other important industries besides agriculture—iron-works and fishing. The county produces about a tenth of the pig-iron made in Great

THE REGION OF EASTERN ENGLAND

Britain. The ore is mined in surface workings and smelted at Scunthorpe and Frodingham. Gainsborough (19,000) is a notable engineering town. Coal is easily obtainable from the neighbouring county.

The fishing industry of the county is now centred at Grimsby (92,000), the greatest fish port in the world.



FIG. 64. THE WOLDS OF LINCOLNSHIRE

Rain-clouds sweeping over the Wolds of Lincolnshire, taken from near the village of Greatham. Away in the distance can be seen the countryside adjacent to Somersby, the birthplace of Tennyson.

⁴¹ *The Times*" copyright

Most of the fish landed here are not for export, but for home consumption. The greatest demand at home is for fish like plaice and sole, cod and haddock. All these are found on the floor of the sea, and they tend to deteriorate more rapidly after leaving the low, even temperature of the ship's hold than the fish which usually live nearer the surface, like the herring, mackerel, and pilchard. Successful trading therefore depends upon perfect organization for landing, packing, and transporting the catch to the large towns. The railway company which owns the port meets this need by running fast special trains to the

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inland fish markets during the night. Grimsby not only handles more than a million hundredweight of fish a year, but also large quantities of imported timber, dairy products, and some iron ore. Coal and textile goods are exported. Farther up the Humber, where the channel is deep close to the shore, Immingham Dock was constructed in 1912, being specially equipped for shipping coal, though

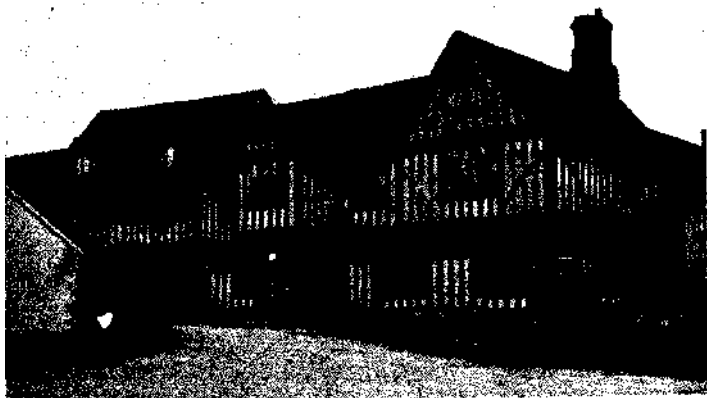


FIG 65 A FOURTEENTH-CENTURY HOUSE AT LAVENHAM, SUFFOLK

handling other commodities also. The other coast towns, such as Mablethorpe and Skegness, are summer resorts.

Turning now to East Anglia, we find that the watershed between the basin of the Wash and the Thames basin or the open sea lies along the line of the chalk ridge between London and Cromer. The counties of Norfolk and Suffolk, though at one time shut in between the Fen marshes and the Essex forests, have always derived wealth from wheat and wool, as the numerous fine churches, historic inns, and wool-merchants' houses remind us. Up to the fourteenth century England was mainly a wool-exporting country. In Edward III's reign the export of wool amounted to 30,000 sacks a year, and was sent

THE REGION OF EASTERN ENGLAND

chiefly to the Netherlands. Then Edward III encouraged Flemish weavers to come and settle at Norwich and elsewhere, and England rapidly became a wool-manufacturing country. Yarmouth, Ipswich, and other east-coast ports were as busy as the more famous Cinque Ports. Clumsy ships plied from port to port, and barges along the navigable rivers. Chaucer, who was the King's Comptroller of Wools, Skins, and Leather, tells us in the *Prologue* how the merchant,

He wolde the see were kept for any thing
Betwixe Middelburgh and Orewelle.

An admiral was specially appointed to safeguard the trade of the east-coast ports. The Orwell port was Ipswich, and Yarmouth the port for Norwich, the staple town for cloth and leather goods. The city records mention wool-mongers, weavers, fullers, shearers, dyers, drapers, mercers, blanket-makers, and a similar variety of occupations concerned with leather. Norwich had over thirty special markets besides the common one. Every year great fairs were held at Yarmouth, Boston, St Ives, and other places. Thousands flocked to them to buy wine from Rhineland, fine cloth from Flanders, salt fish or tar from the Baltic, spices and silks from the Far East. Weaving, dyeing, shearing, fulling, became the most highly organized trades, and Norwich the chief manufacturing town in England. Worstead, a village to the north-east of Norwich, gave its name to a branch of the trade. Other important woollen centres in East Anglia were Sudbury, in Suffolk, and Colchester and Halstead, in Essex. The woollen industry has died out, and its place has been taken by the manufacture of artificial and natural silk, while agriculture and the industries associated with it still progress. Norfolk, Suffolk, and Essex have twice as much arable land as the average English county. The variety and distribution of soils have been described on pp. 68-69. Barley is the dominant crop, particularly in

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Norfolk, where the lighter soils prevail. This is true to a less extent in East and West Suffolk, where wheat runs it a close second. In Essex barley takes second place to wheat, which is grown on the heavier soils. Oats is another widespread crop, and potatoes do well, especially in Norfolk and Essex. Root crops are very important in Norfolk, which excels all other counties in the acreage and output



FIG. 66. LOWESTOFT
By permission of the L.N.E.R.

of turnips, swedes, and mangolds. The roots provide fodder for sheep and cattle, which tread out and manure the soil in the north and east of the county respectively. The importance of sugar-beet is shown by the presence of three factories in Norfolk, two in Suffolk, and one in Essex. Sugar-beet tops are also fed to cattle and sheep. Norfolk has many more cattle and horses than the other two counties, and dairy-farming is spreading. Essex has more sheep than the other areas, and Suffolk the greatest number of pigs. In each of these counties there are two million or more head of poultry.

THE REGION OF EASTERN ENGLAND

Norwich (126,000) is, like Lincoln, a focus of routes from all directions, and has been the chief market for centuries. Boots and shoes are made from local supplies of hides tanned in the district. Other products manufactured are starch, mustard, and sugar. The lack of coal and water-power is now compensated by the supply of electricity. Ipswich (87,600) has similar importance as a

Fu;. (>:. HARWICH

Note the position of Harwich on a spit of land at the mouth of the Stour-Orwell estuaries, which extend ten miles inland. Ipswich is at the head of the Orwell estuary.

Photo Sport and General

route centre in Suffolk. Situated at the head of the Orwell estuary, it has the additional advantage of being a port as well as a grain and cattle market. In consequence its industries include milling and malting, the making of agricultural machines and fertilizers.

The coast-line of Norfolk and Suffolk is subject to powerful erosion by the sea, but deposition occurs in other parts, creating long spits of shingle and sand, which obstruct the mouths of rivers. At Aldeburgh, in particular, there is such a spit which makes the river run along the coast for eleven miles before entering the sea. There

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are numerous holiday resorts, such as Hunstanton, Cromer, Walton, and Clacton; but the only ports south of Grimsby are Yarmouth and Lowestoft for fishing-fleets, Ipswich, and the passenger and train-ferry port of Harwich.

Yarmouth (57,000) and Lowestoft (42,000) are primarily herring ports. During the season between June and November the herring-fleets move southward along the east coast, and Scottish fisher-girls travel from port to port to clean and pack the herrings for export, or to prepare them as bloaters and kippers when they have been smoked.

It is difficult to say where East Anglia ends and the London basin begins. Certainly Harwich (13,000), on the Stour estuary, is a ferry port for the Low Countries, Denmark, and Central Europe. Apart from passenger traffic, its trade is mainly one of imported perishable foodstuffs and light but valuable articles, such as silk goods. The towns and other industries of Essex will be referred to in dealing with the London basin.

Communications by railway and road are well developed. Trace out the following routes:

1. London, Chelmsford, Colchester, Ipswich, Lowestoft, Yarmouth.
2. London, Cambridge, Ely, King's Lynn.
3. The Roman road, the Icknield way from London to Baldock; then by Newmarket and Thetford to Norwich.
4. Harwich, Ipswich, Bury St Edmunds, Ely, March, Peterborough, Grantham.

CHAPTER XII

THE THAMES REGION

THIS region embraces that part of England which adjoins Eastern England on the south-west. It has two clearly defined portions: (a) The clay vale lying between the escarpments of the Oolitic Limestone and the chalk. The vale includes what is sometimes called the Oxford basin of the Thames valley and also the upper basins of the Nen and the Ouse. (b) The basin of the lower Thames, or London basin. The counties included in this region are Berks, Bucks, Bedford, Herts, Middlesex, Oxford, Northants, and parts of Wilts, Gloucester, Huntingdon, Essex, and Kent.

The relief, which is explained more fully on pp. 65-68, may be briefly reviewed. The Thames and its head tributaries, including the Cherwell from the north, have cut out a Y-shaped valley in the soft clays, with the base of the Y at the Thames or Goring Gap. The hills near Oxford, known as the Oxford Heights, arc due to sandstone emerging through the clay. To the north-east and south-west of this basin are low watersheds separating the Thames from the Ouse and the Nen on the one hand and the upper valley of the Bristol Avon on the other. In the London basin both the Thames and its tributary the Kennet flow along synclinal valleys between the White Horse Downs and the Chiltern Hills to the north-west and the Hampshire Downs and North Downs in the south. While the upper basin is distinctly rural in character the lower is metropolitan, but the two are bound together not only by the river, but by the four main-line railways which traverse the region, linking London to the industrial North. Both river and railways thus cut transversely across the 'grain' of the country.

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Little need be said with regard to climatic variations from the normal. The difference between the mean summer and winter temperatures is about 24° F. The eastern part of the region is a degree or so colder in winter than the western part, while there is not much difference in the summer temperatures. Rainfall on the whole is light, mostly about 25 inches, but increasing noticeably

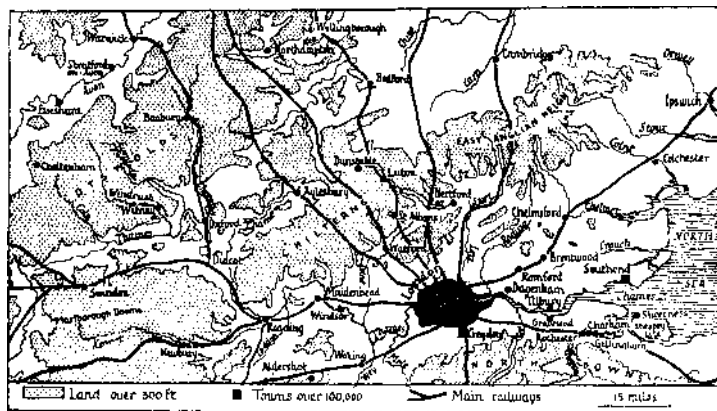


FIG. 68. THE THAMES BASIN

on the higher parts. The number of rainy days over most of the region totals only a third of the year, and the daily average of summer sunshine is five to six hours.

The Oxford Basin. The land is chiefly used for mixed farming. No forests remain, though trees are numerous round the fields. The soil is heavy to plough, and so grass and hay crops predominate. Twice as much of the arable land is sown with wheat and barley as with oats and other grains. Peas, beans, roots, and lucerne are other crops, the total acreage of which, however, is much less than that of either of the grain crops. Potatoes too are grown in relatively small quantities, but Bedfordshire grows more potatoes than do any two or three of the other counties added together.

THE THAMES REGION

As to livestock, sheep are most numerous on the limestone uplands, particularly in Northants and Oxford. West and Central Northants have relatively little arable land, and the number of cattle is much greater than in other parts. Buckinghamshire too has a considerable dairy



FIG. 69. OXFORD

Oxford is one of the most picturesque and interesting towns in Europe. This is a striking view of some of the colleges grouped round the Radcliffe Camera in the centre, the reading-room of the Bodleian Library. The Cherwell joins the Isis just below Oxford.

Photo Sport and General

industry in the Vale of Aylesbury. The distribution of horses, pigs, and poultry is very even.

Population also is evenly distributed. Two-thirds of the total live in scattered rural districts, and apart from the industries in the towns to be mentioned there is no other than that associated with agriculture. Witney has long utilized local supplies of wool to make blankets.

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The only mineral worked is iron ore in the Banbury district and in Northants. Kettering (31,000) and Wellingborough (21,000) smelt the ore, but coal has to be brought from outside the region. Corby is the site of new steel-works. Northampton (92,000) has a very important boot and shoe industry, which employs a third of the total number of workers in this trade, the other chief centres being Leicester and Norwich. Boot-making machinery and stoves are also produced at Northampton. Bedford (41,000) specializes in pumps, oil-engines, and the various component parts of electrical apparatus. Swindon (62,500) builds locomotives and rolling stock for the Great Western Railway, and Oxford (80,500) makes motor-cars. Other towns like Huntingdon and Aylesbury are small market towns. The position of Oxford explains its importance in English history and as a seat of learning. Built at a ford of the Thames near its junction with the Cherwell, river valleys focus upon it from the north, south, and west

The London Basin. The links between this part of the region and the London basin are the gaps through the Chiltern Hills, and particularly the Goring Gap, which is six miles long and a mile wide. The London basin lies between the Chilterns and the North Downs. It extends into Essex, and it is difficult to decide where it merges into East Anglia. The London basin must not be confused with the basin of the river, for many of the tributaries of the lower Thames rise in the Weald, a separate region, as we shall see. The Kennet, flowing due east, collects the streams from the hills on either side. The junction of these subsidiary valleys with the main one is marked by the towns Marlborough, Hungerford, and Newbury. The agriculture of this valley is based upon the well-watered meadows along the floor of the valley. Mixed farming with sheep is found where soil is good on the lower hillsides, and there are sheep pastures on the Downs. The market towns depend as much upon the traffic along

THE THAMES REGION

the Bath Road and the railways as upon the agriculture of the region. Reading (99,250), the bridge town of the Kennet, controls the routes to London, Oxford, Bath, and Southampton. Its main industries are biscuit-making and seed-growing. Its university attaches special import-



FIG. 70. THE RIVER THAMES AT GORING

Goring stands at the entrance to the gap cut by the river through the Chiltern Hills. The bridge marks the route used by the ancient Icknield Street, a reminder of the importance in history of the Thames crossing. The view shows typical countryside of the Upper Thames basin.

Photo Sport and General

ance to agriculture, for within easy reach there are many varieties of cultivation—the water-meadows in the valley, the downlands on the hilltops, and between them varied arable lands and heath lands.

Below Reading, along the meanders of the Thames, are river resorts, like Henley, Marlow, and Maidenhead. Many people whose work is in London live in these

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resorts. These towns and Windsor are situated where the river flows against chalk bluffs, affording security from the flooding to which the flat plain is subject. Between Windsor and Aldershot stretches an area of sands and gravels not suitable for agriculture, but covered with picturesque heath and healthy to live on. Bisley rifle-ranges and the military colleges at Camberley and Sandhurst are in this area. Between Staines and Kingston there is a great bend in the river, within which gravels, covered with light loamy soil, are used for market-gardening. From the south flow the rivers Wey and Mole through the gaps in the Downs controlled by Guildford (31,000) and Dorking (10,000), both important market towns. At the foot of the Downs, farther eastward, at a junction of favourable routes from London to the south, is Croydon (233,000), the great market suburb of London and the premier air-port of Great Britain. Dartford (29,000) is situated at the junction of Watling Street and the road from Sevenoaks. At Gravesend (35,500) the Thames pilots go aboard.

North of the river in the Chiltern Hills are numerous valleys clothed with beech-woods, occupied by picturesque towns and villages, well supplied with excellent water, and served by several main-line railways. High Wycombe and Berkhamstead carry on chair-making and wood-carving industries. Near Wendover is the estate of Chequers, the country residence of the Prime Minister. At Dunstable and Luton straw-plaiting and hat-making are carried on. Three miles from Dunstable, high on the escarpment, are the grounds of the Whipsnade Zoo. St Albans (29,000) and Hertford (11,000), in the upper valleys of the Colne and Lea, are both route centres and market towns. Watford (57,000), one of the dormitories of London, has many small manufactures. The local supplies of good barley and good water are utilized for brewing. At these and other towns industries depending upon transported raw material are also growing, such as

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FIG. 71. **AN** AIR VIEW OF THE MIDDLESEX LANDSCAPE UNDER SUNSHINE AND CLOUD SHADOWS
Harrow-on-the-Hill is in the right foreground. It is one of the hills preserved from erosion by the capping of sand. The towns
are spreading out into the country, but many trees remain along the hedgerows.

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light engineering, printing and paper-making, and the preparation of rubber. Nearer London population is growing apace in numerous residential areas, where hills capped with sand and gravel stand boldly above the clay vale. Harrow, Hampstead, Finchley, Mill Hill, Bushey

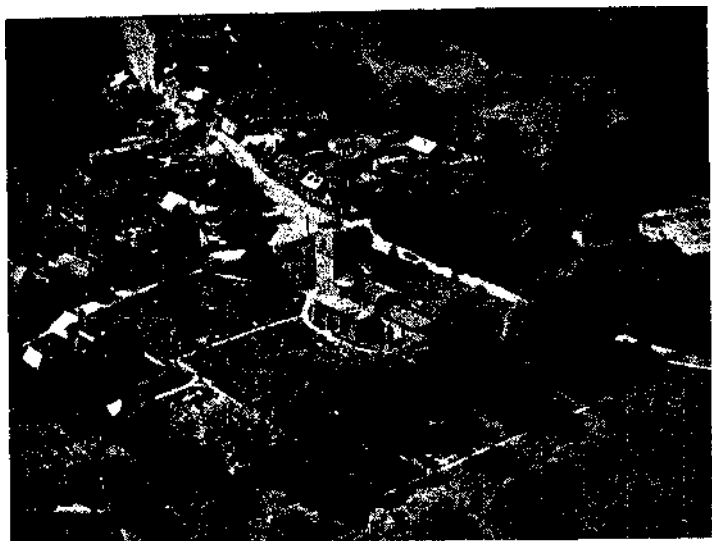


FIG. 72. IVER—A BUCKINGHAMSHIRE VILLAGE

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Heath, are but a few of these well-known suburbs of London.

By contrast the Lea valley, so subject to flood, is rather a barrier to communication, and was entirely unbuilt on until recent times. The North Circular Road crosses it by a great causeway. The railway and road keep to the right bank through Tottenham, Edmonton, Enfield, and other towns. But the river is one of London's chief sources of water, and parts of the valley are being drained and utilized for sports grounds, market-gardens., and allotments.

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Considerable areas have garden crops, tomatoes especially, under glass. In connexion with the garden industry are the small handicrafts of basket- and flowerpot-making.

Proceeding eastward into Essex, we must note first the Forest of Epping, which stretches for many miles. The varied soils overlying the clay and gravel favour a variety of trees, but beeches and oaks predominate. Next observe



FIG. 73. AN ESSEX CREEK: MERSEA ISLAND HOUSEBOATS AND YACHTS
There are oyster-banks in the adjoining waters.

how the creeks penetrate into the land, giving access far up the rivers Crouch, Chelmer, Colne, and Stour. The creeks are noted yachting centres. The importance of London in this area is shown by the towns built at river-crossings on the Roman road to Colchester—Old Ford, Ilford, Romford, Brentwood, and Chelmsford. The other factor in the growth of these and other market towns is the fertile soil.

Much land has been reclaimed along the Thames plain. Canvey Island, for example, is one of several bungalow resorts. River deposits lighten the heavy soil and make market-gardening profitable. Produce finds a ready

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market in Southend (120,000), at the only point of the Thames estuary where cliffs appear. The county borough



FIG. 74. AN ESSEX FLOUR-MILL



FIG. 75. A BACKWATER OF THE CHELMER AND BLACKWATER CANAL
The barges are horse-drawn, and carry timber, coal, and other heavy goods.

of Southend has grown rapidly. It now includes Westcliff, Leigh, Thorpe Bay, and Shoeburyness. Southend is one

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of the 'dormitories' of London, to which it has a frequent train service. The southern and sunny aspect, bracing air, and amusements of all kinds render it popular also as a holiday resort. The chalk is worked for lime and cement at Purfleet and Grays. Farther inland, hills rise prominently to a height of over 250 feet. Contrary to popular conception, there is much diversity of landscape. There are numerous woodlands, well-kept farms, good pasture, and orchards. Fruit-growing and seed-culture are increasing rapidly near the smaller towns. A textile industry in spun and artificial silk is carried on in several places. Of these Braintree and Halstead are typical. Braintree also makes metal window-frames, motor accessories, and brushes. Chelmsford (27,000), the county town, is an important agricultural centre, and has engineering, printing, and bookbinding industries. It was the pioneer place for wireless and broadcasting, and continues radio research and other electrical work. Chelmsford is connected by canal to Maldon, a market town at the Blackwater estuary. Colchester (49,000), an important garrison town since the time of the Romans, has industries similar to those of Chelmsford. Gas-engines and boilers are a special feature of its engineering industry.

Communications focus upon London. Note carefully the main railway routes shown in Fig. 68.

CHAPTER XIII

GREATER LONDON

Position. The central position of London in the physical region round it has already been noted (see p. 67). But the immense significance of London makes it the focus of all the regions of the British Isles, and in that sense it must be considered separately. There are few places which illustrate better the interplay of man and his geographical environment. When the Romans built their bridge in a position near the present London Bridge they were no doubt influenced by the only firm ground to be found close to the river-banks.¹ Lower down there were the marshes, and the estuary was too broad. At Westminster the river was shallower and probably fordable, but still broad. Further, the site of the city was defensible. It was too far from the open sea to be liable to sudden attack until the days of aircraft. Water was available in the springs of the gravel of which the low hills were formed. Again, such a position offered good drainage. The navigable waterway some sixty miles from the open sea, with strong tides keeping it open from excessive silting, and facilitating the progress of ships much farther up the river, has always been a dominant factor. For the greatness of London has at all times depended upon its trade.

The centre from which the city grew focuses upon the low but quite steep-sided hills, on which stand St Paul's Cathedral and the Tower. The streets clustering on and round these hills were narrow, winding, and congested. When this compact area was crowded to full capacity, the city expanded along the north bank. For the south bank

¹ The site had been utilized even before Roman times as a hill fort away from the swamps.



FIG. 76. AS INFRA-RED RAY PHOTOGRAPH TAKEN AT A HEIGHT OF 20,000 FEET OVER

HAYES, MIDDLESEX

The distance to the horizon is about 180 miles, and the width of the horizon about 140 miles. The horizon shows the earth's surface. The Great Western Railway is in the centre of the foreground, the Great Western and Bath Road to the right, the Grand Union Canal on the left. The white square above the centre is Hyde Park. Note the Thames meanders and the development of the north bank compared with that of the south bank.

* Flight " copyright

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was marshy until embankments were constructed to keep out the floods caused by high tides. The roads from London radiated to the gaps in the surrounding hills along the shortest serviceable route. These followed, where possible, the firm gravels. With each new development of transport residences and shops spread out farther and farther along the roads. The lower clay-covered areas were left either as marsh, as in the case of the Lea valley, or as fields, where the great parks now stand. Development along the south bank came later, and still lacks the character of the north side of the river. London has thus spread out in a vast network of roads and buildings, instead of building skyscrapers in the central area. It is thus necessary to define distinct areas, such as the West End, the East End, and so on.

From the earliest times the routes which focus upon London brought trade to it from all parts of Britain; and there began, centuries ago, that entrepot trade by which goods an* brought to London not lor market, but for distribution to other countries. This trade made London of importance to Western Europe, and, indeed, to the whole world. In modern times London has had to face the competition of other great ports facing it across the sea, like Antwerp and Hamburg. This competition has served to develop the navigability of the Channel, and all the facilities of the docks and warehouses.

Docks were more easily constructed because of the curves in the river's course and the clay soil. The first was the West India Dock, built in 1800, followed by the East India Dock in 1806. The staple commodities handled in the West India Dock were, and still are, sugar, rum, and hardwoods. In the same way, the East India Dock deals specially with such Eastern products as silk, tea, and, more recently, bananas. Similarly, Millwall Dock is specially equipped for dealing with grain by suction. But the riverside has always continued its trade in addition to the docks, and there are innumerable

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wharves, quays, and warehouses. In 1908 all the docks constructed and owned by private companies were taken over by Act of Parliament and placed under the control of one authority—that of the Port of London. The Royal Victoria, Royal Albert, and King George V Docks, which

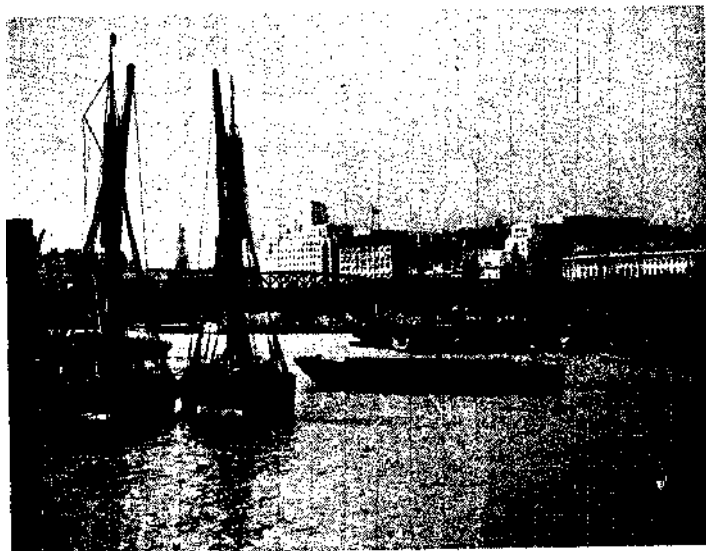


FIG. 77. MODERN LONDON: NEW BUILDINGS ON THE NORTH BANK

The big buildings of modern design, facing the Embankment, are now a striking feature of the view from the opposite bank of the river. This picture, taken near Blackfriars Bridge, shows the new Shell-Mex building, the new building on the Waterloo Bridge approach, and in the distance the spire of St Martin's-in-the-Fields. On the extreme right of the picture is Somerset House.

"The Times" copyright

really comprise one immense area, are the largest yet made. The most recent development was the improvement of Tilbury Dock, opened in 1929. The new entrance is 1000 feet long and 110 feet wide, so that the largest vessels can use it. In addition to the dock, there is a huge floating landing-stage available to large liners at all times, regardless of the tide. Tilbury is served by the L.M.S.

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Railway. Most of the sea-passengers from or to London embark or land there. London can be reached in half an hour, and any part of England without delay.

The problem of transport across a city so widespread is another factor to be noticed. The congested state of London and the value of land prevented the railways from pushing into the heart of the urban area. So the termini are at some distance from the city and the river. The link is supplied partly by road, partly by circuitous railway, and partly underground. On the waterway itself there are many thousands of lighters continually carrying goods to and from the ships, and to the wharves and factories which extend for so many miles along the river-banks. Lighters are allowed free access to the docks, and the familiar sight of a tug towing some six or more lighters serves to remind us of the many thousands of tons of goods which pass upstream daily. The floating cranes, capable of lifting great weights, are but one of many devices for efficient handling of goods.

Immense quantities of merchandise must, however, be stored pending redistribution. Wool, grain, timber, tobacco, rubber, skins and hides, jute, and such goods are bulky. Many of them require special conditions of storage. The Port of London provides facilities for these and every conceivable article of commerce. It is not surprising to find, therefore, that London handles more than half the total imports of the whole country in the following commodities: tea, rubber, paper, and mineral oil; and not much less than half the total imports in the case of meat, wool, butter, eggs, hides and skins. In short, the Port of London handles 60 per cent, of the entrepot trade of Great Britain, 40 per cent, of the total trade, 42 per cent, of the imports, and 23 per cent, of the exports.

So infinite a variety of trade demands skilful marketing and financial organization of the highest order. So that, in addition to the factories found clustering round the

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docks, there are the insurance and shipping offices, the banks, the Stock Exchange, and wholesale and retail establishments of all kinds. The City itself covers only a square mile or so, but into and out of that beehive



FIG. 78. AERIAL VIEW OF THE POOL OF LONDON

The Pool of London is between London Bridge in the foreground and Tower Bridge in the centre. The view is taken looking eastward. The Pool is the limit of navigation for ocean-going ships. On the left may be seen St Katharine's and London Docks. On the alluvial flat inside the first great meander of the Thames there are a dozen or more basins which comprise the Surrey Commercial Docks, with great stores of timber. In the distance another meander nearly encloses the Isle of Dogs, in which the West India Docks are situated. Notice the number of lighters on the river. On the high left bank of the river near Tower Bridge can be seen the Tower of London.

"The Times" copyright

of activity stream every day half a million workers. Beyond the boundaries of the City extends the County of London, which includes the city of Westminster and twenty-seven boroughs. The daily migration within this area probably amounts to between two and three million people. All these sleep in the area of Greater London,

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which may be considered as within a radius of ten miles or so. But there are many places like Brighton or Southend within a fifty- or sixty-mile radius which to some extent act as dormitories of London. The population figures for these respective areas are interesting: City of London 10,996; County of London 4,396,821; Greater London 8,202,818.

The transport requirements of this vast population have been met more easily by reason of the clay through which the Tube railways have been cut. A central authority called the London Transport Board now controls this public service. Further to facilitate transport there is a great new road to the docks called the Silvertown Way; three fine bridges over the Thames have recently been opened, and Waterloo Bridge is being rebuilt. The railway, road, and water services employ more than a quarter of a million people. There is no doubt that a large population tends to attract ever fresh additions to it, like a rolling ball of snow. In the early stages of this process of expansion the marshes were avoided, except in the East End, where proximity to the port and to the wholesale markets afforded compensation. The chief markets are Billingsgate (fish), Leadenhall (poultry), Islington (cattle), Stratford and Spitalfields (fruit and vegetables). Note that Covent Garden (fruit and vegetables) is not near the docks, and has many drawbacks on that account. Similarly, Smithfield, the market for meat, butter, cheese, and eggs, stands midway between the main railway termini and the docks. Many street markets are also regularly held in various parts of London. But as a result of great engineering achievements, and the improved drainage and water-supply, population has spread more and more eastward into Essex. In this new residential and industrial area towns have sprung up like mushrooms, notably the urban district of Dagenham (89,000), which has great motor-works.

The *water-supply* of London is obtained chiefly from the

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Thames and Lea, and after being filtered and purified is pumped into great storage reservoirs excavated for the purpose. There are also many deep artesian wells.

Industries. The swift development of *industry* which has taken place in Greater London since the War is



FIG. 79. A LONDON SHOPPING CENTRE

A striking photograph of Berwick Market, London—one of the street markets.

" *The Times*" copyright

nothing less than a second Industrial Revolution. Greater London now employs nearly four million people out of the total for England and Wales of a little over sixteen and a half millions. Almost unnoticed, well over a thousand new factories have sprung up along the radiating arterial roads. In 1933 alone 220 were erected, nearly half of the total of new factories for the whole country. About 90 per cent, of them are run by electricity, and there are few smoking chimneys. The 'manufacturers'

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mile' along the Great West Road is a striking example. Motor accessories, water- and air-purifying plant, fire-extinguishers, breakfast foods, are typical of these new industries. Farther west at Slough are huge bakeries and other new establishments making gramophones and luxury articles. Other areas with similar developments are to be found along Western Avenue, Acton, where a great brewery has been erected for the firm of Guinness; along the North Circular Road, particularly near Neasden; and along the Eastern Avenue, near Romford. Although they are mostly small undertakings in comparison with the great works on the coalfields, the aggregate number employed is large. This expansion of industry is shared by most of the Home Counties. Actually the number of persons employed in the area covered by the Thames, Wealden, and Hampshire Regions as defined in these chapters, including also the county of Essex, closely approaches six millions, while the total for the industrial counties of England, including and extending from Cheshire, Lancashire, and Yorkshire to the north, is just over five and a quarter millions. And the total for the remainder of England and Wales is under five and a half millions. So that it is no exaggeration to describe South-east England as now the most important industrial area of England and Wales.

