

7:75

UNIVERSITY of CALIFORNIA
AT
LOS ANGELES
LIBRARY



Digitized by the Internet Archive
in 2008 with funding from
Microsoft Corporation



FREQUENTED WAYS

17



The edge of the Sella Group, to show the marginal 'towers' with the snow-sprinkled scree at their bases (see p. 219). The flat shelf below the summit of the main mountain group is well seen to the left above the pine tree. In the immediate foreground limestone crops out again, elsewhere the softer beds form the smooth, undulating pastures. Cf. Plate XX.

(Photo by Kilophot, Wien.)

FREQUENTED WAYS

A GENERAL SURVEY

OF THE LAND FORMS, CLIMATES AND VEGETATION
OF WESTERN EUROPE, CONSIDERED IN THEIR
RELATION TO THE LIFE OF MAN; INCLUDING A
DETAILED STUDY OF SOME TYPICAL REGIONS

BY

MARION I. NEWBIGIN, D.Sc.(Lond.), F.R.G.S.

EDITOR OF 'THE SCOTTISH GEOGRAPHICAL MAGAZINE'

AUTHOR OF 'GEOGRAPHICAL ASPECTS OF BALKAN
PROBLEMS,' 'ANIMAL GEOGRAPHY,' ETC.

WITH ILLUSTRATIONS FROM PHOTOGRAPHS
SKETCH-MAPS AND FIGURES



BOSTON AND NEW YORK
HOUGHTON MIFFLIN COMPANY

1922

30562

2-10-25
2-30
2-3
2-30
P. 166

PREFACE

THIS book is intended, not for the geographer in the technical sense, but for all those interested in their surroundings, and the interrelations between these and the life of man. It has been given more or less definitely the form of a travel book, partly because, as indicated by the title, some at least of the regions described are so much frequented as to be familiar, by actual experience or through reading, to most educated persons, and partly to emphasise the main purpose, which is to suggest the interest and the novelty of the familiar. It is hoped that, despite the detail which it has been thought necessary to give, something of the joy of intensive travel shines through the pages.

It is scarcely necessary to state that the book is entirely pre-war in outlook. The political changes which have transformed the map of Europe are outside its scope, and they are too recent for us to be certain how far the economic effects, so apparent at the moment, will persist. Many, indeed, show already clear signs of being transitory, and in not a few areas old conditions are in process of re-establishing themselves. If, however, there is practically no direct allusion either to the war or its consequences, the studious will find it possible to read between the lines not a little having bearing upon both.

Save where specially mentioned, the photographs are my own. I am much indebted to Sir Leslie Mackenzie and Mr. H. Hodge for the peculiarly interesting views which form Plate XVI. The drawings and sketch-maps are by my sister, Miss Florence Newbigin, who has also prepared the index.

Fairly full references have been given, not limited to books in the English language. Apart from the question of their purely practical usefulness, the insertion of these is meant to drive home the notion that the literary output of a country is as definitely characteristic of it as is its climate or relief. One cannot be said to know any part of the earth's surface until one realises how it appears in the eyes of its inhabitants.

EDINBURGH, *March* 1922.

CONTENTS

	PAGE
INTRODUCTION: WHAT EUROPE HAS TO OFFER . . .	1

PART I

THE GENERAL CHARACTERS OF THE LANDS

CHAP.		
I.	THE SURFACE OF THE LAND	13
II.	WAYS TO THE SUNLIT SOUTH: FIRST STAGE	25
III.	WAYS TO THE SOUTH: SECOND STAGE	32
IV.	MOUNTAIN, HILL AND PLAIN	38
V.	RAIN AND SUNSHINE	48
VI.	THE PLANT AND ITS HOME: A STUDY OF FITNESS	59
VII.	THE PRIMEVAL FOREST	73
VIII.	MYRTLE AND BAY	82
IX.	MEADOW, WOOD AND PASTURE IN THE ALPS	98
X.	MOORS AND HEATHS	114
XI.	THE EARTH AND MAN	128
XII.	VINEYARD, OLIVE GROVE AND GARDEN: THE OLD CONDITIONS AND THE NEW	139

PART II

SPECIAL: SOME TYPICAL REGIONS

CHAP.	PAGE
XIII. WHERE SHALL WE GO?	163
XIV. THE REALM OF SNOW AND ICE: ESSENTIAL FEATURES OF THE ALPS	175
XV. THEN AND NOW IN THE ALPS	189
XVI. HILLS AND VALLEYS IN THE DOLOMITES	207
XVII. NAPLES AND VESUVIUS: A STUDY IN VOLCANIC ACTION	223 ✓
XVIII. BETWEEN THE MOUNTAINS AND THE SEA	240 ✓
XIX. AN UPLAND REGION: THE SCOTTISH HIGHLANDS	249
XX. CITY AND PLAIN IN FRANCE	265
XXI. THE NORTH ITALIAN PLAIN	281 ✓
XXII. PROVENCE AND TRANSAPENNINE ITALY: THE DE- VELOPMENT OF THE TOWN	297 ✓
INDEX	313

LIST OF ILLUSTRATIONS

FULL PAGE

PLATE

	The edge of the Sella Group, to show the marginal 'towers' with the snow-sprinkled screes at their bases	<i>Frontispiece</i>
I.	The Falls of Morar, in the West Highlands of Scotland	<i>to face p 4</i>
II.	Vigo Bay—a characteristic ria	„ 6
III.	A view on the shore of Lake Annecy, showing the limestone cliffs so characteristic of the Subalpine region	„ 38
IV.	An old street in Annecy, a town of the Subalpine region	„ 40
V.	Scots pine in the Spey district	„ 78
VI.	Olive grove on the Riviera	„ 82
VII.	Mediterranean pines	„ 86
VIII.	A slope on the island of Capri	„ 90
IX.	A limestone cliff on the island of Capri	„ 92
X.	Near the tree limit on Mt. Revard, above Aix-les-Bains	„ 100
XI.	The southward-facing slope of the Romanche valley near La Grave	„ 102
XII.	Another view in the Romanche valley, near La Grave	„ 104
XIII.	Basin with Gorge above in the Val de Bagnes, Switzerland	„ 106
XIV.	Pine and Moor—the Conflict	„ 114
XV.	The Moor triumphant	„ 116
XVI.	One of the 'black houses' of the Hebrides	„ 134
„	Old and new type of houses in the Hebrides	„ 134

FREQUENTED WAYS

PLATE	
XVII.	Vines grown pergola-fashion near Domo d'Ossola <i>to face p.</i> 158
XVIII.	View of Sion in the upper Rhone valley ,, 186
XIX.	The Western Margin of the Dolomites: The Schlern from Klobenstein ,, 208
XX.	The Sella Group, from near the Sellajoch Hospice ,, 212
XXI.	Limestone rocks off the shore of Capri ,, 226
XXII.	Near the summit of the cone of Vesuvius, showing the unstable slopes of dust, 'ashes,' lapilli, etc. ,, 228
XXIII.	The guardian of the pit—Bocca Grande at the Sol- fatara ,, 230
XXIV.	An olive grove on Lake Como ,, 243
XXV.	View in Glencoe, showing a typical Highland corrie hanging high above the over-deepened valley ,, 254
XXVI.	View of the Cairngorms from the vicinity of Rothie- murchus Forest ,, 256
XXVII.	View on the island of Arran, with Holy Island in the distance ,, 258
XXVIII.	S.E. buttress of Ben Nevis ,, 262
XXIX.	Canal in Annecy ,, 266
XXX.	Gondolas on the Grand Canal at Venice ,, 294
XXXI.	The Arno at Florence in summer-time, showing the marginal pools in which the mosquitoes breed ,, 306

IN THE TEXT

FIG.	PAGE
1.	The American agave 7
2.	Sketch-map to show the structural features of Europe 19
3.	Sketch-map to illustrate the course of the chief railway lines from the coast of France, Belgium, and Holland to Basel and Dijon 29
4.	Part of the old railway through the Jura from Pontarlier to Lausanne 35
5.	The old railway route through the Jura from Belfort to Berne 35

LIST OF ILLUSTRATIONS

xi

	PAGE
1 The Mastic bush	61
2 Large-leaved Cistus	63
3 The Strawberry tree	76
4 The Evergreen or Holm Oak	86
5 The Rough Smilax	89
6 Sweet Bay or Noble Laurel	93
7 <i>Calycyptus globulus</i>	94
8 The Black Mulberry	155
9 Sketch-map of a part of the Swiss plateau	193
10 Geological sketch-map of the Dolomite Region	212
11 Sketch-map showing the structure of France	266
12 Geological sketch-map of Northern France to show the structure of the Basin of Paris	273
13 A Stone Age implement of the Acheulean type	276

INTRODUCTION

WHAT EUROPE HAS TO OFFER

‘The habitable earth is full of bliss.’

It will be remembered that the old lady in *David Copperfield*, who took such strange and elaborate precautions against death by drowning, expressed great indignation at the impiety of mariners and others who had the presumption to go ‘meandering’ about the world. Her principles were justified by her longevity and the peacefulness of her final end, but, so far have times changed, that even to attain her years, few of us can refrain from the reprehensible practice. We all travel as much as we can, and the ease of travel and the possibility of distant travel increase year by year.

But since the visiting of foreign lands has thus ceased to be a mark of what was once called ‘elegance,’ the really superior person is apt to feel that distance, difficulty or great cost can alone justify a journey, and thus the continent of Europe, especially those parts which are easily reached and much frequented, has, as it were, lost caste. Long ago Prosper Mérimée satirised, in the person of ‘miss Lydia,’ the *nil admirari* type of tourist. Miss Lydia preserved her self-respect by manifesting glacial contempt in the face of the wonders of Italy, and contemptuously comparing an eruption of Vesuvius to the sight of the flaming factory chimneys of Birmingham. But the ‘miss Lydias’ of to-day are constrained to visit the Taj or the temples of Kyoto in order to maintain their characteristic attitude with real distinction. It may be said that they and their wanderings matter very

little, but in point of fact the elaborate organisation of travel to meet their new needs is apt to deceive many persons as to the relative merits of countries near and far. Those whose opportunities for distant travel are limited or non-existent are liable to have their judgment warped by the ceaseless journalistic chatter about colonies and dependencies, about New and Old worlds, and to feel that they are losing much from life by the limited range of their 'meanderings.' We cannot do better therefore than to begin a book devoted to Western Europe by a brief panegyric of the unique continent of Europe.

Europe has, of course, primarily for us the supreme importance of having been the cradle, if not the birthplace, of our civilisation, the region which has produced what seem to us the finest flowers of human genius, which has been the nursing mother of the new nations, the original home of the races now dominant. But these obvious facts must not lead us to forget that although, with the exception of the island continent of Australia, it is the smallest of the continents, yet it shows more variety of scenery, of climate, of vegetation than is to be found within a similar area elsewhere. Does this seem an excessive claim? Let us seek to justify it by the enumeration of a few facts.

In the following chapter we shall consider the question of the natural boundaries of Europe, and also the main points about its structure. Meantime we need only note that while Eastern Europe passes with but little interruption into the vast uniform plains of Asia, and is itself monotonous in form and structure, the western part is extraordinarily varied in climate, in relief, in natural vegetation. Leaving aside meantime the facts of human life, let us note how many of the most striking phenomena of physical geography are exemplified here within a very small area.

Perhaps one of the phenomena of the earth's surface which makes the widest appeal is the fact that at the present day

glaciers occur on various mountain ranges. Now the dweller in London is separated from, say, Chamonix, where magnificent glaciers are found within easy reach of good hotels, by a distance of only seven hundred miles, and so short is the necessary sea passage, so well-organised the train service, that he may accomplish the journey thither in just under twenty-four hours. The dweller in Montreal has a far colder winter climate than his cousin in London, but to see glaciers at his ease he must cross a whole continent ; a distance of more than two thousand three hundred miles separates him from Banff in the heart of the Rockies.

If we consider the inhabitants of Australia, we find that their own continent, though not very greatly inferior in area to Europe, contains no examples of glaciers. The dweller in Melbourne must travel to South Island, New Zealand, before he can see moving ice, and therefore a sea passage of twelve hundred miles must be undertaken before his land journey begins.

But the advantages of living in Western Europe, from the standpoint of a student of glacial phenomena, do not stop here. Not only has he typical mountain glaciers within easy reach, but a sea journey of only moderate length separates him from that quite different kind of glacier which is to be found on the surface of the great plateau of Scandinavia. Further, between the Alps and the Scandinavian plateau he has spread out before him a region from which an ice sheet has recently melted away, and where therefore its effects can be studied in detail. More than this, almost all the great generalisations in regard to ice and its effects have been laid down by European workers, chiefly on the basis of their observations within the area. Thus the land is classic ground : here have the founders of geological science toiled, here they have reaped a rich harvest of observations and deductions.

Perhaps next to ice the inner fires of the earth make the widest appeal, and here again the western European has many

advantages. It is true that the journey to Naples, where an active volcano can be most conveniently observed, is not short. From London a distance of some thirteen hundred miles must be covered before one sees the thin column of vapour rising from the summit of Vesuvius, but what other continent is in better case? We often talk lightly as if New Zealand and Australia were near together, but the dweller in Sydney or Melbourne must make a sea passage of about this total length, to Wellington or Auckland, before beginning his railway journey to the volcanic region of North Island. Again, if active or dying volcanoes are not very near to us, we have in the Auvergne, in the Eifel, in the Lowlands of Scotland, all stages in the dissection of volcanic heaps after the fires have burnt out, and these, no less than the relics of the Ice Age in Europe, have been the training ground of the geologists who have studied volcanic phenomena in detail. The very fact that Arthur's Seat rises in solemn majesty above the city of Edinburgh has helped to make that city a home of geologists, has led to the enrichment of human knowledge.

It is the same with a whole series of other phenomena. To study personally that curious and interesting type of climate which the geographer calls the Mediterranean, the citizen of New York must travel some three thousand four hundred miles by rail to the vicinity of San Francisco. To experience that mild, windy, and rainy type at which we grumble periodically here he must travel to British Columbia. But a journey of less than a thousand miles brings the Londoner to the Riviera, where he may see Mediterranean vegetation and experience the Mediterranean climate in its most typical form. By travelling eastward a distance not much greater he can study at first hand that extreme 'continental' type from which the New Yorker suffers.

Perhaps at this point we should note that because the mid-European plain, narrow to the west, widens as we pass eastward, and has there great uniformity of surface, the conditions

PLATE I



The Falls of Morar, in the West Highlands of Scotland. The short 'river' which connects the deep Loch Morar with the sea falls here over a rocky sill, so that a slight submergence would convert the loch into a fiord. (Cf. Loch Etive a little further south.)

in Russia recall those of the larger continents of Asia and America. To get variety of scenery, of climatic conditions, of surface, the Russian must, generally speaking, make longer journeys than the western European. But since he is an element, if a somewhat remote one, in the civilisation of Europe, we have to note that the geographical peculiarities of his country, reflected in the differences of his literature and social polity, add another factor to the wealth of human experience in Europe.

Without labouring our point excessively we may go on to note that throughout the length and breadth of Australia there is no example of those young folded mountains which we have so beautifully exemplified in the Alps, the Pyrenees, the Atlas, the Caucasus, and so forth, and the same statement is true of the length and breadth of Africa south of the Sahara, as it is of India south of the Himalaya. Over the whole surface of the globe there are only four outstanding examples of that interesting kind of coast-line which we call a fiord coast, these four being Western Scandinavia, British Columbia, Western Patagonia, and south-western New Zealand. Of these the European example is from the human standpoint the most interesting, for the effect of the physical conditions on the people can be studied there more easily than elsewhere, and this coast-line is within easy reach of Great Britain. Further, individual fiords are to be found so near at hand as the western coast of Scotland.