Many factors have contributed to this industrial expansion. Proximity to the supply of every kind of raw material at the port, and to the biggest and richest markets, cheaper land and lower rents and rates, abundance of available labour, are some of the reasons. But electricity has played the greatest part. It is cheaply distributed, and it enables the factories to be bright and clean, and even architecturally attractive.

The occupations which absorb the greatest number of workers are transport, clerical work and commerce, and domestic service of many kinds. The industries which employ the largest number of people are the clothing,

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GREATER LONDON

boot and shoe, and the metal trades. The last of these refine tin and lead, prepare lead products and paints, sheet metal, brass, copper, and bronze. It is worth

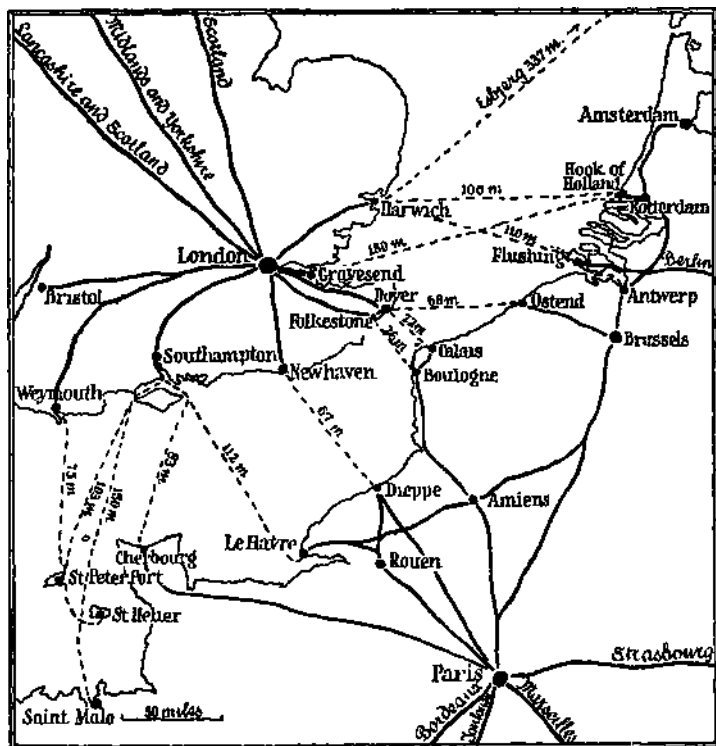


FIG. 80. LONDON: ROUTES ACROSS THE NARROW SEAS

N.B. The Southampton-Cherbourg route is used only by liners on the transatlantic service. For other routes from Harwich and Folkestone see the text

noting that the huge bronze propellers for the Cunarder *Queen Mary* were made in London. Other great trades are woodwork and furniture-making, printing and book-binding, paper-making along the Kent shore, engineering

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and electrical apparatus, oil-refining at Thameshaven and Shellhaven, and the industries connected with food, drink, and tobacco. Along the riverside are electric power-stations and gas-works, and numerous flour-mills and sugar factories. London no longer has a ship-

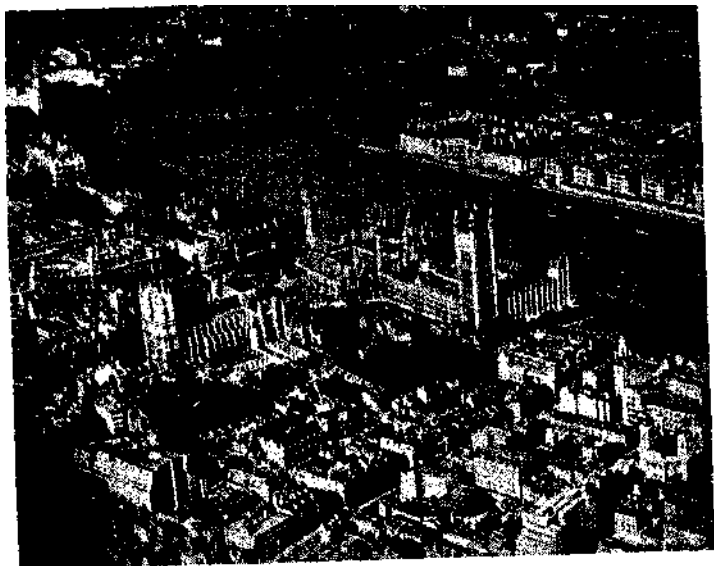


FIG. 81. THE HOUSES OF PARLIAMENT

Note also Westminster Abbey and the bridges—Westminster Bridge in the centre, the railway bridge to Charing Cross, Waterloo Bridge, and Blackfriars Bridge in the distance. On the right bank only the County Hall can be compared to the fine buildings on the left bank.

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building industry, but there are at least ten dry docks of various sizes, capable of dealing with the repair of any ship.

The trade of London is also helped by several outports—Harwich, Dover, Folkestone, and Newhaven. In some respects even Southampton and Liverpool are linked with London. Tilbury is part of the Port of London itself.

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The traffic through these 'packet-stations' consists mainly of passengers. Practically the only trade is in imports of perishable foodstuffs from the Continent. The parts of the Continent served by these outports are as follows:

Harwich to the Hook, 106 miles; to Zeebrugge, 90 miles; to Antwerp, 135 miles; to Flushing, no miles; to Esbjerg, 337 miles.

Dover to Calais, 22 miles; to Ostend, 68 miles.

Folkestone to Boulogne, 26 miles; to Dunkirk, 53 miles.

Newhaven to Dieppe, 67 miles.

Southampton to Le Havre, 112 miles; to Guernsey, 103 miles; to Saint-Malo, 150 miles.

Finally, it must not be forgotten that London is the headquarters of every aspect of national life. The Houses of Parliament, the High Courts of Justice, the University, the British Museum, and institutions of all kinds attract every year millions of visitors, in addition to buyers and sellers from all over the world. One result of this is the number of great hotels and places of amusement.

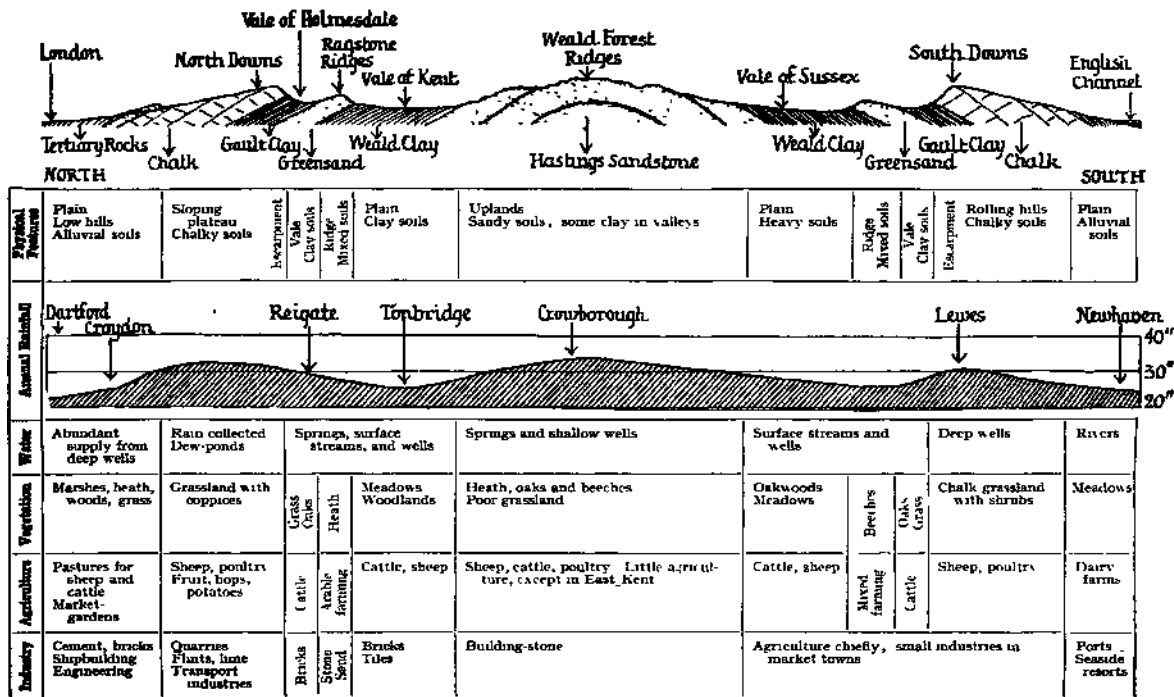
CHAPTER XIV

THE WEALDEN REGION

THIS region comprises the counties of Kent, Surrey, and East and West Sussex. The Kent peninsula has been the highway to the Continent from the earliest days of man. The Pilgrim's Way along the North Downs to Stonehenge, the Roman road called Watling Street from Dover, through Canterbury, to London, the present railway routes to the Channel ports Dover, Folkestone, and Newhaven, and the air route which follows the southern side of the Downs to Croydon, are each eloquent of the Continental importance of the peninsula.

The climate is similar to that of Eastern England. Westerly winds predominate, but cold winds from the east and north-east are frequent in winter. The rainfall is heaviest on the North and South Downs and the central High Weald. As these are composed of porous rocks the water is readily absorbed to feed the springs along the drier clay valleys. Sunshine is abundant over the whole area, though rather less in Surrey than elsewhere.

It is a region specially suited for fruit, garden produce, and agriculture generally, the more so because the markets of London are so near at hand. The connexion between soils and cultivation is remarkably close. Not only so, but there is close relation also between these and both the sites of towns and villages and the nature of the occupations. Look up first the description of the physical features in Chapter IV (pp. 59-61). Then study carefully Fig. 82. It will be seen that between the alluvial plains along the Thames bank and the High Weald is a succession of belts extending east and west across the region. The alluvial plain is rich agricultural land, with sandy soils



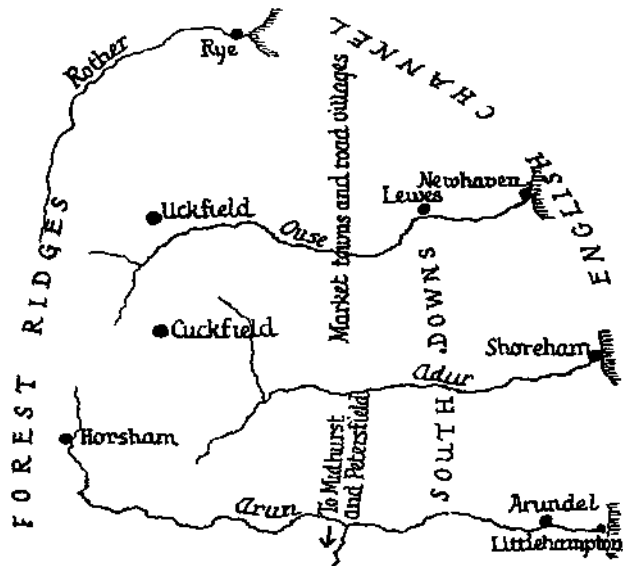
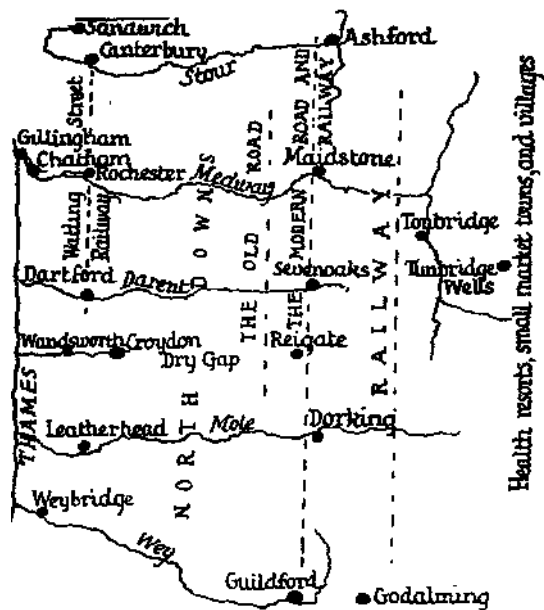


FIG. 82. TOWN SITES IN RELATION TO THE RIVER SYSTEMS, RELIEF, AND GEOLOGICAL FORMATIONS

The diagram is intended to be read downward, beginning with the geological section. The vertical lines in the type portion are to be imagined as running through the diagram from top to bottom. The roads and railways crossing the region from north to south use the gaps in the Downs made by the consequent rivers shown at the bottom of the diagram.

THE WEALDEN REGION

in parts, used for growing a variety of crops, fruit, hops, and potatoes, together with wheat, barley, and roots. On the grass fields sheep and cattle are fattened, especially on those of the London clay areas. This varied agriculture is found also along the lower slopes of the chalk. On the broad chalk down there is sheep pasture, and some wood-



FIG. 83. HARVESTING IN SUSSEX, UNDER THE SHADOW OF THE SOUTH DOWNS

Note the typical downland, with short, close grass and clumps of bushes and beech-trees.

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land where the chalk is covered with layers of clay mixed with flints. Descending the escarpment, another belt of arable and fruit farming is found along the lower slopes facing southward. Next comes the vale of Gault clay, which is seldom ploughed. The meadows between the scattered woodlands support many dairy cows. Along the Greensand ridge, where the soils are lighter and more varied, there is another belt of rich cultivation, extending from East Sussex to mid-Kent. Fruit and hops predominate. Two-thirds of the total hop production of Great

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Britain come from this area. Farther south, on the wet, heavy soil of the Weald clay, roots and beans do particularly well. Pastures for dairy cattle and for hay abound, and sheep are fed to prepare the ground for some wheat-growing. Ascending to the High Weald, we find that grass, heath, and woodlands predominate. In the valleys



FIG. 84. FARNINGHAM, KENT

A typical farming scene in Kent. Farningham Church, in the Darent valley, between Dartford and Sevenoaks.

Photo Sport and General

of the High Weald there are many good farms, but in the main, this sandstone area is used for stock-raising and poultry-keeping.

In each of the three counties there is more land used for growing oats than for either barley or wheat. Kent is essentially the leading county for the cultivation of hops. Kent also has two and a half times as many sheep as the other two counties put together. The Romney Marsh area supports large numbers. Cattle and horses are most numerous in Kent and East Sussex, as are also poultry and pigs.

THE WEALDEN REGION

The towns and villages cluster along the edges of the various outcrops (see Fig. 82), particularly in the river valleys. Water-supply is the chief cause of this distribution. In ancient times the trackways kept to the drier downlands; but it is long since these were replaced by



FIG. 85. THE MEDWAY AT ROCHESTER

The view is taken looking northward. The road and railway bridge in the foreground carries traffic between Rochester on the right of the picture and Gravesend on the Thames bank.

Photo Sport and General

roads linking together the villages along the vales. Where these routes cross the north-south routes leading through the gaps in the Downs to London several important towns have developed, such as Guildford and Rochester.

For long, then, this region was peopled by peasants and fisher folk. But the remarkable development of transport of recent years and the dominating effect of London over the whole area have resulted in the rise of urban industries

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of great importance. The Medway towns—Rochester, Chatham, and Gillingham—are the largest centre, with a joint population of 135,000. Coal, iron, and timber are imported for engineering and shipbuilding trades. Sheerness and Chatham are naval dockyards and build warships. Much of the transport is done by lighters and sailing-barges. This cheap water transport largely explains also the paper industry, the demand for which comes chiefly

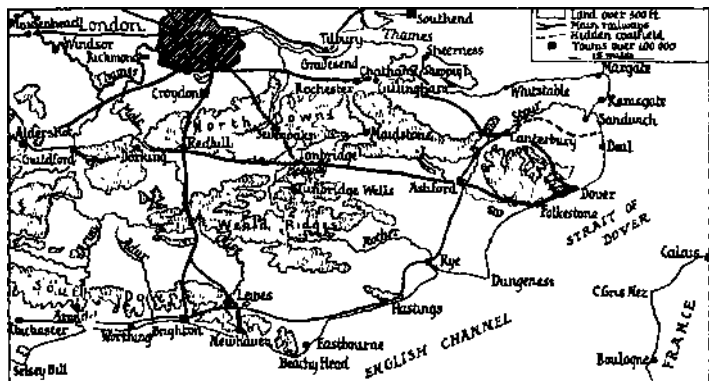


FIG. 86. SOUTH-EASTERN ENGLAND

from London. Cement and lime are also made and exported in large quantities. Rochester makes the familiar steamroller and other kinds of road rollers, Maidstone builds motor-buses, and Ashford-on-the-Stour locomotives. Varied industries dependent on agriculture, such as milling, brewing, and the making of agricultural tools, are carried on in many of the market towns. Other widespread industries which make use of local supplies of raw material, such as building-stone and sand, are brick-making, pottery, the preparation of road material, and lime-burning.

Special mention must be made of the East Kent Coalfield. The only three mines at present at work are

THE WEALDEN REGION

to the west of Deal, at Snowdown, Tilmanstone, and Betteshanger, but the total area of the coalfield is about 200 square miles. Coal is sent by overhead ropeway to Dover. The concealed rocks in this area also contain quite valuable iron ore: one bed has been proved some



FIG. 87. ARUNDEL CASTLE, SUSSEX

Note the meanders of the river Arun. Arundel guards the approach from the coast to the Arun Gap.

"Flight" copyright

sixteen feet thick. So that the iron-smelting industry which was carried on in medieval times with timber as fuel, and ironstone obtained from the Hastings beds and some clay formations, may be revived.

Canterbury (24,500), on the Stour, marks approximately the north-west limit of the concealed coalfield. It is the seat of the archbishop, and its magnificent Gothic cathedral is famous. Note carefully how the routes from the seaport towns in the north-east and south focus upon

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Canterbury. The Roman road Watling Street passed through it.

Tunbridge Wells (35,000), the royal borough and watering-place, is the chief town of the interior. It stands on the High Weald some eight miles to the north-east of the highest point, Crowborough Beacon (800 feet), near which the boundaries of Kent, Surrey, and Sussex meet. The other important towns lie round the coast. Some of them have a long and important history, and others have grown up rapidly in recent times. For instance, the Cinque Ports, Hastings, Romney, Hythe, Dover, and Sandwich, and later Winchelsea and Rye, for centuries provided ships and men in time of war, and controlled the fisheries of the country. These ports declined through the silting up of their harbours, the increase in the size of ships, and the competition of the 'sea-dogs' of the West Country. Dover, of course, remains as important as it always has been, owing to the construction of the modern harbour. Among other ancient towns associated with fishing and shipbuilding are Rochester, Faversham, and Whitstable, still celebrated for oysters.

The modern towns are either pleasure resorts, like Brighton, Eastbourne, Hastings, Ramsgate, and Margate, or towns with a cross-Channel shipping service, like Folkestone and Newhaven. All these are within easy access of London, and many Londoners not only visit them for holidays, but reside in them. In 1801 Brighton had a population of 7500 ; it now has 147,000.

This connexion with London has also led to a great development of roads and railways. The four most important roads are those leading to Portsmouth, Brighton, Hastings, and Dover. The important east-west roads are Watling Street, through Canterbury and Rochester, and another from Canterbury, through Holmesdale, *via* Maidstone, Westerham, Redhill, Reigate, Dorking, and Guildford.

CHAPTER XV

THE HAMPSHIRE REGION

THE region has already been described as the area approximately enclosed by the arc of a circle of 45 miles radius, with the Needles as the centre. This line runs from the northern end of Chesil Beach, along the Dorset heights and the chalk Downs, encircling Salisbury Plain on the north, across the Hampshire Downs, reaching the coast again east of Selsey Bill. It includes the greater part of the counties of Hampshire and Dorset, part of Wiltshire, and the south-west corner of Sussex. Its claim to be treated as a region is first that it comprises the basins of the rivers Frome, Stour, Avon, Test, and Itchen, which, as explained on p. 63, originally formed one river system. It may be noted that the basins of the Frome and the Stour arc in Dorset, while Wiltshire includes most of the Avon basin, and Hampshire the basins of the Test and Itchen. Also the hills serve to separate it from its neighbouring regions, and the human activities focus upon Southampton, much in the same way as the lower Thames basin does upon London. Chalklands occupy about half the area, the other half consisting of lowlands of the newer Tertiary age. Unlike the Weald, the arch of chalk which forms Salisbury Plain remains complete, so that there are no escarpments to compare with the North and South Downs. Nevertheless Salisbury Plain is weathered into rolling ridges and vales. In the south is the Isle of Wight, composed of another chalk anticline cut off by the sea on the east and on the west. The Solent and Spithead are a drowned river valley further deepened by the scouring effect of the tides.

One result of the relief of the region is that it escapes, to

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a great extent, the cold northerly and easterly winds to which the regions previously described are subject. More than half the winds come from the west, south-west, or north-west, and only 29 per cent, from the east, north, or north-east.

The mean monthly temperatures range from 39° F. in January to 63° F. in July; but along the coast tempera-

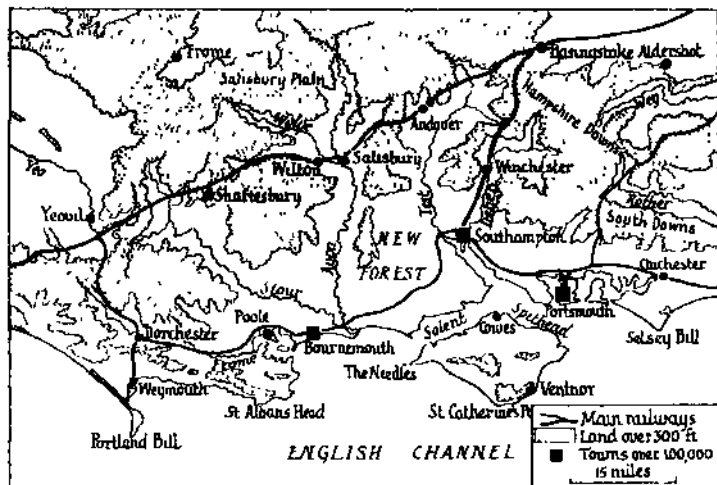


FIG. 88. THE HAMPSHIRE REGION

FIG. 88. THE HAMPSHIRE REGION

tures vary less. Thus, at Bournemouth the mean January and July temperatures are 41° F. and 61·5° F. respectively. The prevalence of westerly winds and the existence of the hills in the north, which attain heights from 700 to nearly 1000 feet, also produce a heavier rainfall. In the high areas 40 inches is a typical amount, though the protected lowlands may get as little as 27 inches. The hills get occasional snowfall in winter. This rainfall steadily reaches a maximum in October, but is fairly even throughout the year. The coastal areas enjoy abundant sunshine, though sea-mists and fogs occur round the Isle of Wight

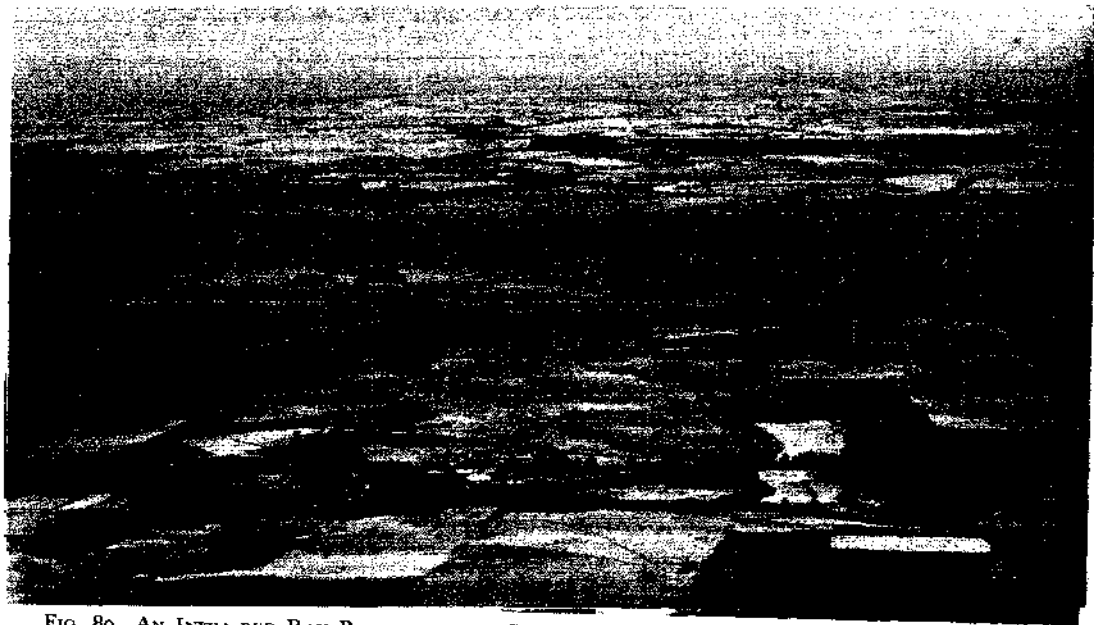


FIG. 89. AN INFRA-RED RAY PHOTOGRAPH OF SALISBURY PLAIN TAKEN FROM A KITE BALLOON OVER
NETHERAVON AERODROME

The large wood in the distance on the right is twelve miles away, near the Andover-Marlborough road. On the horizon
are the downs south of the Kennet valley.

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on the average for some thirty days in the year. The inland areas also get rather less sunshine.

Water-supply is again a controlling factor in agriculture and the town sites of the region. On the chalk, wells have to be sunk 250 feet or more before water is reached; even then they are subject to seasonal variation. For the same reason many of the surface streams, or bournes, flow only during the winter months. There are some nine or ten villages named accordingly 'Winterborne'—*e.g.*, Winterborne Came. In the chalk area there is always the need to store as much rain-water as possible. But the lowland area is well supplied. The rain-water, which the chalk absorbs in great quantities, emerges at the junction with the clay in clear and bountiful springs. As in the Weald, this line of springs is marked by a series of towns and villages. The villages follow the water up the valleys of tributary streams. Thus, as in Lincolnshire, parishes in the chalk area frequently extend from the valley, with its meadows, woodlands, and water, up the sheltered slopes, which can be ploughed and cultivated, to the hilltops, with their pasturage for sheep. Sheep are, in fact, fed at different seasons both on the downs and at the lower levels to assist cultivation by penning them on the arable land and feeding them with roots. The fields in the valley are chiefly put down for hay; the ploughed lands are used for wheat if the price is high enough to stimulate sowing, otherwise for fodder crops. But the area is more suited to the pastoral productions of wool, meat, and milk. Poultry-farming is increasing, and the growing of watercress in the streams of hard, clear water is of some importance. Wool must remain a staple product of the region, although the chalk downs in some parts are much enclosed, because sheep are essential to the system of agriculture. The number of cattle has increased, but there are still many flocks of sheep a thousand strong on the more open downs of Wiltshire and Dorset. Although the number of pigs in Dorset, Wiltshire,

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and Hampshire is practically equal respectively, Wiltshire enjoys the widest reputation for bacon. Similarly, Wilton has given its name to carpets.

The important market and cathedral towns of the chalklands are Salisbury, in Wiltshire, and Winchester, in Hampshire. They stand east and west of each other,



FIG. 90. OLD SARUM CASTLE, NORTH OF SALISBURY
"Flight" copyright

each at a focus of several tributary valleys to the river on which they stand—Salisbury on the Avon and Winchester on the Itchen. Each also is on a route between Southampton and the gaps in the hills giving easy access to the east, north, and west. Winchester (23,000) for a time displaced London as the capital when wool was the staple of trade. Salisbury (26,000) is also a very ancient city, with many historic buildings, besides its spired cathedral. In the higher valleys north of Winchester are two smaller

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market towns—Andover, with Roman and earlier encampments to remind us of its route importance, and Whitchurch. Other small market towns—Blandford, Wilton, and Warminster—lie on routes leading to the west, and Amesbury, Basingstoke, and Alton on routes to the north and east. Wilton still uses wool for felt and baize, as well as carpets. Aldershot, on the edge of the chalk uplands

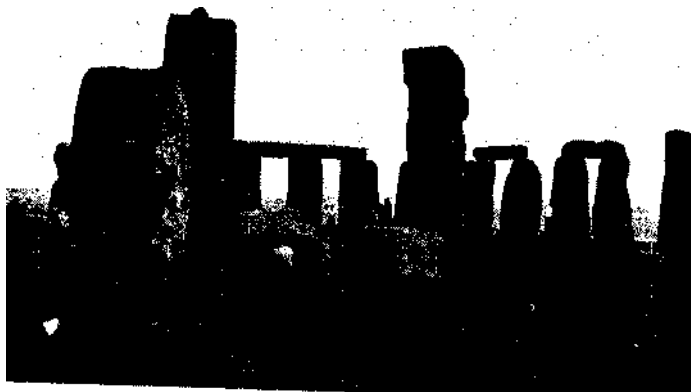


FIG. 91. STONEHENGE, SALISBURY PLAIN

nearest to London, is a great Army training-ground. The porous soil provides healthy camps, and, like Salisbury Plain, the rolling country is excellent for military manoeuvres.

The junction of the chalk with the lowland clays where water is plentiful is marked by the following towns, beginning in the west—Dorchester, Wimborne, Fordingbridge, Romsey, and Chichester. These market towns, many of them with cathedrals and other fine buildings, were important at the time of the Conquest, and even in Roman times. They are now overshadowed by the coastal towns, for traffic is not so much to them as through them. The population tends to decline or remain station-

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ary, because the country folk drift to the busier ports and pleasure resorts. But they remain important locally because of the difference in the character of the country to the north of them from that to the south.

The characteristic of the southern lowlands is the number of sand and gravel areas interspersed among the clay tracts. Originally, no doubt, it was all forested with such trees as oak and ash on the clays, and pine, beech, and birch on the sands. But on the gravelly soils containing but little loam only rough grass or rolling heather heaths are found. On the other hand, some of the heavy clay areas are distinctly marshy. Yet it is this haphazard arrangement of heather, marsh, and pine-woods, and the way the roads wander through them, that makes the region so attractive. For successful farming most of the soils need lime, and the crop production of the lowlands is on the whole less than that of the chalklands. There are fewer sheep, but the number of cattle is increasing, particularly dairy cows. For the latter the rich meadows which flank the rivers Test and Itchen are particularly suitable, and the demand for milk increases.

Another effect of the large towns is to develop mixed farming, including vegetables, flowers, and garden produce generally. There are also numerous orchards and fields of small fruits. The lower Avon valley, west of the New Forest, has especially this type of cultivation, and a fair amount of wheat is also grown. But in addition the attractiveness of the region is leading to settlement of areas hitherto unproductive, by people who have retired from business or the professions and have sufficient means and knowledge to make the most of a site and its soils. So that the belt of country within a few miles of the coast has considerably increased its population. But, apart from this, the settlements in the lowlands are mostly only villages.

The holiday resorts are to be found where cliffs occur. Pine plantations, heather, and deeply cut valleys called

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'chines' are valuable assets. Of these towns the most important is Bournemouth. In the middle of the last century it was a mere hamlet; in 1921 the population was 91,760; it now exceeds 117,000. It is favourably placed for journeys by sea or land to interesting places on the



• FIG. 92. AUTUMN IN THE NEW FOREST

The New Forest covers 92,000 acres, and belongs to the Crown. It was set apart by William the Conqueror for a hunting-ground.

Photo Sport and General

adjoining coast or in the Isle of Wight. The development of a good motor road along the coast is another way in which these modern towns are serving to unite the region. Similarly, in the Isle of Wight Cowes, the royal yachting centre, attracts many wealthy residents, and such places as Ryde, Ventnor, and Shanklin many visitors at all times of the year. To the west of Bournemouth is Poole, on a very spacious but rather shallow harbour. Considerable quantities of white Tertiary clay are exported

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annually to the Potteries, and there is some coastal trade in coal and timber. Westward, sheltering under the lee of Portland Bill, is the old port and seaside resort of Weymouth. It is a passenger port for the Channel Islands, and handles considerable quantities of early vegetables and fruit. There is also an important naval



FIG. 93. THE NAVAL HARBOUR AT PORTLAND, NEAR WEYMOUTH
Portland Bill protects the harbour from westerly gales.

Photo Sport and General

harbour. Similarly, protected by the Isle of Wight, the land-locked naval harbour of Portsmouth occupies a central position on the coast of the plain of Selsey. A fortified chalk ridge overlooks the harbour, which is four miles long and two miles wide. Portsmouth (249,000) and Gosport (38,000) occupy opposite sides of the harbour, and are connected by a floating bridge. They together constitute a great naval depot, arsenal, seaport, and health resort.

The county borough of Southampton is the most central and important town in the region. It is not only one of the five greatest ports in Britain, but it acts as the

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chief link between the Hampshire region and the rest of Britain and the world. In almost every way Southampton gives a lead to the region around it. Its importance has grown rapidly. Although it is one of the oldest towns in the country, it remained until the nineteenth century mainly a watering-place. Its population now numbers 176,000, which is an increase of 9·3 per cent, in the last ten years. It was the increase in the size and speed of ships which served to emphasize the great advantages of the position of Southampton. The port is constructed on the narrow neck of land separating the mouths of the Test and the Itchen. It is sheltered, and is not dependent to the same extent as London on the water brought down by the rivers, for the drowned valley affords deep water sufficient for the largest liner. The tides rise and fall only thirteen feet or less, and the double tide prolongs the period of high water. The quaysides are easily accessible. Routes radiate from the port, which owes much to the service of the Southern Railway. Southampton is sufficiently far inland to effect a great saving of distance and time in railway transport, and yet not so far as to discourage ships from calling when *en route* for other ports. Served also by some twenty-six shipping companies, it is the premier passenger port for Britain. In addition, it handles large quantities of mails. It is conveniently near the great military camps, and troops embark here for service overseas.

Although Southampton takes more than a third of the total passenger traffic of the United Kingdom, it cannot compare with London or Liverpool as a cargo port. But even in this trade it ranks fifth among the ports, and the increase of goods traffic is striking, not only with perishable commodities, such as fruit, vegetables, and flowers, but also with grain, wool, meat, hides, and timber. This is partly due to the efficient organization and machinery for handling all types of cargo, but also because so many ships are leaving regularly for all parts of the world. But

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the bulk of the cargoes handled are imported goods—fruit and wine from Mediterranean countries and South Africa, bananas from the Canary Islands, wool, meat, hides, skins, timber, and feathers from Australia and South Africa, tea, rice, jute, and vegetable products from India and Malay. In entrepot or re-export trade Southampton shares with Liverpool a place next to, but far behind, London. The exports are mainly general manufactures—hardware and machinery from the Midlands and the North—and are taken by Continental liners calling in transit to their home ports.

Locally Southampton provides extensive employment in various industries connected with shipping, aircraft, and the entrepot trade. All kinds of raw materials are available, as well as good sites and electric power. The port also stimulates production of food-supplies, not only for the population of the port, but for provisioning the liners.

For communications trace out the following:

i. Southampton,	TAT Winchester	{	Whitchurch, Newbury, Didcot, Oxford. Basingstoke, London, Epsom, A, r x A n g the Test Gap. Alton, Aldershot, using the Itchen-Wey Gap.
2. Southampton	^ Warm	{	nster, Trowbridge, ath, «V» Wylve Valfcy. Gillingham, Sherborne.
- Salisbury, Wilton
3. Southampton, Andover, Marlborough, Swindon.
4. Chichester, Havant, Southampton, Bournemouth,
 Poole, Dorchester.

CHAPTER X VI

THE REGION OF SOUTH-WESTERN ENGLAND

WE have mentioned in Chapter III that this peninsula belongs in structure to the highland regions of Great Britain. The people too possess many of the racial characteristics of the Bretons and the Welsh. Yet from the practical point of view the human interests are inevitably bound up with Southern England. The people of Cornwall particularly have, in past centuries, felt themselves cut off from England, and resisted any attempt upon their independence. But, although their love of the sea has led many thousands to migrate to other lands, the life of the region, certainly since the fourteenth century, has become more and more concerned with Southern England and the country as a whole.

The difficulties of communication caused by the relief have always been, and remain, barriers to easy intercourse. The physical map shows this clearly. The great mass of Dartmoor certainly has a main road across it, but for many miles north and south of the road there are vast tracts of heather and bogs almost inaccessible. This is hardly less true of Exmoor, in the north, and of Bodmin Moor, in the west. Even to-day the main road and railways run lengthways through the peninsula, either along the central axis, skirting the moorlands, or along the north and south coasts, far enough inland to pass the heads of the deeply cut estuaries. In each case they send off* branches to the popular residential towns and pleasure resorts on the coast; but travel across the peninsula is much more troublesome and slow.

In this connexion the arrangement of the river valleys is important. Note first the Tamar valley, which has

SOUTH-WESTERN ENGLAND

always been much more a boundary and a barrier than a means of communication. The Tamar rises near Hartland Point, on the north coast, and flows not into the adjoining bay, but across the peninsula to Plymouth. The Torridge, which rises quite near it, after starting on a similar course, doubles back and enters Barnstaple Bay.

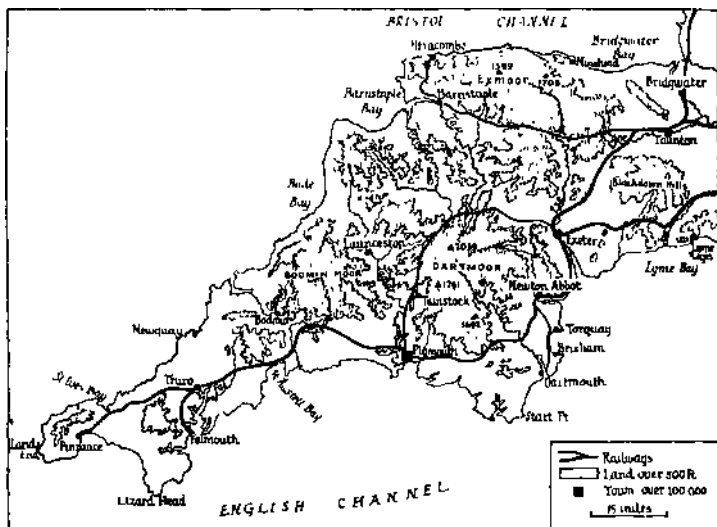


FIG. 94. SOUTH-WESTERN ENGLAND

Similarly, the Exe, rising in Exmoor only a few miles from the coast, flows across the peninsula to Exeter and the sea. But the Tone, which rises also in Exmoor, after flowing southward as though to join the Exe, turns eastward through the Vale of Taunton, to enter the river Parret, which drains the Somerset flood plain. It is probable that the low watershed which now separates the Exe and Tone valleys was once the course of a river flowing eastward between parallel folds of the old mountain system, and that the tilting of the land to the west and south, which has led to the drowning by the sea of so many of the river

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valleys, has enabled many streams which were flowing southward to capture those flowing eastward. The region has abundant water-supply, and the deep, narrow valleys of the rivers between the steep-sided hills, either rounded or rugged, according to the rock structure, afford great variety of scenery.

The outstanding aspect of the climate of this region is its mildness, due to abundant moisture, combined with a high mean temperature for the year—viz., 48° – 51° F., according to altitude. The range of temperature between summer and winter is only 18° F. in the west, and little more in the east of the region. Owing to its position, even the cold easterly winds of winter are warmed somewhat in their passage over the Channel, while the westerly winds, though strong, bring heavy rain, particularly on the high moors. The upland farmer says of the weather that it rains every day, and twice on Sundays; but the coasts enjoy plentiful sunshine, in spite of sea-mists at times. There are marked local contrasts, as may be found by visiting on the same day two such places as Penzance and St Ives, the one pleasantly warm and almost enervating, the other cooler and bracing.

The main occupations in the past have been fishing, mining, and quarrying. The agriculture of the region is carried on mostly by small farms, and there is nearly twice as much pastureland as ploughland. The crops grown on the arable land are mainly those needed for livestock—viz., oats and mixed corn—i.e., oats and barley sown together—roots, and cabbage for fodder. The cereals are grown in the valleys on clay soils, which are drained and treated with lime. The root crops are grown on the loamy soils of Devon, which also produce good meadows. The mild, equable climate permits animals to remain out through the winter, and the grass grows all the year round. Although Devon has more cattle than her two neighbours, the proportion in relation to area is lower than either. While Somerset supplies milk to

SOUTH-WESTERN ENGLAND

London, Cornwall and Devon are too far away, and so utilize the milk for butter and cream, cheese and dried milk. In Devon the dairy farming is carried on chiefly in the neighbourhood of the seaside resorts, the red Devon cattle in the interior being raised mainly for beef. Sheep and pigs wherever possible utilize the rough grazing lands of the moorlands, though many pigs are kept near dairy establishments, particularly in Cornwall. There are interesting ancient customs with regard to the common use of the moorland pastures during the summer months. In some parts particularly favoured by a southerly aspect, rich soil, and nearness to supplies of seaweed for manure, early potatoes and broccoli are grown, in competition with similar supplies from the Scilly and the Channel Islands. Early flowers are of increasing importance in Cornwall. Both Devon and Cornwall have numerous orchards, the fruit being used for cider- and perry-making. Small fruits are grown in the valleys of the Tamar and the Dart. But some farmers also have an interest in fishing. For just as the sea penetrates many miles into the land at several places, so the lure of the sea is felt in the hearts of fishermen, farmers, and miners alike. They join the Navy or enter the merchant service, where their excellent seamanship, learned in the hard school of fishing experience, is much valued.

Fishing is carried on from numerous villages round the coast, although there are considerable fleets of sailing-vessels concentrated in some harbours, like Brixham, Plymouth, and Newlyn, near Penzance. These fishing-fleets are not run by large companies to the same extent as those on the east coast. The West Countryman prefers to sacrifice profit and preserve his independence.

The fish landed in the largest quantities in Britain are cod, haddock, and herring. These are all found chiefly in the colder waters of the North Sea and Iceland. The herring spawn at different times round the coast, so that there is a herring season which ranges from June in

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Scottish waters to December in the south-west, which seems to be the limit of the herring region. But the mackerel, and still more the pilchard, is a southern fish. As a result of the variety of coastal conditions fish of many kinds- can be caught, such as hake, skate, plaice, whiting, and sole, a variety that affords continuous fishing



FIG. 95. FOWEY

Fowey occupies a sheltered position on the south coast of Cornwall, near the mouth of the river Fowey, the lower valley of which is drowned by the sea. The climate is extremely mild, and vegetation flourishes.

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throughout the year. Newlyn and St Ives land heavy catches of herring, pilchard, and mackerel; Plymouth and Brixham chiefly sole, plaice, and whiting. Lobster-fishing is also profitable round this rocky coast.

As to mining, there is little to be said, except of historic interest. When the production of copper ceased some years ago the St Just area had alone produced a total of some 40,000 tons of pure copper. For tin also Cornwall was, until a few years ago, the chief area of production in Europe. But gradually most of the mines have ceased

SOUTH-WESTERN ENGLAND

working, not because the ores are completely exhausted, but because they have been found more easily obtainable, and in larger quantities, in Bolivia and the Malay region. In Cornwall the ores occurred in veins, but in Malay tin is found also as an alluvial deposit. The Cornish toast

**You can't do less than drink success
To Copper, Fish, and Tin**

has had to give way to fish and clay. For now the most successful mining industry in Cornwall and Devon is that of china-clay, or kaolin. This greyish clay produced by the weathering of felspar in the granite is found in deep pockets among the granite. It is dug out, washed, dried, and exported to the Potteries or abroad. It is also used for certain processes in the making of paper, cotton, and calico goods. St Austell is the chief area of production. The annual output exceeds £1,000,000 in value, but the waste heaps dot the countryside. The granite itself is also quarried for monumental uses, and for facing public buildings in many large cities. The chief quarries are at Penryn, and on Bodmin Moor and Dartmoor. Slates too are worked, the chief quarry being at Delabole, near Camelford. Limestones are also quarried near Plymouth and Torquay.

The population of the peninsula is thinly scattered in villages and small towns, which are most numerous in the more fertile areas of the south-east. But in the neighbourhood of Exeter, Plymouth, Torquay, and the holiday resorts, such as Ilfracombe, Newquay, and Exmouth, population is more concentrated. In Cornwall there are several towns which have claims to be the county town: "Launceston, because the school-books say so; Bodmin, because it is the Assize town; Penzance, because it thinks it ought to be; Falmouth, because it wishes to be; and Truro, because it is."¹ Falmouth (13,000), on a magnificent estuary, is a repairing-station for ships and a port of

¹ This statement is attributed to a Bishop of Truro.

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call, though wireless has reduced the latter importance. Penzance (11,000) is one of many fishing ports, much frequented also by invalids, on account of its extremely mild climate and picturesque setting. Truro (11,000), a market town with a modern cathedral, is also the administrative centre of the county.

Plymouth (208,000) is the largest city in the peninsula.



FIG. 96. SIDMOUTH

A health resort on the south-east coast of Devonshire.

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It shares with the naval station of Devonport a splendid natural harbour. Coastal ships and some liners call there regularly, particularly those serving West Africa and the United States, and the railways afford fast trains for passengers and mails. But it is too remote from coalfields and a large industrial area to have any volume of trade. Besides shipbuilding, there is a number of small industries, such as oil-refining and the making of soap, cattle foods, and fertilizers.

Exeter (66,000), at the head of the Exe estuary, owes its importance to being the focus of routes. Both roads

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and railways radiate from it to all parts of the peninsula. It is therefore, like Truro, both the ecclesiastical and administrative headquarters of the county. It was formerly the chief market for the woollen products of the West, but its industries now have only local importance, though shipping facilities remain.

Torquay (46,000) is the chief of many seaside resorts along the coast. The only other towns in Devon with

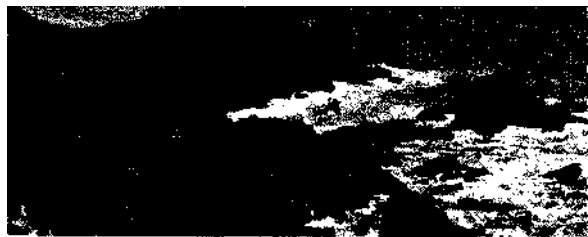


FIG. 97. BOLT TAIL, NEAR KINGSBRIDGE, SOUTH DEVON

a population over 10,000 are Newton Abbot, at the head of the Teign estuary, Exmouth, and Barnstaple, a route centre on the north coast.

The Scilly Isles, twenty-five miles west by south of Land's End, are built of granite. There are five small inhabited islands and many islets and rocks. Mackerel-fishing and the cultivation of early vegetables, particularly potatoes, and flowers are the main source of livelihood. The largest island is St Mary's.

The Channel Islands. Jersey and Guernsey are the two most important. The islands are structurally like the neighbouring part of France. The land is fertile and carefully cultivated. The potato crop in Jersey is very

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important, but tomatoes and other vegetables, flowers, and grapes find a profitable market in England. Channel Island cattle are also famous breeds which are much favoured in the West of England. There are regular steamer services to Weymouth and Southampton from the ports of St Helier, in Jersey, and St Peter Port, in Guernsey.

CHAPTER XVII

THE LOWER SEVERN-SOMERSET REGION

THIS region lies between the Oolitic escarpment and the upland mass of Wales. It is thus a plain bounded by hills on all sides, except in the south-west, where the Severn estuary cuts far inland. West of the Severn the region includes the plain of Hereford, relieved by many low hills and drained by the picturesque river Wye. Farther west the river Usk cuts a gap between the Brecon Beacons and Black Mountain, and crosses the plain of Gwent to the sea. Between the Wye and the Severn are the Malvern Hills and the Forest of Dean, through which the Wye has cut a famous gorge. East of the Severn the plain is overlooked by the Clent Hills, the Cotswolds, and the Mendip Hills, which attain 1000 feet in places, and in the extreme south by the Quantock Hills. Notice the north-easterly trend of the Malvern and Cotswold Hills and the south-easterly trend of the Mendips and the Quantocks. The region thus includes the counties of Somerset, Gloucester, Worcester, Hereford, and Monmouth.

The region lies in a track frequently followed by cyclones or disturbances, and is wide open to the stream of south-westerly winds which make their influence felt over the whole region. It enjoys, therefore, a very mild winter, and a low range of temperature throughout the year. But it is also exposed to gales and very high tides, which often flood the coastal belt. Both the daily and annual ranges of temperature are greater on the uplands than on the plain. The rainfall similarly ranges from 40-30 inches, decreasing northward under the shelter of the Welsh mountains. Rain falls throughout the year, but

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is heaviest in autumn and winter, and clouds reduce the amount of sunshine, so that cereal crops are slow to ripen and often fail.

The physical characteristics have been noted in Chapter IV (see p. 63). In Somerset most of the plain is but little above sea-level, and is very subject to winter floods. It is used almost entirely for cattle pastures, but in the lowest areas peat-cutting has long been an industry.



FIG. 98. SELWORTHY, NEAP. MINEHEAD

A considerable acreage is devoted to apple orchards for cider-making. On the marls of the higher ground some mixed farming, including crops of wheat, oats, and barley, is carried on, but the soil is often thin, and poor from too much rain. Root crops are widely grown, and the production of sugar-beet, though small, is increasing. The number of livestock is naturally large, particularly of dairy cows and pigs. The number of sheep is somewhat surprising. The most fertile parts are the Vale of Taunton, between the Quantocks and the Blackdown Hills, and the Cheddar valley. Both areas, in addition to dairy products—Cheddar cheese and cream—raise strawberries and other small fruits.

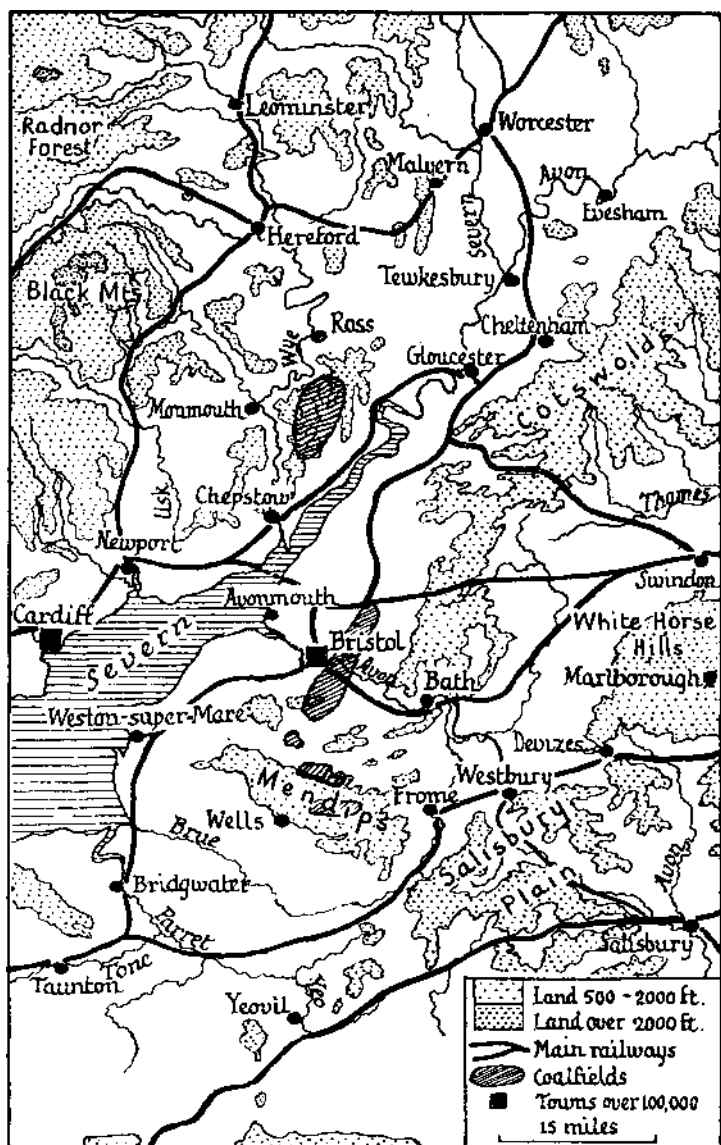


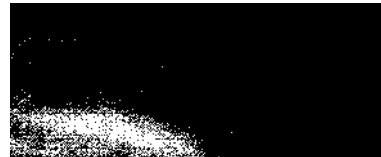
FIG. 99. THE PLAINS OF HEREFORD AND SOMERSET

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There are many small market towns. The largest is the county town, Taunton (25,000). Small industries are carried on, such as paper- and brush-making at the cathedral city of Wells, boots and shoes at Street, gloves at Yeovil, bricks and tiles at Bridgwater, and the quarrying of Carboniferous Limestone at several places along the Mendips. An important artificial silk factory is to be erected at Bridgwater. Yeovil specializes in the making of oil-engines. Cider is made in many places. On the Mendips are several coal-mining villages round the town of Norton Radstock. Along the coast Weston-super-Mare (29,000), Burnham, and Minehead are pleasure resorts. North of the Mendips on the Bristol Avon is Bath (69,000), a city famous since Roman times for its hot mineral vsprings. The working of Oolitic Limestone is carried on round Bath and elsewhere. There are also engineering, printing, and book-binding industries. This book has been printed there.

The once prosperous woollen industry still continues at Frome, Westbury, Chippenham, and Trowbridge, each a railway junction. The preparation of dried and condensed milk and the collection of supplies of fresh milk for London are done by factories at Wells and Chippenham.

The lower Avon forms the county boundary. Situated seven miles from its port of Avonmouth is the county borough of Bristol (397,000), mainly in Gloucester, but partly in Somerset. Moderate-sized ships still come through the gorge to Bristol itself. Ever since the days of Cabot Bristol has maintained its hold on American and Irish trade. Bananas are the special feature of its import trade, which includes also tobacco in large quantities, grain, meat, timber, and oil. It has large manufacturing industries in tobacco, chocolate, rolling stock, and aircraft. Bristol has within a radius of fifty miles a population of 3,000,000, and within a hundred miles 11,000,000. The Great Western Railway links it to London, and by means of the Severn Tunnel to South Wales; and the London,



Λ**f*5P-



FIG. 100. THE WEST REGIONAL TRANSMITTING STATION IN SOUTH-WEST SOMERSET
Situated at Washford, between Taunton and Minehead. The Quantock Hills are in the background.

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Midland and Scottish Railway to the Midlands and the North.

The plain between Bristol and Gloucester has rich pastures excellent for dairy cattle. Orchards occupy the higher ground. Much butter and cheese come from this part. On the northward extension of this plain into the

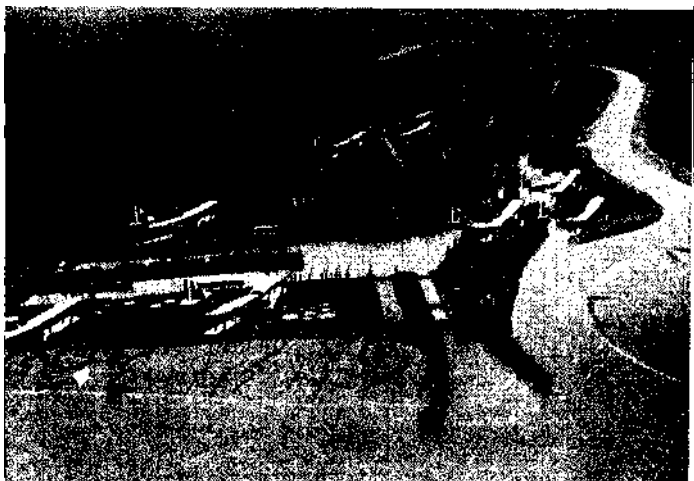


FIG. 101. AVONMOUTH DOCKS

The course of the river Avon is narrow, winding, and navigable only at high tide; but some ships still use it and reach Bristol.

"Flight" copyright

Vale of Evesham, where the soils are lighter and more loamy, market-gardening and fruit-farming predominate. Small fruits, early vegetables, and flowers call for quick delivery, and the railways meet this demand. Gloucester (53,000), the historic cathedral city situated at the lowest road-crossing of the Severn, is a natural focus of land and water routes. A ship-canal from Sharpness enables 800-ton vessels to reach the city. But the railway bridge at Sharpness and the Severn Tunnel have deflected traffic to the advantage of Bristol. Its trade has long been chiefly

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concerned with coal and iron, and canals to Worcester and Birmingham facilitate the transport of heavy goods. Its industries include the making of rail way-wagons, machinery, paper, leather, and cloth. Tewkesbury and Evesham are historic market towns, and Cheltenham (49,000) is an important residential town and spa.



FIG. 102. ROSS-ON-WYE

Worcester (50,500), at the junction of east-west, north-south routes, is a county capital and cathedral city, which manufactures gloves, porcelain, and sauce.

The plain of Hereford is one of the most rural parts of England. It is mainly a pastoral and fruit-growing area. The famous Hereford cattle are bred for the markets of the Midlands. But oats, wheat, barley, and root crops are grown in the eastern part, which also is the only area outside the Weald where hops are grown. The county is also famous for its production of cider and perry, for which orchards occupy a large area. There are also many

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gardens of small fruits. The chief potato cultivation is near Ross-on-Wye. Hereford (24,000) is a cathedral city controlling routes from many directions.

The Forest of Dean is an outlier of the great South Wales Coalfield. Much coal is mined, and iron industries were once of great importance.



FIG. 103. THE WYE AT CHEPSTOW

The castle guarded the coastal route from Wales. Salmon ascend the river in the season.

Monmouth (5000), on the Wye, is one of the many castled towns along the border of Wales. Chepstow, at the head of the estuary, is another such town. The Usk valley is an important agricultural area, but coal and iron industries at Newport, on the Usk, attract more notice. These will be considered in connexion with the South Wales Coalfield.

CHAPTER XVIII

THE MIDLAND REGION

THE heart of England consists of a broad plateau much dissected by river valleys. In the west, separated from it by the Severn valley, are the South Shropshire Hills, an extension of the Welsh uplands. The Upper Trent valley separates it from the Pennine uplands, and the Warwickshire Avon from the Oolitic escarpment.

The floor underlying the region is formed of older rocks extending southward from the Pennines. These older rocks, including the Coal Measures, rise above the newer rocks in five radiating ridges. The first carries Charnwood Forest and the Leicester Coalfield; the second the Tamworth or Warwickshire Coalfield. Between these two is the plain of Leicester. The third produces Cannock Chase, the Clent and Lickey Hills, and the South Staffordshire Coalfield. Between the second and third is the plain of Warwickshire, once covered by the Forest of Arden. The fourth produces the Wrekin and the Shropshire Coalfield, and the fifth the North Staffordshire Coalfield. The New Red Sandstone rocks form the red plains between them. The surface is composed of Red Marls, which are clayey soils, and there are many areas covered by glacial deposits. The plateau is highest round the margins: the Clent Hills reach a height of 1036 feet, and there are many hills exceeding 700 feet in height. Yet it is an open country, affording easy routes. It is primarily an agricultural area, interspersed with important manufacturing industries and large cities. The region includes Shropshire, Stafford, Warwick, Leicester, Nottingham, Rutland (Red Land), the northern part of Worcester, and the southern parts of Derby and Cheshire.

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The region lies in the lee of the Welsh uplands, but is open alike to the south-westerly winds from the Severn estuary and to easterly winds. Rainfall is relatively low, except on the hills, and falls throughout the year, but more abundantly between June and October. The total

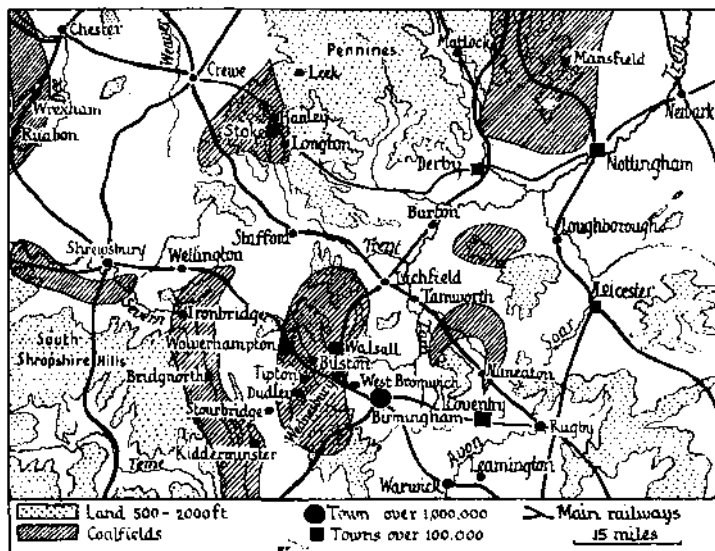


FIG. 10 THE MIDLANDS

is usually less than 30 inches though Leek receives about 35 inches. Nottingham has only 22.5 inches. Mean January temperatures vary between 39° F. in Shropshire and 37° F. in the eastern part, and July temperatures between 59° F. and 61° F. respectively. The range of temperature therefore varies from 20° to 24° , a figure which appropriately stands midway between the corresponding facts for the south-west and eastern regions.

Agriculture over the whole area is influenced by the large industrial towns, which create a market for garden and dairy products. The differing physical conditions

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also cause variations. Thus, in Shropshire on the northern plains, where soils are heavy, dairying is of outstanding importance. On the plain of the Severn the light loamy soils, low rainfall, and moderate temperatures lead to arable farming, the chief crops being wheat, barley, and



FIG. 105. BRIDGNORTH

This is one of the route centres of the Severn valley. It is a market town with a carpet-making industry.

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root crops, used largely for feeding sheep. There are nearly three times as many sheep per acre as there are cattle. In Central Shropshire heavy loams alternate with light sandy soils, due largely to glacial deposits. As a result both grassland and arable land are valuable; crops are varied, and the balance of sheep and cattle is more equal. In Northern Worcester arable farming predominates, with market-gardening towards the borders of the Black Country. Fruit is also grown round Bromsgrove,

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and in the Avon valley. There are many large herds of dairy cows. The Arden Forest country of Central Warwickshire is rolling and monotonous pastureland; only about a fifth of the area is ploughland. Both beef and dairy cattle are grazed, and milk has a ready sale close by. Market-gardens also grow potato crops in considerable quantity for the towns.