The geographer draws a sharp distinction between a fiord coast, which in its typical form occurs only in high latitudes where there are signs of recent glaciation, and that other type of sea inlet which he calls a ria. In the fiord the valley walls rise steeply from the water's edge, leaving at best but a narrow tract of land which can be cultivated; the fiord itself often branches and winds, and its inner deep basin or basins is separated by a rocky sill (Plate I.), which sometimes forms a bar at low water, from the ocean without. A ria is but a

drowned river valley, sloping steadily seawards, and of such rias we have splendid examples in the south-west corner of Ireland and off the west coast of Spain (Plate II.), within easy reach of the fiords with which they may be contrasted.

If the traveller's interests lean to the botanical side, nowhere so well as in Europe can he find many diverse plant associations within easy reach of one another. The heather moors of Scotland ; the coniferous forests of the Alpine slopes ; the close, dense turf of the higher mountains, so profusely spangled with bright-coloured flowers ; the resinous and scented plants of the Mediterranean, with their poorly developed leaves and their often gorgeous and fragile flowers : these form well-defined plant groups, sharply separated from each other, and yet all within comparatively easy reach.

That curious phenomenon of the ousting of native plants or animals by introduced ones is so often discussed in connection with Australia or New Zealand, that many people have an impression that it is peculiar to that part of the world, and yet the continent of Europe shows innumerable examples. Almost as soon as one crosses the Channel the white-flowered Robinia, or false acacia, appears in every hedgerow, and yet it is a comparatively recent introduction from North America. As we journey southwards, and the climate becomes warmer, the Tree of Heaven appears as a wild plant, forming thickets of self-sown seedlings wherever it is permitted. It is also a recent introduction, this time from the east. Round the shores of the Mediterranean many American or South African plants have run wild—the tall agave (Fig. 1) ornaments almost every rock and crag, the Cape fig-marigold (*Mesembryanthemum*) hangs its long trailing stems with their closely adpressed fleshy leaves and brilliant magenta-pink or yellow flowers over every rocky surface available, the prickly pear becomes a weed on waste ground, and there are many other similar cases.

Finally, if the traveller's interests lie chiefly with man,

PLATE II



Vigo Bay, off the coast of Spain, a characteristic ría.

within a short radius from London he may find remnants of the most primitive types in the caves of southern France—the handprints on a smoked rock surface where blood



FIG. 1.—The American Agave, often called an aloe, one of the most characteristic introduced plants of the Mediterranean region, where it now grows wild everywhere.

brotherhood was sworn ; the magical pictures of transfixed elk or deer which the wise men of the hunting tribes drew so laboriously ; the places of burial ; the fragments of old time feasts ; the manifold traces from which the social life, habits,

food, dress, and so forth of the first inhabitants of Europe can be partially reconstructed.

From this period onwards the changes of human life can be followed step by step, as they cannot be followed, within so limited an area, in any other part of the globe.

When finally we come down to our own day, we find that the variety of surface and relief is reflected in a great variety of tongues and of social traditions. France, which is so near to us in space, and which in parts is so similar in physical features, offers striking contrasts in modes of life, in social conditions, and it is but one of the countries which lie within easy reach. In brief, alike the specialist in some particular branch of geographical science, the student of human life, and the unspecialised traveller can find in Western Europe within a short distance, and at a very moderate outlay, a wealth of material which dwellers in less-favoured regions must seek over a very much larger part of the surface. The interest of the study of the area is intensified by the reflection that the variety of conditions existing in Western Europe has led to the evolution there of the races which have spread over the greater part of the earth, and have been the most potent agents in modifying its surface.

In the chapters which follow an attempt will be made to prove the statements just made as to the infinite variety of Europe by a more detailed study of some of its characters, and also to suggest the joys of what we may describe as intensive travel within its borders.

The subject is a very large one, and a selection of material must necessarily be made. The method adopted is to consider generally the structure of Europe, with special reference to those features which influence the great travel routes, and which can thus be most easily observed by the tourist. Some notes on climate must then be added, for it is a subject upon which very vague notions exist generally. The plants of Western Europe, considered from various aspects, require more

detailed discussion, especially as reflections of the local soil and climate. Finally, even for those who have no interest in botany, the question of the relation of cultivated plants to the possible forms of human society in an area is one of surpassing interest. We shall try to show, for example, that the question of where the vine can be grown in Western Europe, and what are the best modes of growing it in the different localities, a question which can be studied by the least specialised, is one bound up with many interesting human problems.

Finally, when in this fashion we have suggested, however superficially, the interest which modern methods of geographical investigation may give to travel, we shall consider a few type regions, applying the new methods to these. In these chapters the object will be not to attempt to answer fully the utilitarian question—Where shall we go? but rather the further question—What shall we see when we get there?

PART I

THE GENERAL CHARACTERS OF THE LANDS

CHAPTER I

THE SURFACE OF THE LAND

‘ Russet lawns, and fallows grey,
Where the nibbling flocks do stray ;
Mountains, on whose barren breast
The labouring clouds do often rest ;
Meadows trim with daisies pied,
Shallow brooks, and rivers wide.’

BEFORE we can proceed to consider the main points in regard to the structure of Europe, we must begin by defining the term, and it will probably come as a surprise to those whose geography has been of the older type, to learn that not only is there considerable difference of opinion among geographers nowadays as to what constitutes Europe, but that not a few of them would abandon the conception altogether, and boldly separate the western part, deeply interpenetrated by water, and having a surface of very varied relief both above and below water, from the wide, uniform eastern region, remote from sea influences.

The argument relied upon by those who would keep the existing conception of a European continent may be very simply stated. If we glance at a population map of the world, we find that in the great Eurasian land-mass two widely separated areas of dense population exist. In the Far East in the low grounds, and especially in the wide river valleys of the monsoon regions, human beings, depending chiefly upon agriculture, are densely clustered. In the Far West, chiefly but not exclusively in the mid-European plain, the population is even denser, a population which depends largely,

though not entirely, upon manufacture for its maintenance. Even here, however, in small areas, as round Naples, in Malta, etc., we have a local development of extraordinarily high densities associated primarily with agriculture.

Stretching between the two areas, which are literally blackened by human beings and their activities, is a great area of steppe, desert or high mountain land, relatively unfavourable to human life and for the most part but scantily peopled. Thus we may say that from the standpoint of human life Asia is the fertile, warm and well-watered region lying to the east of the central wastes, and Europe the densely-peopled area to the west of them. Originally the populous part of Europe was the warmer, more fertile parts of the western area; now, as already suggested, the densest population clusters round the coalfields, which often lie in relatively infertile regions.

Between the two patches where the human ants cluster thickly, the central tract of land is scantily peopled by pastoral nomads, or was once so peopled, and thus, theoretically, the line separating Europe from Asia should be the line delimiting generally the eastward extension of a dense sedentary population. This is more or less marked by the crest of the Ural Mountains, and the course of the Ural River, which form the traditional eastern boundary of Europe, though the actual line does not quite follow that river.

But even if we regard the Urals as forming a more or less formidable barrier to the passage of hordes, whether of men or beasts, seeking to enter Europe from the Asiatic wastes, we have still to note that south of that barrier, between it and the northern end of the Caspian Sea, there intervenes a belt of steppe—more than three hundred and fifty miles wide—barred only by the not very formidable Ural River. Through this open gate invaders from Asia have always entered—the Huns and the Tartars among tribes of men, the rat and the hamster among animals; for it is characteristic

of the steppe animals that they, no less than the men, tend periodically to overrun their means of subsistence, and to descend upon the surrounding cultivated lands.

In these latter days, however, the cultivators are being avenged on the steppe-dwellers, for Russian peasants are pushing cultivation out into the steppes, are exerting both a physical and an economic pressure on the Kirghiz nomads.

It results from this, that if we are to take as the natural eastern boundary of Europe the scantily peopled region in Russia where cultivation thins out, we have to recognise that it is a boundary which has varied throughout the ages, one which has been pushed now to this side and now to the other. Europe throughout its history has looked west; its inhabitants have migrated westwards, the trend of civilisation has been westwards. Asia, on the other hand, looks to the east, and in this respect Russia resembles Asia. We need therefore have little hesitation in regarding the greater part of Russia as Asiatic in character, as not belonging strictly speaking to the European world. In other words, in spite of the text-book tradition, we may regard Europe as ending to the east at about the longitude of the western end of the Black Sea.

The next point is to consider the southern boundary. Here again tradition does more or less violence to the actual condition of affairs. Crete is in Europe, Cyprus in Asia, but no very great distinction in climate or products exists between the two. Politically Algiers, which is in Africa, is part of France, and part of the southern rim of the Mediterranean resembles the northern. Indeed any logical classification of the lands, based on modern principles, would recognise the whole Mediterranean seaboard as forming a unity. If we regard its fertile parts as forming part of Europe in our sense, then the south and south-eastern boundary of that continent is formed by the desert, the Sahara and the Syrian deserts, a barrier alike to men and animals, and one which man has not yet succeeded in conquering. Thus in the east, the south-east

and the south, we may abandon the boundaries of tradition for others more in accordance with modern geographical views.

What about the remaining boundaries? The western is, of course, not doubtful, for it is made by the great Atlantic Ocean. The northern is the Arctic Ocean, but we should note that by shutting off most of Russia from our conception of Europe, we deprive that continent of truly Arctic lands. Canada, in a table of statistics, covers an enormous part of the earth's surface, but of that area a very large part is useless Arctic waste. Even in Russia the cultivation of cereal crops is not possible beyond the Arctic Circle, and not always up to that limit. But, for reasons which we shall consider directly, barley can be cultivated almost to the extreme north of Norway, at any rate on the west, and practically the whole of the coast of that country is available for summer pleasure trips. The Canadians do not take summer trips to the coast of Baffin Land!

Thus by drawing the boundaries of Europe after the fashion just described, we find ourselves confronted with an area of great variety of surface, of truly temperate climate, never excessively hot, never excessively cold, of great local fertility and with an entire absence of deserts or steppes—with an entire absence also of what are called basins of internal drainage. In other words, in Europe in this narrow sense no river loses itself in desert sands, nor ends uselessly in a salt-encrusted depression, as do so many of the rivers of Central Asia, and some of those of European Russia. Nay, further, no great river in Europe flows northwards to the cold Arctic Ocean, as do the great rivers of Siberia and some of those of Canada, with the result of sterilising vast extents of level land, owing to the flooding produced yearly when the upper reaches bring down great volumes of water, while the mouth is still blocked by ice.

Finally, as we have already seen, Europe is deeply interpenetrated by water, and the inland seas lend themselves to easy

navigation, and therefore promote free intercommunication between the various regions, and thus a free interchange of products. That part of the surface which is furthest removed from the sea has the advantage of great navigable rivers, especially the Danube and the Rhine, which increase the ease of communication. All these characters have had much to do with making Europe the great home of civilisation.

Having now fixed the boundaries of what we shall regard as Europe, let us glance for a little at its structure, beginning with the seas.

Off the west coast of Spain and Portugal, and to a less extent off the west coast of Ireland—all exposed coasts, beaten upon by the fierce Atlantic breakers—the sea-floor steepens rapidly to the great ocean depths. On the other hand, as we all know, the North Sea, with its connecting seas and channels, is shallow—it is merely a submerged part of the continental mass. The position of the British Isles on the outer margin of this submerged plain gives rise to sheltered ports on both sides of the 'Narrow Sea,' and the tides and currents which sweep through it, combined with the irregularity of the sea-floor, here with shallow areas containing sandbanks eminently suited for spawning grounds, there with holes which afford shelter from storms, make it admirably suited for fish—a fact which largely accounts for the way population is distributed round its shores.

The Baltic, with but a narrow, island-blocked connection with the North Sea, is much shallower, is liable to be partially frozen in winter, and has fresher water than the North Sea. It is an interesting fact that just as the Swedish plain bears some deep lakes, so the generally shallow floor of the Baltic is in places hollowed out by deep depressions. The irregularity of the sea-floor both in the North Sea and the Baltic is one of the reasons for believing that both not long ago formed land surfaces—they have been moulded as land surfaces are moulded, by such agents as ice, running water, and so forth.

Very different is the Mediterranean. It is in places very deep, sinking to two thousand four hundred fathoms; it is salt; it has but little tide; its fisheries are poor, from the point of view of food that is, for the presence of precious corals and sponges increases their commercial value. Instead of being merely a flooded part of the continental shelf, it is a deep fosse, owing its present form to earth movements at the time when the great folds which produced the surrounding mountain chains were ridged up. To these earth movements we have to ascribe the presence of active volcanoes, the frequency of volcanic phenomena generally, and the constant occurrence of earthquakes in parts of the area. A line of shallow water, stretching through Sicily and Malta to the African coast, shows one of the lines of subsidence. A movement of elevation here would divide the Mediterranean into two basins, an eastern and a western, and the migrating birds as they travel to and fro between Europe and Africa follow this line of vanished land.

Long ago the present Mediterranean was continued as a great sea through Central Asia. A part of that eastern extension persists, in somewhat altered shape, as the Black Sea, just as still another part forms the Caspian. The Black Sea is deep, sinking to below one thousand fathoms; it is remarkably fresh owing to the great rivers which enter it, and, owing to the absence of movement in its depths, the water there is charged with sulphuretted hydrogen produced by decay, and is therefore devoid of all forms of life.

Now let us turn to the structure of the land. The first point to realise is that in the south, near the deep hollows of the Mediterranean, we have lofty mountain chains, represented by the Sierra Nevada, the Pyrenees, the Alps in their many branches, the Apennines, the Carpathians, the Balkan Mountains, the Caucasus and so forth. As the sketch-map (Fig. 2) suggests, all these ranges are connected together, though the connection is not always apparent. They are composed in

part of rocks of recent geological date, and are members of a great system of folds which appeared on the earth's surface

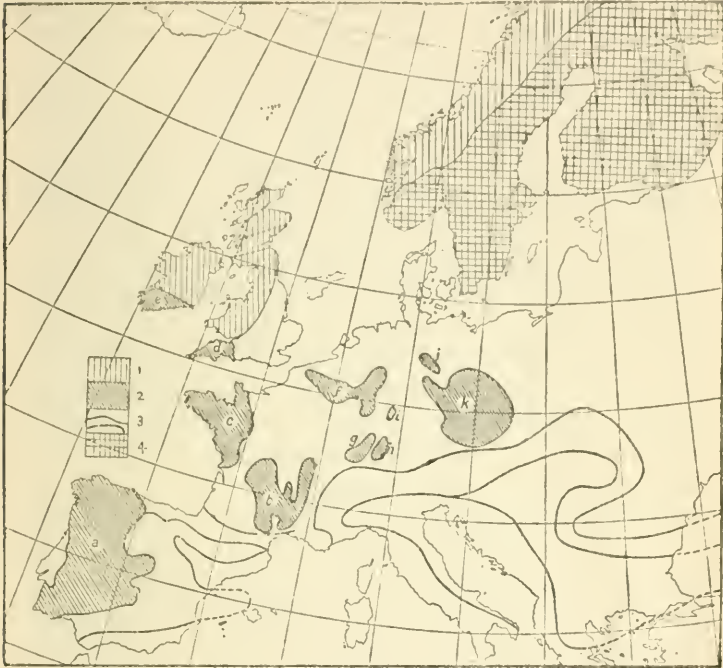


FIG. 2.—Sketch-map to show the structural features of Europe.

1. The Northern Uplands, a remnant of the Caledonian Land.

2. The earth blocks of Central Europe, remnants of the Armorican and Hercynian chains. The chief elements are lettered (a) the Plateau of Spain; (b) the Central Plateau of France; (c) the Uplands of Brittany, continued across (d) Cornwall and (e) south-west Ireland; (f) the Vosges Forest; (g) the Odenwald and Spessart; (h) the Bavarian and Bohemian Highlands.

3. The general position of the great folds, forming the mountain chains of Southern and Central Europe.

4. The oldest land surface of Europe, exposed by denudation. This region forms a fragment of another part of which was ridged up to produce the mountain chains (1).

late in geological time, to which are due the rocky mountain ranges of the present day.

We need not here discuss in detail the origin and characters of these great folds, but it is worth note that the force which caused folding acted from the south towards the north and north-west. Now, in Central Europe, at the time when the folding was going on, there already existed the worn-down fragments of very ancient mountain chains (the Armorican and Hercynian chains, 2 on map), composed of hard and resistant rocks. If we think of the folds as earth waves similar to ocean waves we have to think of these mountain fragments as the shore. The folds broke as it were against the foreshore, so literally sometimes that great masses of rock were carried over to the north, as the spray dashes over obstructing rocks, and we have mountains in the northern parts of the Alps which have, as the geologists say, 'no roots,' which are, as we may imagine, fragments of consolidated foam left stranded. Where the opposing force of the foreland was least there the mountain folds travelled furthest north; where it was greatest their course was blocked.

Note on the sketch-map how the folds make a bay between the Central Plateau of France and the block formed by the Highlands of the Black Forest and Vosges; note also the larger bay to the east formed by the Carpathians beyond the obstruction of the Bavarian and Bohemian highlands. On the other hand, the Central Plateau of France offered great resistance to the folds, which are here pushed far to the south, and to east and west of the plateau, but especially to the east, there are gaps in the chains of mountains (the lower Rhone Valley marks the eastern gap) which have greatly influenced the history of France, for they have permitted the influences of the Mediterranean to penetrate to the north-west, and so allowed France to form a unity, despite the differences in character between its Atlantic and its Mediterranean segments.

A secondary effect of the existence of the earth blocks in Central Europe at the time when the mountain chains of the south took origin, has been to give rise to fertile plains within

the bays which we have described. Thus the great curve of the Alps between the Cevennes and the Black Forest region has to the south-east the plain of the Po, fertilised by the abundant waste of the surrounding mountains; the greater curve of the Carpathians shelters the large Plain of Hungary, fertilised in a similar fashion. These plains were originally great hollows in front of the mountains, which have been filled up by their waste. Spain has been less fortunate than some of the surrounding lands, for the presence of a very large earth block to the west has complicated the folds, and reduced the fertile plains to small patches, with considerable difficulties of intercommunication.

From the traveller's point of view we have to note that these folded mountains of southern Europe not only give rise to magnificent scenery, but, owing to their elevation, many of their peaks are capped with masses of eternal snow, from which glaciers stream down the valleys.

We have spoken of the earth blocks of Central Europe as remnants of old mountain chains. Let us look at them in a little more detail, noting first their characters.

They can be recognised by the rocks of which they are composed, and by their structure, which shows that they once displayed that complex folding so well seen in the Alps, remnants of which still exist in these blocks. (It may be well seen, for example, along the valley of the Meuse in the Ardennes.) But so long have these mountains been exposed to the action of the weather that the hills have been made low and the valleys have been exalted. No longer do we get the elevation, the sharp forms, the rapidity of waste, and the other features so characteristic of young folded mountains. In the Apennines one sees hills of considerable size made of soft rock like clay—but in the old mountains all soft rocks have long since been worn away.

On the seashore at a frequented resort, as the tide flows one may see splendid sand castles rising above the level surface,

with moats and towers, lofty walls and all the devices that the ingenuity of their youthful builders can suggest. When the tide ebbs at most a slight irregularity of the surface, smoothed by the action of the waves, marks the site of the vanished edifice. With such worn-down castles we may compare the mountain remnants of Europe, save that we have to remember that they were originally built up of very varied materials, and the denuding forces have been selective, taking away the softer or more easily dissolved beds, leaving the hardest and most resistant. Further, their present form, sometimes bold, *e.g.* in the Cevennes and in Spain, is due to the fact that when the young folded mountains arose in the south, an effect of repercussion, as it were, caused certain lands to crack and sink, with the result that some of the ancient uplands regained sharpness of outline.

What are the chief of these mountain remnants? If we begin in the south-west we note that much of Spain is occupied by such a mountain remnant or earth-block, which, partly for the reason just given, and partly because it has been greatly dissected by weather, has been so modified that its edges and the harder parts of its mass stand up and give the appearance of mountain ranges, the ranges which school children used to be (and sometimes still are) taught to reel off in a string.

In France a large block forms the Central Plateau, whose edge stands up steeply from the lower Rhone Valley, and again gives rise to the appearance of a mountain chain—the Cevennes. In Brittany another remnant gives rise to the uplands of the region, uplands which have produced a strikingly distinct type of civilisation, and are inhabited by people of different racial affinities from those of the dwellers in most other parts of France.

It has long been recognised that across the Channel from Brittany the same type of rock reappears in Cornwall and Devon, forming the uplands there; it again reappears in the south-west of Ireland.

In Belgium the uplands of the Ardennes, which are continued into the high ground across the Rhine, are of the same type, as are the Vosges, the Black Forest Uplands, the Odenwald and Spessart region, the Harz, and finally that great mass of upland formed by the Thuringenwald, the Bavarian and Bohemian highlands, which is described in the geography books as forming various 'ranges.' Of the uplands named the Vosges and the Black Forest are specially interesting. They are separated by a narrow gap in which the Rhine flows—a gap due ultimately to a snapping of the earth's crust, with the consequent formation as a result of denudation of a steep-edged valley or 'rift,' which separates an originally continuous mass of highland into two parts, and permits the Rhine to escape northwards. All these various earth-blocks can be readily recognised from the accompanying sketch-map.

We have, however, left unmentioned another great area of upland, shown by a different kind of shading on the map. This occurs in part of Scandinavia, Scotland, the north-west of England, Wales, and much of Ireland. The regions named are fragments of a once continuous land surface (the Caledonian Land), which in very early geological times stretched across part of what is now the North Atlantic Ocean, and bore folded mountain ranges. The countries named therefore also consist of old, resistant and folded rocks. The remaining shading in the extreme north-west of Scotland and in Sweden and Finland indicates the position of the oldest known land surface in Europe (4 on map).

The next point is to consider the characters of the parts left blank on the sketch-map. These are regions where the ancient rocks have sunk down, leaving depressed areas. The latter in course of time tended naturally to be filled up by waste from the higher lands, the waste being deposited in beds which showed no very great deviation from the horizontal. Between the Finno-Scandinavian mass and the ancient rocks of Great Britain lies another such depressed area, now

partially filled by comparatively young and soft beds. Part of this area lies beneath the waters of the North Sea, though not long ago it was dry land. Another part forms the fertile plain of eastern England. Again, a similar region lies between the Ardennes and the uplands of Brittany, and has been completely filled by soft rocks, to form the plain of Northern France. The depression between the Central Plateau and Brittany similarly forms the plain of south-western France, and so on. At their edges these plains, which are better called basins (*e.g.* the basin of Paris) slope towards the ancient uplands.

This description gives us an idea of the main structural elements of Europe. It will be noted that the variety of surface to which we have already called attention is due to the complexity of structure, for level fertile plains alternate within short distances with worn-down uplands and young folded mountains: or, in other words, centres of dense population with superb holiday grounds.

CHAPTER II

WAYS TO THE SUNLIT SOUTH : FIRST STAGE

‘ Fairy Lands girt by some heavenly sea.’

THE significance of the structural features of Europe already described may perhaps be best appreciated by looking at them from the point of view of their relation to the main travel routes, for, as some one has judiciously remarked, it is a curious fact that railways follow more or less the direction you would have recommended them to take, if you had considered the question carefully !

Let us note first the direction of the main routes. The part of the Mediterranean seaboard which exerts most attractive influence on us may be said to lie between the mouth of the Rhone and the head of the Adriatic Sea, the whole of peninsular Italy being, of course, included. Now to reach this area, starting from the United Kingdom, the direction to be followed varies from nearly due south to south-east. This part of southern Europe has always appeared in the guise of fairyland to northerners, and to reach fairyland from London a triple rampart has to be crossed, in addition to the moat which has such terrors for many—the Straits of Dover.

The first line of fortification is breached and not continuous. It is made up by some of the ancient uplands shown on Fig. 2, and, as the map shows, these are more or less separated from one another. Thus the Central Plateau of France (Auvergne), though it sends in the Morvan a long arm to the north-east, does not reach the Vosges : the Vosges in their turn are not perfectly continuous with the great block formed by the

Hardt, the Rhenish Highlands and the Ardennes. These two gaps allow for the passage of railroads.

The second fortress wall is formed by the Jura Mountains, which are separated from the Alps proper by the plain or plateau of Switzerland, and by a similar plain in Wurtemberg and Bavaria. The Jura also are breached, though less noticeably than the ancient uplands to the north-west of them, the chief breaches being due to the exit of the great rivers, the Rhine, the Rhone, and so forth, which, rising in the Central Alps, have to find a way of escape through the wall of the Jura in front. Again the breaches allow of the passage of railways.

Very interesting is the relation of the Jura to the uplands in front. Between the Central Plateau of France and the Alps there runs a long wide valley which, in its upper part, follows the curve of the Jura, and is occupied first by the southward flowing Saône and then by the combined Saône and Rhone. On the other hand, the Rhine, after its exit from the mountains at Basel, runs northward (first north-east and then north-west) in what, as we have explained, is a rift in the ancient uplands. As is seen on the map, Fig. 3, the southern end of the upland here formed a very rigid obstacle in the way of the Jura folds as they were pushed to the north-west. But while the Jura approach the Black Forest so nearly as only to allow room for the Rhine to escape, between the Jura and the Vosges, on the other hand, there lies a gap, some fifteen miles wide, by means of which there is easy communication between the Saône Valley and the middle Rhine Valley. This is the Gate of Burgundy, a gap of great importance in connection with the course of the main routes. It is worth note that so low is the watershed here between Rhine and Rhone, that a canal actually connects the Rhine and the Doubs (a tributary of the Saône).

What we have called the third of the great walls, guarding Italy from approach from the north-west, is formed by the Alps themselves, and the breaches in this wall are narrow and

steep, and will demand rather more careful consideration. At present we need only note that the successive members of the triple rampart are higher and more difficult as we pass from the north-west to the south-east. Further, while the lowest and outermost is widely breached, the possible lines of passage become successively more difficult and narrower as we approach the Central Alpine chain. If we think of the tourists of the north-west as a great army advancing upon Italy, then we have to realise that at first there are many lines of possible advance, but the more nearly we approach the citadel the more closely are the advancing forces compelled to concentrate upon a very small number of possible routes. With this general conception in view let us note a few details.

There are two main junctions which may be regarded as marking the end of the first stage of the journey—the traverse of the broken belt of ancient uplands. The traveller who has reached Dijon or Basel has conquered the first of the three difficulties which lie between him and fairyland.

To reach Dijon practically only one route is possible, that which leads from Paris first up the valley of the Seine, then up that of the Yonne, and finally along the line of the Canal of Burgundy and over the limestone region of the Côte d'Or to Dijon and the upper part of the Saône Valley. (See the map which forms Fig. 3, p. 29.)

On the other hand, the time-table offers a bewildering variety of routes to Basel, though on investigation these reduce themselves to three, with variants.

The quickest route, but that with a very limited service, leads from Calais across the plain direct to the Plateau of Langres, which is a dome-shaped region, connecting, as it were, the Morvan to the Vosges, and formed of ancient rocks, more or less thinly covered by later beds. This route avoids Paris, passes through Laon and Reims, crosses the low plateau without great difficulty, goes through Belfort and the Gate of Burgundy, and so reaches the middle Rhine Valley and Basel.

It traverses what is now French territory for the whole of its course, and enters Swiss territory at Basel. Now Paris is in a very special sense the centre of France, and the fact that this route avoids Paris indicates that it is intended to serve British rather than local traffic, hence the very limited service of trains. The more usual route to Basel includes Paris, and thus is necessarily longer, for it involves a loop (Amiens to Paris, Paris to Châlons, where the other route is joined, and thus two sides of a triangle, instead of one.) We may note here that the most recently opened approach to Italy, that *via* the Lötschberg tunnel, avoids Basel, reaching Berne directly from Belfort.

If the descriptions of the uplands already given have been followed, it will be obvious that there are two other possible routes to Basel. As the town lies at the end of the Middle Rhine Valley, it may be reached by travelling up the valley, which may be entered either (1) where its western rampart breaks down in the north, *e.g.* at Cologne, or (2) where there is a noticeable gap in its retaining wall further south, at the Col de Saverne, *e.g.* near Strasburg.

The former of these two routes, which is the longest of the more usual ones, involves the wide sea crossing to Flushing or from Harwich to the Hook of Holland, and then a journey *via* the level plain of Holland to Cologne, after which the valley is followed to Strasburg, Mulhouse and Basel. As a number of routes pierce the eastern retaining wall of the Rhine Valley, and permit of access to many of the towns of the eastern part of the European plain, the heavy composite train which is made up at the Hook divides up *en route*, and its Basel component is not a large one. The Flushing train also chiefly serves Germany.

The other route mentioned is interesting. It involves the sea passage from Calais to Ostend, then a journey *via* Brussels to Namur. Between Namur and Luxemburg the Ardennes are crossed. From Luxemburg the Moselle Valley is reached

at Metz, an interesting intersection point of routes. At Metz the line turns nearly due east, and, skirting the anterior

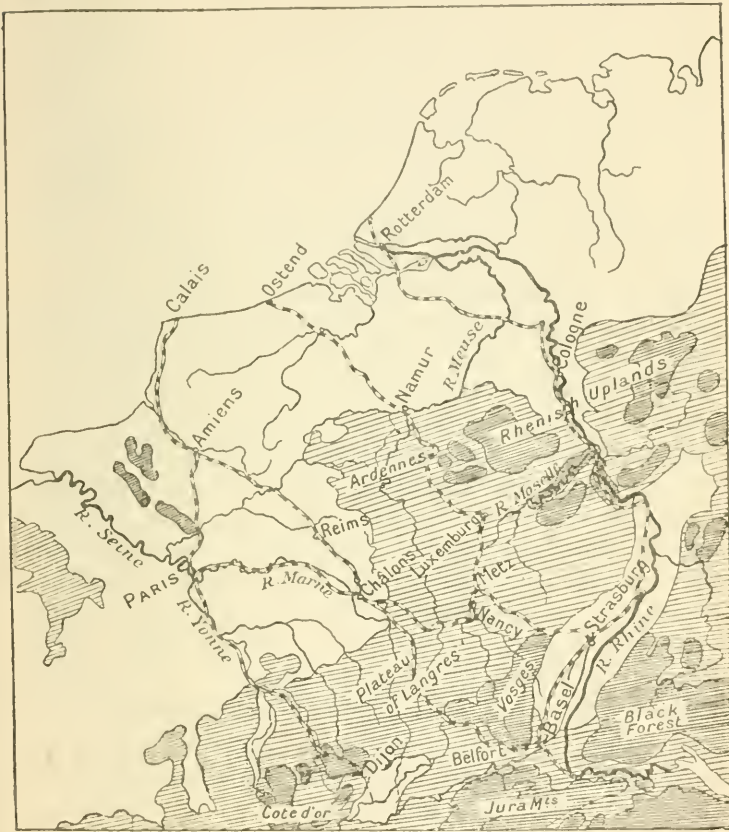


FIG. 3.—Sketch-map to illustrate the course of the chief railway lines from the coast of France, Belgium, and Holland to Basel and Dijon. Note the number of routes which converge upon Basel. The areas left uncoloured lie between sea-level and a height of 650 feet; those lightly shaded between 650 feet and 1600 feet above sea-level; those shaded dark above 1600 feet and below 4900 feet.

end of the Vosges, reaches Strasburg, and so has the road open up the Rhine Valley to Basel.

But we have to note, in connection with this route, that further up the Moselle than Metz lies the town of Nancy, also an important intersection point. Now the Moselle once ran into the Meuse near Toul, and its old course allows an easy crossing from the Moselle valley at Nancy to the Meuse. The next river, the Marne, also once flowed into the Meuse, and thus there is another easy passage from the valley of the Meuse to that of the Marne, and the Marne drains into the Seine and so leads to Paris. Thus it is possible for a traveller to reach Strasburg *via* Paris, the Paris and Brussels routes joining not long before the train enters Strasburg.