Shrewsbury (32,000), situated near the most northerly part of the Severn valley, is an important market centre, not only for the county, but also for Wales. Railway-lines radiate from it in several directions. The castle also reminds us of its command of routes. Near the Wyre Forest and other small coalfields of the mid-Severn area are several small towns, but Wenlock and Oakengates, near Wellington, are the only ones with a population over 10,000. Kidderminster (29,000) and Stourport, at the southern end of the coalfields, together employ several thousand people in the carpet industry, which has been carried on there for 200 years. This is the most important English district for this industry. It indicates the lasting importance of wool in the region.

In Staffordshire the two coalfields in the north and south respectively dominate the occupations. Nevertheless agriculture is important. Four main areas may be distinguished. In the north is a large moorland area, mostly poor grassland, but including rich meadows on the banks of the Dove. This is the chief district of the county for cattle, sheep, and horses. In the neighbourhood of the Potteries soils vary, and crops of wheat, barley, and roots are as important as dairy-farms. South of that, round Cannock Chase, where soils are light, there is much open heath; but on the mid-Stafford plains, with their stiff clayey soils, dairy-farming monopolizes the land. In the hilly region of the south of the county soils are very suitable for arable farming, but the demands of the towns encourage dairy-farming.

The pottery centres of the north coalfield are Longton,

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Stoke, Hanley, Burslem, and Tunstall. They form almost one continuous town, and are now united as the borough of Stoke-on-Trent, with a population of 277,000. The local clays and marls are suitable for rough earthenware like drainpipes and tiles. The fireclays make good ovens



FIG. 106. THE ENTRANCE TO DOVEDALE,

A considerable portion of this beautiful valley, famous for its fishing, has been presented to the National Trust as a public park.

By permission of the L.M.S.R.

for baking the pottery, and coal is at hand. China-clay is imported from Cornwall and Devon by canal or road transport from the Mersey; flints are brought from Norfolk; felspar from North Wales; chemicals and paints from the Mersey district. It is still the most famous region in the world for earthenware. Newcastle-under-Lyme is not a pottery town, but an old agricultural centre. To the south of the Potteries in the agricultural area Stafford (29,000) has locomotive and

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machine-making industries, in addition to boot and shoe factories.

The Black Country of the South Staffordshire Coalfield is one of the busiest industrial regions of Britain, with more varied manufactures in metal than any other area of its size. Of these the chief groups are hardware, which



FIG. 107. THE POTTERY TOWN OF HANLEY
"The Times" copyright

ranges from iron castings (stoves, grates) to tubes, chains, tools of all kinds, locks, keys, bolts and screws, lathes, machines, power-presses, motor-cars, engines, and electrical apparatus. All kinds of other metals are brought to this region to supplement iron in the variety of manufactures, and a most complex system of transport has grown up to meet all demands. Birmingham (more than 1,900,000) stands at the junction of the county boundaries of Stafford, Warwick, and Worcester. It is situated high on the plateau, near but not on the coalfield (see p. 133), and

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THE MIDLAND REGION

the railway approach from the south is steep. It is the receiving and distributing centre of the Midlands. The handicap of distance from the ports of Liverpool, London, Bristol, and Hull, which varies from fifty to eighty miles, has been overcome by great organization. Its industries are countless, but include, in addition to iron and engineering, brass, copper, zinc, and their alloys, chemicals, glass, pottery, rubber, asbestos, textiles, clothing and foods, printing and electrical apparatus. Other great towns crowded in this area include Wolverhampton, West Bromwich, Walsall, and Dudley, each of which specializes in certain of the products mentioned, but also shares in the general variety.

Canals have played a great part in this area, and Birmingham is the canal centre of Great Britain (see Fig. 53, p. 133). They unite Birmingham and Wolverhampton to each other, to the coalfields, and to the ports. To overcome differences of level, numerous locks and long tunnels (one is nearly 4000 yards long) were constructed: costly work, which indicates the importance attached to them. New flights of locks on the Grand Union Canal between Napton and Birmingham have been under construction since 1931. They are now open, and make the canal navigable by bigger and faster craft. The scheme cost £1,000,000.

Across the plain of Warwickshire we pass to the Warwickshire Coalfield, briefly noted on p. 134. This coalfield has similarities to both the South Stafford and the Leicester Coalfields in the quality of the coal. Its iron and steel industries are also varied. Warwick and Leamington make stoves and grates. Coventry (167,000), the chief town, began the making of cycles and motor-cars, which has grown to so great an industry. In addition, tools of all kinds are made, as well as castings and forgings. Fabric gloves and silk goods are also made there. Nuneaton too has a silk industry. Coventry stands near the head of the Avon valley, on the main line

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through Rugby to Birmingham. Rugby (24,000) is not only an important railway junction and engineering town, but is one of the chief centres in England for electrical appliances and machinery. Rugby radio station, covering some 900 acres, contains a larger collection of radio equipment than any other single station. The long-wave aerials are carried on steel masts 820 feet high, and there are numerous short-wave aerials to secure successful transmission, however the atmospheric conditions may vary. Warwick (13,000), the historic county town, with its castle and other ancient buildings, makes agricultural implements.

The Soar valley is the most important area of the East Midlands. The county boundaries of Leicester, Nottingham, and Derby meet at its junction with the Trent. In the west of its basin is Charnwood Forest, so important for water-supply, and for the quarrying of road material and the making of artificial stones, paving-stones, and kerb-stones. West of Charnwood is the Leicestershire Coalfield, already mentioned. East of the Soar is the famous hunting country, of which Market Harborough is the centre. The rich grasslands support valuable herds of beef and dairy cattle. Much milk and Stilton cheese are produced in the Wold country, stretching northward to Melton Mowbray; while in the valley itself is Leicester (239,000), a city of growing importance. Not only is it the headquarters of hosiery in all its branches, an industry which extends to the towns north of it as far as Mansfield, but it has also numerous boot and shoe factories. Among many articles made there laces and ribbons are important. In addition, the complicated machinery for these industries is made there; other industries include milling, malting, printing, and rubber-making. With the great pastoral and agricultural area round it, Leicester is naturally a great market, with cattle and sheep fairs. It controls also the distributing trade in leather goods over a wide area. Loughborough (27,000) shares in this hosiery

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trade, but is also an important engineering centre, and specializes in electric motors and railway materials.

Nottingham (269,000) is the chief centre of the Trent valley. It stands high on the banks of the river, which is liable to floods and difficult to cross. Nottingham, the premier centre of the lace industry, shares with Leicester the hosiery and boot-making industries. Its ancient iron



FIG. 108. HOAR-FROST ON A WINTER MORNING IN CHATSWORTH PARK
Chatsworth is in the Derwent valley, not the Dukeries, which lie east of the Pennines.

industry has developed into engineering; castings, motor-cars, and cycles are made, as well as machines for artificial silk and knitted goods of all kinds. Nottingham is also the largest inland centre of the tobacco trade.

To the north of Nottingham lies the great coalfield extending beyond Leeds. The soils of the Nottinghamshire part of it are not very fertile, and there are still large areas of woodland, the remains of the former Sherwood Forest. Part of this attractive country lying south of Worksop and east of Mansfield is known as the Dukeries, because there are several great parks adjacent to one another in which are the mansions of dukes and earls. On the edges of this

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area are several important and relatively new mines working the hidden coalfield. Mansfield (46,000) is the chief centre. Red sands valuable for moulding in the iron industry are found near. Cotton and other textiles and sewing-thread are also made there.

The Isle of Axholme, along the left bank of the Trent, in the north-west corner of Lincolnshire, is an area very



FIG. 109. A BRIDGE ACROSS THE DERWENT, IN DERBYSHIRE

like the Fens, once a useless marsh; now drained and exceedingly productive of wheat, potatoes, and other vegetables.

The main drainage of the Midland plateau is to the Trent. Of its left-bank tributaries the Dove and Derwent are the chief; the Tame and the Soar drain the area last described. The Trent valley is a fertile area, and affords easy communication to many parts. The four towns of Leicester, Nottingham, Derby, and Stafford are each county towns. These counties have more grassland for producing hay and pasture than arable land; but Nottingham, like Stafford, has quite a good proportion of arable land, and grows considerable quantities of wheat,

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oats, and barley. On the alluvial pastures both dairy and beef cattle are grazed, and milk is sent far afield.

The other notable towns in the Trent basin are Lichfield (8500), an ancient cathedral city at the crossing of two Roman roads; Burton (49,000), the largest brewing centre in the country, with lesser porcelain and textile industries; and Derby (142,000), a great route centre, with the chief works of the L.M.S. Railway, the Rolls-Royce motor-car works, an important silk industry, and well-known china industries.

As to communications, trace the following routes on the map:

1. Rugby, Nuneaton, Tamworth, Lichfield, Stafford, Crewe.
2. Gloucester, Birmingham, Tamworth, Burton, Derby, Chesterfield, Sheffield.
3. Rugby, Leicester, Loughborough, Nottingham, Sheffield.
4. Leamington, Birmingham, Wolverhampton, Shrewsbury.

CHAPTER XIX

THE YORKSHIRE REGION

THE great county of Yorkshire covers over 6000 square miles. The area of Lincolnshire, the next largest English county, is 2644 square miles. It is necessary, therefore, to subdivide the area, and the natural divisions are: (i) Holderness and the Wolds, which nearly coincide with the East Riding administrative division; (ii) the Vale of Pickering, between the Wolds and the North York moors; (iii) the North York moors and the Vale of Cleveland, to the north of them; (iv) the Vale of York; (v) the industrial area of the coalfields of West and South Yorkshire.

Holderness and the Wolds. The undulating uplands of the Wolds, of an average height of about 400 feet, but attaining to 800 feet, are covered with light soils, thin on the highest parts, but deeper on the tablelands and in the valleys, where peat, clay, and gravel also occur. As on the Wolds of Lincolnshire the breeding of sheep is associated with the growing of barley, turnips, and wheat. There are but few plantations, chiefly of beech, and little permanent grass. The plain of Holderness, between the Wolds, the Humber, and the coast, is covered deep with glacial drift, ranging from stiff clay to beds of sand and gravel, and alluvium along the Humberside, where some twenty square miles of land have been reclaimed by embankment and drainage. The sea-coast of Holderness is subjected to rapid erosion by the sea, owing to the soft material forming the cliffs, but the chalk of Flamborough Head offers greater resistance. The sand and shingle thus removed are deposited at points as far south as the Wash, but particularly at Spurn Head, which is extending more and more to the south and west.

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The temperatures in this area range from about 40° F. in January to 60° F. in July. The average rainfall is about 25 inches. In spite of the light rainfall, careful drainage is necessary; and the abundance of surface water combined with summer warmth and suitable soils makes

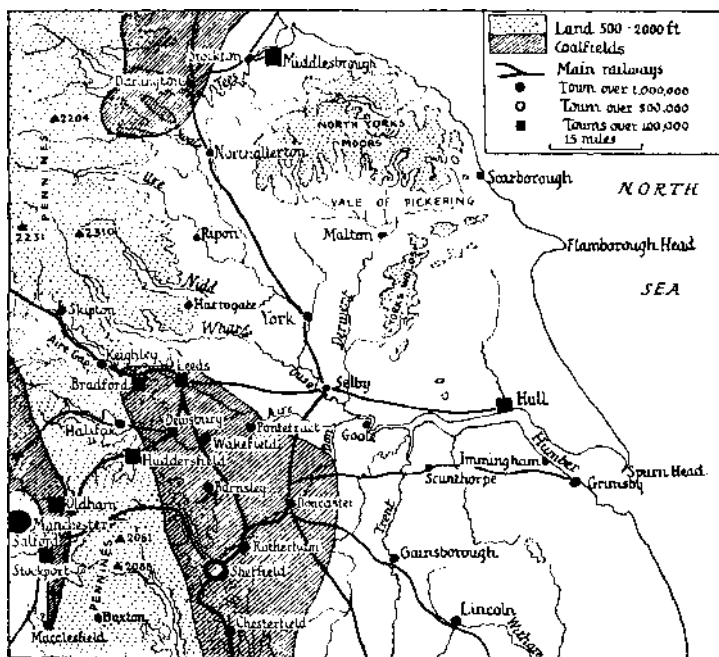


FIG. HO. THE YORKSHIRE REGION

this area similar to that of Eastern England. The two chief crops are oats and wheat, though barley, roots, clover, and potatoes are also important. There are numerous cattle, but few sheep on the plain.

Apart from farming, occupations depend either upon the available minerals, as in the case of brick- and cement-works, or upon agriculture, as with brewing and milling, or upon the Humber advantages, as in the case of ship-

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building. Since the Humber constitutes a sea highway-penetrating far inland towards the industrial west of the county, there are only a few market towns, like Beverley (14,000), which builds trawlers; and, on the coast, summer resorts, the busiest of which is Bridlington (20,000). But the old seaport of Hull (313,000) has commanding importance. Situated at the mouth of the river Hull, and



FIG. H I. THE HUMBER

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in a sheltered position, with permanent deep water close to the shore, the importance of Hull grew rapidly as the size of ships increased. Since then it has developed a unique system of canals, which *via* the Humber connect the port to the West Riding industrial cities. Then came railways and dock construction, so that Hull is now the third port of Great Britain. The trade of Hull centres upon the port; for in other respects the city is somewhat isolated. It has no trade interest in the opposite bank of the Humber, and but little with the region in the immediate hinterland. It is a great port for the Dogger Bank fisheries. The port receives also large quantities of oil-seeds, wheat, butter, bacon, and timber. These imports support local industries in seed-crushing for cattle foods,

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paint, varnish, and soap manufactures, flour-milling, and others. The port also does a great coastal trade, including wool brought from London, which is still the chief wool market.

The Vale of Pickering. The broad, flat-floored valley, which runs east-west between the North York moors and the Wolds, is also almost enclosed at each end by irregular uplands, highest in the Hambledon hills of the west. The Derwent flows westward through a gap cut at the time the eastern exit of the vale was dammed by the ice-sheet and a moraine. This old lake-bed is still very subject to flood. But the deep alluvial soils, which vary from heavy clay to gravel, are ideal for agriculture. The valley is also sheltered from northerly winds. The low central area is mostly rich pasture, but encircling this, on the better-drained land, is a fertile belt growing good crops of cereals and fodder. The broad spurs of the moors to the north provide only rough pasture. On the south is to be found the Wold cultivation already mentioned. It is a great cattle- and horse-rearing region. The market towns of Malton, Pickering, and Helmsley each control gaps leading into the Vale from the south-west, north, and west respectively. The Vale constitutes a great highway between the densely populated area in the west and the seaside towns of Scarborough and Filey.

The North York Moors. A considerable part of this broad, undulating moorland is over 1000 feet, and the highest part nearly 1500 feet. The moors cover an area nearly 40 miles long and 20 miles across from north to south, and are much eroded by streams which drain southward into the Vale of Pickering, and by the river Esk, which has carved out a deep valley running eastward to Whitby. The part of the moorland usually known as the Cleveland Hills lies north of the Esk. Consisting of sandstones and limestones, the moors are covered by thin, stony soils. There is much peat, but for the most part it is covered on the lower slopes either with heather or rough

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grass. In the valleys clay soils occur, varied by sand deposits brought down from the hills and, along the coastal belt, by glacial clays and sands. The area is much exposed to easterly winds and heavy rains, which reduce the fertility of the valleys, so that they contain only a few small villages, and at higher levels isolated farms of which cattle and sheep are the mainstay. The old market and seaport town of Whitby (11,000) lies deep between two cliffs, and is popular as a summer resort.

Several million tons of iron ore have been obtained from the Cleveland Hills, but the production has fallen rapidly of late years as the mines become more difficult and costly to work. The ore at present obtained comes from the northern part of the Hills, and is sent to the Tees-mouth furnaces.

The Vale of Cleveland runs from Thirsk to the sea between the Cleveland Hills and the Tees. Between Thirsk and Northallerton the soils vary between sands and clays, but eastward the boulder-clay produces heavy soils, and grassland predominates. Dairy-produce, hay, and straw constitute the chief output. The Yorkshire town of Middlesbrough will be considered with the Tees industrial area.

The Vale of York. This great plain, which extends southward into the Trent basin, is a region of mixed soils, and is therefore an area of mixed farming. The soils are chiefly glacial deposits, but there are also areas of alluvium and river-gravels. The January temperatures approach 40° F., and this is the most northerly area where the summer temperature attains 60° F. The rainfall is about 25 inches per year. The chief crop of this agricultural region is oats, but barley, roots, and potatoes are important. Cattle are fairly numerous, but sheep are fewer in proportion than in the other areas.

The population is chiefly occupied with agriculture. Small market towns are evenly distributed about the plain at convenient points, avoiding the areas liable to

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flood, and often at the mouths of the Pennine dales. The chief of these are the cathedral city of Ripon (8500), Knaresborough (6000), and Selby (10,000).

The city and county town of York (85,000) is situated at the crossing of river routes from north to south and the east-west roads, which take advantage of a morainic ridge.



FIG. 112. THE REMAINS OF RIEVAULX ABBEY, FOUNDED IN 1131

One of the ruined abbeys in the Yorkshire dales.

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It stands, therefore, well above flood-level, only a few miles above the head of navigation on the Ouse. The famous minster, castle, and city walls are eloquent of its importance from the earliest times. It is a great railway • junction, and has industries concerned with hardware, glass, beer, leather, and cocoa. It is also a great agricultural market and a garrison town.

On the west the plain of York extends in finger-like projections to the famous Yorkshire dales. Most of these are named after the streams—Teesdale, Swaledale,

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Nidderdale, and Wharfedale. But the valley of the Ure is called Wensleydale, after the picturesque village of Wensley. Space does not permit of a description of these attractive dales, with their varied scenery, historic abbeys, and castles, woodlands, and waterfalls. Bolton Abbey in Wharfedale and Fountains Abbey in Nidderdale are two of the best known. The dales are traversed by good roads, but the best way is to spend a holiday exploring them on foot. Harrogate (40,000) is famous as a spa and one of the best centres for visiting the dales. It is situated south of Nidderdale. Ilkley is a smaller and similar resort, and is situated in Wharfedale. Farther north in the Ure valley is the cathedral city of Ripon, another inland spa. Very little wheat and few root crops are grown on the cultivated land of the dales. Permanent grasslands prevail and support both cattle and sheep.

The Yorkshire Industrial Area. A description of the structure of this region is given on pp. 48-49, and of the coalfield on pp. 128-130. The coalfield begins south of Wharfedale, and is one continuous area extending to Nottingham and Derby. The visible coalfield is in the west, and the hidden coalfield extends eastward to the Humber. But it is convenient to consider two parts separately: that of West Yorkshire, which is the home of the great woollen industry, and that of South-west Yorkshire, which is associated with the steel industry of Sheffield. There is a high ridge between the western and the southern portions which acts as a partial barrier.

The area between Leeds and Bradford, Huddersfield and Wakefield, contains over forty large towns. There is a westerly extension of the wool region up Airedale as far as Skipton. In this crowded area four-fifths of the total number of workers in wool in Great Britain are congregated, and half of these live in the Aire valley.

The natural advantages which gave rise to the industry have been summarized on p. 149.

The industry has three main branches. The worsted

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trade uses the long-fibre wools, the woollen branch the short-fibre wools, and the carpet trade the lowest grades of wool. Fibres recovered from tailor's clippings, old clothes, and such-like are called shoddy. After sorting all wools are very carefully washed and prepared for the complex carding-machine. Worsted then passes through one series of processes—spinning, weaving, dyeing, and finishing—woollen materials through a separate though similar sequence. It is the highly technical details of the various stages of manufacture which lead to such specialization. One result is that the worsted section of the trade is located mainly in the valley of the Aire and its tributaries, and the woollen branch mainly in the southern part of the area, though there is a good deal of overlapping.

Bradford (298,000), on a small tributary of the Aire, is the chief market for wool as a whole, but it is also the headquarters of the worsted trade and of dyeing. Leeds (483,000), situated at the entrance to Airedale, has many factories both in the woollen and worsted trade. But woollen manufactures occupy only a small percentage of the city's workers. Five times as many are employed in the wholesale clothing trade; engineering, with special reference to locomotives and factory equipment, comes next in importance. The woollen industry shares only an equal place with the building trade and printing. But there are a hundred other varied industries which give Leeds its distinctive position as the main commercial centre. It is also the chief distributing centre for the whole of Yorkshire.

Huddersfield (113,000), on the Colne, a tributary of the Calder, partakes of both the woollen and worsted trade, and pays special attention to designing fabrics. It has many associated industries, including commercial motors. Halifax (98,000), on another tributary of the Calder, specializes in spinning and weaving, and includes carpets among its many manufactures. Dewsbury (54,000) and

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several satellite towns, including Batley and Morley, specialize in the manufacture of shoddy. Keighley (40,000) makes looms and other machines for both Yorkshire and Lancashire factories. Situated in the Aire valley, it is in the transition area of the woollen and cotton industries. Wakefield is also an engineering town. The woollen-manufacturing area ends abruptly along the Colne-Calder valley.

In the southern area Sheffield (512,000) stands more or less alone at the junction of five valleys, but not on any through route of importance. The steel industry began in Sheffield in very early times. Here, again, the abundance of water-power played a great part. The local ore is not of very high quality, and for a long time past Sheffield has obtained the best available ores from Sweden and Spain. Local supplies of limestone assisted as a flux in the smelting of the ores. The Millstone Grit and other hard sandstones make excellent grindstones, and ganister¹ the best lining for the furnaces. When local supplies of timber became exhausted in the eighteenth century coal saved the industry. Sheffield stands near the western limit of the visible coalfield, and the famous Silkstone and Barnsley seams are within a short range. The value of water-power therefore declined, but it is still sufficiently important to justify the pumping of water from one of the streams back up the valley for use again.

Sheffield products and the names of the great firms which make them are world-famous. The best known is cutlery, with which is associated stainless steel and numerous small steel articles like hand tools, clock-springs, and so on. But the heavy steel products are more impressive. These include huge forgings for ships and machines, armour-plates and big guns for battleships, girders and constructional steel, and any apparatus requiring special properties of strength or hardness.

¹ A siliceous stone which when crushed and mixed with fire-clay will stand intense heat.

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Many of these are too large to send by rail or road, and are dispatched by canal to the Humber ports. Silver-plating is also an important industry in Sheffield.

Rotherham (70,000) merges into Sheffield on the east of the city, and shares its industries, while maintaining its older industry in brass and wrought-iron. The Sheffield district, like Birmingham, refines non-ferrous metals and makes brass (alloy of copper and zinc), bronze (copper and tin), and nickel-silver (copper, nickel, and zinc). Barnsley (72,000), 14 miles to the north, has also iron and steel industries; and so has Penistone, about as far away up the Don valley. Other industrial towns to some extent connected with the industries of Sheffield are Chesterfield (64,000) and Staveley, coal-mining and iron-smelting towns over the border in Derbyshire. Matlock (10,500), in the Derwent valley of Derbyshire, is a popular resort; lead-mining and -quarrying are carried on in the neighbourhood of Matlock. Buxton (15,000) is another famous Derbyshire health resort, with mineral springs. Though over 1000 feet above sea-level, it has a protected position in a basin of the limestone area south of the Peak. Dove Dale and other attractive dales lie near, and the railway road from Derby to Manchester through Buxton is as picturesque as any in England.

Between the areas last described and the Humber estuary the towns are concerned chiefly with coal-mining. But Doncaster (63,000), besides being a great coal-mining centre, has iron- and steel- and railway-works. Doncaster is an important railway centre, and was always a market town. Its other industries follow upon the recent mining of coal in the hidden area of the coalfield. It stands near the head of navigation of the old Don valley, which is subject to floods. The towns and villages are found on 'island' sites of harder rocks. Goole (20,000), at the head of the Humber estuary, is an important rival of Hull and Immingham. The Aire and Calder canal system provides excellent communication between Goole and Leeds and

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Doncaster. The port of Goole handles about 2 per cent, of the total exports and 1 per cent, of the total imports of the country. It is especially a coal-exporting port, and imports chiefly bulky commodities, like iron ore and timber.

The important routes across the Pennines and to Scotland by the Aire valley and the west-coast route will be considered in a later chapter (see p. 273).

CHAPTER XX

THE REGION OF NORTH-EASTERN ENGLAND

THE region which lies between the North York moors and the Cheviots, and between the Pennines and the coast, lies to the north of the Exe-Tees line, and so belongs to the upland region of the British Isles. But, just as it is a border country between England and Scotland, so also is it a transition area between the upland and lowland regions of England. It extends for about 100 miles from north to south. The moorlands, too high for agriculture, reach far eastward, leaving only a narrow plain 50 miles wide at its maximum. There are only three gateways to the plain. The Northallerton Gate, some ten miles wide and not over 200 feet at its highest, leads to the Vale of York. The Cheviot Gate provides a narrow but important route into Scotland, and the Tyne Gap the only practicable route to the west. Along the north side of this gap, less than 500 feet at its highest, ran the Roman wall and road.

The old rocks of the Pennines, including the Coal Measures, reach the coast in the northern part, and only in the south-east is there a belt of younger rocks, ending in the Oolitic Limestone of the Cleveland Hills. This structure provides a convenient subdivision of the region. The north and west consist of moorland and dales. Next is the coalfield. The plateau of East Durham and the valley of the Tees constitute the other two subdivisions. The region covers the counties of Northumberland and Durham. The climatic differences of the separate parts are too small to require detail. For the region as a whole, the mean January and July temperatures are about 37⁰ F. and 59⁰ F. respectively. Rainfall varies from about 25 inches on the coast to 40 inches or more on the hills.

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The whole region contains about 2,250,000 people. Of these less than a tenth live in the area of moorland and dales, although they form more than half the total area. There the only possible farming is sheep-rearing, with the grazing of some cattle in the dales, and a few crops of oats and potatoes grown in sheltered spots. The moors are used solely for sheep-grazing and grouse-shooting. The only

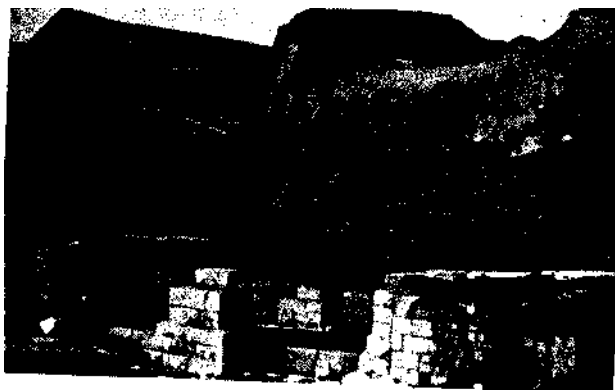


FIG. 113. AN ARTIST'S VIEW OF THE ROMAN WALL WHICH PROTECTED THE TYNE GAP, BETWEEN NEWCASTLE AND CARLISLE

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other occupation is the quarrying of limestone in considerable quantity for the iron furnaces of the coalfield, and of basalt for building and road-metal. The only towns of importance are Berwick (12,000) and Alnwick (7000). Both are of great historic interest. Berwick continually changed hands in the Border warfare, but has remained an English town since the fifteenth century. It is not only an important bridge town on the route into Scotland, but is also the outlet of the valley of the Tweed. Alnwick possesses the famous castle of the Duke of Northumberland and the ruin of a twelfth-century abbey.

NORTH-EASTERN ENGLAND

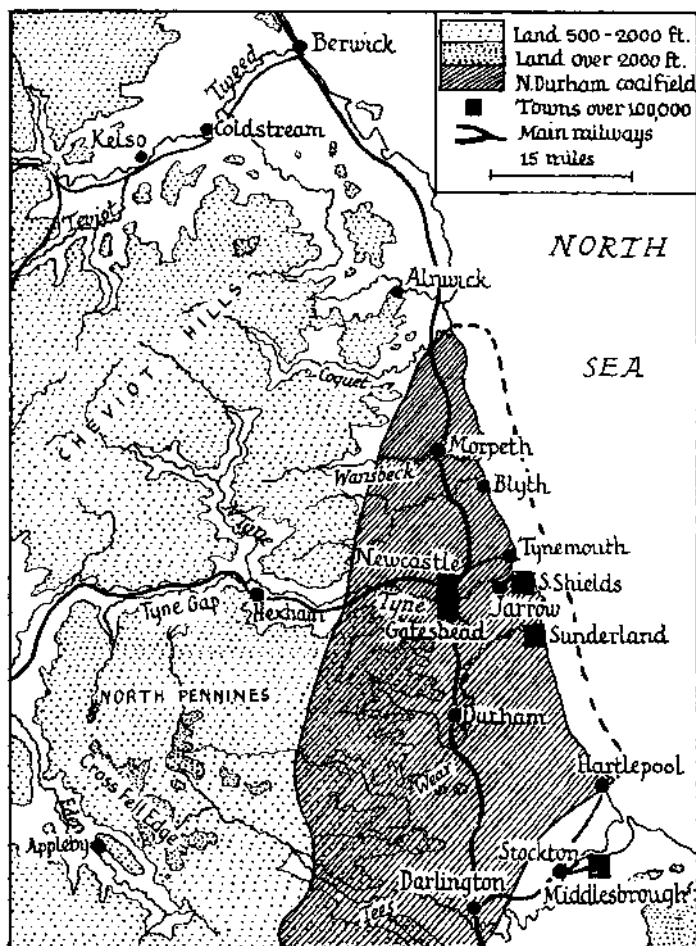


FIG. 114. NORTH-EASTERN ENGLAND

The region of the coalfield, which embraces the lower valleys of the Tyne, the Wear, and the Wansbeck, has a broken relief and many fertile valleys. Cultivation is

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dominated by the demands of the towns for dairy-produce, potatoes, and other vegetables. Most of the land is used for pasture and hay crops, but oats are also grown in good quantity.

The coalfield borders the coast from the mouth of the river Coquet to Hartlepool, a distance of 50 miles, and extends from Tyneside to the south-west about a similar distance. No part of it is more than 25 miles from a seaport, and the average distance from pit to port is only 10 miles.

The advantage of this has been noted with other aspects of the coalfield on p. 126. The mineral wealth, combined with fertile agricultural land, explains why this area, though only a quarter of the whole, contains three-quarters of the population. Nearly a million of these live round the estuary of the Tyne. All the large towns, with the exception of Darlington (72,000), are on or near the coast. For it is easier to convey the coal to the coast for manufactures or export than to take raw materials inland. Nevertheless population is fairly dense over the whole coalfield, owing to the necessity of the miners living near the pits. The numerous towns and villages are therefore arranged rather haphazard, and the housing conditions are far from good, being crowded and subject to subsidence on the worked areas. Railway communication is plentifully supplied to all parts of the coalfield.