To sum up, in order to reach Italy the traveller from the north-west must first travel either to the upper (north) end of the Saône-Rhone valley at Dijon, or to the upper (south) end of the Middle Rhine valley at Basel. To reach Dijon he can journey to Paris by any one of a considerable variety of routes ; from Paris it is possible to make almost a bee-line to his destination, despite the intervention of the Côte d'Or, for the great tributaries of the Seine have opened out a way for him. No perfectly direct route leads to Basel, for the Vosges intervene. The quickest route leads round the southern end of these mountains and avoids Paris. Only very slightly longer is the route near the extreme northern end of the Vosges, which passes by Brussels, Metz, and Strasburg. Travellers from Paris can reach this route directly through Nancy. About one hundred miles longer, and yet not without its advantages to the judicious traveller, is the route which leads right down the middle Rhine valley from Cologne.

To have grasped the geographical reasons which have determined the course of those various routes is to have acquired a grip of the chief structural features of the western part of the European plain, and the traveller with discretion will so vary his journeys, outward and inward, as not only to see the four main routes, but also so as to traverse, so far as possible, their more interesting parts by daylight.

This description of them may seem to some needlessly detailed, and more than a little dull, but one has to remember that the Alps and their continuations separate parts of Europe which differ from one another profoundly, not only in their natural features, but in the history and social conditions of their peoples. It is impossible to realise fully the contrasts between the two areas, unless one understands the relative difficulty of communication in different places, and the lines along which this communication has taken place. The great Rhone valley allows Mediterranean influences to penetrate so far with the greatest of ease, and we find that Arles and Avignon are Mediterranean in character, though politically French. Lyons, lying in the same valley, but outside the reach of the Mediterranean climate, is wholly northern in type. To appreciate the conditions which have determined the main routes of travel, is to appreciate also the lines along which more subtle influences have passed, and the extent of such influences is related to the relative ease or difficulty of inter-communication.

CHAPTER III

WAYS TO THE SOUTH : SECOND STAGE

‘ Lo ! where the pass expands
Its stony jaws, the abrupt mountain bends
And seems, with its accumulated crags,
To overhang the world.’

To appreciate the significance of the second great step in the southern journey, let us look for a moment at the structure of the Jura. The Jura proper extend from about Chambéry to the region lying north-west of Zurich. To the north-east the line is continued by the Swabian Jura and the Franconian Jura, but these do not show the characteristic folding which is so clearly developed in the Franco-Swiss Jura.

The latter are of younger date than the Alps proper, are, of course, much lower, and display a very simple form of up-fold and downfold, the upfolds corresponding broadly to the higher ground and the downfolds to the valleys. So simple and direct a relation between mountain structure and form is rare, and is in itself evidence of very recent origin. The arches of the upfolds in the Jura are generally broken at the summit, and there clays and similar rocks appear, so that the broad plateau-like summits of the ridges are often marshy. But to a great extent the Jura are built up of limestones, and the steep escarpments of the limestone rocks are one of the most obvious and attractive features of a journey through the region.

As any good physical map will show, the whole chain consists of a series of ridges (the upfolds) separated by long

valleys (the downfolds), the ridges being most numerous, and thus the chain widest, opposite the gap between the end of the Central Plateau of France and the end of the Vosges (*cf.* what is said on p. 26), that is to the north-west of Lake Neuchâtel. The position of the chief valleys, which run along the chain (*i.e.* are longitudinal), from the human point of view makes the construction of transverse lines of communication laborious, and further renders it difficult for the great rivers of the Alps to escape. Thus it will be noted that the Aare runs parallel to the Jura for a long distance before it can make its way through the chain, and this is true also of the Rhone between its exit from Lake Geneva and its sudden bend to the north-west in the latitude of Chambéry. In the heart of the chain two other streams of considerable size occur, whose courses are of interest as throwing light on the structure of the chain. Of these one, the Ain, runs south-west, in a direction parallel to the folds, until it makes its escape into the Saône-Rhone depression, where it enters the Rhone not far from Lyons. The other, the Doubs, begins by running in exactly the opposite direction, that is to the north-east, as though it were aiming for the Rhine, then it turns upon itself at a very sharp angle, flows almost due west for a time, again changes direction, and, when it finally emerges from the chain, it is to travel south-west to the Rhone. Without going into details as to the meaning of this complicated course, we may note that the river finds its way from one narrow longitudinal valley to the next by means of a narrow gap or *cluse*, such cluses being common in the Jura, and of great importance in connection with means of communication. Another very good example of a cluse is seen east of Bellegarde, and permits river, road, and railway to escape from one longitudinal valley to the next.

To sum up then, the Franco-Swiss Jura, which we have called the second great rampart in the way of the traveller from the north-west to the magic land of the Mediterranean,

is of complicated structure, resembling a series of broad, ruinous walls with intervening ditches. It is thus a considerable obstacle to transverse traffic, but the existence of a number of narrow gaps, which we may compare to postern gates leading through the walls and thus permitting communication between one ditch and the next, facilitates the passage of road and rail. As compared with the first obstacle, that formed by the broken rim of ancient uplands, the Jura are more formidable, because more continuous. On the other hand, they are of far less extent, which makes it possible to avoid them, more or less completely, by a detour.

Let us see which course is adopted by the various routes. If we begin at Dijon, one of the points which we regarded as marking the end of the first stage of the journey south, we find that from this town three routes lie before us. We may follow the Saône-Rhone valley practically to its mouth, thus avoiding the Jura altogether, and then travel along the coast, between the Alps and the sea, till Italy is reached. This is apparently an obvious method of getting over the barrier alike of Jura and Alps. In point of fact, however, the Alps approach the coast so closely that both road and rail have been constructed with great difficulty, and the southward bend of the coast, the bend which helps to give the Riviera its special climate, makes the route long.

The second possibility is to follow the Saône valley till the end of the Jura is reached, and then travel south-eastward. This line of advance leads to the Mt. Cenis tunnel, and at Culoz connects with the circuitous route to Geneva, a town which, so far as international through routes are concerned, lies in a backwater. In the vicinity of Culoz the Mt. Cenis route skirts the Jura, passing the beautiful Lac du Bourget and Chambéry on its way to the Alps.

The third through route from Dijon used to lead *via* Frasne to Pontarlier, through the Jura by a somewhat complicated route (Fig. 4) and so to Lausanne. From Lausanne the road lies clear

up the lake of Geneva and then to the Upper Rhone valley, where the Simplon tunnel leads through to Italy. This route, it will be seen, actually pierces the Jura, and this at a point where the chain is wide. The difficulty of the passage led to a reversal of the train at Vallorbe, rendered parts of the line liable to snow-block in winter, and gave rise to various other difficulties. It will be noted, from what has been already said, that in the Jura, in contradistinction to the Alps, one great tunnel is not

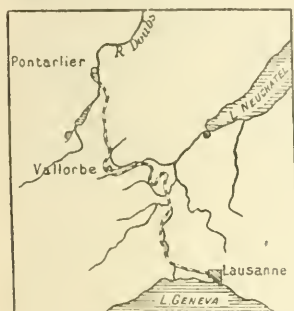


FIG. 4.—Part of the old railway through the Jura from Pontarlier to Lausanne. The curious curves on the course of the line are due to the fact that the railway follows a river valley for a certain distance, and then takes advantage of a *cluse* to enter another adjacent valley. The section between Pontarlier and Vallorbe has now been cut off by the Mont d'Or tunnel.



FIG. 5.—The old railway route through the Jura from Belfort to Berne. Note as in Fig. 4 the circuitous course of the line, again due to the peculiar structure of the Jura mountains. The large loop to the west has now been cut off by a tunnel.

required. Owing to the existence of a number of parallel chains, with intervening valleys, it is impossible to tunnel through the chain as a whole, and the route is often circuitous, because the line must edge its way along one valley in order to find an easy access to another. In the case of this particular route, the line was found somewhat too circuitous, with too heavy gradients for the traffic, and a new tunnel has been pierced to straighten it (Mont d'Or tunnel). In connection with the tunnel a new section of line has been constructed,

which takes off at Frasné, now the French frontier station, avoids the easterly bend to Pontarlier, and runs direct to Vallorbe, the first Swiss station.

Let us turn next to the other great intermediate station on the way to Italy, that of Basel. Basel owes part of its importance as a railway junction to the fact that it commands the direct access from north-western Europe to the St. Gothard tunnel. From Basel the narrow anterior end of the Jura is traversed, and the journey is then continued *via* Olten to Lucerne, and so to the St. Gothard and Milan. Another, more circuitous, route leads from Basel, again through the anterior end of the Jura, to Zurich, then between the main Alpine chain and the limestone range in front, *via* the Arlberg to Innsbruck, thence southwards to Italy over the Brenner.

Recently, however, another through route has been connected up to Basel. It is possible for passengers coming from Eastern Germany to travel direct to the Simplon by means of the new Lötschberg tunnel. This involves a journey to Berne, from Berne to Thun and Kandersteg, and then through the tunnel to the Rhone valley at Brig, where the Simplon tunnel is entered. For travellers coming from the north-west, it is quicker to avoid Basel, and travel direct from Belfort through the Jura to Berne. The route through the Jura here is indirect (cf. Fig. 5), the line, among other interesting features, taking advantage of the cluse of the Doubs of which we have spoken above (p. 33). Like the corresponding traverse of the Jura between Pontarlier and Vallorbe this is too indirect and difficult for heavy international traffic, and has been corrected by the construction of a new tunnel (from Moutiers to Granges).

If we stop here for a moment to sum up the routes by which the Jura can be circumvented or traversed, we find that one possibility is to travel down the Saône-Rhone valley to the coast, and so avoid the Jura altogether; this route involves a great number of minor tunnels through those spurs of the Alps which approach the coast closely, but no great tunnel.

The second route leads to the Mont Cenis tunnel : this also practically avoids the Jura, and has as its special feature the journey down the side of the Lac du Bourget and so past Aix-les-Bains.

To reach the Simplon, on the other hand, a direct traverse of the Jura is necessary, whether we choose the older route, by Frasné and Lausanne, or the newer by Belfort, Berne and the Lötschberg.

Basel forms the direct access to the St. Gothard, certainly the most beautiful of the great routes, on account of the number of lakes seen *en route*. A leisurely traveller, whose aim is Venice or its vicinity, may use the Arlberg tunnel to reach Innsbruck, and then the Brenner route, with no great tunnel but many minor ones, to pass the Central Chain of the Alps.

CHAPTER IV

MOUNTAIN, HILL, AND PLAIN

‘ Wo die Bächlein fließen,
Wo die Blumen spriessen,
Wo das Edelweiss
Blüht in Schnee und Eis.’

HAVING now in imagination crossed or rounded the Jura, we must stop to consider what lies behind. To do this most satisfactorily we must begin by looking at a few general points in regard to the Alps. Their structure is extraordinarily complex, whether we consider the rocks of which they are composed, the nature of the folds which appear in them, or their present topographic form, but here we shall discuss only a few of the more general and obvious points. Even these, however, cannot be made very simple, and those unfamiliar with the region will find the following description difficult to understand, unless it is followed step by step on a map.

The southern side of the Alps arises with great steepness from the plain of Northern Italy ; on the other hand, on the north and north-western sides the Central Chain has in front of it an area of elevated ground, or marginal range, which diminishes the sharpness of the contrast between mountain and plain, and further the plain here is of greater mean elevation. Let us consider a few points in regard to this marginal range.

Suppose we stand on the cathedral terrace at Avignon on a clear day. To the west and north-west we see hilly country, in which the nearest lofty peak is Mt. Ventoux (over 6000 feet).

PLATE III



A view on the shore of Lake Annecy, showing the limestone cliffs so characteristic of the Subalpine region.

Again, those who break their journey southwards at Chambéry to see the Grande Chartreuse find in the vicinity of the monastery fine limestone peaks exceeding six thousand five hundred feet in height. These two elevated areas are representative of a very extensive region, which extends from the central chain of the Alps to the edge of the lower Rhone valley, and is characterised by the occurrence of splendid escarpments of limestone, all the more conspicuous owing to the way in which they rise above forests and meadows of distinctively southern type (Plate III.). The broken chains of these regions offer some resemblance to the ranges of the Jura, but whereas the Jura are separated by a depression from the Alps, the Subalpine chains, as the French geographers call them, are closely attached to the Alps, from which they are cut off only by deep and narrow river valleys, such as that of Grésivaudan, in which the Isère flows, and the valley of the Drac south of Grenoble. They form a charming region, not greatly visited by English tourists, save in certain limited areas; blazing hot in summer and then liable to those sudden thunderstorms characteristic of regions of high relief; with an interesting flora, and, as contrasted with the Alps, a wealth of human associations. Those who are fond of walking and yet shrink from the perils of the high mountains will find here, save in the height of summer, a region full of varied charm. (See Plates III. and IV.)

The Subalpine chains are continued into Switzerland, but there we find in front of them a zone of hills of somewhat different structure, often but not always calcareous, which runs from the region of Chablais on the south shore of the Lake of Geneva, in front of the Bernese Oberland and its continuation in the Glarner Alps, to end in the Säntis, at the eastern end of the lake of Zurich. These are the Fore Alps, which are continued beyond the Rhine in a belt of hillocks fringing the Calcareous Alps of Bavaria. The Fore Alps include many of the Swiss hills ascended by the ordinary tourist, as distin-

guished from the climber, and have the great beauty of being intersected with numerous lakes, usually narrow in proportion to their length, often steep-sided, and sometimes of curiously irregular form. This description applies, for instance, to Thun and Brienz, once a single lake, to the lake of Lucerne, to the Walensee. Less beautiful, because extending further out into the plain beyond the Fore Alps, are the lakes of Constance and Zurich. The presence of the lakes and of the often boldly-shaped mountains, the relative ease of access, the mild climate, give to the Fore Alps a number of health and pleasure resorts, including some of the most frequented of the Alpine towns, *e.g.* Lucerne.

We have just stated that the Fore Alps include a number of hills constantly ascended by tourists, whether on foot or by the aid of mountain railways. The great object of these ascents is to permit of the enjoyment of a view which is generally more varied than that from the summits of the Central Chain. This is because, in clear weather, we have not only the snow-clad Alps in the background, the charming foreground of lake and wood, but also a third element, the plain. The Rigi, Pilatus, the Stanserhorn, may serve as familiar types of such mountains, though in point of fact the Rigi, which is not a limestone mountain, is included in another category by geologists owing to its structure.

If we generalise the view towards the plain as seen from any of these border mountains, we find that from the lofty Fore Alps (Pilatus is nearly 7000 feet) we look down upon a country of hills, traversed by numerous streams, representing the drainage of the mountains, and with not a few lakes. Extending our view in imagination to cover the whole area up to the Jura, we find that the hills diminish and flatten out till we come to a plain (or plateau, for it has a considerable mean elevation), which ends abruptly against the wall of the Jura. The lowest part of the plain, the whole of which was once flooded by the sea, lies nearest the Jura, and here we have

PLATE IV



An old street in Annecy, a town of the Subalpine region.

the long lake of Neuchâtel, with that of Bienne, and the continuation of the depression in the valley of the Aare. This plain is the Switzerland of the Swiss, as the Fore Alps are the Switzerland of one kind of tourists, and the high mountain resorts the Switzerland of another type. Here, except for Basel, lie the most important towns, extending in a belt from Geneva to Schaffhausen, and from Lausanne to Zurich. The whole region has been much modified by the glaciers which at one time streamed down to the plateau from the Alps (see Fig. 14), and the pushing of the Aare to the very foot of the Jura is partly due to the morainic debris in the vicinity of the Fore Alps, and partly to the fact that the rivers as they leave the mountains throw down much transported matter, which raises the ground-level and causes them to run straight out from the mountains till they are blocked, as it were, by the Jura.

Now let us turn to the eastern region. Beyond the Rhine, as we have seen, the Franco-Swiss Jura are continued by the Swabian and Franconian Jura, which run north-east, and thus constantly increase the distance between themselves and the Central Chain of the Alps. Thus beyond Lake Constance and the Rhine the narrow Swiss plateau widens out into the far more extensive high plain of Wurtemberg and Bavaria. Between the Rhine and Danube there is practically no true watershed, for only morainic hills separate the two, and the Danube leaks into the Rhine. Once past the point, however, where it approaches this latter river, the Danube swings far to the north, following the line of the Swabian Jura, as the Aare follows the Swiss Jura. It continues its northward course till the mountains of Bohemia force it south. Finally, as we approach Vienna, the proximity of the Alps to the ancient upland of Bohemia reduces the plain to a minimum. As compared with the Swiss plateau this Bavarian plain is featureless. Even more than the Swiss plateau is it encumbered with morainic material, which not only produces a

slope which has forced the Danube far to the north, but leads to the formation of a marshy country, with many lowland lakes.

We need only add a word as to the great plain on the south side of the Alps. In geologically recent times this was flooded by the sea, and the areas which now form the beautiful Italian lakes were then arms of the sea, comparable to the present fiords of Norway. Lake Garda shows very markedly in its upper end this fiord-like character. The presence of the Apennines to the south of the plain gives the river of the plain, the Po, two great sets of tributaries, as compared with the Aare in the northern plain, which has important tributaries only from the Alpine side. Thus on the Italian plain, in addition to towns on the Alpine tributaries (compare, for example, Novara, Verona, etc., with Berne, Freiburg, Zurich in Switzerland), and on the main stream, we have other towns on the Apennine streams (Modena, Alessandria, etc.). The plain here also is lower and more fertile than either the Swiss or Bavarian plain.

It will appear from this description that the traveller from the north, having overcome the obstacle of the Jura, must usually cross the northern plain, then the Fore Alps, and, after a great tunnel has taken him through the Central Chain, reaches the fertile Italian plain. In regard to the passage through the main chain, all that we need say at present is that the usual course adopted is to penetrate as far as possible by means of a river valley into the northern side of the chain, then utilise a tunnel which opens on some similar river valley on the other side of the chain. This valley is then followed to the plain.

The question as to which tunnel it is best to use is in the general case settled by the needs of the individual traveller. If, however, no special condition influences his choice, the St. Gothard should be used either for the outward or return journey. The scenery on this route is superior to that of any of the others, for not only is the journey through the Central

Alps highly attractive, but the marginal lakes of both sides of the chain are skirted or even crossed (Lugano), and in the course of a short day's journey one passes through a great variety of scenery and vegetation. Further, the St. Gothard route has the great advantage that the south end of the tunnel lies in Swiss territory. Thus it is possible to cross the main pass, or one of the adjacent passes, *e.g.* the San Bernardino, on foot or by carriage, sending the luggage through the tunnel to await the arrival at Lugano. Theoretically the first entrance into Italy should always be made on foot or by carriage, for only thus can one appreciate fully the contrasts between the Transalpine and Mediterranean lands. Practically the custom-house difficulty is a very serious one, and as geographically, though not politically, Lugano is in Italy, the St. Gothard route permits the pedestrian to cross the Alps without the risk of losing his property.

The Simplon route, *via* Lausanne, includes a very interesting traverse of the Jura (Fig. 4), and towards the end, as the train swings and jolts on its way down to Lake Geneva, a very instructive glimpse of Lake Neuchâtel and the Swiss plain. Beyond Lausanne the journey along the lake and past the Rhone delta is both beautiful and interesting, but that up the Rhone valley is a disappointment. The valley is so narrow and so steep-sided that the view is practically limited to the tumbling waterfalls, and yet one has a feeling that if the corridor was wider, or the human body more pliant, it would be possible to arrange an attitude in which something could be seen of the great mountains. At the other side the glimpse of Lake Maggiore is beautiful but all too brief.

On the Mont Cenis route the most attractive stretch is that which leads past the Lac du Bourget; further on the interest is not very great, though in the journey from Turin to Modane, on the return route, the vision of Monte Viso and the Gran Paradiso, standing like two great sentinels guarding the way, is impressive. The chestnut woods, also, on both sides of the

chain here, are interesting, for the chestnut has meant much to the inhabitants of southern Europe.

The two other routes to which we have alluded, the Riviera one and the Arlberg-Brenner, are both too circuitous to be used except under special circumstances. The Riviera route permits the traveller to stop to visit the curious old towns of Provence, which are too little known to English travellers. The view from the cathedral terrace at Avignon in spring, when the plain is flushed pink with peach and almond blossom, and the melting snow has swollen the great turbid river, is one of the most striking in Western Europe.

The Brenner has much historical importance and the glimpses of the Dolomites as one descends to Botzen are imposing, but on the whole the scenery is less interesting than further west, and the fact that the Adige has deserted its old course through Lake Garda, and that the railway follows the river, makes it necessary to abandon the through route if that lake is to be visited. Parenthetically we may remark that the traveller who does this, and yet has not much time to spare, will find that the task of adjusting the times of the boats and of the trains on the small railways which serve the neighbourhood of the lake, to the times of the trains on the through route, is somewhat complicated.

The number of 'ways to the south' just described speaks to many travellers; why is it that so many are drawn southwards in this fashion? One reason is that to the tourist from the north the Mediterranean region offers the supreme advantage of warmth and sunshine at a period when both are lacking in his home. But as the region is poor as compared with the industrial regions of the mid-European plain, and as parts of it are barren, or malarious, or liable to strong wind, the winter traffic is concentrated on a small number of regions where the migrants from the north can find 'comfort' approximating to that to which they are accustomed at home. Thus Russians, Austrians, and the inhabitants of the eastern

part of Germany tend to stream, in winter and spring, over the Brenner Pass, past Verona and Bologna to Naples and its surroundings, or onward to Sicily. The inhabitants of Western Germany and the neighbouring lands utilise largely the St. Gothard in order to concentrate on the Italian Riviera. The French and the inhabitants of Great Britain frequent chiefly the French Riviera. If one bears in mind facts of this kind, the train service, which to many travellers is a complete mystery, will be found easier to understand. Through routes are, as it were, worn smooth by the continual passage of steady traffic, and passengers travelling across the stream are always liable to find difficulties, more especially in a country like Italy where the traffic is largely periodic, and a poor and harassed administration is not able to cope fully with its seasonal variations. For example, most travellers who have changed trains at Bologna are apt to assume that the confusion there has been arranged by the powers of evil for their special discomfort. In point of fact it is due to the convergence here of many lines of traffic, leading to specially favoured parts of the Mediterranean area.

Finally, in the Mediterranean region, and especially in Italy, the great variety of surface, due to the frequent approach of the folded mountains to the seaboard, with its distinctively Mediterranean characters, and the occurrence of small areas of notable fertility, more or less enclosed by mountains, led to the development of many city states, whose surplus wealth was stored in the form of artistic treasures. These works of art, no less than the relics of the classical period, bring an army of travellers far outnumbering those who only seek a favourable climate during the northern winter. Parts of the Mediterranean area are thus visited by very large numbers of tourists.

REFERENCES. Further details in regard to the points dealt with in the preceding three chapters must for the most part be sought in the various textbooks of physical geography. The author's *Introduction*

to *Physical Geography* gives a summary account of the subject, with some further references. Three other books may also be noted:—James Geikie's *Mountains, their Origin, Growth and Decay*; Lyde, *The Continent of Europe*; and Cole, *The Growth of Europe* (Home University Library). The first contains an admirably clear summary of recent work upon the Alps.

As regards maps and atlases, it may be noted that some of the foreign school atlases give clearer pictures of the surface than are to be obtained in most of our own atlases. The two following, both inexpensive, may be mentioned as specially interesting:—*Atlas f. Schweizerische Mittelschulen*, with some reproductions of portions of the Swiss topographical map, and Lehmann u. Scobel's *Atlas f. höhere Lehranstalten*.

Separate maps from most of the larger library atlases can be obtained, and are useful for the different countries of Europe, but many of these err in being too much loaded with names and too closely printed for easy reading in a railway train. The combination of a railway map, taken from a time-table, and a clear and simple physical map taken from a school atlas is the most satisfactory for use during journeys. As school atlases have now generally the separate maps mounted on guards, it is easy to remove any particular plate and re-insert it later, or separate physical maps can be bought cheaply at most educational booksellers. Some of the recently published war maps of Central Europe are good and clear, and show the physical features well. Most guide-books, e.g. Baedeker and Murray, also contain useful maps. The serious traveller, it may be noted incidentally, never enters a railway train without a map.

For a detailed study of any locality maps on scales more or less equivalent to those of our Ordnance Survey sheets are essential. Generally these can be purchased more cheaply in the country concerned than in London, but it is well to avoid trying to buy them at a frontier town. Such maps are never cheap, but neat-fingered persons can economise by buying the sheets unmounted, and then cutting them up and mounting them on linen themselves. Those who are not accustomed to working with large scale maps will find the Swiss 1:50,000 topographical map an admirable one to practise on, especially if used on the spot. There are few more fascinating occupations than that of working out on this map a route which seems 'possible,' and then proceeding to test the possibility in the field.

In most frequented regions, especially perhaps in France and

Switzerland, admirably clear but rough maps are published by local Clubs, Syndicats d'Initiative, etc., and are to be obtained gratis or for a trifle at tourist offices and elsewhere. These are often exceedingly useful in giving a first notion of the geography of a locality, which can be elaborated later by the help of more costly maps. As regards French topographical maps, one should notice that there are two series of these, the Army map, with contours, and the Home Office (Ministre de l'Intérieur) without.

CHAPTER V

RAIN AND SUNSHINE

‘ Who covereth the heaven with clouds, who prepareth rain for the earth, who maketh grass to grow upon the mountains.’

It is impossible to travel in Central Europe with much profit without a general knowledge of the chief types of climate found in the continent, and yet, for very many people, erroneous ideas implanted in school days make an appreciation of the facts difficult. There is no notion in regard to climate so deeply rooted as the belief that in any longitude, and at any season of the year, to travel southward is to travel into warmer regions. The idea that this is a fundamental truth is so widespread, that given that of two places, A and B, the one, B, lies further south, the vast majority of ‘ well-informed ’ people will say at once that of course B is always warmer than A. To reply, in current geographical slang, that latitude is only one of the factors which influence climate, is perhaps not to shed a great deal of light upon the subject, and we may conveniently here give a little space to the facts as regards the distribution of temperature in Europe in winter and summer respectively.

The first point is that, apart from the Mediterranean belt, in winter the temperature in the low grounds depends chiefly upon distance from the Atlantic Ocean ; or, in other words, cold increases as we travel east. Vienna, which is south of London, but also far to the east, is very much colder in winter than is London. Bergen, in the latitude of the Shetlands, is

not so cold in winter as is Belgrade, in the latitude of Bordeaux. In winter, therefore, save in the case of regions of special climate, like the Riviera, to travel south is not necessarily to escape cold ; if we at the same time travel eastwards it is to find it. In more technical language, in winter, except round the Mediterranean Sea, lines of equal temperature (isotherms) run north and south, and not, as is so generally supposed, east and west. Taking our previous example, if B is east of A, in winter it will be almost certainly colder, even if it is in a lower latitude.

Let us turn now to summer conditions. At this season the lines tend to run, over land surfaces, from south-west to north-east. In other words, though, broadly speaking, more southerly places are now warmer than more northerly ones, yet distance from the ocean increases the summer heat. Thus Moscow, in the latitude of Edinburgh, is far colder than that place in winter, but in summer it is considerably hotter than London. Vienna, which was colder than London in winter, is very noticeably hotter in summer.

If we summarise the summer and winter conditions in Europe, we may say that free access to breezes from the ocean cools the summer and moderates the winter ; remoteness from the Atlantic increases the heat of summer and the cold of winter. The distribution of many important plants, and therefore of types of civilisation, is greatly influenced by these facts. Further, if we think of the matter meantime as a question of exposure to Atlantic influences, we shall be prepared to find that a mountain barrier between a place and the Atlantic tends to deprive it of the moderating effect. Thus the part of eastern England between the Wash and the Thames has a relatively extreme climate, because it is sheltered from the Atlantic by Ireland and the Welsh Mountains ; it is near enough to the continent to be influenced by continental conditions. The south of Sweden has a more extreme climate than the south of Norway, that is, hotter summers and cooler winters,

because the Scandinavian mountains intervene between it and the sea. On the other hand, where the mountain barrier is absent, oceanic influences may penetrate far inland.

The second point in regard to which the majority of persons have not clear notions is in connection with the prevailing winds. Europe generally, again apart from the Mediterranean region, is in a zone of prevailing westerly winds. This does not mean, however, that the wind is necessarily always westerly at the surface. Suppose we stand on a bridge above a swift river, for instance, the Isar at Munich in August when the stream is swollen with melting ice. To the onlooker from the bridge it is perfectly obvious that the river is flowing in one definite direction, which, if he or she be of exact mind, can be ascertained to be about NNE. If, on the other hand, one were a chip floating in the stream, it would be as obvious that the direction changes constantly, as one whirls round in the tumultuous eddies. We, at the surface of the ground, are in the position of the chip as regards the great stream of circulating air. The general direction of the air current is westwards, but on the main stream countless swirls (cyclones) form, and the circulation in connection with these may, for long periods, obscure to us the prevailing drift.

Into the many difficult points connected with these swirls we need not go here, except to indicate that they are ocean-born, and, being caught in the great air-stream, as it were, approach the shores of Great Britain from the west, along certain more or less definite lines. Their continued existence depends upon the moving centre of low pressure contained in the swirl being constantly fed by ascending moist air. This is easy during their passage across the ocean, but the possibility disappears when they travel over land. Thus in the southern hemisphere, where there is but little land in what are called temperate latitudes, the swirls continue to travel for great distances. But in the northern hemisphere, those which cross the Atlantic have only a short life, for as they approach

the shores of Europe, and especially those outposts of Europe formed by the British Islands, they tend to diminish in intensity, and at best can travel only a limited distance into the continental area.

Their fate in detail differs a little in summer and winter. In winter a great mass of cold, heavy air lies over the continent of Europe, and this air repels the cyclones, fends them off, as it is sometimes stated, so that they tend to traverse the British Islands, cross the North Sea, and die away in the Scandinavian peninsula. One of the results of this, it may be noted incidentally, is that Norway is not a very good place for 'winter sports,' on account of the prevalence of wind there, as compared with the usual calm at Alpine resorts. For reasons with which again we need not trouble here, cyclones bring with them much rain, and thus we have, especially in Ireland and in the western parts of Great Britain and Scandinavia, in the western promontory of France, and the similar projection of Spain, heavy winter rain, and mild winters because of the indraught of warm air from the Atlantic, and because of the effect of the rainfall itself, which, as we say, 'liberates latent heat'—not a very satisfactory form of expression. The rest of Europe, again except for the Mediterranean area, receives relatively little rain in winter, for the cyclones do not penetrate far inland, and, in any case, have lost most of their moisture on the coastal rim. The result is that the interior of Europe tends to have cold, calm winters, with but little rain, while the coastal regions tend to have mild, windy and wet winters.

In summer the cyclones are weaker, but as no protective area of heavy air fends them off the continent, they penetrate further inland, and bring rain not only to the coastal region but also to some extent to the interior. Most of the rain of the interior, however, is due to the heating up of the surface, with resultant ascent of heated air and thunderstorms giving torrential rains of short duration. The total amount

of rain decreases as we pass eastwards, the decrease in eastern Russia suggesting the approach of the deserts of Asia.

We have thus to distinguish so far between two types of climate:—the so-called oceanic type, with mild, windy and wet winters, and cool, damp summers, and the continental type with cold, dry, calm winters, and hot summers, often with heavy thunderstorms in the earlier part and dryness, increasing to the east, in the latter part.