Tyneside. The Tyne is navigable for fourteen miles from the sea. Throughout this length the lowlands are filled with industrial establishments, furnaces, shipyards, wharves, and docks. The residential and business centres occupy the higher ground of the U-shaped valley. The important towns are Tynemouth, North and South Shields, at the mouth of the estuary, and Newcastle and Gateshead, near the head of it. The focus of this dense population is Newcastle (283,000), the capital of the whole region. This city is about ten miles from the sea. The great bridge across the Tyne was placed there

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because the valley narrows at this point, where also the way from the south approaches by a natural route. So that Newcastle is built at the crossing of the north-south route with that to the west *via* the Tyne Gap. Newcastle is the chief passenger port to Norway

Shipbuilding is the principal industry of Tyneside. Material is obtained not only from the local iron- and



FIG. 115. THE TYNE
By permission of the L.N.E.K.

steel-works,* but from the Tees area as well. The ships range from the largest liners and warships to coastal vessels and colliers. The tonnage constructed amounts to nearly half the total for the whole country; only the Clyde area exceeds the Tyne in output. The industry of shipbuilding extends to each of the main estuaries. The Tyne, the Wear, the Tees, and the Hartlepoons share the total output of the north-east region, in the approximate proportions of 6 : 4 : 2 : 1. The engineering industries, which began with machinery for mining, transporting, and shipping coal, now include marine engines, locomotives, and railway and tramway equipment. They deal also with non-ferrous metals, such as lead, tin, and copper, particularly for making brass

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and ship-fittings. Other industries include the making of chemicals and glass. There are also great flour-mills and food factories.

The Tyne and other north-east ports rival Cardiff in the export of coal. Most of this export goes to the Baltic, Northern Europe, and Mediterranean countries. The value of the exported coal amounts to half that of the total exports. Ships, machinery, and chemicals come next in order; while the imports are chiefly raw materials—ores and timber, petroleum and grain.

Gateshead (122,000), opposite Newcastle, on the south bank of the Tyne, which in this part is a county boundary, has similar industries. South Shields (113,000) and Wallsend (45,000) are coal-exporting ports, and Tyne-mouth (65,000) and Jarrow (32,000) have shipbuilding and chemical industries. North of Tyneside the chief coal port is Blyth (32,000), which owes its importance to the railway companies. The hard steam coal and pulverized coal of this pit are of great value to shipping. To the south of the Tyne Sunderland (186,000), at the mouth of the Wear, is the largest of the ports between the Tyne and the Tees. The rocky channel of its estuary permits only moderate-sized vessels to enter. The coal which is exported comes from a small but important part of the coalfield. Timber is the chief import. Cargo-vessels and marine engines are built. Sunderland is only fifteen miles south of the Tyne, and really belongs to Tyneside. Glass, which is made by fusing pure sand with sodium carbonate and limestone, is another manufacture of Tyneside.

The area extending to the south-west of the coast between Sunderland and Hartlepool is a plateau composed of Magnesian Limestone. It is exposed and bleak, and the soils are poor, so that little agriculture is possible. Most of the land is permanent grassland, and population is scanty. But the coalfield underlies the surface rocks, and is worked in the north-eastern part of the plateau. Seaham Harbour (19,000) exports the coal. The city of

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Durham (16,000) is built on a high cliff, round which the Wear has cut its valley between the eastern plateau and the Pennine moorlands. This site made Durham so strong a fortress that it was never captured, although it was then a wealthy city and of supreme importance. The position proved a hindrance to development when Border peace came to be firmly established. But it retains import-



FIG. 116. THE TEES
By permission of the L.N.E.K.

ance as a centre of learning and as the seat of the Bishop of Durham. Bishop Auckland (12,000) is a mining centre south-west of Durham. Although the coal produced in this area is very good for coke-making, it is fast being worked out.

Tees-side. The low fertile plain of the Tees is the last area of this region to consider. The Tees is a county boundary between Durham and Yorkshire, but the area partakes of both the agricultural activities of the Vale of York, through the Northallerton Gate, and of the industries of Tyneside. The former interest focuses upon the important market towns of Darlington and Stockton, and the industrial interest upon Middlesbrough and the Hartlepools. In this connexion it is interesting to recall

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that the first railway was constructed between Stockton and Darlington in 1825, and Stephenson's No. 1 Engine is exhibited in Darlington Station. Darlington (72,000) is still an important railway centre, with railway- and engineering-works. Stockton (68,000) and West Hartlepool (68,000) are both shipbuilding centres, exporting



FIG. 117. THE TEES BRIDGE AT MIDDLESBROUGH

The only bridge of its kind in Europe. The central span is lifted by the pulleys horizontally when ships are to pass under it.

Photo Central Press

coal and Magnesian Limestone and importing iron and steel. These towns, together with Middlesbrough (138,000) and their holiday resorts Redcar and Saltburn, have a population of a quarter of a million, whose occupations are intimately connected with those of Tyneside, as mentioned above.

Middlesbrough is a most important iron and steel centre. The steel for the famous bridges across Sydney Harbour, the Nile Bridge at Khartoum, and the Tyne Bridge at Newcastle, as well as that of the casings for the

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London Underground Railway, was made on Tecs-side. For each ton of pig-iron produced two and a half tons of ore are used, together with about three tons of coal (to produce the necessary amount of coke), and half a ton of limestone. Middlesbrough is within twenty miles of suitable coal; limestone is obtained from Teesdale, a similar distance away; while the ore of the Cleveland Hills lies within ten miles or less. So that the cost of transporting these bulky materials is at a minimum, and Tyneside constitutes a near market for this steel output, which amounts to a fifth of that for the whole country. Besides steel castings, wire ropes, corrugated-iron goods, and so on, there is an important chemical industry centred at Billingham, on the north bank of the river. This is based on the salt and gypsum obtainable by solution and by mining respectively of the lower layers of Triassic rocks which provide the floor of the valley, but rock phosphate from South Africa is also imported. The important new factory for obtaining petrol from coal has already been mentioned (sec p. 119).

The Hartlepoons and North Shields are the two chief fishing ports of this coast.

The main communications are clear and easily traced. The railway from York passes through Darlington, Durham, Gateshead, Newcastle, Morpeth, converging towards the coast, and following closely to it into Berwick. Two cross-country railways may be noted:

1. Newcastle, Hexham and the south Tyne valley, Halt-whistle, and Brampton, to Carlisle.
2. Darlington, through Barnard Castle, Bowes, and Kirkby Stephen, to Tebay Junction, in the Lune valley, and then northward, through Shap, to Penrith. This route is also partly followed by a branch of the Great North Road, which, however, keeps north of Kirkby Stephen, through Appleby, to Penrith.

CHAPTER XXI

THE CUMBRIAN REGION

THE natural boundaries of the region are perfectly clear -- viz., the escarpment of the Pennines, in the east, Solway Firth, in the north, and Morccambe Bay, in the south. A description of the physical basis of the region has been given on pp. 46-47, and of the coalfield on p. 126. It remains to trace their effect upon human activities. Routes focus upon Carlisle from the north and upon Appleby from the south-east, using the valley of the river Greta, a tributary of the Tees. The Tync Gap gives access from the east. The region covers the counties of Cumberland and Westmorland, and may be divided into the central mountainous area, the Carlisle plain, the Eden valley, and the southern coastal area.

As to climate, the region, being in the west of England and near the path frequently followed by cyclones, is subject to much cloud and heavy rain, which roughly increases with altitude. But valleys intervening between high mountain-ridges frequently share the heavy rain, amounting in places to over 100 inches in the year. Along the coast the normal rainfall is about 40 inches. The sheltered Carlisle plain and the Eden valley have only about 33 inches. Temperatures also vary with altitude, but on the whole the mean annual temperature is as high as 48° F. Typical mean temperatures for January and July are as follows—Carlisle 38°-60° F., Keswick 40°-59° F., Appleby 37°-58° F.

In such a region agriculture must of necessity be very restricted. The mountainous area is deeply cut by valleys, the floors of which are often only a few hundred feet above sea-level. But the soil is too rain-washed and

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the sunshine too limited for crops to be grown successfully, except in small favoured areas. But on the Carlisle plain, where alluvial soils have been deposited, and in the Eden valley, with rich red soils, the climatic conditions favour

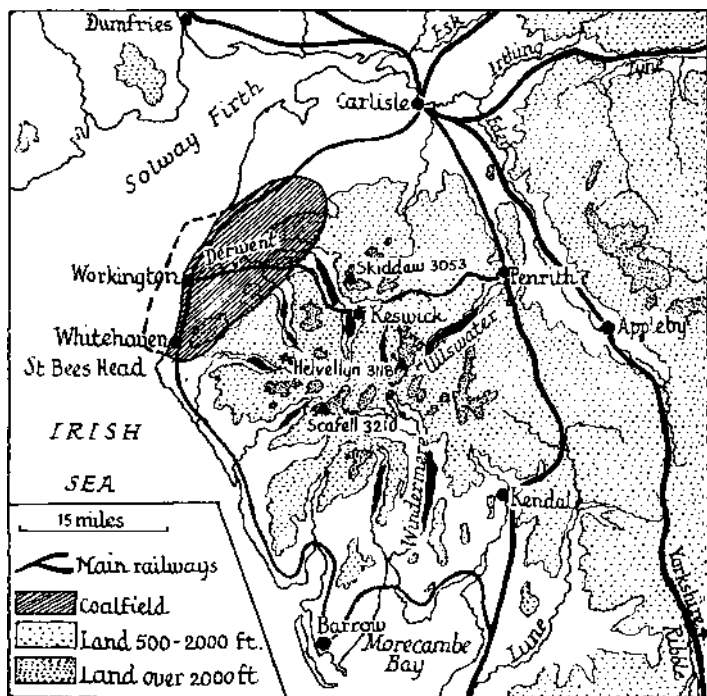


FIG. 118. THE LAKK DISTRICT: CUMBRIA

some mixed farming, with considerable acreages used for oats, root crops, and potatoes. Except in certain areas, however, only about a third of these lowlands is arable land, the rest being permanent or hay pastures, used for raising and fattening stock. Stock-raising is also the mainstay of the mountainous area. Sheep do well on the rough but well-drained mountain-pastures. And in

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the mountain valleys the mild, humid conditions are thoroughly suited for grass, and cattle can thrive throughout the year.

The predominance of sheep pasture from early times gave rise to a domestic woollen industry; but the main industry of the region naturally concerns the mining and marketing of the coal on the western seaboard. Much of the coal is used in the local blast-furnaces at Workington (25,000); some is sent to Belfast, and some to Barrow. The coal was formerly not considered good for coke-making, and coke was obtained from the Durham area; but with improved methods the coal can now be used for this purpose. Haematite iron ore occurs with mountain limestone to the south-east of Whitehaven (21,000), a coal-mining town, but Workington now imports Spanish and manganese ores. The iron-works are close to the coast, so that the pig-iron can easily be shipped to Belfast, Scotland, or abroad, or sent by rail to Sheffield. Southward, in the Furness peninsula, there is another area of available iron ore. Barrow-in-Furness, which in the middle of the last century was only a small fishing village, has become the largest town in the whole region, with a present population of 66,000. This is the more remarkable seeing that there was no coal and no natural harbour. Its artificial harbour is protected from the west winds by Walney Island. Barrow is one of the five chief shipbuilding centres in Great Britain. In the valley of the river Kent, on which Kendal stands, there are some paper-mills.

The next largest town after Barrow is Carlisle (57,000), which is built at the confluence of two rivers on a high site facing northward. This historic city has made good use of its command of routes. Traffic from the north by Nithsdale, Annandale, and Liddisdale must all pass through Carlisle. So also must east-west traffic between the Tyne Gap and Workington; while from the south the routes through Penrith and the Eden valley meet at Carlisle. This through traffic explains the need for the

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numerous hotels and garages; and engineering is important for the same reason. Other industries include the making of biscuits, woollen goods, and other textiles. Another town which has gained greatly from its position is Kendal (16,000). The west-coast route from Lancaster, through Shap, to Penrith and Carlisle goes through



FIG. 119. THIRLMERE

By permission of the L.M.S.R.

Kendal, which also has a railway to Lake Windermere. Kendal green cloth is a famous product of its woollen manufacture; boots, shoes, and paper are also made there.

In various parts of the Lake District there are important quarries. Some of them, as in Borrowdale, work slates of attractive colour, though rather heavy; others prepare monumental stone or road-metal.

Another valuable purpose served by the mountainous area is that of supplying water to large cities. Lake

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Thirlmerc is one of Manchester's main reservoirs. Considerable schemes of afforestation are being carried out by the Government on the mountain-slopes. But perhaps the most precious value of all attaches to its inspiring scenery and the great expanse of fells, which bring health and happiness to so many walkers and climbers. Associated with the tourist interest in the Lake District are several centres, such as Keswick, Ambleside, and Bowness, on Lake Windermere, which, though small, are expanding.

CHAPTER XXII

THE LANCASTRIAN REGION

THE greater part of this region is lowland, extending from the narrow Morecambe plain, in the north, to the broad Cheshire plain, between the Welsh uplands and the Pennines. But it includes also the western flanks of the Pennines south of the Aire Gap, and the two upland spurs of the Pennines known as Bowland Forest and Rosscndale Forest. The river systems of the Lune, Ribble, and Mersey are important features. The copious supply of soft water is essential to the region, and the upper valleys form valuable routes. The region embraces the counties of Lancashire proper, Cheshire, and that part of Yorkshire which extends over Bowland Forest.

The soils of the plain are very varied and chiefly of glacial origin. In North Cheshire and West Lancashire rich loams prevail, but in the Dee valley and farther north heavier clays occur. Between Liverpool and Preston sandy soils cover the underlying clay. In other parts are found morainic gravels, and soils deposited by rivers or winds. On the uplands the soils are mainly derived from the underlying grits and limestones. The upland soils, as well as the sandy soils of the plain, favour the accumulation of peat. These areas retain moisture like a sponge, and are known as 'mosses.' When drained they form rich agricultural land.

The climate of the region is of great importance for agriculture and the cotton industry, although suitable atmospheric conditions can now be produced artificially in the factories if required. Temperatures on the average range from about 40° F. in winter to 60° F. in summer. Thus, the conditions are normally mild throughout the

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year. Combined with this equable temperature there is adequate rainfall, distributed evenly throughout the year. The amount increases from about 26 inches in the south-west, which is sheltered by the Welsh uplands, to about 50 inches or more in the neighbourhood of Rossendale Forest. In the northern part of the region there is also a steady increase in rainfall from the coast to the flanks of the Pennines.

Although human activities centre upon the manufacturing industries, agriculture remains important. The fertile soils and the mild, moist climate are favourable to agriculture. The large population in the manufacturing areas, and the fertilizers which can be obtained cheaply from the chemical industry in the south-west, stimulate intensive cultivation. In North Cheshire and West and South-west Lancashire arable land much exceeds permanent pasture. By far the most important crops are oats and potatoes, which are usually grown in rotation with clover and grass. Wheat-crops occupy only about a fifth of the area devoted to oats. Potatoes do particularly well on the peaty soils, and the sandy soils of Cheshire suit early potatoes. The cultivation of vegetables, and market-gardening generally, flourish in the Mersey valley, particularly on the drained mosses and in the neighbourhood of Liverpool, Chester, and other towns. In the Wirral peninsula and on the mixed soils of the south-east arable land and permanent grassland are of equal importance; but in South Cheshire and the Dee valley almost all the land is used for permanent pasture.

Both Lancashire and Cheshire rear nearly as many cattle as the pastoral county of Somerset. The majority are dairy cows, and these are found on nearly every farm. Cheshire has, of course, always been famous for its cheese. But the well-watered slopes of Bowland, where arable farming is difficult, also support large numbers of cattle, bred both for milk and for beef. Skipton, Settle, and Preston have important cattle markets. As to sheep,

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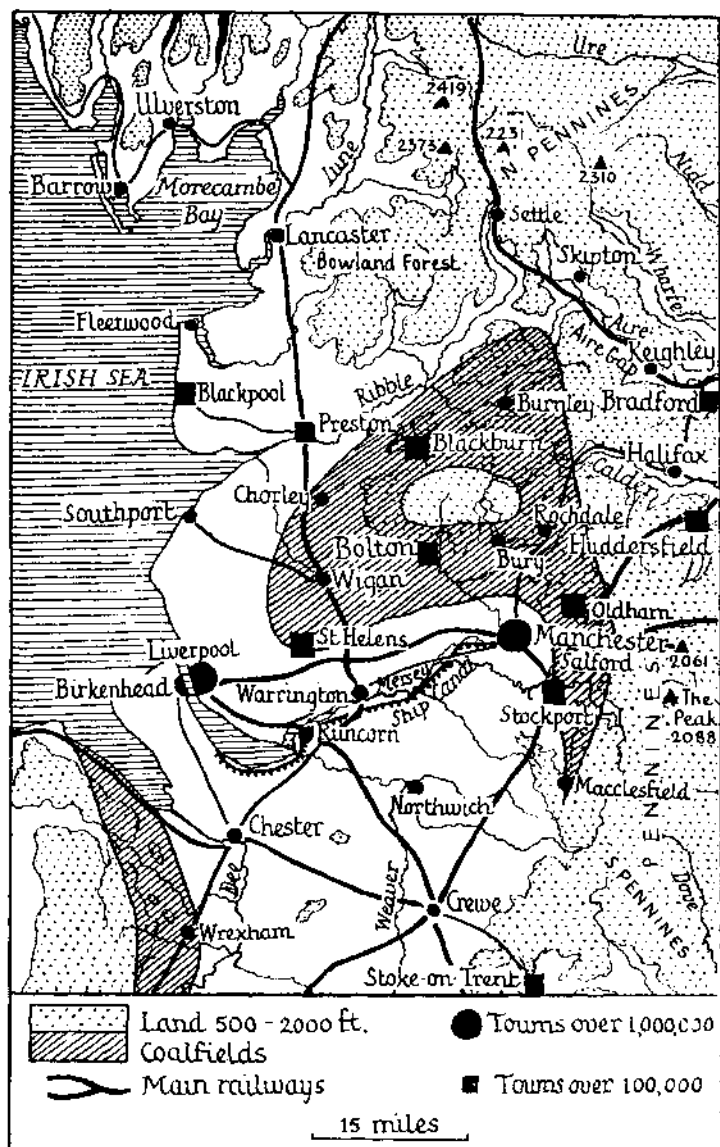


FIG. 120. LANCASTRIA

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Lancashire has nearly four times as many as Cheshire. The rougher grasslands on Bowland and the Pennines provide pasture for the sheep throughout the year, except when snow falls. Pigs and poultry are found in the largest numbers in the Fylde (Field) district of Lancashire, between Bowland and the seacoast. There are more fowls in Lancashire than in any other county of Great Britain.

Before considering the cotton industry, which is always associated with Lancashire as a whole, it is convenient to subdivide the region, if only to show how much the industry depends upon coal and water, and is therefore concentrated in East Lancashire. We may take as our subdivisions: (a) the Lune valley and the Fylde; (b) the Ribble basin; (c) South-east Lancashire and North-east Cheshire; (d) West Lancashire and North-west Cheshire.

The Lune Valley and the Fylde. The importance of the lower Lune valley lies chiefly in its control of north-south communications. This was recognized in Roman times by the establishment of a military station on the site of the present town of Lancaster. To-day the west-coast route to Scotland, after passing through Preston and Lancaster, follows the coast for a few miles to the north, and then climbs 1000 feet to Shap, on the ridge between Cumbria and the Pennines. An alternative route uses the Lune valley, and then crosses the ridge to the head of the Eden valley. Lancaster (43,000) specializes in the manufacture of linoleum and oilcloth, using jute and other fibres. Small ships can reach the town, which is ten miles from the sea. The other important towns in this area are Fleetwood (23,000), the best-equipped fishing port on the west coast, and Blackpool (102,000), the well-known seaside resort.

The Ribble Basin. The Ribble first flows southward through a steep-sided valley, collecting many tributaries, but near the head of the Aire valley it turns south-westward, and its valley widens as it approaches the sea.

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It collects also important tributaries from Bowland and Rossendale Forests, notably the Caldcr (not to be confused with the Calder tributary of the Yorkshire Ousc). The Caldcr and Colne valleys form an important route leading to the Aire valley. Along this route on the northern flank of Rossendale are situated Blackburn, Accrington, Burnley, Nelson, and other towns which specialize in weaving, though there is also some spinning. Four-fifths of the looms of Lancashire are to be found in these towns. Blackburn (123,000) has no equal as a weaving centre. Its factories cater chiefly for the trade in cheap cloths for India and China. But textile machinery and paper are also made, the latter from esparto grass and wood-pulp imported through Preston. Burnley (98,000) rivals Blackburn in the weaving of cotton goods of good quality at low cost. Accrington (43,000) also makes and prints cloths and light cotton goods. Preston (119,000), the administrative centre of the county, has a many-sided importance, due to its position no less than to its industries. Situated at the head of the Ribble estuary, it stands on the west-coast route coming from Crewe to Lancaster. From the east the Ribble valley collects the cross-Pennine routes by the Aire and Calder valleys. Preston is therefore not only a port for cargo-ships, but a great market centre for livestock and agricultural produce. Spinning is no less important here than weaving, and Preston produces fabrics of the highest quality in cotton and artificial silk. Engineering in many forms is also carried on.

South-east Lancashire and North-east Cheshire. The rest of the cotton industry is mainly concentrated in South-east Lancashire, though it extends into the adjoining counties. The extent of the coalfield is explained on pp. 130-131, and the main factors controlling the cotton industry on pp. 149-150. In the towns which lie to the north and east of Manchester in the form of a great horseshoe are to be found four-fifths of the spindles of the industry. Bolton (177,000) handles particularly the finer

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Egyptian cotton, carries out the bleaching, dyeing, and printing of cotton fabrics, and makes textile machinery. Oldham (140,000) also has an engineering industry, and specializes more in American cottons. Rochdale (90,000)



FIG. 121. COTTON-SPINNING IN A SALFORD MILL
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and Wigan (85,000), besides the various cotton industries, make asbestos articles. Wigan is also the chief coal-mining centre, and manufactures machinery, as well as cotton and linen articles. In general, it may be said that the raw cotton, after being brought from the Liverpool or Manchester docks, goes through a number of wonderful processes, passing from factory to factory. When finished

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the articles are usually dispatched to Manchester warehouses, ready for packing and distribution to markets at home and overseas. Manchester and Salford, though separate cities, form one great centre, with a joint population approaching a million. Manchester is thus the organizing and financial centre of the industry. Manchester rivals Hull for the fourth place among British ports. Egyptian cotton and petroleum are its largest imports, which include goods of all kinds. It exports not only cotton goods, but the iron and steel products of Yorkshire and the Midlands and other manufactured articles. The Manchester area is one of the world's greatest engineering districts, producing not only every kind of textile machine, but particularly electrical machinery. In fact, machines for every conceivable purpose can be procured from the host of great engineering firms to be found there. Other important industries of Manchester deal with chemicals, glass, chinaware, rubber, and foods. Transport in itself is a great industry. And the great highway connecting Manchester to Liverpool is the most recent evidence of its importance. Most of the towns referred to are situated on the banks of rivers flowing from the Pennines or Rosscendale. Manchester stands at the confluence of three such river valleys, and is thus a gateway to West Lancashire.

The cotton industry extends beyond the county boundary to Stockport, Hyde, Stalybridge, Macclesfield, and Congleton, in Cheshire; to Leek, in Staffordshire; and to Glossop and other towns, in North-west Derbyshire.

West Lancashire and North-west Cheshire. West of Stockport is the basin of the river Weaver, under which lie the Cheshire salt deposits. Common salt forms the basis of the alkali industry, and this area is one of the greatest chemical-manufacturing regions in the world. A great company called Imperial Chemical Industries, Ltd., now controls the various chemical works at St Helens (107,000), Widnes, Runcorn, Northwich, and

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elsewhere. These places are well served by canals, and are close to coalfields, to the ports, and to a great industrial market. The chemicals are of great value to the (otton trade for bleaching and dyeing; for soap-making carried on at Warrington, Widnes, and near Liverpool; for glass-making at St Helens, the greatest glass-producing town in Britain; for tanning leather, as at Runcorn; and for the paper industry. Paper-making is one of the important industries of Lancashire. The abundance of pure soft water, nearness to the port for raw materials, to the chemical-works and supplies of power and heat, are all favourable to this manufacture. Cotton goods have to be carefully packed to satisfy the varying demands of foreign countries, and there is a big demand for paper throughout the cotton industry. Bury, Bolton, and Darwcn arc important centres of this trade, and paper is made at many other places round Rossendale and along the Pennine valleys.

Warrington (79,000), on the right bank of the Mersey, almost equidistant from Liverpool and Manchester, is the lowest bridge town of the Mersey, and therefore a great route centre.

The Manchester Ship Canal is 35^ miles long, and has a minimum depth of 28 feet and a minimum width of 120 feet. Large cargo-vessels can therefore use the quays along its banks. There may soon be a continuous series of such quays, at which goods can be collected or unloaded for the busy industrial area around. Manchester and Liverpool arc not, therefore, competing ports, but rather the one is the complement of the other.

Liverpool and Mrcrscyside constitute the natural focus of West Lancashire. The waterway had the initial advantage of facing America, for long the only source for the supply of raw cotton. The sandbanks which at first hindered navigation have been dredged to admit the largest ships. The difficulty of transport across the marshy plain was overcome by the construction of the

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Ship Canal and good roads. Other canals link Liverpool to Leeds, to the Potteries, and to Birmingham (see Fig. 52). The marshes flanking the estuary facilitated the construc-

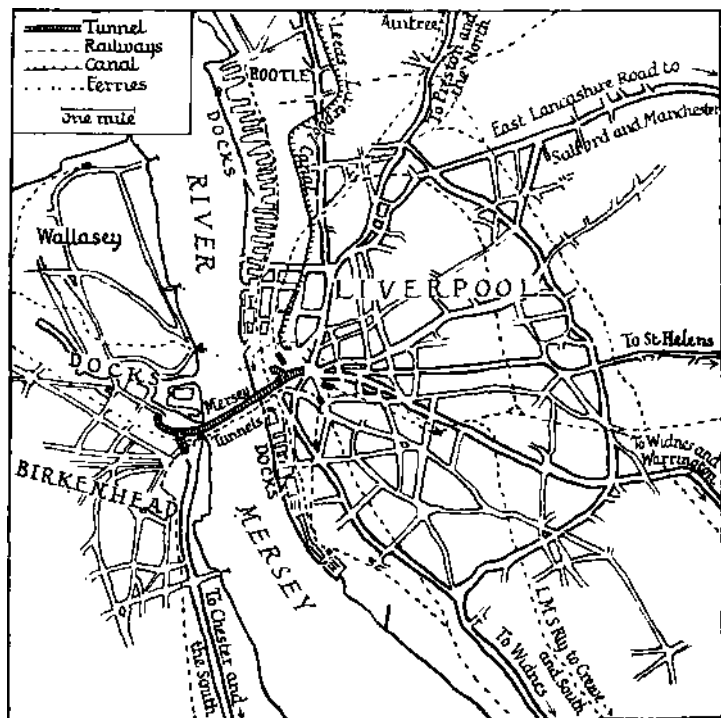


FIG. 122. DIACRAM MAP OF THE MERSEY TUNNEL

'The new Mersey Tunnel provides a through route from the South to the North clear of the congested area of Lancashire, and, by means of the new East Lancashire Road, a similar route between Birkenhead and Manchester. The tunnel makes the docks on both sides of the Mersey easily accessible to all tons of road transport. Over four thousand vehicles can pass through it in one hour, for the journey takes only 15 minutes and a half.

tion of docks and warehouses, which now entirely monopolize the waterside. Factories have to find inland sites, so that most of the transport between ship and factory is done not by lighters, as at London, but almost entirely by road

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and railway. The need of linking the industries established on opposite sides of the estuary, and at the same time of reducing the hindrance to navigation caused by numerous ferries, accounts for the construction of the great tunnel under the Mersey.

Liverpool (856,000) now has every facility for utilizing raw materials and assembling and marketing articles of all kinds. Shipbuilding and repairing, all kinds of engineering, milling, sugar-refining, and the manufacture of margarine, soap, tobacco, artificial silk, and chemicals are the chief of many industries. Liverpool is therefore much more than the greatest market for raw cotton and the port for Lancashire. It shares with London more than half the total value of trade with foreign countries, and even excels London in the export trade, while it rivals Southampton as a passenger port. Birkenhead (148,000) is now virtually part of Liverpool, and shares the industries mentioned above. Bootle (77,000) has a very important tin-smelting industry. Farther north on the coast stands Southport (79,000), a popular residential town and holiday resort.

The Dee estuary is badly silted, and the proximity of Liverpool renders unnecessary the development of a port. But the nearness of coal and other minerals encourages industrial activity along its shores. The importance of the site of Chester as controlling the routes round the head of the estuary was recognized in Roman times. Chester (41,000), the county and market town, is an important railway-junction, with small industries in engineering, smelting of lead and iron, artificial silk, and flour-milling.

The Isle of Man, situated half-way between England and Ireland, has a similar geological structure to North Wales. It is 33 miles long and 12 miles broad, and contains nearly 50,000 inhabitants. Though mountainous, with Snaefell (2034 feet) the highest point, much of the land is cultivated, oats being the chief crop. Sheep-breeding, fishing, and slate-quarrying are the main

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industries. The island is a great holiday resort. Douglas is the capital and chief port. The other towns are Castletown, Ramsey, and Peel.

The textile industries of Lancashire and Yorkshire are closely connected, and each invades the province of the other. We must note, therefore, the main means of communication between the two areas:

- i. The L.M.S. line—Manchester, Stalybridge, Huddersfield, Leeds. This route is also followed by the Huddersfield Canal, which, however, is not so much used now as the great new road, which crosses the moorland.
2. The Rochdale Canal, which by means of locks and tunnels crosses the Pennines at a height of 600 feet to Halifax. This route is also closely followed by the L.M.S. Railway and by a great main road.
3. The route taken by the Liverpool-Leeds Canal through Nelson, Skipton, and the Aire valley. The railway follows a similar route, but the modern road cuts off the bend to the north by crossing the moors from Colnc to Cross Hill.
4. The L.M.S. route from Manchester to Sheffield, which entails two long tunnels, owing to the utilization of the Derwent valley (Cowburn Tunnel, 2 miles, and Totley Tunnel, 3½ miles).
5. The L.N.E.R. route from Manchester to Sheffield by the Mersey and Don valleys (Woodhead Tunnel, 3 miles).

CHAPTER XXIII

WALES

THIS hill-country, so clearly defined by its 400 miles of scacoast on the north, west, and south, stands like a huge rampart on the west of the English plain. As we have seen (p. 31), its mass no doubt affected the lines of folding of the hills of England. The high relief has also helped the Welsh people to preserve in their language, their literature, and their characteristics a type of culture quite their own. Although the country was much more easily conquered than Scotland or Ireland, the people have retained their national pride. The mountain-blocks which we noted in considering the structure of the country (sec pp. 49-53) prevented effective union of the Welsh princes to resist invasion. And the valleys which separate the hill masses provided natural gateways to the invader. But even so many parts remain remote to-day, and thus customs and habits of thought which had their origin in the earliest times of human settlement have been passed on from one generation to the next. In this chapter it is the valleys rather than the mountains which will occupy our attention.