The third main type of climate within the European area is that of the Mediterranean area. This is a region of transitions. In summer it lies outside the belt of prevailing westerlies, and just within the trade-wind area. Thus it is traversed by warm, dry easterly winds, blowing from the great continental mass of Eurasia. In winter, as the climatic zones shift south with the sun, it comes into the westerly wind belt, and receives rain, more or less abundant, from winter cyclones which sweep along the Mediterranean Sea from the Atlantic. The presence of the sea permits the cyclones to travel a long distance east, and thus gives the belt of Mediterranean climate a great extension eastward, but even so, regions sheltered by high land from rain-bearing winds, *e.g.* eastern Spain, and regions remote from the great ocean, *e.g.* the extreme east, suffer from lack of moisture. Thus, as contrasted with regions of oceanic climate which have rain at all seasons, and with those of continental climate which have chiefly summer rain, Mediterranean regions have winter rain. They resemble regions of oceanic climate in their small range of temperature, *i.e.* the difference between summer and winter is not great, but in the Mediterranean region the temperature throughout the year is of course higher.

In addition to these main types of climate, a number of minor varieties exist, often of great importance to the seeker after health or the tourist. Thus the heat and drought of the continental summer is greatly modified by elevation

and the proximity of mountains, and the mountain climate, alike in summer and winter, is of great interest.

Again, the fact that mountains so often approach the Mediterranean seaboard nearly (cf. p. 18), means local disturbances of the air circulation, and local modifications of climate. Sometimes the presence of the mountains gives rise to special winds, like the biting mistral which makes the late winter unpleasant in Provence, or the Bora which, even in summer, blows with great violence on the Dalmatian coast; at other times, as in the case of the French Riviera, the mountains make the winter climate particularly mild and give shelter from cold winds.

As suggested above, part of that infinite variety of Europe to which we have already called attention is due to the number of types of climate found within a small area. The differences in temperature and in the amount and season of rainfall affect the natural vegetation, and the kinds of plants which can be most readily cultivated. Cultivated plants have a great influence on human life, and the variety of types of human societies to be found within the area are to be associated with the variety of climates, while the fact that the whole area is small has facilitated exchange, whether of material objects or of ideas.

What effect have the different types of climate upon the tourist as tourist? They naturally exercise considerable influence on his movements at different seasons. In winter a traveller who wants warmth and sunshine within easy reach must almost necessarily seek the shores of the Mediterranean, for though he may find warmth, say, on the Atlantic coasts of Spain and Portugal, or that of the southern part of France, he must be prepared there for a good deal of rain and some wind, and the *type* of climate is much that which he has left at home.

In spring, however, the coasts of the Mediterranean, and more especially the Rivas of France and Italy, are dis-

appointing. There is here a very distinct 'lag' in the rise of temperature, so that it is not uncommon to find that at one period of spring the deciduous trees are further advanced in Provence than on the Riviera. The palms and similar plants which have 'served the senses' of the winter visitors are more or less tattered and shabby, and new growths are slow to replace the old. For the glories of the spring one wants to be somewhat further north, *e.g.* on the Italian lakes, while, a little later, nothing equals its sudden splendours in the continental type of climate, where the rapid rise of temperature is followed by a correspondingly rapid unfolding of leaves and flowers.

When summer has fully come the areas of oceanic climate are preferable to those of the continental type, for not only is the air cooler, but in the latter regions rain diminishes, except in special localities, as the summer wears on, and the foliage soon becomes burnt and dusty. At this season the Mediterranean area is even less attractive, for here there may be no rain to refresh the foliage, the dust is all-pervading, and the whole region falls more or less under a régime of semi-desert conditions. It is at this season that the glory of the English woods and fields strikes the returning traveller so specially.

Generally, in the height of summer the low grounds of the interior of the continent are more or less intolerably hot, and the inhabitants escape when they can to the sea, the mountains, or to regions of oceanic climate. As the heat of summer abates, these lowlands become possible and pleasant, and when the chill of coming winter is making itself felt there, one may find a modified summer in the south, where the first rains have refreshed the land, and the extraordinarily long autumn of Italy, with its wonderful harvest of fruit, can be enjoyed to the full. As the winter comes we may note that those who want sunshine but are indifferent to night cold, will find in some of the mountain resorts high sun temperatures,

clear skies and exhilarating air, with the disadvantage that the temperature falls with great rapidity as the sun goes down.

Finally, we must note that though an appreciation of the fact that the above main types of climate exist in Europe is of great assistance in obtaining a grasp of its geography, yet it is impossible to draw hard and fast lines between the different climatic zones, and it is not always prudent to make deductions about the probable climate of a place, merely from its geographical position. Local conditions often count for a great deal. Thus, in the first place, we find that the Mediterranean climate has often but a short extension inland, so that, for example, the plain of North Italy has a somewhat extreme climate, though it seems to be so near the Inland Sea. Milan is much colder than London in winter and has a much heavier rainfall, but its summers are hotter. Thus as regards temperature it shows continental characters, but its heavy rainfall, coming chiefly in spring and autumn, is a special character, due to the vicinity of the Alps. As compared with the towns actually on the plain, like Milan, those lodged in the southward-facing valleys of the Alps to the north, especially on the shores of the lakes, are much milder. Even here, however, the mildness is only relative. Riva, on Lake Garda, is in December and January colder than London, much colder than the Scilly Islands. By February, however, it has become warmer than London, and the month of May is as hot as a London August. But these statements, be it remembered, are based on average figures, and the actual conditions at any definite time may vary considerably from the mean.

As we have just mentioned the Scilly Islands, it may be well to illustrate some of the points in regard to climate which we have been discussing by a comparison between the so-called Riviera of Cornwall and that of France, a comparison energetic railway companies are fond of making. If we take the winter temperature conditions in the Scilly Islands as

the most favourable that the British area has to offer, and at the same time as representing generally the conditions which prevail in the south-west of England, we find that while the mean temperature during December and February is similar to that of Mentone, the temperature of January is distinctly higher in the Scilly Islands. The mildness of the winter temperatures is indicated not only by the thermometer, but by the fact that many delicate plants will live without any winter protection. As the year wears on, however, while the temperature at Mentone rises with some rapidity, that in the Scilly Islands remains stationary for a long time, and then rises, with extreme slowness at first, to a maximum far below that of Mentone, below that of London even. The autumn fall is again deliberate, but Mentone remains warmer till December. Thus we have the anomaly that while the Scilly Islands can produce 'sub-tropical' vegetation, they will not ripen the more delicate temperate fruits.

In a somewhat less marked form these conditions prevail all along the south-west coast, and suggest that, so far as temperature is concerned, the English 'Riviera' has the advantage in the winter months. When we look at rainfall it seems as if this impression is confirmed, for parts of the south coast of England have a lower rainfall than parts of the Riviera. But the superiority of the French or Italian Riviera as a winter station, if not apparent when average figures are considered, is due to the fact that the two regions belong to different climatic zones. In the south of England the climate is oceanic, that is, the warmth is due to mild, moist air from the Atlantic, and the total rainfall to the fact that it rains often, though not very heavily. Did the damp winds fail to blow from the Atlantic the temperature would be lower, and thus we have the paradox that the finer it is the colder it is. A spell of clear bright weather often means cold weather, a high mean temperature cloudy skies and frequent rain.

On the other hand, the high temperatures on the Riviera are due to full exposure to the sun, in a region well-sheltered from cold winds by the mountain backing. Rain comes in heavy downpours, clears the air and is of considerable sanitary importance, and as the storm which brought it passes over the sun reappears. Further to the west a similar bright type of weather appears, but the cold blasts from the north, whether or not they rise to the violence which entitles them to the name of mistral, lower the mean temperature and render the region unpleasant for invalids.

The subject might be elaborated further in a number of other examples. We shall confine ourselves to two others, forming an interesting contrast. Botzen, on the Brenner route, is well known to travellers as the centre of a great fruit-growing district, just as the Scilly Islands are a region of spring flowers. During the months of November, December, January and February Botzen is considerably colder than London, during December and January much colder. Thereafter, however, the temperature takes a sudden upward leap, May is nearly as hot as a London July; September, the great fruit-ripening month, is much hotter than a London July. Put in another way, Botzen has seven months with a temperature of above 50° F., London has five. But while London has no month with a mean temperature of less than 38° F., Botzen has three such months. Thus we may say that Botzen shows the continental climate in its ordinary form, hot summer, cold winter, sudden rise in temperature in spring, very sudden drop at the end of the long autumn. The fruit-growing depends upon the hot sunny summer and warm autumn, with the absence of very severe winter temperatures, just as the spring flowers of the Scilly Islands depend upon the very mild winters.

Let us compare Munich, which lies almost directly north, with Botzen. Here the winter is far colder, for no less than five months have a mean temperature which fails to rise to

38° F., and three months have temperatures considerably below freezing. But when we look at the summer, we find that only in the hottest month, July, is the mean temperature slightly higher than at London. At all other seasons it is lower, in spite of the southerly position in relation to London. Here then we have the typical continental winter, but not the typical continental summer, and the difference in the temperature between Munich and Botzen throughout the year is far greater than the mere difference of latitude warrants. In this case we have to note that while Botzen lies to the south of the Alps, and thus is at once exposed to the southern sun and sheltered from the north winds, Munich lies on the northern slope, with little protection from cold winds, and a less free exposure to the sun—in other words, the local conditions affect the climate greatly.

REFERENCES. The great storehouse of facts in regard to climate, European and other, is Hann's *Handbuch der Klimatologie*, only a part of which has been translated. Lyde's book, mentioned at the end of the last chapter (*The Continent of Europe*), gives a very full treatment of the subject for that continent, and several of the books mentioned at the end of Chaps. VIII. and IX. discuss the climates of the regions with which they are specially concerned.

CHAPTER VI

THE PLANT AND ITS HOME: A STUDY OF FITNESS

'Follow to the deep wood's weeds,
Follow to the wild-briar dingle.'

THE majority of travellers must always be those who seek in their travels rest and refreshment from their everyday work and surroundings, and as we are now predominantly a nation of town-dwellers, the tendency is to seek these in country districts. Among the sights of such regions it must always be the trees and flowers which make the widest appeal, and here recent scientific developments have done much for the unspecialised traveller.

Till a comparatively short time ago an interest in plants was held to involve necessarily an acquaintance, more or less detailed, with systematic botany. This in its turn meant carrying a flora, preferably, for most people, an illustrated one, a supply of blotting paper, pressing boards, and a variety of other necessaries which will suggest themselves at once to the experienced. The plants collected found usually a temporary home in the water jug till such time as they could be decently shrouded in blotting paper, interred within the boards, and buried beneath one of the legs of the bed, to the huge indignation of the chambermaid. The operation of washing, never very easy in a mountain inn, was rendered more difficult by the floating remnants of the collection which seemed to accumulate to an alarming extent at the bottom of the ewer, and the net result was

that one said to one's friends later, in a casual fashion, 'We found twenty-three gentians and eleven campanulas in the Alps this year,' whereat the friend probably rejoined, 'Oh! we specialised in Primulas and Androsaces.' Meantime the specimens mouldered till the next spring cleaning consigned them to the ash bin.

In other words, till recently, an interest in flowers, if at all detailed, meant the collecting of isolated specimens. But the botanists have been slowly coming to their own, and now consider plants not as individuals but as members of a community, the particular community present showing an intimate connection with the local peculiarities of climate, of soil, of exposure and so forth.

An example may make the difference clear. Let us suppose that we set out for a ramble on one of those rough hill slopes which back the fashionable resorts of the Riviera, on a day in early spring. In place of, or if you will in addition to, the time-honoured vasculum, we start with certain conceptions of the prevailing climatic conditions. The period is one of bright sunshine and warmth, but one also in which rain is to be expected. We know that a period of high temperature and severe drought is yet to come. We therefore look for plants which take advantage of the favouring spring conditions to flower and set seed, and then die down to the ground during the drought of summer, leaving seeds, underground stems, etc., to start life again at the time of the autumn showers. We find examples in the many kinds of anemones, in the curious Italian arum, in the bell hyacinth, in the asphodel and many another. We note also that when these plants die down in summer there will be blank spaces left where they once bloomed, so that the Mediterranean region shows its semi-desertic character in the presence of such gaps in summer, or as we say, in the absence of a complete cover of vegetation. Save in rare cases, our more northern lands show no such bare spaces,

except where the shade in summer in the beech woods is so thick that even mosses can scarcely grow.

We look next at the innumerable shrubs, many of them now in full and gorgeous bloom. We note their small leaves, sometimes silvery, sometimes dull green; the frequency of spines; the tendency for the leaves to arrange themselves



FIG. 6.—The Mastic bush (*Pistacia lentiscus*), one of the most characteristic shrubs of the Mediterranean maquis.

obliquely to the sun's rays, instead of perpendicularly to them as do the leaves of most of our forest trees. More especially, as we climb the rough and stony ways we feel, borne to us on waves of warm air, the aromatic scent of rosemary and mastic bush, of lavender and myrtle. We reflect

that, unlike anemone and bulbous plant, these shrubs must face the scorching rays of the summer sun, with their roots in soil which may not be moistened for weeks or even months at a time. Our broad-leaved, delicate-textured trees and shrubs would wilt and die in that furnace heat, and in the conflict with the blazing rays the oils, to which the scents of the Mediterranean plants are due, play their protective part in diminishing loss of water. On our upland heaths, where the strong wind takes away moisture from leaves and branches at a rapid rate, while the roots in the cold soil can absorb it but slowly, we find a development of furze and broom, comparable to, though less varied than, the manifold brooms of the Mediterranean region, and just as the hillsides of the Riviera slopes blaze into bloom for a short period in spring, so do our heaths clothe themselves in splendour during the most favourable season of their year. Thus we gain some conception of what is meant by physiological drought—the shrubs of the Mediterranean suffer from drought because water is actually lacking in the hot season; the shrubs of our heaths and moors suffer from drought because the temperature or the quality of the soil is such that they can absorb water but slowly, though water may be superabundant in the soil.

We need not stop here to consider in detail the other characters of the Mediterranean vegetation—the point is that though it is interesting, indeed highly desirable, to know the names of the commoner plants, it is their fitness for their special surroundings rather than their systematic position to which we should devote attention, and this need not involve the making of a collection. On the other hand a photograph, or, if the necessary skill be present, a sketch, will enable one to study at leisure the fact that owing to the response to similar conditions, plants of very different families may show similar characters.

In the previous chapter we suggested that the spring

of the Mediterranean, despite the novelists, is in some ways disappointing, as compared with the spring of the north. Some of the Mediterranean plants, it is true, show in spring a lush green which delights the eye, but the number of these is relatively small compared with those who dare not deck themselves with a mantle of splendour to greet the youthful Apollo, for they know that they must also face him when he comes to the fierce strength of his manhood—even in spring they are, as it were, upon their guard. How different is the attitude of the northern plants! They know that their sun god is gentle, even in the time of his fullest power; his face may be oftentimes veiled from his worshippers, but he never blasts them with the fire of his wrath. When they throw off the wrappings of winter, therefore, it is for ever; they need nothing to shield them from their lord. It is the frankness of their



FIG. 7.—Sage-leaved *Cistus*, showing the large, delicate, rose-like flowers, and the relatively small leaves. A spring-flowering Mediterranean plant.

abandon that gives the glory to our spring.

Let us compare the Mediterranean slope, with its scented shrubs and glory of short-lived spring plants, to an oak or beech wood in England. In winter here there is prac-

tically no sign of life. The annuals are long since gone, the herbaceous plants have died to the ground, and their buds are protected by the forest litter, by the remnants of their own dead leaves or stems, or by their underground position. The trees have lost their leaves, their trunks and branches are protected by bark, the buds are sheathed in scales, generally with the addition of hairs or a wet-resisting envelope of gum. The shrubs which form the undergrowth, rose, bramble, guelder rose, hawthorn, hazel, blackthorn, dogwood, and so forth, offer similarly few points of attack to frost or damp.