Rivers. The main mountain masses all attain similar heights, which suggests that the present relief is the result of the cutting of river valleys along lines of weak rock-structure in a former plateau. It is certain that the existing river system of Wales is the result of many changes during countless years. There is no doubt that the head-streams of some rivers have been captured by others, and some have probably even been recaptured. Many of the existing river valleys emphasize the structural lines. Thus, the upper Dee and Severn flow north-eastward; the

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Dovey and other streams near it flow south-westward—that is, in the direction followed by the rift valley of Menai Strait, by the Snowdon massif, and by the Lleyn peninsula. But in the south the upper Usk valley runs west to east, in conformity with this trend of the mountain-ranges. The Wye, which rises close to the Severn in



FIG. 123. IN THE HEART OF WALES: A MERIONETHSHIRE VALLEY

The absence of spurs and the U-shaped valley are evidence of glacial erosion. Note the sheep-dogs quietly following the flock which they have rounded up on the mountain-slopes.

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Plynlimmon, flows first south-east, then to the north-east, before turning east, and finally south, through its gorge in the Forest of Dean, to the Severn estuary.

The main watershed runs from Snowdonia roughly parallel to the coast, which it joins near Cardigan. The Dee, Clwyd, and Conway flow to the Irish Sea, the Ogwen and other streams into Menai Strait. The Severn, Wye, and Usk drain eastward, and then southward to

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the Bristol Channel. The rivers which drain the South Wales Coalfield are mainly consequents. The Ebbw, Taff, Neath, and Tawe have deep, straight valleys, parts of

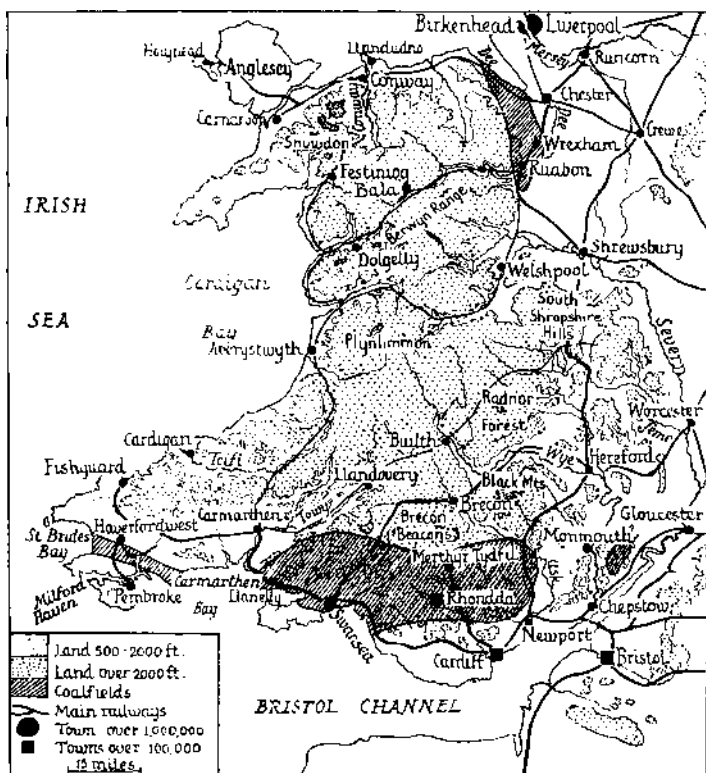


FIG. 124. WALES

which are old fault-lines. West of the Gower peninsula there are the Towy and other streams, draining southward to Carmarthen Bay and Milford Haven. The rivers draining westward to the coast of Cardigan Bay are short and swift. The Dovey and streams north of it flow in a

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south-westerly direction. South of the Dovey estuary the main river valleys run straight to the coast from the plateau. But the upper tributaries tend to follow the line of the watershed, roughly in a north-south direction. The Rheidol has a particularly steep-sided gorge near Devil's Bridge, which has clearly been cut along the bottom of an older valley which had gently sloping sides. It is thought that the gorge is due to the Rheidol gaining considerable volume of water when its upper course cut itself back and captured the head-waters of the Tcifi. The Ystwyth converges near the Rheidol at Aberystwyth. The present Tcifi flows parallel to the watershed, and enters the sea at Cardigan.

Routes. It will be noted that although the Dee, Severn, and Wye offer promising gateways into Wales none of them affords an easy through route. Neither do their valleys lead to any centre which can become a focus for the whole country. Instead they radiate and tend to isolate the parts of Wales from one another. There is no undisputed Welsh capital. The most convenient meeting-place for Wales as a whole is Shrewsbury, in England, which is well served by railways and roads.

From Southern England railway routes to Wales focus upon Newport, *via* the Severn Tunnel. The G.W. main line avoids Bristol, keeping to the north before descending into the tunnel, over four miles long. Between Newport and Llanelly the route runs through a highly industrialized area of coal-mines and iron-works. But the remainder of the route to Fishguard lies through attractive farming country. Fishguard, the port for Ireland, is 261 miles from London. Similarly, the other main routes focus upon Chester, in the north. The L.M.S. line from London and Crewe runs along the north coast often close to the shore, and sends off branches inland at various points. South of Bangor it crosses the tubular Menai Bridge to Anglesey and Holyhead Island, on which is situated the port for Dublin. The G.W. route from Chester runs

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southward to Ruabon, and then ascends the valley of the Dee. At the entrance to this vale two roads, the railway, and canal are crowded close together. Near this spot are two aqueducts built by the famous engineer Telford over a century ago. The canal is carried in a trough of iron for 1000 feet across the river at a height of 121 feet. The railway viaduct, opened in 1848, is similarly imposing.



FIG. 125. FISHGUARD

The line proceeds from Llangollen up the Vale to Corwen and Bala, and then diverges to Dolgelly and Barmouth, or to Festiniog.

Routes from Birmingham and the Midlands focus upon Shrewsbury, which is also well served by fast trains from Lancashire and the north. The distance to Aberystwyth is about eighty miles, and the route runs up the Severn valley, through Welshpool, Montgomery, and Newtown. It then crosses a pass to the Dovey valley, and descends sharply, through Machynlleth, and so along the coastal plain to Aberystwyth. Tourists cross mid-Wales also from Shrewsbury to such centres as Llandrindod Wells and Llandovery, on the way to Carmarthen. Hereford is another gateway. The railway runs up the Wye valley,

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through Hay, and then either across into the Usk valley for Brecon and Swansea, or, continuing up the Wye valley, proceeds through Builth, Rhayader, Llanidloes, to Newtown, thus linking with the line to Aberystwyth. All these routes are linked up as they enter England by the railway which runs north from Newport, through Abergavenny, Hereford, Ludlow, Shrewsbury, Chester, or Crewe.



FIG. 126. THE GREEN BRIDGE OF WALES

A natural arch of rock near Warren, on the coast of Pembrokeshire. Contrast this coast with that seen in the next photograph.

The main roads naturally use the same gateway towns, but can negotiate more difficult gradients, and so take more direct ways from one valley to another. The north-coast road closely follows the line of the railway. The road from Shrewsbury to Holyhead goes first to Llangollen, up the Vale to Corwen, and then across to Bettws-y-Coed, Capel Curig, and through the mountain-passes to Bangor and Holyhead. The road from Oxford and Worcester to Aberystwyth keeps north of Hereford, through Leominster, Kingston, and Rhayader, whence it follows the upper Wye valley, skirting the base of Plynlimmon before descending sharply to the coast.

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Gloucester is the focus of roads crossing the Severn to South Wales. The main road proceeds first to Ross, in the Wye valley, which it follows to Monmouth, and then forks to the south through Usk, Newport, and Cardiff, or to Abergavenny. There the road forks again, one branch turning to the south-west for Merthyr Tydfil, Neath, and Swansea; the other follows the Usk valley westward through Brecon into the Towy valley at Llandovery. This road first follows the Towy valley, through Llandilo, to Carmarthen, and then proceeds westward to Haverfordwest, where it turns northward to Fishguard.

The climate of Wales is what one would expect in a country situated near the west coast and with so large a land mass rising steeply near the sea. Rainfall, distributed throughout the year, but with a maximum in autumn, amounts to 40 inches or less on the low island of Anglesey, the south-west peninsula, and the plain of Gwent. Places along the west coast get between 40 and 50 inches, but inland the whole mountainous area gets over 60 inches, and this rises to 100, or even 150, inches in some of the highest parts. The driest parts are in the north-east—in the Vale of Clwyd and on Deeside, where the protection of the mountains on the west reduces the rainfall to 30 inches or less. The mean temperatures along the west coast range from about 42° F. in January to about 59° F. in July. The summer temperatures on the north coast are similar to those on the west, but the north coast is a little colder in winter. On the south coast the mean January temperature at Cardiff is on the average 4° F. lower than that at Pembroke, but there is not much difference between their summer temperatures, the mean being about 61 °F. In the interior the actual temperatures are much affected by altitude and aspect.

Nor is it surprising in these conditions that agriculture should be limited in its scope and to favoured areas. No less than a third of the total area of Wales (including

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Monmouth) provides only rough grazing in mountainous country. Of the cultivated area 77 per cent, is under permanent grass. Less than an eighth of the total area of the country consists of arable land. In England the proportion of arable land is a quarter—just twice as much—and only a seventh of the total area in England is rough grazing—*i.e.*, less than half as much in proportion.

FIG. 127. PENDINE SANDS

Pendine sands lie to the west of the Towy estuary, on the Carmarthen coast. They are so extensive, flat, and firm that they have been used for motor speed trials.

On the arable land by far the most important crop is oats. Barley occupies less than a fifth of the acreage under oats, and the acreage under wheat is even less, though it has increased appreciably during the last two or three years under the stimulus of Government control. The cereal crops are used chiefly for feeding livestock. The best farming areas are in the south-west, the plain of Gwent on the south coast, Anglesey, and the Vale of Clwyd, in Denbigh. The south-western counties of Cardigan, Pembroke, and Carmarthen enjoy more sunshine than any other part of Wales, and not only grow the largest proportion of crops, but also have the largest number of

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dairy cows, pigs, and poultry. Glamorgan too has numerous dairy cattle. The explanation is partly found in the markets for milk among the industrial centres. Dairy cattle are fairly numerous also near the seaside resorts of the north coast. Anglesey is one of the best cattle-raising



FIG. 128. THE NANT GWYNANT VALLEY, CARNARVONSHIRE
The two flocks of sheep have been separated by the dog, following the whistled direction of the shepherd.

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areas. Here and in the rest of Wales cattle are bred chiefly for beef, transport difficulties rendering the production of milk on a large scale unprofitable. For this reason root crops are relatively unimportant in Wales, except in the dairy areas. Potatoes are more important than mangolds and turnips. Pig-rearing receives much attention in Anglesey, Carnarvon, and Denbigh, as well as in the south-western counties. Poultry are fairly

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evenly distributed, but are fewer in number than they might be. The total for the whole of Wales increased by nearly 500,000 during 1933, but is still only 4,500,000, compared with 7,500,000 in Lancashire and 6,500,000 in Yorkshire. Sheep naturally loom largest in the figures for livestock. The average number of sheep per thousand acres in England is about 430. But in Wales the figure is twice that, and in the hill counties of Brecon, Denbigh, Merioneth, Montgomery, and Radnor the proportion rises to well over 1000. The sheep are grazed on the mountain pastures during the late spring and summer, and are brought down to lower pastures during the autumn, and spend the winter there. It is a wonderful sight to see a dog marshalling a flock of sheep. He is better for the purpose than two or three men, and understands the meaning of every whistle from his master. He will even detect and sort out sheep belonging to another flock.

The other industries in Wales, except on the coalfields, are naturally few and local in character. Quarrying is one of the most important industries. The Penrhyn slate quarries at Bcthesda, Llanberis, and Festiniog are the main source of supply in Great Britain. There are also extensive quarries for road-metal at Penmacnmawr on the north coast, in Anglesey, and at other places. The working of copper, lead, and other ores found in veins of the old rocks in Anglesey and other parts has practically ceased, and the rambler often comes upon abandoned workings. The woollen industry, which formerly flourished in many inland places, has been unable to withstand the competition from England, and is now restricted to the valley of the Teifi, south of Lampeter, and a few isolated factories at Newtown and other places in Central and West Wales. They make chiefly flannel. But handicrafts have revived under the stimulus of tourist traffic by road. For the splendour of the scenery of Wales is inexhaustible. It is a much larger area than the Lake District, and there

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are great belts of moorland for the rambler to explore on foot. In the valleys of Monmouth and Pembroke are numerous ruined castles to interest the visitor. Conway, Carnarvon, and many places along the English border have similar historic buildings. Snowdonia is a great area for the sport of rock-climbing; for the angler there are plenty of trout in the rivers and good



FIG. 129. CAREW CASTLE, PEMBROKESHIRE

The castle is situated at the head of one of the upper branches of Milford Haven. Another more famous castle at Pembroke is similarly placed.

salmon-fishing. Among the lakes well known for their scenery are Bala, high up in the Dee valley, Ogwen, in Nant Ffrancon Pass, and Padarn, near Llanberis, in Snowdonia. The lake systems in the Severn and Wye valleys are chiefly artificial. Liverpool uses Lake Vyrnwy, in one of the upper Severn valleys. Birmingham draws its water-supply from Lakes Elan and Claerwen, near Rhayader, in the Wye valley. Some are utilized or made artificially by damming, to provide power in industry or for generating electricity. The lakes serve a useful purpose also in checking the flow of water after heavy rain, which quickly runs off the mountains, where, as in

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many places, there is but a thin covering of soil and peat.

The Principality of Wales—*i.e.*, excluding Monmouth, which for some purposes is considered part of Wales—covers an area of nearly 7500 square miles. This is roughly equal to the area of Yorkshire and Lancashire

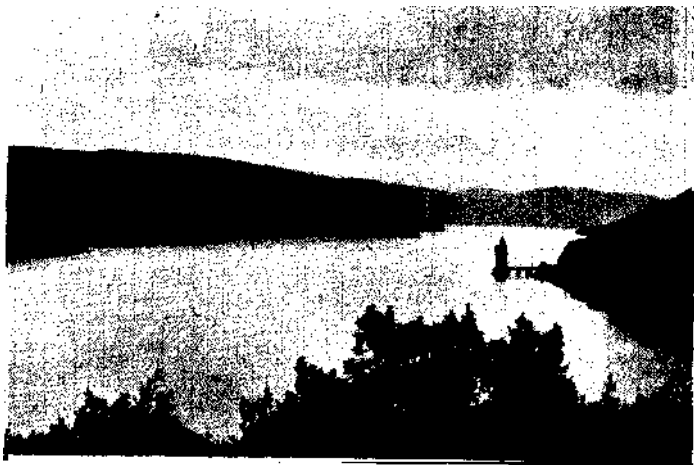


FIG. 130. LAKE VYRNWY, NORTH WALES—LIVERPOOL'S RESERVOIR
Photo Central Press

combined. But the population is less than a quarter of that in the two English counties. The reason for such a small population is partly explained by the map, which shows that most of the country stands above the 500-foot contour. But it is due also to the manufacturing industries being almost entirely confined to the South Wales Coalfield and the much smaller field in North-east Wales. The nature and extent of these coalfield[^] have already been described in Chapter VIII.

The South Wales Coalfield. The part of South Wales which lies between Brecknock Beacons and the coast, and between the Towy and the Wye, contains about 1,800,000

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people, or three-quarters of the total population of Wales. The iron industry began here, as in the Weald, using wood and charcoal for fuel, and local ores found on the northern fringe. Pontypool and Merthyr Tydfil were early centres of the industry. When coal replaced wood, late in the eighteenth century, canals were constructed, linking Pontypool to Newport and Merthyr Tydfil to Cardiff. Since then these ports have steadily grown in importance, while the northern towns have met with increasing difficulties, arising from the cost of transport and the need for imported ores. A number of furnaces has been dispensed with. But Merthyr Tydfil (71,000), Dowlais, Tredegar, and Ebbw Vale are still the Black Country of Wales.

The coalfield covers 1000 square miles, and contains some 400 pits. The bituminous coal lies mainly east of the Taff valley. The Rhondda valley is the centre of the steam-coal area, while the anthracite lies west of the Neath valley, which is an eroded fault-line. Further details of the coalfield have been noted in Chapter VIII (pp. 135-136). Many of these valleys are, like the Rhondda, enclosed at their northern ends, but some, like the Taff and the neighbouring valley of the Cynon, provide through routes to Brecon in the one case and round to Neath in the other. In many of them towns extend in almost an unbroken ribbon along the river-banks, and are gloomy in aspect. The chief mining centre of the coalfield is the urban district of Rhondda (141,000), which occupies a central position in the Rhondda valley and is one of the three largest centres of population in Wales.

Between Abergavenny and Merthyr Tydfil there is communication by road and railway from east to west. Similarly, across the middle of the coalfield road and railway connect Pontypool, through Hengoed, with the Cynon valley, mentioned above. Along the coastal plain east-west communication is easy. There are several towns with names familiar to us all with populations

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exceeding 30,000, such as Aberdare (49,000), Mountain Ash, Abertillery, and Caerphilly. Pontypridd (43,000) stands at the junction of the Rhondda and Taff valleys. But the largest towns of all are on the coast, and of these Cardiff holds pride of place.

Cardiff (224,000) is primarily the headquarters of commercial organization and the greatest coal-exporting port, with outports at Barry and Penarth. In normal

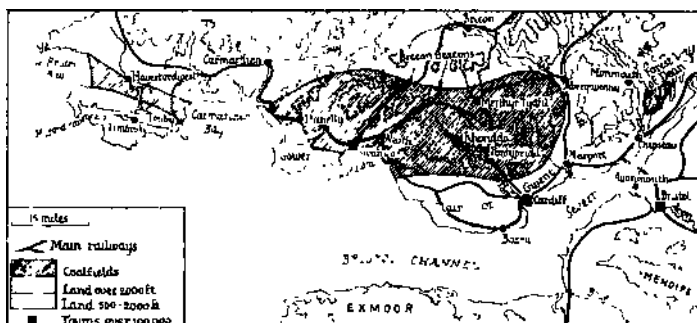


Fig. 131. SOUTH WALES

times 20,000,000 tons are exported annually from the Cardiff ports and Newport. Although the demand of European countries for South Wales coal has seriously declined, much coal is shipped to coaling-stations on the great ocean routes of the world, including those in the Mediterranean. No port is better equipped than Cardiff for handling coal, and the coal is the best obtainable. Cardiff also has some of the largest furnaces in Great Britain, and does engineering and ship-repairing on a large scale. The exports of coal, iron, and steel goods have a value twice that of the imports, which consist mainly of iron ore, timber for the mines, potatoes, bacon, and general foodstuffs for distribution inland. For the import of iron ore Cardiff is a close competitor to Middlesbrough. Cardiff has a fine collection of public

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buildings in Cathays Park, including the Welsh National Museum and University College. The other chief colleges of the University of Wales are at Swansea, Aberystwyth, and Bangor, another illustration of the lack of a convenient national centre. Newport (89,000) has similar coal-exporting and iron and steel industries. Swansea (165,000) and Llanelly (38,000), east and west of the



FIG. 132. TI-NIJY

Gower peninsula respectively, are primarily centres of the tin-plate industry, together with copper-smelting. Tin-plating is carried on at several other places.

The anthracite side of the coal industry has been better able by organization to withstand post-War trading difficulties than the rest of the coalfield. The metallurgical industries, using tin, copper, lead, and zinc especially, are also firmly established. Both Swansea and Llanelly export anthracite, though the quantities are smaller than of other kinds of coal. The export of anthracite to Canada now exceeds by 200,000 tons the amount which Canada obtains from U.S.A., which ten years ago had the monopoly of this trade. The ships bring back grain. Swansea also stores and distributes fuel-oils. Port Talbot

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(41,000), east of Swansea, is another port which has rapidly developed metallurgical industries, producing tin- and copper-plate and galvanized iron. It uses coal from the Rhondda valley. In many cases ores are unloaded from the ship into the yards of the smelting firms at the ports, thus saving heavy transport costs. There are



several residential and holiday resorts, like Porthcawl and Tenby.

To the west of the coalfield, Carmarthen (10,000) is the largest agricultural market town west of Hereford. Pembroke and Milford are situated on the shores of Milford Haven, a fine natural harbour ten miles long and over a mile wide. Pembroke (12,000), once a naval station, is now mainly used for storing oil-fuel for ships. Milford (10,000) is the chief fishing port of Wales, the other leading fishing ports being Swansea and Cardiff. The herring, mackerel, cod, hake, and other fish landed at these ports in 1933 were worth well over a million pounds. Minor fishing ports of Wales include Pwllheli,

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Bangor, and Conway, which handle chiefly plaice, soles, and shellfish.

In the rest of Wales the largest towns are the holiday resorts on the north coast—Llandudno (14,000), Colwyn Bay (21,000), and Rhyl (13,000). The chief west-coast centres are Aberystwyth (9000) and Barmouth. Bangor (11,000) and Carnarvon (8000) are the focus of routes on the Menai Strait. The inland market centres, such as Newtown, Welshpool, Builth, and Llandrindod Wells, are all quite small towns, but well known to those who visit Wales to fish or climb. Llangollen is popular among holiday-makers from the Midlands.

On the small northern coalfield Wrexham (19,000) is the main market and coal-mining centre, and has a leather industry. Ruabon is a mining town, and Flint, with other towns on the shores of the Dee estuary, shares in the chemical and artificial-silk industries of Lancashire and Cheshire.

CHAPTER XXIV

SCOTLAND: THE SOUTHERN UPLAND REGION

THE natural regions of Scotland are well known and can clearly be distinguished—viz., the Highlands, the Central Lowlands, and the Southern Uplands. The Highlands occupy two-thirds of the whole country, and the Southern Uplands are more extensive than the Central Lowlands. Yet more than three-quarters of the population of Scotland live in the Central Lowlands, which have always been the centre of Scottish life and culture. The Lowlanders learned in early days the value of unity. Yet Highlanders and Lowlanders alike have reason to be proud of their country and of the national characteristics of energy, courage, and capacity. Their love of freedom for long made them hostile to England. Scotland has been united to England in Government for over two hundred years, and the people, though thoroughly British, have retained a love of country which unites Scotsmen the world over.

We shall consider first the Southern Uplands, a region which contains many reminders of the warfare between the English and the Scots, which for centuries ebbed and flowed across it.

The Southern Upland region lies between the English border and the southern boundary of the rift valley of Central Scotland, which may be taken approximately as the line from Girvan, on the coast of Ayr, to Dunbar, in East Lothian. It thus includes the counties of Wigtown, Kirkcudbright, Dumfries, Roxburgh, Berwick, Selkirk, West Lothian, and parts of East Lothian, Midlothian, Peebles, Lanark, and Ayr.

The physical features and structure of the region are

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described in Chapter III. Briefly, the region may be said to have three divisions. The central part, which is the highest, lies between the Nithsdale-Cumnock Gap, on the west, and the Esk valley, to the east. West of this area, where the hills are lower, but more rugged, is the Galloway country, with a broad and irregular coastal plain in the south; while on the east of the central area the Tweed basin is clearly defined.

Climatic conditions vary with the relief. Conditions are mild in the coastal regions under the influence of the sea. But inland, conditions become more extreme, mainly owing to the high altitudes. Winter temperatures fall from west to east, the west coast having a mean January temperature of about 40° F. and the lower Tweed basin about 37° F. In summer, however, there is little difference between east and west, and July temperatures range about 59° F. In Galloway the rainfall tends to increase from west to east and from south to north, the amount rising from under 40 inches to 50 or more. Between the Nith and the Esk, in the central portion of the region, the rainfall is heavy, and exceeds 50 inches. In the basin of the Tweed, rainfall varies with altitude from 60 inches on the higher levels to under 30 inches on the lowland known as the Merse, which lies below the 400-foot contour. Rainfall is fairly evenly distributed throughout the year, but with maximum amounts in the spring and autumn in the west and during August and October in the east. The heavy rainfall is accompanied by much cloud, which restricts the successful cultivation of cereals to the sunnier spots.

Stock-raising, and particularly sheep-rearing, is generally more important in the region than arable farming. In Galloway, especially in Wigtown county, there are dairy-cattle areas of importance. The collection and dispatch of milk to the large towns of Northern and Central England, and even to London, are highly organized. Cream, butter, and cheese are also made for

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these markets. Cheese is made in the remoter parls, like the Rhinns, where quick transport of milk is impossible. Waste milk products are used for pig-rearing. On the arable land the chief crops are oats, turnips, and potatoes, the first two being mainly fed to the dairy cattle. The

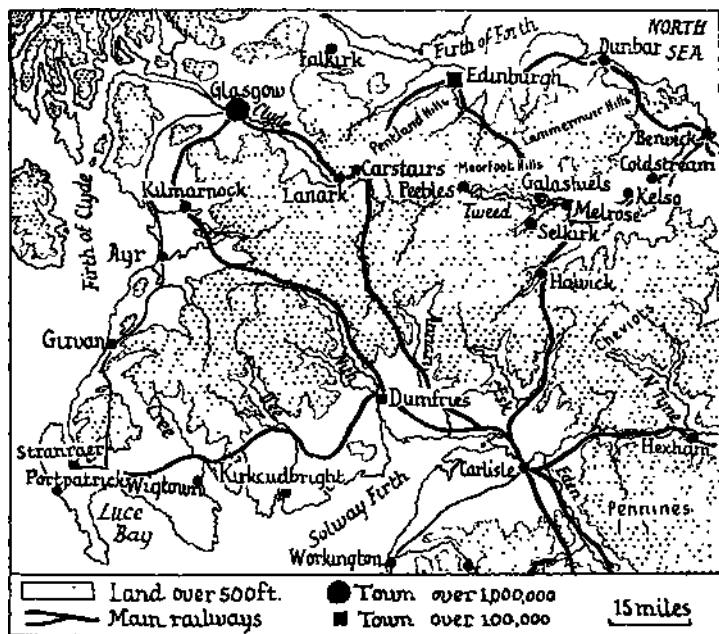


FIG. 134. THE SOUTHERN UPLANDS OF SCOTLAND

sheep are bred rather for mutton than wool, though southern breeds, with good fleeces, are kept on the lower pastures and where mixed farming is practised. The towns are small and mainly markets for livestock. Stranraer, Wigtown, Dalbeattie, and Kirkcudbright, are typical centres situated near the heads of the estuaries. Stranraer, the largest of these, has 6000 inhabitants. There is a regular steamer service to Larne, in Northern

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Ireland. Quarrying near Dalbeattie and elsewhere and some fishing along the coast are the only other occupations. Near Dairy a power-station is being built on the Dee for the supply of electricity to the whole of South-west Scotland. The total population of the counties of Wigtown and Kirkcudbright is less than 60,000.



FIG. 135. STRANRAER: THE PIER-HEAD AND LOCH RYAN

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FIG. 135. STRANRAER: THE PIER-HEAD AND LOCH RYAN

By permission of the L.M.S.R.

Similarly, in the county of Dumfries, which roughly comprises the central part of the region, the population is only 81,000. In this part only a fifth of the area is arable land, the rest being permanent grass and heath. The cultivated lands are found chiefly in lower Annandale, Eskdale, and Nithsdale, where there are rich alluvial soils on which oats, potatoes, and root crops are grown. In the hill-country sheep-rearing again predominates. Farming occupies a quarter of the population, and is therefore the chief occupation. But outlying pockets of coal of the Ayrshire Coalfield occur in upper Nithsdale,

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and at the junction of the Esk and Liddel. There is an important colliery at Sanquhar. Peat from the Solway Moss is used locally. The making of tiles and bricks from clays in the lower valley and quarrying are other occupations. Dumfries (23,000) is the only town of any size, and makes woollen and linen goods. Annan (4000) is the most important fishing town of the coast, and is famous for salmon and shrimps.

This area is, however, important for the routes between England and Scotland, and both roads and railways follow the dales. The west-coast route from England through Carlisle ascends Nithsdale, through Dumfries and the Cumnock Pass, to Kilmarnock and Glasgow. Another branch ascends Annandale, through Bcattock and the Moffat Pass, to Clydesdale, and so either to Glasgow or eastward to Edinburgh. A third uses Liddisdale to gain access to the Tweed valley by Teviotdale, which is entered at Hawick, and thence to Galashiels and Edinburgh. A coastal route also turns westward from Carlisle across the plain to Stranraer, which is only thirty-five miles from Larne, in Northern Ireland. This port offers the quickest route to Ireland from Scotland and the north of England.

The Tweed basin is a well-defined region. From time immemorial the possession of this region has been keenly contested, as the numerous hill forts, Roman camps, trackways, and the ruins of medieval castles and abbeys testify. The monks of the great abbeys at Dryburgh, Kelso, Melrose, and Jedburgh laid the foundation for the agriculture and sheep-rearing of the region, the towns, and their industries. Even to-day the ruins are an asset, by attracting tourists. Since the destruction of the monasteries in the sixteenth century and the union of England and Scotland in 1707 Tweeddale has fully developed its resources. The most fertile part is the lowland Merse, or March—*i.e.*, the disputed territory. In the county of Berwick agriculture occupies a high

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proportion of the population. But the farming even here is dominated by the needs of the sheep and cattle. Oats, turnips, and beans are grown chiefly for fodder, and barley for distilling and brewing. Some wheat is also grown. Narrow tongues of ploughed land extend up the dales. Above them are the expansive grassy moorlands. But the sheep occupy both moorland and the lowland, where they are fed in pens as part of the scheme of farming. Altogether the region supports quite a million sheep.

The deep, narrow valleys of the tributaries, the Ettrick, Tcviot, and Till, on the right bank, the Whiteadder, Leader Water, and Gala, on the left bank, shelter the towns, which are not only market centres, but active manufacturing centres. The streams provide water-power for the woollen factories, coal and fertilizers are available from Midlothian or Northumberland, and railways link the area to Eastern and Western England and to the Central Lowlands. Quite a third of the population is employed in the processes of cleansing, spinning, weaving, and dyeing the wool for the famous tweed fabrics. Hawick (17,000), in Teviotdale, specializes in hosiery. Galashiels, on the Gala, Peebles, on the Tweed, and Selkirk, on the Ettrick, are smaller but busy woollen centres. The local supply of wool has to be largely supplemented by imported wool, which comes chiefly from New Zealand. Berwick (12,000) is the natural outlet for the valley. As it controls also the east-coast gateway into Scotland it frequently changed hands in the Border warfare, but has remained an English town since the fifteenth century. Another small but interesting route centre is St Boswells, near Melrose, where the Waverley route, which uses the Tcviot and Gala valleys, meets the line going westward up the Tweed valley, and also a line from the fishing haven of Eyemouth. St Boswells is a busy market town for livestock, Kelso and Coldstream for grain and sheep.



FIG. 136. THE TWEED AND CHEVIOT HILLS, COLDSTREAM
Photo Valentine and Sons, Ltd.

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The route from England to Scotland by the east coast is very important. After crossing the Tweed at Berwick the line follows a low pass west of St Abb's Head to Dunbar, and then turns westward to Edinburgh. For the remainder of the route to Aberdeen see p. 318.

CHAPTER XXV

SCOTLAND: THE CENTRAL LOWLAND REGION

THIS name is suitable only in the sense of comparison with the highland areas to the north and south of it. It is rather a rift valley, the floor of which has been much crumpled, and through which volcanic rocks have forced their way and by offering greater resistance to erosion remain as conspicuous hills. The boundaries of this midland valley may be taken as the line between Stonehaven and Dumbarton, in the north, and the line between Dunbar and Girvan, in the south. The physical map shows that a good deal of the area between these two boundaries is occupied by land over 1000 feet, and that some of the hills rise to over 2000 feet. Thus, there is the line of volcanic hills—Renfrew Heights, Campsies, Ochils, and Sidlaws. Between these hills and the Highlands, extending from the coast to the river Earn, is the Vale of Strathmore, some sixteen miles wide. On the southern side of the midland valley there is a broad, fairly level upland cut by the Clyde into two parts, and in the east a mountain mass of old rock forming the Pentland Hills, which rise to nearly 2000 feet. In addition, there are several conspicuous isolated hills, such as Stirling Law, Dumbarton Law, and Edinburgh Castle Rock, the plugs of old volcanoes left upstanding after the erosion of the softer rocks which once covered them.

The rivers have greatly dissected the floor of the valley, and the sea has flooded the lower parts, so that at its narrowest only twenty-five miles separate the Firths of Clyde and Forth. From the Highlands the North and South Esk drain to the coast near Montrose. The Tay and Earn have cut a broad gap between the Ochils and Sidlaws;

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the Forth and Teith between the Ochils and Campsie Fells. The Clyde collects the main drainage from the Southern Uplands, and there are several smaller streams which flow either south-westward to the Firth of Clyde or north-eastward to the Forth and North Sea.

The whole valley is open to the south-west winds, and receives a rainfall that is more than adequate. Conditions vary considerably within short distances. Thus, Greenock

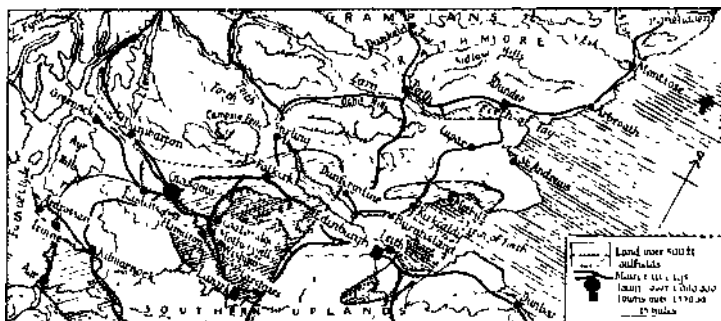


FIG. 137. THE CENTRAL LOWLANDS OF SCOTLAND

has a rainfall of over 60 inches, while Glasgow and Kilmarnock have less than 40 inches. But on the whole rainfall decreases eastward, Falkirk receiving 32, Dundee 27, and Edinburgh 26 inches. The mean temperatures for January and July of the following places show comparatively uniform conditions—Glasgow 39°-58° F.; Stirling 39°-59° F.; Edinburgh 39°-58° F.

The soils are varied, and fertile when sufficiently drained. This is true no less in the areas of the coalfields. Agriculture, therefore, is important, although it employs a smaller proportion of people than manufacturing, mining, trade, and transport. Pastoral farming prevails in the west, and arable farming in the drier, sunnier east. The proportion of land under permanent grass decreases notably eastward. As a consequence there is a marked

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concentration of cattle, including dairy cows, in Ayrshire and Lanark, but few sheep. These are most numerous along the north and south edges of the valley, on the line of volcanic hills, and in Fife. The importance of dairying in the west is due partly to the heavier rainfall, and partly to the market for milk in industrial Clydesdale. There is considerable milk production also near Dundee and Edinburgh. But elsewhere in the eastern districts crops are the main object of farming, and cattle and sheep are used to fertilize the ground, and then sold to the butcher.

Some of the best farming land is found in Strathmore and Carse o' Gowrie, on Tayside. The main crops are oats, barley, turnips, and potatoes. Artificial fertilizers can be easily obtained from the coalfields and the ports. Fruit crops are important along the southward-facing Carse o' Gowrie. The length of the summer day in these latitudes compensates to some extent for the reduced heating-power of the sun's rays, due to their lower angle. In this part the towns lie along three lines. Towns like Dunkeld, Crieff, and Callander control the entrance to the glens leading to the Highlands, and are served by railways. Rothesay, on Bute, and Stonehaven, at the extreme west and east respectively of this line of towns, are seaside resorts and fishing ports. Then there is a series of market towns distributed along the centre of the vale. Of these Forfar and Brechin are the most important. The others stand in the gaps made by the rivers between the volcanic hills. Perth (35,000) was always an important administrative centre, even a minor seaport, and was noted at one time for skins and gloves, but now chiefly for bleaching linen and dyeing and cleaning all kinds of fabrics. Stirling (23,000) and Dumbarton (22,000), with their strong castles, were mainly of military importance, but Stirling developed a woollen trade in plaids and tartans, and Dumbarton partook of the shipbuilding development of the Clyde (p. 307). Montrose (10,000) commands the gap between the Sidlaws and the sea, and is

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thus on the coast route to the north. It has similar industries to Dundee. Flax was formerly cultivated near, and linen manufactured, but now jute and other fibres are imported. The linen centres in Angus (Forfarshire) and Fife form the most important area in the British Isles for this textile after Northern Ireland. Arbroath, Brechin, Forfar,

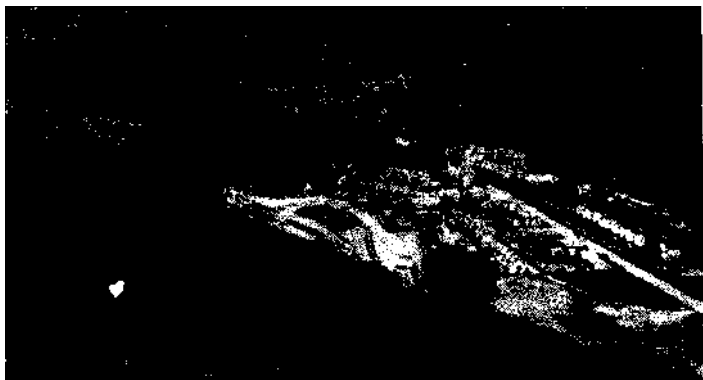


FIG. 138. DUNKELD AND BIRNAM FROM BIRNAM HILL

Note the steep edge of the Highlands. The entrance to Glen Garry, the valley of the Tay, is not visible, but is to the left of the photograph.

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and Dundee are the chief centres north of the Tay, and Dunfermline, Kirkcaldy, and Cupar, in the Fife peninsula, south of it. The industry employs about 40,000 people, but in many of these towns is declining.

Dundee (176,000), now the third city in Scotland, was originally just a fishing port situated at a point where the Firth of Tay is easily ferried. Then began its textile industry, making first linen, and later cotton cloth, for the English colonies in America. Now jute, hemp, and other

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fibres are imported for manufacture. Dundee also has a[^]-considerable jam-making industry, using imported sugar, fruit obtained from the Carsc, and oranges from abroad. In addition, the city contains engineering-works, the coal for which is brought mainly from the Tyne by sea.

The peninsula of Fife was once a kingdom, and owed its independence to its isolation, for the Ochils almost shut in the landward end between the Tay and Forth. But in modern times the railways have placed it on the main route to the north by the construction of great bridges across the Forth and the Tay.

Moreover, there is the coalfield, which has made the southern part of the peninsula a busy industrial region. On the coast between the Forth Bridge and Fifeness there are some sixteen towns in a space of about forty miles.

The chief of these is Kirkcaldy (44,000), a port with a great industry producing linoleum, linen, oilcloth, and similar goods. Dunfermline (35,000), farther west, situated a little distance from the coast, is famous for table-linen. The linen yarn comes from Belfast. Other busy towns are Methil (18,000), the chief coal-exporting port in Scotland, and Burntisland, which serves the western mines of the area. At Inverkeithing there are iron-foundries. The ancient market town of Cupar stands in the basin of the river Eden, and the university town of St Andrews, famous also as the headquarters of golf, near the estuary.

Opposite Fife, across the Firth of Forth, in the Lothians, is the other portion of the coalfield, as described on p. 138. The importance of the towns in this area is due, firstly, to the coastal plain some ten miles wide, along which runs the east-coast route to England. The towns lie either along this road and railway or along the coast. The coal goes mainly to Edinburgh and district. Musselburgh (17,000) is an old fishing port. Prestonpans and Dunbar are famous in history, the battles illustrating the importance of the route. Edinburgh (439,000), the chief

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administrative and professional city in Scotland, has been in turn the main fortress and market town, a royal residence and industrial centre. Its manufactures include engineering, textiles, brewing, and milling. Printing and publishing are also important, stimulated by the university and law-courts. Water-supply from lakes is abundant in



FIG. 139. PRINCES STREET AND THE CASTLE, EDINBURGH

Note the steep face of the volcanic plug on which the castle stands.

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Scotland, and Edinburgh has several reservoirs in the Pentland Hills, but breweries obtain water also from bores.

Leith, its port, exports coal and imports chiefly food-stuffs for distribution over the Lowlands. Westward, at the head of the Firth, is Alloa (13,000), on the Clackmannan extension of the central or Lanarkshire Coalfield ; and a few miles to the south lies Falkirk (37,000), with the port of Grangemouth. These places provide an outlet to the Continent for the products of the Glasgow area, and the Forth and Clyde Canal affords also an inlet for pit-props and iron ore from Sweden. Alloa has tweed-making,

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brewing, and some iron industries, and Falkirk great iron- and steel-works. Between these towns is the site of Bannockburn, which reminds us of the importance of this area on north-south routes. Broxburn, a few miles south-east of Falkirk, is the main centre in Scotland of the oil-shale industry. When purified by distillation, the products obtained from the oil-shales include naphtha, lubricating oils, and paraffin, as well as gasolene.

To the west we enter the Clyde basin. From the hills near Lanark the Clyde flows in a deeply cut valley, which runs almost straight to its estuary in the north-west. In its lower part the river meanders across a broad plain, almost encircled by hills. But farther up the river is enclosed within a valley about half a mile wide, on each side of which bluffs rise sharply. Approaching Lanark, its valley narrows still more, and the river descends swiftly over a series of falls. Above Lanark its valley becomes a typical glen.

The Clyde basin, once isolated and remote from the rest of the midland valley, has during the last two hundred years become the busiest part of Scotland, and contains nearly half the total population. Contact with America in the west gradually exceeded in importance that with Europe in the east. After the union with England the tobacco trade with the American colonics was the first stimulus. During the first half of the nineteenth century cotton manufacture became concentrated round Glasgow, some towns, like New Lanark, specializing in spinning, others, like Airdrie and Hamilton, in weaving. Allied industries, such as bleaching and dyeing, followed. After this industry had suffered from the American Civil War and English competition it was saved by the rapid development of the coalfield, and still more by the blackband and clayband iron ores which provided new resources. The railways took full advantage of them. From this in turn grew up the great shipbuilding industry, for which the Clyde is now world-famous.

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The natural town centres before this industrial development were Lanark, on the pastoral uplands; Rutherglen, near Glasgow, in the agricultural area; and Dumbarton, the fishing port on the estuary. But as trade grew Glasgow, in the lower basin, and Hamilton, higher up the valley, became more important as convenient market centres. Glasgow was the focus of a ring of towns making



FIG. 140. A STORMY SUNSET ON THE CLYDE, LOOKING TOWARDS
THE GARE LOCH

cotton goods. Coal and iron developments led to the rise of Airdrie (26,000), conveniently situated near the moorland on the road to Edinburgh. Near by, Coatbridge (43,000) became a great iron centre, served by railway and canal. Another centre of coal production was the market town of Hamilton (38,000), while on the railway route to the east the new towns of Motherwell and Wishaw (65,000) grew up. Numerous other towns have similarly developed, so that to-day there is no branch of iron and steel engineering which is not represented. Not only engineering of all kinds, but manufactures of chemicals, textiles, tobacco, pottery, and foodstuffs are characteristic.

THE CENTRAL LOWLAND REGION

All kinds of raw materials are imported, including the bulk of the iron ore now used. The main cotton centre is Paisley (86,000), which makes also machinery, cornflour, and starch. Dumbarton (22,000) is specially concerned with paper-making, bleaching, and dyeing. Lanark (6000), the county town, remains chiefly a market for cattle and horses, and for the milk and oats produced on the upland farms.

Glasgow contains over a million inhabitants, or more than a fifth of the total population of Scotland. Of many factors contributing to the importance of Glasgow, the second city of Great Britain, one of the chief was the excavation of the deep channel and docks. The old valley of the Clyde was opened up by removing the morainic deposits which had filled it since the Ice Age. Large ships engaged upon American and world trade can reach it. At the same time, it is the lowest bridge town of the Clyde, and routes from the Lowlands and from England focus upon it. With abundant supplies of coal and iron, of electrical power from the Clyde Falls, raw materials of all kinds from the docks, water-supply from Loch Katrine and elsewhere, a mild climate of the west coast, and a hardworking people, industries of many kinds are possible. The industries using heavy goods are concentrated near the river. Nearly half the workers are engaged upon engineering and metal-work generally. Industries associated with timber, grain, chemicals, paper, and oils occupy most of the remainder, for tobacco and textiles are now of minor importance there.

Westward from Glasgow to the Clyde estuary engineering becomes more and more connected with shipbuilding. The old town of Dumbarton, situated where the river Leven from Loch Lomond enters the Clyde, shares in this industry. But new towns have sprung up. Clydebank, situated half-way between Glasgow and the head of the Firth, has increased its population from 1600 to 47,000 within fifty years. The *Queen Mary* was built there. Along

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the southern bank of the estuary are the towns Port Glasgow (20,000) and Greenock (79,000), likewise engaged in engineering and shipbuilding. Greenock also has an important sugar-refining industry, and makes woollen goods.

In Ayrshire there is another coalfield, but the mining towns are isolated and small, so that the county appears more agricultural than industrial. The two chief towns are Kilmarnock (38,000), at the junction of valley routes, and Ayr (37,000), on the coast. They had early manufactures of woollen and leather goods, but engineering-works are now much more important. Ardrossan and Troon export coal and build ships. Irvine (12,000) is an old river-port which has iron-works and cotton-mills.

After mining and manufactures agriculture is the chief occupation. The main agricultural products are milk on the plains west of Ayr, butter and cheese in the more remote southern valleys. On the hills sheep are bred more for mutton than wool.

CHAPTER XXVI

SCOTLAND: THE HIGHLAND REGION

THIS region of mountains, moors, and lochs occupies two-thirds of the whole country. So vast and so varied a country claims a far more detailed description than is possible here. We must content ourselves with the briefest survey of its major features. First, we notice that the Great Glen is Nature's boundary between the North-western Highlands and the Central Highlands, generally known as the Grampians. Along the eastern margin of the Highlands are lowland areas of fairly low plateau in Caithness, round the Moray Firth, and in the Buchan area. The Highland plateau of the west and north is deeply dissected by river- and ice-action into compact blocks and heights, most of which reach between 3000 and 4000 feet. The glens which separate them are deep and narrow. The Orkney Islands, separated from the mainland by Pentland Firth, are a northward extension of the plains of Caithness planed down by erosion and invaded by the sea. The Inner Hebrides, including the large islands of Skye and Mull, and the Outer Hebrides, including Lewis, Harris, and North and South Uist, are also outliers of the main mountain system. The sheltered sea-channel between them and the mainland, called the Minch, and the coast, with its fjords and fringe of islands, remind us of Norway; and the country presents many similar difficulties to its inhabitants. Settlements are restricted to the narrow coastal levels and to more favoured spots in the glens. But there is much marsh and bog, and the soils are often acid.

The climate is mild but wet. Temperatures range from a mean for January of about 39⁰ F. to a mean for July

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of about 54° F. The summer days are long, but a rainfall which amounts to 50 or 80 inches at places on the coast moderates the summer warmth. On the high ground there is much winter snowfall.

The crofters, a peasant population, win with much labour small crops of oats and potatoes. But the mainstay is fishing, and thus population is restricted mainly to the coasts. Mallaig since the War has become an important centre for trawlers. A few cattle provide milk or are sold in the local market. Sheep graze on the mountain-slopes, and are often taken in summer to mountain pastures farther off. The wives and daughters do much of the farm-work and weave the wool. Some go off to clean the fish landed on the east coast of Britain by the fishing-fleet. In the islands of the Hebrides and elsewhere the local supply of wool is made up in the homes. But more usually the spinning is done in small factories, and the weaving of the tweed on the croft. Merchants buy the wool crop, and later the finished cloth, to sell at good prices in England.

Access to these remote parts is gained by the railways to Kyle of Lochalsh from Inverness, to Mallaig from Fort William and the south. A third railway goes to Oban, from which steamers make the 80-mile crossing to the Outer Hebrides, going through the Sound of Mull. Kyle of Lochalsh has grown into a town since it replaced Strome Ferry as the terminus of the railway. Steamers cross the mile of water, and also go to Portree (2000), the only town in Skye, and the outer islands. Stornoway (4000) is the main port and market centre of Lewis, and a busy place in the herring season. The railway route from Glasgow to Mallaig, facing the southern end of Skye, provides the most wonderful scenery of any journey in the British Isles. Following first the shores of the Clyde, Loch Long, and Loch Lomond, it reaches Crianlarich, a junction near the imposing peak of Ben More, from which the L.M.S. line runs to Oban. Northward the

THE HIGHLAND REGION

line climbs 1000 feet across the watershed between the Atlantic and the North Sea, up a glen too deep to be bridged. So the glen is followed up one side and down the other. Later the line crosses Rannoch Moor, fifteen

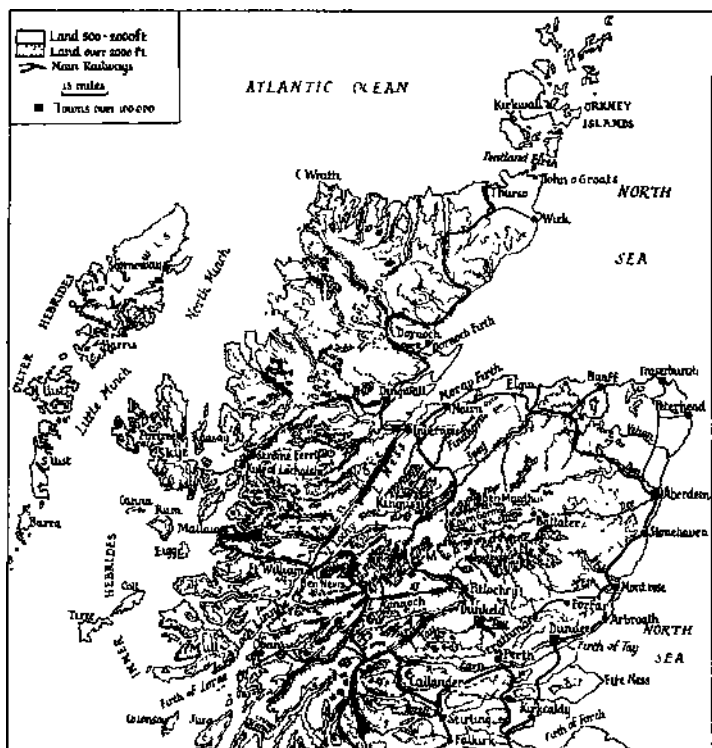


FIG. 141. THE HIGHLANDS OF SCOTLAND

miles of boulders and bogs, vividly described in *Kidnapped*. Brushwood sunk in the bog supports the track. Then the line turns sharply westward, down Glen Spean, with its countless cataracts, to Fort William, at the foot of Ben Nevis (4406 feet). Following the shores of Loch Eil, a

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county boundary, through gorges, across lofty viaducts at the head of Loch Shiel and elsewhere, the line passes Loch Morar, a crater lake 1000 feet deep, and reaches Mallaig some six hours after leaving Glasgow.

Oban (6000) is a great centre for tourists and a summer resort. Fort William (2500), at the southern entrance to the Caledonian Canal, and Inverness (23,000), at the



FIG. 142. THE HEAD OF LOCH LONG AT ARROGHAR

northern end, are important route centres. There is little traffic through the canal, for the only industries in its neighbourhood are aluminium-works at Fort William and a woollen industry at Inverness. This historic town has railway connexions with the south across the Highlands, with Wick, in the north, with Kyle, on the west coast, and with Aberdeen, on the east. Note the great curves the railway to the north makes round Beaully, Cromarty, and Dornoch Firths, and again up Helmsdale, before entering Caithness. The local markets are Dingwall, Thurso, the port for the Orkneys, and Wick (8000), which is also the chief port for fish. In the Orkney Islands

THE HIGHLAND REGION

fishing, weaving, and the rearing of sheep and ponies are the main occupations, for agriculture is difficult. Kirkwall and Lerwick are the chief centres in the Orkneys and Shetlands respectively.

The Central Highlands are carved into three great blocks in the north by the rivers Spey and Dee. West of

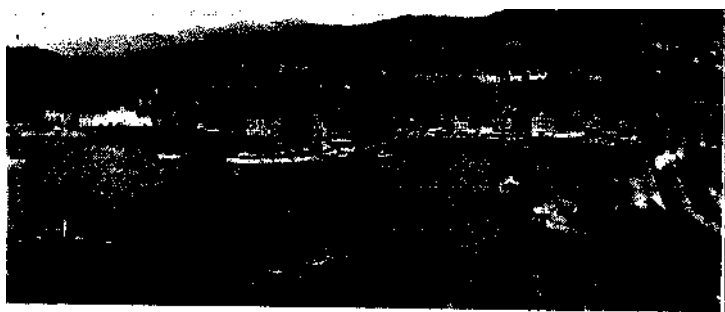


FIG. 143. OBAN
By permission of the L.M.S.R.

the Spey are the Monadhliath Mountains; between the Spey and Dee are the Cairn Gorms; and south of the Dee the Battocks. To the south the great river system of the Tay cuts deep valleys round well-known mountains, such as Ben Lawers and Ben More. The Spey is a longitudinal river following the trend of the mountains from roughly south-west to north-east. The Dee and Don flow practically due eastward. The Tay, rising in Ben Lui, to the north of Loch Lomond, goes first north-eastward, then transversely—*i.e.*, across the grain of the mountains—into

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another valley running north-eastward, which contains Loch Tay. But later it takes the direction of its tributary the Tummel to the south-east, emerging from the Highlands at Dunkeld. After flowing along Strathmore for a little distance it again cuts a gap through the Sidlaw Range at Perth, and finally turns north-eastward again



FIG. 144. INVERNESS

in the Firth. Many of these Highland valleys descend not regularly, but in a series of steps. In many parts of their upper courses the rivers meander in flat, badly drained basins. Between these successive basins the river descends in a series of falls or through a gorge. The depth and certain other features of the basins containing lakes suggest that they are due more to faulting than to erosion. The basins sometimes contain tracts of alluvial soil suitable for limited agriculture, but more often they are marshy. Most of this part of the Highland area, therefore, is kept for grouse-shooting and deer-stalking, and the rivers for salmon- and trout-fishing. The salmon go up the rivers between October and January, leaping the falls, and the young fish come down to the sea in May. Settle*

THE HIGHLAND REGION

ments in such country are naturally small and few. In many parts there are only the isolated cottages of the shepherd or the gamekeeper. The main centres lie along the route taken by the railway—viz., Pitlochry, Blair Atholl, Dalwhinnie, Kingussie, and Aviemore. The railway and the great main road use first the valley of the



FIG. 145. ARDRISHAIG AND THE GRIN AN CANAL

By permission of the L.M.S.R.

Tay and its tributary the Garry, and then cross the Drumochter Pass to the Spey valley. Near Aviemore the railway branches either to Inverness, or down the Spey valley to link with the coast route. The route to Oban uses the valleys of the Teith and Tay, crossing the route from Glasgow to Mallaig described above at Crianlarich, between Ben Lui and Ben More.

The south-western part of the Highlands, round Loch Lomond and the Trossachs, is a favourite holiday district easily accessible from the populous centres of the midland valley. In the same way, the Crinan Canal through Kintyre brings Mull, Jura, Islay, and other islands into contact with Glasgow. So that products are now

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more easily marketed, and there is more money in circulation.

The lowland in the north-east of Caithness was even in Norse times regarded as a productive area. There, and again round the Moray Firth, good cattle pastures, turnip and oat crops, are a feature. Between Inverness and the mouth of the Spey stretches a belt of lowland some ten miles wide, on which barley is the chief crop; the soil is fertile, the summer warmth on this coast is more marked than on the east coast, and the rainfall is low. Root crops for cattle are widely grown, but in the Spey valley sheep predominate. The chief towns, like the county town of Elgin (8800) and Nairn (4000), a holiday resort, are on the route to Aberdeen. The region, known as Buchan, which lies to the east of a line from Banff to the Dee is one of considerable agricultural importance. This is due not only to the variety of glacial soils, which have not weathered so much as those in England, but also to the climate, with its cool summer and mild autumn. The outstanding crop is turnips, which are valuable for feeding the numerous cattle. Oats and grass occupy large areas. Fishing is also very important round the coast of Banff and Aberdeen counties. The fish handled include haddock, cod, and plaice, as well as halibut from the deeper fishing-grounds. There are many fishing villages, such as Lossiemouth, Cullen, and Buckie, but Fraserburgh (10,000) and Peterhead (13,000) are the main harbours for the fishing-fleet. Near Peterhead there are also granite quarries. The inland towns are market centres served by the railway. Huntly (4000), the largest of them, makes woollen goods. Distilling is also important.

The valley of the Don and, to a lesser extent, that of the Dee have areas of rich agricultural land on which oats, turnips, and barley are the chief crops. But the Dee valley has the finer scenery and much forest, and contains the more important towns. Braemar, up in the hills, has the King's residence Balmoral near by. Ballater is the

THE HIGHLAND REGION

terminus of the railway and a popular holiday resort, and there are several residential areas in the lower valley. Aberdeen (167,000) is not only the natural focus of the two valleys, but the fourth city in Scotland. It is the chief port of Northern Scotland, particularly for fish and for coastal ships, which bring coal, cement, and general

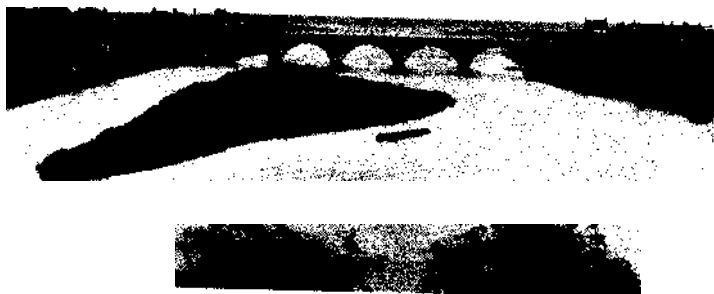


FIG. 146. THE BRIDGE OF DON, ABERDEEN
By permission of the L.M.S.R.

cargoes. Imports from foreign countries include oil, esparto-grass and wood-pulp for its paper-making industry, wheat, flour, and fertilizers. Grey granite is quarried and exported, and the polishing of granite for public buildings and monuments is one of the main industries. There are many fine buildings of this stone in the city. Fish-curing, the making of chemicals, marine engineering, and the building of trawlers and other fishing-craft are leading industries. The city is also a great market for cattle and agricultural produce. Its long-established eminence as one of the chief educational centres of Scotland is as well known as the energy and capacity of its people.

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Aberdeen is the terminus for the express trains from England. From Edinburgh northward the line crosses the Forth Bridge to the Fife peninsula, which it traverses, first along the coast and then by the Eden valley, afterwards turning to the north and crossing the Tay Bridge to Dundee. From Dundee it keeps close to the coast through Arbroath, Montrose, Stonehaven, to Aberdeen.

CHAPTER XXVII

IRELAND: NORTHERN IRELAND

THE position of this island off the west coast of Great Britain has had important effects throughout its history. In the north-east Ireland is as close to Scotland as England is to France across the Strait of Dover. Dublin is nearer to Holyhead than Dover is to Ostend; and Rosslare is as near to Fishguard as Folkestone is to Dunkirk. This close proximity is sufficient to make the interests of the two great islands interdependent, yet not sufficient enough to secure real understanding and co-operation. The result has been that Ireland lost her independence and for centuries was ruled by England, often with harshness. Politically Ireland is now divided into two parts, Northern Ireland and the Irish Free State, each with its own Parliament, the latter State having the freedom of a Dominion in the British Empire. The political dispute impeding the trade between the Irish Free State and Great Britain can be removed with goodwill, but the consequences of the geographical position of Ireland cannot be ignored.

This relationship of Ireland to Great Britain is seen also in the structure of the country, as we noted in Chapter III. The Sperrin and Donegal Mountains represent the Central Highlands of Scotland; the valley extending from Belfast Lough, through Armagh, to the south-west is a smaller example of the central rift valley of Scotland; and the Mourne Mountains are a continuation of the Southern Uplands. The mountains of Southern Ireland are a continuation of the ancient foldings of South Wales and North Devon; while the central plain of Ireland, though very different in relief from the Pennine upfold, is composed of similar rocks.

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The relief of Ireland is much less definite than that of Great Britain. The mountains are nowhere so high as the main peaks of the Grampians, and they are much more dissected by river valleys. The river systems also are confused, and the rivers for the most part meander sluggishly across the plain. But in a general way the

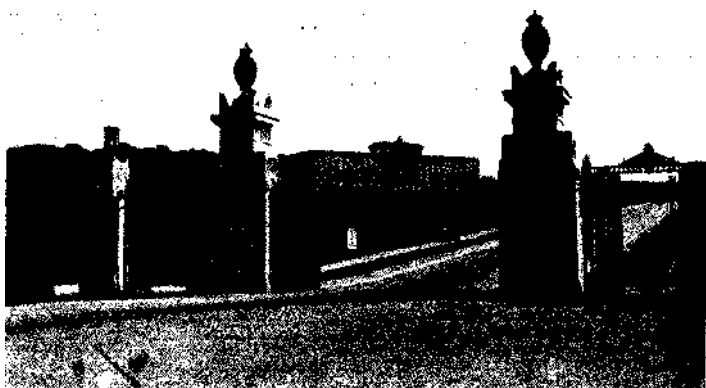


FIG. 147. STOKMONT: THE PARLIAMENT HOUSE OF NORTHERN IRELAND

relief map shows three natural divisions—a mountainous area north of latitude 54° N., another similar area south of a line joining Dublin and Galway, and between the two a plain fifty miles broad from north to south, extending between the east and west coasts for a hundred miles. On the west the mountains of Mayo and Connemara shut off the plain from the Atlantic, except for two lowland corridors leading to Clew Bay and Galway Bay. The mountainous areas in the north and south have also many valleys which give easy access from the central plain to the coast. Thus, in the north the Blackwater and Lagan valleys lead to Belfast Lough, and the Bann valley to the north coast; the Erne to Donegal Bay. In the south the

NORTHERN IRELAND

Slaney gives access to Wexford, the Barrow to Waterford, and the Shannon to Limerick. Yet the mountains are widely distributed. Two out of every three of the Irish ^counties have heights exceeding 1000 feet, and there are peaks of over 2000 feet in twelve of the counties.