When spring comes the whole of the wood does not wake at once. The oaks, tender-leaved and distrustful of the changeable oceanic spring, are reluctant to give hostages to fortune. The boldest members of the community are the humblest. Celandine, primrose, violet, dog's mercury and similar forms must bloom and leaf early, for little light can reach them when the trees are at their thickest. A little later come sheets of wood anemones, forget-me-nots, blue hyacinth, while the bracken and other ferns do not unfold till much later, for they are less light-demanding than the flowering plants. The latter need free exposure to wind if their flowers are inconspicuous, or if they are bright-coloured to the view of insects. Thus we find that hazel and willow flower very early, when no leaves prevent the cloud of pollen sweeping from one branch to another or from one tree to another. Rose and hawthorn wait till late spring before their splendid blooms unfold, but the sloe, with its humbler flowers, must needs be earlier lest in the glory of late spring its humbler appeal be neglected.

In the tropical wood there is a great development of climbing plants, which use the trunks of the tall trees to scramble upward to the light. In our woods these are relatively infrequent, but we may note how the ivy creeps along the ground, rooting as it goes, and, when opportunity offers,

climbs up the boles of the trees, to throw off at the top its modest guise of climber, and with the new aspect of a shrub to flower and seed in the open. Of humbler form is the honeysuckle, which employs shrubs rather than trees as its host-plant, and pours its honied sweetness into the evening air, to attract the night-flying moths. This heavy fragrance prevents it from being overlooked, even though it does not flower till its supporting shrub is in full leaf.

Not only in our crowded summer woods are there tiers of plants above ground—tree above, shrub beneath, herb below,—it has also been shown that the layers of soil themselves are distributed among a number of competitors. A pretty example of this is the association of dog's mercury with the little *Adoxa* in the ash-woods of Derbyshire. In early spring, that is at the beginning of April, the *Adoxa*, whose roots lie in the upper layers of the soil, flowers freely in the shelter of the unfolding shoots of dog's mercury. Later the *Adoxa* dies down and the dog's mercury, whose roots occupy deeper layers of soil, unfolds completely and forms great stretches of green in the woods. Other examples of similar conditions occur.

In general the notable contrasts between the Mediterranean slopes and the English wood are due to the fact that in the former area, while the temperature throughout the year is high enough for some plant growth, water is deficient during the summer season; in the latter, while water is present in the soil in sufficient amounts for plant growth throughout the year, the temperature in winter is too low. In the Mediterranean area therefore plants sensitive to drought can only appear above the surface during the cooler and damper season; those which are permanently above the surface must be drought-resistant. The time of keenest competition as it were among the plants is that during which both moisture and relatively high temperatures are available, *i.e.* especially during the spring.

In regions of oceanic climate plants can only flourish during the warmer part of the year, and the fact that low-growing plants are less exposed to wind than tall ones makes it possible for a considerable number of herbs to flower and develop leaves at a time when the temperature is not high enough for the trees to leaf. Thus in the wood, the most characteristic plant formation of the oceanic climate, there is, to some extent, a seasonal differentiation between the herbaceous plants, largely spring-blooming, and the trees and shrubs, which reach their full development in summer. There is often at the same time a differentiation in the layers of the soil, which permits plants to occupy the same area, without directly competing with one another.

This method of studying plants, that is, not as individuals but as groups occupying a particular habitat, and controlled by that habitat, is called ecological botany. In ecological botany the influence of the habitat may be considered under two heads. We have first the climatic factors, that is, the effect of the amount and season of rainfall, of the mean variations of temperature, the amount of sunshine and moisture in the air, the force of the wind and so forth. These climatic factors determine broadly the type of vegetation found within a given area; for instance, the presence of forest depends upon a certain distribution of moisture throughout the year. At the same time, even in a region of practically uniform climate, local variations in soil and surface exercise a marked effect upon plant life. Thus the ecological botanist distinguishes between the climatic and the edaphic factors, the latter being the result of the chemical composition of the soil, its water content, the extent to which it is aerated and so on. Because the botanists, to an increasing extent, are demonstrating the intimate connection between plant communities and the climate and nature of the soil, their science is becoming more and more geographical.

Let us enlarge this statement a little. If we say simply—

many kinds of gentians grow in the Alps, we have an isolated fact, of interest no doubt but of no great significance. If, on the other hand, we can show that there is a close connection between those peculiarities of form and structure which the gentians and many other 'alpines' display, and the special features of mountain climate and mountain soil, then the presence of the alpine formation, as it is called, in a particular region, enables us to draw certain conclusions as to the soil and climate of the region, and, conversely, the existence of a particular type of climate and soil conditions permits us to assume that an alpine community of plants will be present—that is, we have a geographical generalisation of great importance. Thus while systematic botany can in the nature of things make an appeal only to a limited number of persons, ecological botany is of importance to all those who are interested in the utilisation of the surface of the earth, and that is practically to all humanity.

The broad distinctions of climate determine the existence on the surface of a relatively small number of plant communities, such as woodland, grassland, moorland, desert, and so forth, and these the ecologist calls formations. But while a particular type of formation, say the deciduous wood, may reign over a considerable area, it is not constant in characters throughout. Thus while oak-woods are frequent over heavy soils in England, the type of oak-wood is not always the same; here we have a type in which the pedunculate oak predominates as a forest tree among lower shrubs, and here one in which tall oaks are few and the shrubs are the most conspicuous features of the wood. In both cases it is found that there are associated groups of other plants which depend more or less closely upon the presence of what is called the dominant species. Such divisions within the limits of a formation are called associations, and within the association there may be even smaller vegetation units, the plant-societies. Meantime, however, it is sufficient for our

purpose to recognise the distinction between the formation, the larger unit, and the association, the smaller.

One other preliminary point must be noticed before we proceed to consider the chief plant formations of Europe. The continent, as we have already emphasised, has been the home of civilisation for a prolonged period. In consequence the natural vegetation has been profoundly modified, and in many cases it is impossible to reconstruct with certainty the original formations. Nevertheless, the progress of plant physiology, the study of the existing remnants of the original vegetation, and historical research make it possible to arrive at least at some general conclusions as to the appearance of the plant covering of Europe before it had been radically modified by man's activities, and these general conclusions add interest to the study of present conditions.

From a consideration of the whole of the evidence it seems fairly clear that at least the greater part of Europe, in the sense in which we are using this term, was originally clothed in what we may describe as temperate forest. From this region of temperate forest the Mediterranean region is excluded, for it had originally its own type of forest, which persists in part. Further, the steppe region of southern Russia has probably always had a greater or less extension westward, though its original western boundary is obscure.

Outside these eastern and southern boundary zones, was the temperate forest once continuous over Europe? Probably not, though its exact limits are difficult to trace. At present the western seaboard of the continent, especially in North Germany, Holland and Belgium is largely without forest, and we all know that treeless moors, or deer-'forests,' have a very wide distribution in the Highlands of Scotland, while in Ireland also there is relatively little wood. The question whether these extensive moors and heaths have always been devoid of trees is a difficult one, and the subject is rendered additionally thorny by the fact that social and

even political questions are more or less involved. It seems, however, tolerably certain that there must always have been a belt—of undetermined width—of treeless land on the coast, where the wind rendered forest growth difficult. The soil also on the moist seaboard is generally more or less unsuitable for tree growth, though whether this is a primary condition or a result of deforestation is a debated question. But, as stated, we may be reasonably certain that before man in Europe began to alter greatly the characters of the surface, the widespread and extensive forests of continental Europe and of the lower grounds of the British Islands were generally separated from the seaboard by a belt of moor and heath. Was this all? Leaving aside the elevated grounds, to which we shall return directly, we may note that there is reason to believe that through the forest belt there always went a band of ground with at best but thin wood—a band of great importance in connection with the development of European civilisation. Its origin requires a little consideration.

During the Ice Age, as can be readily shown by the deposits left by the ice, the ice from the north overrode a considerable area in the Netherlands, Germany, and so forth, descending, for instance, in the west as far as the mouth of the Rhine, and in the east to the region of the headwaters of the Oder and the Vistula. At the same time the enlarged glaciers of the Alps pushed northwards, but the two sheets did not meet, and between them was a belt of land which at one period was subjected to cold steppe conditions, and where, apparently owing to the action of wind, a fine-grained, lime-containing deposit called loess accumulated in thick layers. This loess, which is clay-like in appearance, extends from Picardy to Poland, and includes some of what are now the most fertile lands of Europe, those specially suited for wheat and sugar-beet. The loess belt is continued into Russia, where in part it is mingled with humus (*i.e.* material obtained

from the decay of vegetable matter), and forms the soil of the famous black earth region, before the war one of the sources of our wheat.

The loess tracts, as we know from fossil remains, have been from a very early period favourite regions with European man. Before he had learnt to polish his stone implements, when he was as yet but a hunter pursuing the animals of the Ice Age, he hunted in the loess areas, where free movement was probably relatively easy, where game was more abundant than in the gloomy depths of the forest, where pitfalls for his prey and perhaps dwellings for himself could be easily dug, and through all the ages since he has never in Europe relaxed his hold on these tracts.

Now we know that loess, though suitable for herbaceous plants, is relatively unsuited to trees, and the loess areas, so far back as we can trace history, have been at best scantily wooded. According to some the treeless condition is primitive—for Neolithic man sowed and reaped here, and his stone axes, polished though they were, would hardly enable him to effect clearings on a large scale. According to another singularly ingenious hypothesis, the loess belt was clear of trees at the end of the Ice Age, because of the steppe conditions which then prevailed. It would, if left to itself, have become gradually clothed with trees as the climate improved after the passing away of the ice, but by this time Neolithic man had domesticated hoofed animals, and his grazing herds prevented the establishment of forest even over the tracts which he did not cultivate. This is of course not more than an interesting guess, but the point of importance is that in addition to the areas of natural grassland formed by the eastern steppe, and the moors and heaths on the seaward margin, Europe, even before man was dominant, contained an inland belt of land adapted by its thin wood or scrub to easy clearing with primitive implements, and allowing for the grazing of herds. These loess lands were the lands of

early settlement, though the coastal lands were also settled to some extent, as we know from the presence of 'kitchen-middens.' Between such areas where settlement was relatively easy lay the dark, impenetrable forest, difficult to clear for primitive peoples, especially as the climate made the use of fire somewhat difficult; difficult also to plough when cleared, as compared with the friable loess, and, owing to its density probably sheltering but little game, and offering little pasture for domesticated animals. These primeval woods formed the real dividing lines between peoples, and only their edges, or the natural clearings within them, could be utilised by the flocks. The presence of encircling wood, however, round the cultivated lands meant that the civilisation of Central Europe had from the start a double basis—the people were at once pastoral and agricultural. Later the primitive woods were largely cleared by organised effort, and the existing forests of Central Europe are the greatly modified and reduced descendants of the original nearly continuous wood.

In addition, however, to the loess lands there were other parts of Central Europe where the primitive forest was absent. These are the regions which rise above the limit where tree growth is possible, and yet are able to produce a seasonal growth of plants yielding rich fodder, and thus supplementing the pastures of the lowlands. These are the regions which are in summer covered with so varied a growth of Alpine plants, some of which reappear in Arctic regions.

The net result is that the temperate forest region of Europe offers at least three well-defined plant formations for study:—(1) The remanants, often greatly modified, of the original forest (chapter vii.); (2) The moors and heaths, now often of great extent, found especially near the coastal belt (chapter x.); (3) The Arctic-alpine formation of the heights (chapter ix.), whether of the Alps, of the Scandinavian mountains, or of the Scottish Highlands, where this flora is

only moderately well-developed. Other formations, of more limited extent, such as those of swamp or sand dune, also occur, but studies of the three named are sufficient to give an insight into the methods of the ecological botanist.

We shall discuss them briefly in separate chapters, but meantime may add in a word that the fourth formation which can be studied in Europe within easy reach of Great Britain is that of the Mediterranean region (chapter viii.). This region was once, in all probability, fairly well-forested, but fragments only of the forest remain, in specially favoured localities. Its special feature, as already suggested, is its wealth of shrubs, which generally show adaptation to summer drought, and of herbaceous plants whose activities are confined to the moister season. Owing to the summer drought pasture is difficult to obtain, and, except where elevation or some other cause increases the local rainfall, cattle tend to be scanty. While the civilisation of Central Europe was based from the start on pastoral and agricultural industries combined, that of the Mediterranean region was always based on a combination of agriculture and fruit-growing, which is a form of gardening.

CHAPTER VII

THE PRIMEVAL FOREST

‘ There rolls the deep where grew the tree.’

WE have suggested in the last chapter that we have to think of the greater part of Europe as originally forming a sea of green, from which emerged like islands the higher mountains, the loess belts, and a band of unknown width on the margin of the ocean. Dr. Gradmann gives an interesting description of the probable original limits of this forest :—‘ We obtain the impression of a continuous primeval forest, stretching from the Alps to the North Sea and the Baltic, from the Atlantic coast to the plains of Hungary and the steppes of Southern Russia, and, further to the north, continued into the belt of wood which crosses Siberia. Only a few gaps break the continuity of this primitive forest. Here are the summits of the Alps and the Carpathians, and the more important elevations of certain lower mountains, such as the Sudetes, the Harz, the Black Forest, the Vosges, the Swiss Jura, which raise their bare summits above the sea of wood. Here are further the landes and heaths, the salt-marshes and moors of the coast of the North Sea ; inland are some fresh-water marshes and larger patches of moor ; except for these the only gaps are the bare patches over rock falls and masses of scree, or the clearings due to lightning, gales, or heavy snowfalls, destined to be regrown over within a short period. Only on steep sunny slopes, and perhaps, in regions of very great dryness, also on the plains, as in the case of the heaths of South Bavaria, or of certain loess and chalk hills in Central

Germany, have we to think of the wood as being somewhat thinner—elsewhere there reigns unbroken the dense, continuous primeval forest.’

This primitive forest must have been to a very large extent made up of broad-leaved trees, for the present predominance of conifers is largely due to man’s interference, a point to which we shall return. Now such a broad-leaved temperate forest is the characteristic plant formation of a moist climate, without excessive extremes. We have spoken of the climates of Europe, and have distinguished between the oceanic type which prevails within reach of Atlantic influences, and the more extreme continental type which is present where these influences fail to reach. But we must not forget that, compared to Asia, the whole of Europe has a climate which may be described as oceanic—hence the contrast between the broad-leaved forest of Europe and the steppes and coniferous forests of temperate Asia.

The distribution of the beech, the typical broad-leaved tree of the oceanic climate, is of great interest in this connection. Its eastern limit almost coincides with that which we have taken as the eastern limit of Europe in the narrow sense in which we defined this term in Chapter I. In the north-west of Europe the beech occurs down to sea-level wherever the climate is warm enough ; thus it is absent as an indigenous tree from the north of Norway and from Scotland, but forms beautiful native woods in south-east England. But its distribution is determined not only by the need for a tolerably long warm period, but also by the fact that it requires a large amount of moisture in its growing season. Thus its eastern limit is indicated, roughly speaking, by a line from Königsberg to Odessa, though, after avoiding the Russian steppes, it reappears in the Caucasus, where the elevation brings greater moisture.