These physical divisions roughly correspond with the provinces of great antiquity into which Ireland was formerly divided—Ulster, Munster, Leinster, and Connaught. Ulster was the mountainous province of the north, and Munster that of the south-west. The other two provinces shared the central plain between them, Leinster occupying the east and Connaught the west, the boundary being the broad and sluggish Shannon. Leinster, however, included also the south-eastern counties Kilkenny and Wexford. Of the nine counties which formerly constituted Ulster six—Londonderry, Antrim, Down, Tyrone, Armagh, and Fermanagh—now form the state of Northern Ireland. The other three are part of the Irish Free State, Donegal, or Tirconnail, being almost cut off in the north-west, Cavan and Monaghan lying along the southern boundary. It is convenient, therefore, to divide Ireland into the following regions: (i) Northern Ireland; (ii) the Irish Free State, consisting of (*a*) the north-west highlands, (*b*) the central plain, (*c*) the southern uplands.

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Following the structural divisions previously mentioned, we can consider separately the three parts of Northern Ireland thus: (*a*) the southern hill counties of Down and Armagh; (*b*) the midland valley and the volcanic plateau of Antrim; (*c*) the Sperrin Mountain region, covering most of Londonderry and Tyrone. These three parts together form a basin, the centre of which contains Lough Neagh, the largest lake in the British Isles, 18 miles long and 11 miles wide. But there are important gaps in the outer rim of mountains. First, the corridor between

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Lough Neagh and Central Ireland, followed by the Ulster Canal; the Newry-Bann valley, from Lough Neagh to Carlingford Lough; the Lagan valley, leading to Belfast Lough; and the broad valley of the lower Bann, from Lough Neagh to the sea. In the south-west the valley of

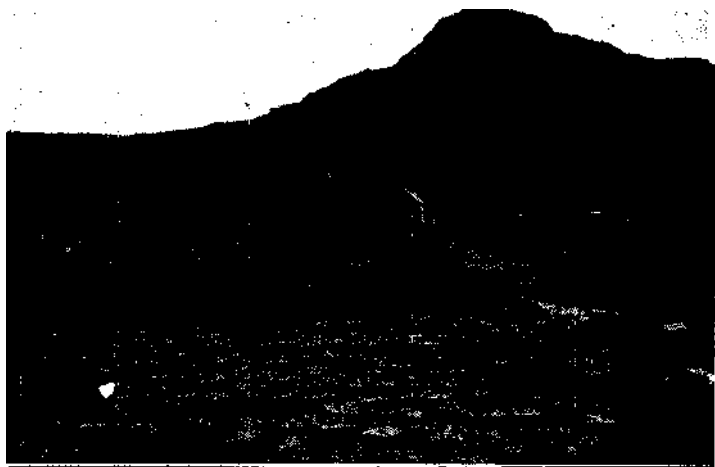


FIG. 148. THE GIANT'S CAUSEWAY

By permission of the L.M.S.R.

the Erne, almost filled with lakes, runs transversely from south-east to north-west.

The climate of Northern Ireland is on the whole cool. The winters are colder than elsewhere in Ireland, and the summers also cooler. The mean temperatures for January and July are about 39° F. and 58° F. respectively. The rainfall is fairly heavy. Derry, for instance, gets 42 inches, but in sheltered positions, such as Armagh and Belfast, the amount decreases considerably to 32 and 34 inches respectively. The mountains and high ground naturally experience more rain than the towns mentioned.

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These conditions are too cool, and the rainfall too much distributed throughout the year, to favour cereal crops generally. But oats do well, and there is a considerable amount of arable land, producing hay, potato, and turnip crops. The flax crop is important, and belongs almost exclusively to this part of Ireland. The well-watered valley pastures support a good number of cattle, including

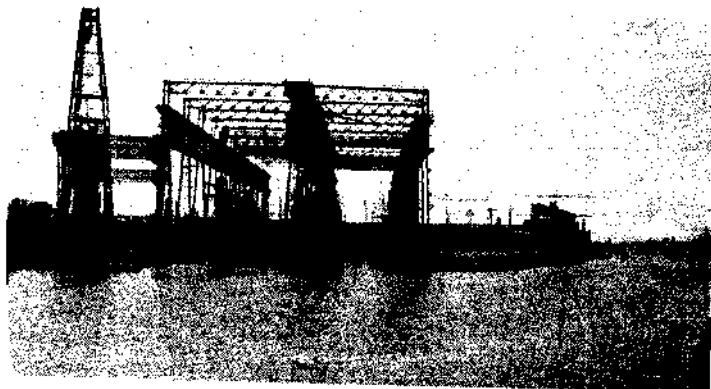


FIG. 149. HARLAND AND WOLFF'S SHIPBUILDING YARD, BELFAST

dairy cows, and milk is collected and marketed on a co-operative plan. Waste products of the dairy industry support numbers of pigs, and poultry abound. On the mountain-slopes the cool, moist conditions maintain sheep pastures throughout the year.

Although industry occupies rather more people than farming, the latter is no less important. In most of the towns and villages people are employed in some branch or other of the linen industry. For flax has to pass through many processes to extract and prepare the fibres for spinning and weaving them into linen. But at Belfast and elsewhere there are also shipbuilding and other industries of great importance. The factories of the linen industry, however, are more widespread than the others. The

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towns within a thirty-mile radius of Belfast are the most important linen centres. Lisburn, which claims to be the birthplace of the industry, Portadown, Lurgan, and Ballymena are typical, and each has more than 10,000 inhabitants. The local supply of flax is quite insufficient to meet the demand, and a far larger amount is imported, mainly from Belgium and Latvia.

Down and Armagh contain some of the best-kept farms in Ireland. Those on the lower lands are particularly prosperous, partly because the industrial towns to the north provide a ready market. Not only are there good crops of oats and potatoes, but cattle and poultry are reared in large numbers for export. Eggs too are exported in large quantities. Sheep are very numerous, as the hills are grass-covered to the summit, except in the highest part of the Mourne Mountains. Between Portadown and Armagh is to be found the best fruit-growing region in Ireland, producing apples and strawberries. Flax also flourishes in this neighbourhood.

There are many market towns. Portadown and Lurgan are also Hnen-manufacturing centres. Armagh, the ecclesiastical centre founded by St Patrick, is the seat of both the Catholic and Protestant Primates of Ireland. In the south the port of Newry (12,000) is situated about six miles from Carlingford Lough. It receives imports of coal, timber, and grain, and exports linen, granite, and farm produce. The town has foundries, flour-mills, and textile factories. Across the Lough the Mourne Mountains ascend steeply from the water, and attain in Slieve Donard a height of 2796 feet. There are charming little resorts in the nooks of the coast, and Newcastle, on the east coast, is noted. The county town is Downpatrick, at the southern end of Strangford Lough. Near by on the coast is the fishing port of Ardglass, once the chief port of the north. The great sea inlet of Strangford Lough is full of little islands. East of it is the Ards peninsula, famous for the Ulster motor-race. At the northern end of the Lough

NORTHERN IRELAND

is the wool-manufacturing town of Newtownards. On the north coast are situated Bangor, a thriving residential town, and Donaghadee, a health resort.

Belfast (415,000), the northern capital and the second city of Ireland, has during the last century increased its

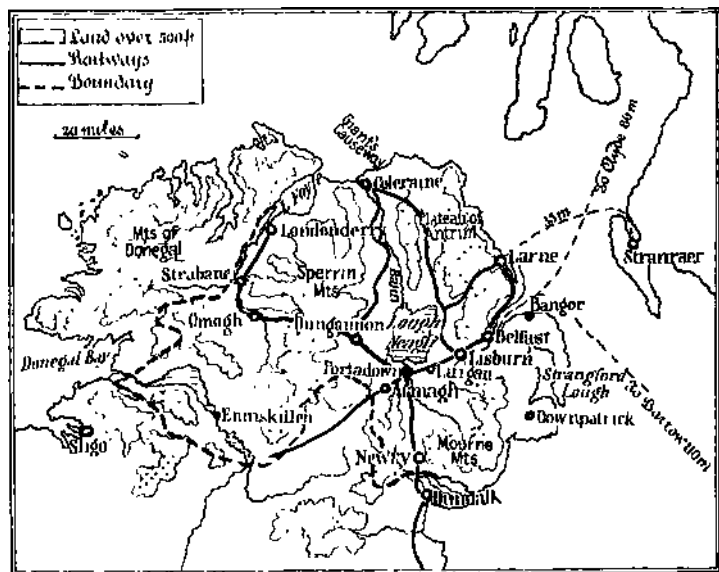


FIG. 150. NORTHERN IRELAND

population eightfold. This great development is due partly to its position as a focus of routes facing Great Britain. But it is due far more to the will to work and the skill to succeed shown by the people. We so often speak of natural advantages of a town that it is well to note that Belfast had few such. For there was neither a natural harbour nor raw materials. The river Lagan and the approach from the sea had to be dredged and the channel straightened. Coal and steel have to be imported; timber too. The Lagan Canal was constructed to facilitate

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the transport of heavy materials. As a result, one of the greatest shipbuilding firms has yards at Belfast, in which many famous liners have been built. There are also several other large industries, such as rope-making, distilling, and the manufactures of soap and tobacco. Belfast claims the largest shipyard, spinning-mill, and tobacco factory in the United Kingdom. As a port Belfast is

FIG. 151. BELFAST

the busiest in Ireland. There are regular steamer services to Glasgow, Fleetwood, and Liverpool. Coastal vessels bring coal and iron, miscellaneous foodstuffs, and manufactured cotton, woollen, and metal goods. From abroad ships bring timber and flax.

Much of Antrim is open moorland, supporting relatively only a few sheep. Around the plateau are, however, fertile tracts used for cattle pasture and potato-growing. In the many glens which make the county an ideal holiday area cultivation is more intense. On the coast there are many popular resorts, including the ancient town of Carrickfergus, on Belfast Lough, the passenger port of Larne, with a daily service to Stranraer, Ballycastle, and Portrush, which is close to the Giant's Cause-

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way. At Larne bauxite is prepared for the extraction of aluminium.

In the lower Bann valley the soils are varied, some being derived from the underlying rocks and others being of glacial origin. The latter are often difficult to drain, and are chiefly used for cattle pasture. Both the better-drained and the alluvial soils are suitable for growing oats



FIG. 152. FERRY STEAMERS IN BELFAST HARBOUR

and potatoes, and mixed farming is general. The chief town, though small, is Coleraine, which is situated about five miles from the sea. The railway from Coleraine to Derry follows the coast, but a more direct route by road crosses the hills. This little port is valuable to the area for its export of potatoes and imports of coal and other goods.

Between the Sperrin and Donegal Mountains is the basin of the Foyle, of which Londonderry (Derry) is the natural focus. But the State boundary follows the river as far as Strabane, and impedes the trade between the two sides of the river-basin. The historic city of Derry (45,000) is 25 miles from the sea, but is next in importance

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to Belfast. Liners sailing between Glasgow and America call at Lough Foyle, transferring passengers to tenders off Moville, on the Irish Free State coast. There are also cross-channel services to Heysham and Glasgow. The main industry of Derry is the manufacture of linen goods, such as shirts and collars. These goods and agricultural produce constitute the main exports, imports being of a general character.

The river is tidal and navigable for barges as far as Strabane, a junction of routes. The railway from Derry to Belfast passes through it and the county town of Omagh, which has flour-mills and shirt factories. Farther on, to the south-west of Lough Neagh, is Dungannon, a busy little manufacturing town in the centre of the Tyrone Coalfield. Linen and other goods are made there. The coalfield contains several thick seams of good coal, but the amount mined annually is comparatively small.

In Southern Tyrone, an almost entirely pastoral country, life is leisurely. The road and railway which follow the valleys- to the west run side by side, and in places trains amble through the village streets. The Erne valley, in the adjoining county of Fermanagh, is most remarkable for its maze of lakes and islands. At the head of the lower Lough Erne, which is a more open sheet of water, is the town of Enniskillen. It is the market centre of fertile and attractive country which claims to rival Killarney. The valley contains numerous dairy cattle, and potatoes form the chief crop.

CHAPTER XXVIII
IRELAND: THE IRISH FREE STATE
(SAORSTATEIREANN)

THIS part of Ireland is a land of much natural beauty, seldom marred by industrial ugliness. The people are hospitable, courteous, and genial, and the country, with its long history, has many ancient monuments. These characteristics, combined with the widespread opportunities of salmon- and trout-fishing, hunting, and other sports, make the country attractive to many visitors.

THE NORTH-WESTERN COUNTIES

Donegal, or Tirconnail, lies apart from the rest of the Free State, with which it has no direct railway communication. It is the wildest part of Ireland, windswept and bare of trees on the western side. Though subject to heavy rainfall, the climate is always mild. There are numerous sheep, but few cattle, except round Lough Swilly; potatoes are grown in all parts on the plains. The mountains are cut by many glens, and many of the river valleys are invaded by the sea. In the north the largest of these sea loughs is Lough Swilly. Between it and Lough Foyle is the peninsula of Inishowen. Donegal contains a larger population than might be expected; but it is evenly distributed, and there are no towns of any size. Letterkenny, at the head of Lough Swilly, has a noteworthy new cathedral. This town and others in the Inishowen peninsula share the shirt-making industry of Derry. They are also market and tourist centres, for the whole region is attractive for its varied scenery and river-fishing.

In South Donegal the mountains meet the sea in

majestic cliffs, which rise sheer from the water to nearly 2000 feet in Slieve League. On the coast near by, at the



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THE IRISH FREE STATE

300-mile coast are villages where fishing is almost the only occupation. Bundoran, near the mouth of the Erne, is one of the chief health resorts in Ireland.

In Sligo and Leitrim mountains and lakes occupy most of the area, but the scenery is less wild and the country more cultivated. The head-waters of the river Shannon expand to form Lough Allen and other lakes. Some coal



FIG. 154. THE LAKE ISLE OF INNISFREE, SLIGO

Innisfree is a small island in Lough Gill, and the photograph was taken from Dromohaire.

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is mined at Arigna, near Lough Allen. The county town Sligo (14,000) is the main port for the north-west, and has a weekly service to Liverpool and Glasgow. The imports are chiefly coal and grain; eggs form the main export, for poultry are kept in large numbers in the country around. Cattle for export are sent usually by rail to the east coast. Much attention is paid to the rearing of pigs.

In the peninsula between Donegal Bay and Galway Bay are the mountains of Mayo and Connemara, separated by Clew Bay. This western rampart to the central plain is perhaps more isolated from the rest of the country

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than even Donegal. The inhabitants of the western part include descendants of the earliest occupants of the country. The only railways run to Killala, in the north; along the north shore of Clew Bay, through Westport, to Achill, on the west coast; and in the south, through Galway, to the coast at Clifden. The west is exposed to the full blast of westerly gales, and the heavy rain produces large areas of boggy moorland. On the eastern side of the mountains are large lakes, Corrib, Mask, and others, forming a great natural moat between the central plain and the ancient mountain strongholds. The people subsist in sheltered spots, and cultivation is limited to potato-growing. Here, as elsewhere in the north-western highlands, rough tweeds are made from the wool of sheep, which graze on the drier slopes of the hills. The Connemara mountain area contains a higher concentration of sheep than might be expected in so wet a region.

THE CENTRAL PLAIN

This lowland region is the key to the rest of Ireland. From the days of the Vikings throughout history the successful invader made this part of Ireland secure for himself. For that reason the country round Dublin was long known as the English Pale. But, for all that, the plain is not, as the physical map suggests, a vast fertile area. It is a region extremely difficult to drain, containing large bogland areas for which Ireland is far-famed. Means of communication are therefore restricted.

The Carboniferous rocks which underlie the plain scarcely ever appear at the surface. They lie flat, and are overlain with glacial clays and other deposits. The more sandy and stony drumlins and eskers, which run in an easterly direction, provide almost the only routes for roads and railways. Most of the area is about 300 feet above sea-level, but there are two broad bridges of higher ground extending from north to south between the moun-

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tainous parts of Ireland. Between them is the basin of the Shannon, in the centre of which stands Lough Ree. It seems that the underlying porous limestone is normally more or less saturated with water. The clay which floors these rock-basins holds the surface water, and peat



FIG. 155. CUTTING PEAT, BOG OF ALLEN

Photo Will F. Taylor

accumulates upon the higher clay areas. Under its weight the clay slowly slides to lower levels and becomes bog. Many of these bogs have been largely reclaimed by cutting drainage channels, but the Bog of Allen, west of Dublin, remains famous. Peat-cutting is estimated to give seasonal employment to some 800,000 people. Four million tons of fuel a year are used by those who live near the bogs. These conditions are due more to the low-lying relief than to rainfall, for the plain receives much less

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rain than the other parts. Athlone gets 37 inches, Kells, in Meath, 37, Birr, in Offaly, 32-5, and Dublin 27. There is also a greater range of temperature than in most of the other parts. Thus, the mean January and July temperatures at Birr are 39*8° F. and 58-8° F. respectively, and at Dublin 41° F. and 60° F.

The combined factors of climate, relief, and soil favour good pasture, but render the cultivation of other crops unprofitable, except in the better-drained east. The typical crops there and on the higher parts of the midlands are turnips and barley. Naturally, too, the plain is a great region for cattle. Not dairy cows, for the circuitous roads between the farms prevent quick collection of milk, but cattle, which are reared for beef, and which in normal times collect in great numbers in the eastern part of the plain, ready for export. The county of Meath contains, perhaps, the best pastures in Ireland. In the Kildare country the Gurragh is famous for breeding hunters and racehorses.

The population of the plain is sparse. In the Irish Free State as a whole there are only some forty towns with more than 5000 inhabitants. About half of these are inland towns, and they contain an aggregate of about 160,000 people. The remainder, which are on the coast, contain over 2,000,000. Of these towns Dublin, Waterford, Cork, and Limerick are far the most important, and their joint population forms nearly half the total for the coastal towns. The last three towns will be noticed later.

Dublin (4ig,000¹) holds the central position on the east coast at the lowest bridge-point of the Liffey, which flows round the northern side of the Wicklow Mountains. Its importance as the main national centre is emphasized by the Government buildings, the Castle, cathedrals, and university. As a port, Dublin handles over 40 per cent, of the total shipping trade of the Free State. The imports consist mainly of grain from the United States and

¹ This is the total population of Dublin City (317,000) and four adjoining urban districts.

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Argentina, coal from Britain and elsewhere, oil for fuel, animal foods, fertilizers, clothing and manufactured articles, foodstuffs, and tobacco. Dublin is the main distributing centre of Ireland, and we will note its connexion with the interior later. The supplies of coal and raw material from abroad alone make possible its con-



FIG. 156. GLEN OF THE DOWNS, WICKLOW MOUNTAINS

siderable industries. For local resources are small, and mainly agricultural, and there is, as we have seen, no large population on the plain behind it. It is the centre of great distilleries and breweries; but the firm of Guinness has established a great brewery also in London. Other industries include textile factories making woollen, linen, and artificial-silk goods, and tobacco manufacture.

The exports are mainly agricultural, and their total value has fallen to less than half what it was a few years ago. Live cattle exceed in value the other exports, which include eggs, poultry, fats, hides, and skins. The out-port, Dun Laoghaire (Kingstown; 19,000), is essentially a

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passenger port, but also stores coal. The main service runs to Holyhead, 57 miles away, and many coastal ships call there. The main railway routes from Dublin are as follows:

The Great Southern Railway, which crosses the upper valleys of the Barrow and Nore to the Golden Vale (or



FIG. 157. A CHARACTERISTIC STRETCH OF THE COUNTRYSIDE NEAR
EDGEWORTHSTOWN, IN COUNTY LONGFORD

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Vein) of Tipperary, and then southward across a low pass in the hills to Mallow, on the Blackwater, and Cork. This route is less important than formerly for mails and passengers, owing to improved shipping facilities at English ports. The Great Northern route follows the coast to Dundalk and the Newry valley for Belfast and Londonderry. Traffic on this line has declined since the political partition of Ireland. A third route runs westward to Mullingar, the junction for either Sligo, in the north-west, or for Galway, in the west, through the important bridge town of Athlone (8000), well known for its broadcasting station. There are also canals, the most important

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of which is the Grand Canal, 208 miles long, linking Dublin to the Shannon north of Lough Derg. A branch of the canal turns southward to link up the Barrow valley. The Royal Canal, 96 miles long, runs to Mullingar and beyond, but is almost derelict.

Drogheda (13,000), on the Boyne estuary, and Dundalk (14,000) are secondary ports, handling mainly coastwise traffic along the east coast. The linen industry in the Free State is carried on at Dundalk, Drogheda, Balbriggan, and Dublin, all of which are on the east coast. On the west coast Galway (Gaillimh; 14,000) is a port which is trying to build up a passenger service between America and Britain. Transatlantic ships of Continental companies sometimes call, but it is unlikely for several reasons that the route will develop to any extent. Galway is, however, an ideal holiday resort and an important market centre. Westport is a small town with a trade between it and Liverpool.

CHAPTER XXIX

IRELAND: THE IRISH FREE STATE—*continued*

SOUTHERN IRELAND

THE southern part of Ireland has two natural divisions, the uplands of the south-east and the parallel east-west mountains and valleys of the south-west. In the former the rivers Slaney, Barrow, and Nore drain southward, while the Suir, Blackwater, Lee, and Bandon flow in longitudinal valleys eastward, and turn southward only in their lower valleys. The south-east uplands are similar in structure to Central Wales, but the mountains of the south-west belong to the uplands of South Wales, Cornwall, and Devon.

The Wicklow Mountains have broad masses of moorland over 2000 feet above sea-level, and summits exceeding 3000 feet. They are cut by deep and narrow glens popular to visitors. The Vale of Avoca, in the south, is one of the best known. On the coast Bray is the best-known seaside resort, and Wicklow is a small haven importing some coal and flour. Arklow is the chief fishing port of the Free State. The plain between the mountains and the coast broadens southward, and has gained the name of the Garden of Ireland. But this and the broader plain of Wexford are almost hemmed in by hills, and remain isolated from the interior. There is no road or railway from this part of the coast inland. But the country is well drained, and the mixed marls and clays make good arable land. Bogs are absent, and the climate is fairly dry, warm, and sunny. Wexford is the premier agricultural county of the State and the best part of Ireland for barley; wheat and potatoes are the other chief crops. There are numerous dairy cattle and sheep. Much

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attention is also paid to the rearing of pigs. Enniscorthy is the chief inland centre. It is situated on a hill opposite the historic Vinegar Hill, and between them flows the Slaney. Wexford (12,000), after Dublin, is perhaps the oldest town in Ireland, and yet is modern in its activities. There are several factories making agricultural machinery and hardware, woollen goods and other articles. As a port it has a small trade, but Rosslare Harbour offers superior advantages, though the industries mentioned are lacking there. Rosslare, like Fishguard, in South Wales, was specially constructed by railway companies to provide a link between the express service from London and from Cork. This route saves nearly three hours on the Holyhead-Kingstown (Dun Laoghaire) route.

On the combined estuaries of the Barrow, Nore, and Suir, on the south coast, is the port of Waterford, which at one time had a better service to England than Dublin. The larger ships cannot call, as the harbour is shallow at low tide. It has suffered also from the competition of Rosslare in regard not only to cross-channel, but also to coastwise traffic. But it retains a large distributing trade in coal and grain, and exports many cattle, sheep, and pigs. Goods are now distributed chiefly by road, but heavy commodities are carried on the Barrow Canal. The city of Waterford (27,000) lies on the south side of the river, while the main railway centre and the activities of the port are on the north shore. Quays line both banks, and a bridge spans the Suir. Waterford has bacon-curing establishments, dairying, and many other small industries. For instance, many goods which formerly arrived ready for sale are now packed in* Irish towns. New Ross is the lowest bridge town of the Barrow-Nore. Kilkenny (10,000), the main market centre of the Nore valley, is a picturesque town, with many historic buildings. It is one of the centres of the woollen industry. In the counties Leix, Kilkenny, and Tipperary extends a coalfield from which both bituminous and harder coals are obtained at

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Castlecomer. This is the only Free State coalfield of any value, and the output is small.

West of Waterford extends the lofty range of the Knockmealdown Mountains, and to the north-west the Galtee Mountains. The river Suir rises in the south-



FIG. 158. THE QUAY AND REGINALD'S TOWER, WATERFORD

By permission of the G.W.R.

westward extension of the Slieve Bloom Mountains, flowing first southward across the Golden Vale, and, after a sharp bend to the north, turning eastward to its estuary. Its valley and the rest of the plain extending to Limerick contain excellent pastures, and constitute the chief dairy-farming district in Ireland. This is due partly to climate, and partly to the well-drained soils overlying the limestone. Limerick, Tipperary, and Waterford have each a rainfall of about 39 inches a year, as compared with 31 inches at Kilkenny, which is sheltered by hills in

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the west. Mean temperatures for January range from about 42° F. in the west of the area to about 40° F. in the east. Mean July temperatures are in the neighbourhood of 60° F. Crops of turnips and potatoes are grown, and many pigs are fed on the by-products of the dairy industry. Part of the success of the dairy industry is due to the ease of communication afforded by the direct longitudinal valleys of the rivers. These enable milk-producers to co-operate and maintain supplies to the markets, such as Limerick, Waterford, and Cork. New sugar-beet factories have been established at Thurles, in North Tipperary. Clonmel (9000), in the south, is the county capital.

County Cork is the largest of the Irish counties, covering nearly 3000 square miles. Its long coast, extending from the mouth of the Blackwater at Youghal to Glengarriff, in Ban try Bay, is one of the most impressive for its scenery to be found anywhere. The valleys of the Lee and Bandon are fertile and pleasing. The numerous abbeys, round towers, and ancient churches remind one of the Tweed valley of the Scottish Uplands. In the south of the county, particularly to the west of Cork, there is a marked concentration of both dairy cattle and pigs, showing the connexion between the two industries. In addition to roots and potatoes, oats are quite an important crop. Cork (Corcaigh; 78,000), on the Lee estuary, is the natural focus of these productive valleys. The railway links it also to the Golden Vale. As a port it has a better harbour than Waterford, but its westerly position is unfavourable to the export of perishable goods and livestock, for which a short sea-route is preferable. Butter, pigs, and bacon are exported. Half the imports consist of coal and grain, particularly maize for animal food; salt, fertilizers, and iron goods form most of the remainder. For the distribution of heavy goods Cork has to rely upon the railway, as there are no canals. Coastal and cross-channel ships can enter the port at low water, but larger vessels must use the tide, and "the largest liners anchor in the lower

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harbour. The packet-station of Cobh (Queenstown), on an island, is concerned almost entirely with passenger traffic, and is a port of call for Atlantic liners. The building of Ford motor-cars and tractors is the industry which employs most workers, but Cork has also breweries



FIG. 159. THE MARINA, CORK
By permission of the G.W.R.

and distilleries, woollen- and flour-mills, bacon-curing and chemical works.

The valleys of South-west Cork and Kerry are drowned by the sea. The land of the peninsulas is almost entirely occupied by mountains, which support large numbers of sheep. Some cattle are kept in favourable spots, but there is practically no arable land. This region is famous for having the mildest and most equable climate of the British Isles. The mean January temperature is as high as 44° F. or more, and the mean July temperature is about

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58° F. The rainfall is very heavy, owing to the south-west aspect and the mountainous character of the coast. In places it exceeds 100 inches. Kerry is the western counterpart of Wexford, in the sense that it is almost enclosed by mountains. Still more, this area faces the Atlantic, instead of the narrow sea and England. It was

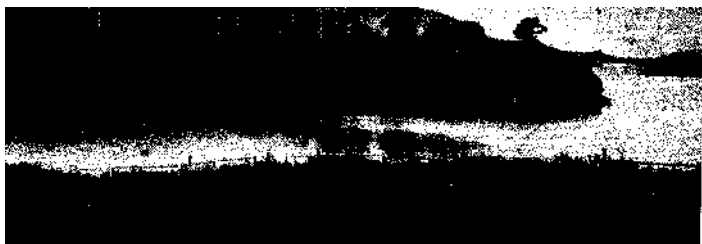


FIG. 160. KILLARNEY
Photo Central Press

therefore much isolated. But the fame of Killarney brings many visitors. The neighbouring mountains, Macgillycuddy's Reeks (3414 feet), are the highest in Ireland.

Bantry, Glengariff, Kenmare, and Castlemaine are towns situated at the head of the respective bays, and are famed for the majestic scenery around them. Tralee, the capital of Kerry, is a market centre and business town. Limerick (39,000), at the head of the Shannon estuary, is too far from the sea to be of much value as a port for exports, but large quantities of coal and grain are imported. The bigger ships anchor several miles away. Even Foynes, on the south bank of the estuary, is thirty-six miles

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from the sea. This port handles large quantities of petroleum and coal. Limerick is an ancient city with a modern appearance. Bacon-curing is the greatest industry. It is one of the largest centres also for making condensed milk. In addition, there are flour-mills and tobacco factories.

Not far from Limerick, at Ardnacrusha, is the powerhouse of the Shannon electricity scheme, the work on which began in 1925 and has since been completed. Owing to the shortage of coal in Ireland electricity is of great importance. The power-station in 1933 supplied 60 per cent, of the current used in the State, the remainder being generated by steam with the use of coal. It is hoped to increase the output to cover this deficiency.

The river Shannon falls only six inches per mile over 125 miles of its course. From Killaloe, the town, at the southern end of Lough Derg, which is about 100 feet above sea-level, the distance to Limerick is only fifteen miles, so that the fall is rapid. A canal was therefore cut to divert most of the water from the rapids over which it previously flowed, and thus to secure the full fall at the power-house. Provision had to be made for a navigation canal and for the salmon, both to enable them to ascend the river and to prevent them from getting into the turbines. The main grid-lines run through Maryborough to Dublin and to Cork. From Dublin they serve the east-coast towns to Dundalk, in the north, and to Wexford, in the south. Other lines serve Tralee and Killarney in the west; Waterford and the south-coast towns; Galway, Athlone, Longford, Cavan, and other places in the central plain.

But agriculture remains the chief industry of the Free State. The value of agricultural products is seven times that of all the manufactures. The total value of the fish caught is about a million pounds, a value no greater than that of the fish landed at Welsh ports. The prosperity of Ireland as a whole depends, therefore, largely upon its pastoral industry. Industrial Britain needs food-supplies,

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and is a nearer market than any other. Great Britain can meet all the requirements of the Free State in manufactured goods. By co-operation, therefore, Great Britain and Ireland can derive great mutual benefit, and the sooner the present obstacles to trade are removed the better it will be for both countries.

The recent trade agreement between the United Kingdom and the Free State, whereby Great Britain will import cattle worth about £1,000,000 and export to Ireland coal of similar value, is a good augury of the full restoration of mutual trade, which the geography of the British Isles shows to be the natural relationship.

APPENDIX

AREA AND POPULATION OF THE BRITISH ISLES

As frequent mention has been made of the area and population of various parts of the British Isles, the following table is provided for ready reference:

	AREA IN SQUARE MILES	POPULATION (Census 1931)
England (excluding Monmouthshire)	50,327	37,359,045
Wales (including Monmouthshire) .	8,016	2,593,332
Scotland	29,795	4,842,980
Total for Great Britain .	88,138	44,795,357
Northern Ireland .	5,458	1,256,561
Total for the United Kingdom	93,596	46,051,918
Irish Free State	26,601	2,971,992 ^x
Isle o f Man	221	49,308
Channel Islands	75	93,205
Total for the British Isles	120,493	49,166,423

¹ Census 1926.

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