The summer drought excludes the tree from the whole of the lower grounds within the Mediterranean region, but

it reappears so soon as elevation brings sufficient summer rain, at least so far south as the mountains of Sicily, Castille and Central Greece. So susceptible is it, however, to want of rain, that it has only a limited extension up the Rhone valley from Geneva, dying out so soon as it ceases to feel the moist breath of the lake, *i.e.* it does not extend very far beyond the town of Martigny, though it is a very characteristic plant of Switzerland generally. Again, it is absent from the lower Rhone valley, as from Provence and Languedoc generally, and only appears at the town of Lyons, where the summer climate is moister. Thus the tree, which forms beautiful woods in the vicinity of Lake Geneva, on the Swiss plateau generally, in the Fore Alps and in the Jura, is worth careful note, for its presence means that the climate in summer is relatively moist, and the warm season prolonged. In earlier days, like the different kinds of oaks, the tree had great economic importance, for its mast, in combination with acorns, formed a very considerable part of the food of the herds of pigs, once so supremely important in the life of the inhabitants of Europe. But these were the days before winter food for cattle was available to any considerable extent, and when the fact that the flesh of pigs could be readily preserved for winter use made the animals of great value. They still, of course, retain considerable significance, but the world's supply of swine is increased by the existence of the maize belt of the United States, which supplies abundant cheap and fattening food, and has modified the whole conditions of the trade. Acorn and beech mast cannot now be said to affect the supply of pork or ham, except in certain limited areas, *e.g.* to some extent in Serbia.

The distribution of the beech, as we have just shown, emphasises the contrast between the oceanic climate, in its various forms, and the Mediterranean one, for the beech will not tolerate the typical Mediterranean climate. But it is worth note that while the beech underlines, as it were, the

contrast between the mild moist summer of part of the north-west and the hot dry summer of the Mediterranean region, there are other plants of the forest which emphasise the resemblance between the mild damp winter of the Atlantic belt and the equally mild and also moist winter of the Mediterranean. Because of the resemblance between the two climates at this season certain Mediterranean plants



FIG. 8.—The Strawberry tree (*Arbutus*), an ever-green shrub or tree, native to the Mediterranean but also extending to south-west Ireland, where the mild climate suits it well.

have succeeded in extending their range to the north-west. The arbutus (Fig. 8), which flourishes in south-west Ireland as it does also in the whole of the Mediterranean region, is an excellent example, and its presence indicates the difference between the climate of south-west Ireland and that of any part of continental Europe outside the Mediterranean region. Another

example, somewhat less familiar, is that of black bryony. Natives of the south of England, especially of the south-west, are familiar with this plant from childhood, and feel no surprise at seeing its graceful trails, with their splendid scarlet berries, twining round the bushes of the Alps. On the other hand, to natives of north-eastern England, the whole of Scotland, and by far the greater part of Ireland, no

less than to the Russian, the Austrian and the German, the plant when first seen in the Alps is a treasure because an entire stranger. It is a Mediterranean plant which found its way first to the Alps, whither it was attracted by the mountain climate, which in some respects resembles that of the ocean belt. From the Alps this plant has extended its range westwards through France to England, Belgium and so forth.

Many other examples could be given, but the point is simply that while the broad-leaved forest corresponds generally to the oceanic climate and the Mediterranean scrub forest to the Mediterranean climate, yet in nature there are no hard and fast lines, and the transitions from one type of climate to another are marked by the plants, the more adaptable forms of which are able to transgress the limits of their own climate and establish themselves in neighbouring territory. Part of the reason why man has thriven so well in Europe is due to the existence of these numerous transitional belts, both of climate and of vegetation, which have enabled him to thrust himself and his chosen plants in along the lines of weakness, as it were, that is, in the regions where the native plants had a less strong hold than elsewhere. His grip of the loess belts through all the period since his first appearance in Europe is an interesting example of this, and from his *points d'appui* here and in the Mediterranean region European man has succeeded in spreading not only over the whole of Europe but over much of the rest of the world also.

But what are we to say as to the special characters of the European temperate forest? The first point is that, speaking broadly, the lower grounds and the more fertile regions, with the exceptions already noted, were originally clothed in broad-leaved forest, in which, there can be little doubt, oaks generally predominated, the beech taking its place in special cases. Forest in which other trees predominated,

like the ash-woods of the English limestone regions, were probably always relatively rare.

In the higher latitudes, at the greater elevations, and in less fertile regions conifers tended to predominate, often accompanied, however, by the birch, which is very resistant to cold and wind, and by the alder, which is especially the tree of damp regions (Plate XV.). In general, as we all know, conifers keep their leaves through the year, or are evergreen, though to this statement the larch forms a familiar exception. As we shall see later, the Mediterranean forest also is typically evergreen, so that we have to think of the deciduous broad-leaved forest of Central Europe as being bounded to the north and south alike, no less than at its upper limit, by evergreen trees. It may seem at first sight strange, in view of what has been said as to the way in which plants respond to the effect of the surrounding conditions, that the cold blasts of the mountain heights, the cold, wind and snow of high latitudes, and the hot dry air of the Mediterranean region, should all alike lead to a predominance of evergreen plants. The reason is in reality relatively simple. Trees with broad and tender leaves like oak and beech divide their year into two sharply contrasted periods. In winter they economise water and offer the maximum resistance to cold, wind and snow ; in summer they demand enormous quantities of water and have no protection against cold or snow and little against strong wind—but then they can only live in climates and at elevations where such risks have not to be faced in summer. Taking the Scots pine as a typical conifer, we find that it is so shaped that snow slips off its branches, its slender leaves offer little resistance to wind, its tough leaves alike in summer and winter are protected against cold and excessive loss of water. It remains, as it were, permanently upon its guard (p. 63), but at any season of the year can take advantage of favourable conditions, should these occur. In the case of Mediterranean plants the chief risk

PLATE V



Scots pine in the Spey district. Note the characteristic rounded forms of the hills in the background.



is not from cold or wind, but from excessive loss of water, which perhaps cannot be replaced; these plants again therefore remain permanently protected, and present a general resemblance in their evergreen condition to the northern conifers, though the details of structure are quite different.

We have spoken of the tendency for oak and beech to predominate in the broad-leaved woods. They are not of course the only forest-forming, broad-leaved trees even in northern Europe, but the point is that the broad-leaved forest at best contains a relatively small number of trees, and that these are markedly social, tending to occur in almost pure woods. This presence of a small number of species is equally characteristic of the coniferous woods, and is indeed a general feature of the vegetation of Europe. In the Highlands of Scotland there occurs only one native forest-forming conifer—the Scots pine (Plate V.). Switzerland has some half a dozen forest-forming conifers, a number considerably greater, but yet still small when compared with the wealth of species found in western North America, just as the number of our broad-leaved trees is insignificant as compared with those found in eastern North America or eastern temperate Asia.

One consequence of this is that not only the majority of the trees used for ornamental purposes, but even the species employed in economic forestry are for the most part introduced. It is one of the most interesting facts of geography, that while Europe has given the recently developed temperate parts of the world most of their cultivated plants, yet, on the other hand, she is indebted to those recently developed regions for a great number of the trees now grown—and in all probability the two facts are related. Does this seem far-fetched? It is clear at least that the plough of the Ice Age made broad its furrows over what was to be one great home of civilised man. It killed out or drove south very many plants which once lived there, and which can still live when reintroduced; it drove out or killed out many animals; it disturbed drainage

conditions ; it piled up clays or gravels, and the winds of the period of steppe climate swept the finer particles together to form the fertile loess ; it introduced a thousand changes and disturbances into the old condition of things, and before the balance of nature could be readjusted man developed intelligence enough to take advantage of the oscillations produced, and made for himself such a place in nature as he has to this day failed to make in the heart of the stable, unchanging continent of Africa, where the mighty equatorial forest still mocks his efforts. Where nature left disorder he has made at least a kind of order, where she destroyed he has—in however partial a fashion—reconstructed.

To find examples of the effects of the Ice Age, so far as the forests are concerned, it is not necessary to cross the channel, for the Highlands of Scotland are full of striking illustrations. Let the tourist seek the Black Wood of Rannoch, the Forest of Rothiemurchus (Plate XXVI.), or the forest which fringes the flanks of 'dark Lochnagar.' In each case the pines of the primitive forest represent at once a conquest and a defeat (Plate XIV.): a conquest, for the pines where they prosper have driven out the all-invading heather, and their presence means a re-acquisition of ground deforested by the effects of the Glacial Period ; a defeat, for the fact that they and they alone represent the conifers of continental Europe means that the colonisation of Great Britain after the ice had passed away was but slow and partial. On his journey north the traveller may note that the spruce woods, the plantations of larch, of Douglas and of many another introduced tree show that man, when he will, can accomplish what nature has failed to do.

His will, in so far as afforestation is concerned, has not hitherto been very strenuously applied in Britain, but in France and Germany especially, the destruction of the original woods by man has been followed by a reconstruction. The destruction was to gain fresh land for cultivation, and therefore the reconstruction has been largely on lands which are not

well suited for cultivation. Both for this reason, and also because of the commercial value of the timber of coniferous trees, the latter now greatly predominate over broad-leaved forms, and, generally, the best wooded regions are those of considerable elevation—such as the Black Forest, Vosges, Harz and so forth, or are districts which could not be easily utilised for cultivation, *e.g.* the landes of France. The former prevalence of broad-leaved forests, now of somewhat limited distribution, must be deduced from a variety of facts, among which are the occurrence over Europe of many kinds of shrubs and herbaceous plants whose natural home is the forest.

For those who have no detailed interest in botany the point of importance is to realise that, let us say, the chestnut woods which fringe the railway line as one ascends towards the Mt. Cenis tunnel on the Italian side, the beech woods near Sixt, the avenues of catalpas at Argelès in the Pyrenees, the fir-woods of any Swiss valley, the patches of Robinia and the willows along the watercourses in the plain of Lombardy—to mention but a few of the pictures which any traveller can call up—have each and all a tale to tell. Each owes its origin to a combination of causes, physical and economic, each represents a stage in a process of ceaseless change and adjustment, and he who would travel aright must not only have the seeing eye to perceive such things, but should have the background of knowledge which enables him to grasp some part of their significance.

REFERENCES. The book which gave the first great stimulus to the study of ecological botany was Schimper's work, translated as *Plant Geography*. An account of later developments, in so far as they refer to the British Isles, will be found in *Types of British Vegetation*, edited by A. G. Tansley, with a short bibliography. Gradmann's interesting paper on the primeval forest of Europe, quoted on p. 73, will be found in the *Geographische Zeitschrift*, xvii. (1901), and de Martonne's *Traité de Géographie Physique* gives an account of the general subject, with a bibliography.

CHAPTER VIII

MYRTLE AND BAY

‘Awake, O north wind; and come, thou south; blow upon my garden, that the spices thereof may flow out.’

MEDITERRANEAN plants, which we have to consider in this chapter, have always attracted the attention of northerners, and most of the monographs which have been written upon the subject have been written not by natives of the region, but by sojourners. Some of these doubtless owe their origin to the fact that the mild winter, which is also, as we have seen, the most active period for plants, brings, at least in its latter part, many seekers after health, who find occupation and sometimes, let us hope, the recovery which they seek, in long rambles over the scented slopes. From one point of view, therefore, the host of books and papers on the flora of the Mediterranean has the pathetic interest that attaches to the tameness of the birds in the beautiful gardens at Meran. One does not need to have been a winter visitor there to know that that tameness speaks to innumerable invalids of infinite leisure.

But there is also another explanation. To any one with a natural love of plants the contrast between those of the Mediterranean seaboard—native or naturalised—and those of north-western Europe is so striking, so inspiring, that it constitutes in itself a call to labour too insistent to be disregarded. Some of us will always remember, with a rush of emotion which time does not diminish, the joy at the first sight of some favoured spot.

PLATE VI



Olive grove on the Riviera.



It is not only the coming from winter gloom to a glory like that of summer ; it is not the penetrating scents, not the sight of cypress or pine against the clear evening sky, not the pink cyclamens against the green of the olives, the brilliant fragility of the cistuses, blooming in the midst of the rocks, the tall candelabra of the agaves, the oranges among their stiff foliage, the great pods of the carob hanging between the deep green, ash-like leaves, not the glory of camellia or pittosporum alone, it is the combination of so many new impressions, which makes the first moments seem crowded with glorious life. To feel the sensation in its strength one must surely arrive in some characteristic region on a spring afternoon, when the night seems to fall before the eyes have had time to appreciate one-tenth of the feast spread out, when one darts from one treasure to another in the gathering gloom, with no thought to spare for the wonderful blue of the ocean which yet, if not consciously observed, forms a setting to all the other splendours. When finally one stumbles through the dark with an armful of treasures, it is with the feeling that no to-morrow, no life can be long enough to see, to learn, to enjoy all that this fairyland has to offer. Many visitors have had this feeling, and the result is a formidable list of monographs in which the authors have oftentimes sought to conceal the strength of their passion by a veil of arid nomenclature—really a lovers' language for those who can read the cipher !

In somewhat the same way we find that there is a copious literature (in the technical sense) devoted by American geologists to British glacial phenomena. They say, in explanation, that in these islands moraines and kames, boulder clay and erratics, ice-scratches and what-not are so familiar to all of us from childhood that they make little impression, and that it is necessary to have come from a region where glaciation was partial in order to appreciate the strangeness of the surface forms visible here—that is,

it needs the stranger to show us the interest of the familiar. Whether this be so or not, there is no doubt that to most northern folk the vegetation of Mediterranean lands makes a very strong appeal, equalled only by the glory of the Alps in the early summer.

An important point in regard to it is that, as already suggested, it has a very limited and, further, a somewhat irregular distribution. One naturally thinks of Italy as the Mediterranean country *par excellence*, and yet a very considerable part of the surface there bears the Central European type of vegetation. One may endeavour to exclude a large part of the area without Mediterranean plants by saying that the whole of the plain of Lombardy is not Italy but Cisalpine Gaul, but this quibble will hardly serve, for parts of the areas fringing the great lakes, to the north of the plain, have a distinctly Mediterranean character; one finds, for example, lemon, olive, pomegranate, loquat, terebinth trees, the great reed, and so forth, round the shores of Lake Garda. Again, south of the plain of Lombardy the mainland contains many elevated regions in which the typical Mediterranean evergreens are absent. Once again, taking the Mediterranean area as a whole we find that the easterly increase in the cold of winter (cf. p. 48), combines with elevation to limit greatly the area of distribution of the Mediterranean plants in the north-eastern part of the region. Thus though Greece is typically Mediterranean, yet, taking the Balkan Peninsula as a whole, Mediterranean plants cover but a small area there, and on the eastern coast of the Adriatic especially they give place, a very short distance inland, to a purely Central European flora. Bosnia and Serbia retain extensive tracts of mid-European forest, with oaks and beech predominating, and the pigs of Serbia owe their numbers to this fact, just as the cattle of the same country are due to a non-Mediterranean abundance of pasture. In regions where it is typically developed, as *e.g.* on the Riviera, round

Naples, in Sicily, and so on, the Mediterranean vegetation forms a very well-defined unit, and brings with it an equally well-defined mode of life, depending upon the characteristic cultivated plants. Everywhere, however, the Mediterranean belt is hemmed in by areas of quite other characters, giving rise to a different type of civilisation.

As the Mediterranean region has been for a prolonged period the home of civilised man, we find that the native vegetation has not only been encroached upon by the invading plants of other areas, but has also been attacked by man, who here, no less than to the north, has cleared the forest and modified the surface greatly in the course of cultivation. To what extent high forest once existed over the area generally remains uncertain, but there can be no doubt that the forests have been very extensively cleared; for one motive which must early have led to forest preservation and re-forestation in the north—the necessity of abundant firewood for the winter cold, operated to a smaller extent in the south, where firewood was chiefly required for cooking only. Further, as true forest in the Mediterranean is near the natural limit of its range, reforestation and natural regeneration are both alike difficult. In other words, as in the loess region, very little human interference would turn the scale definitely against the forest, and the goat, one of the most characteristic domestic animals of the region, is a great forest destroyer. The net result is that we find that unaltered or little altered Mediterranean vegetation occurs for the most part only in hilly regions or regions where the surface soil is thin and barren, or too wet for cultivation, and that generally forest is limited to the greater elevations.

Broadly speaking, typical Mediterranean vegetation occurs in three forms—the forest, now chiefly mountain or hill forest; the maquis or scrub, containing evergreen shrubs, and probably to a large extent replacing forest which has been cleared from the lower grounds; and finally the garigue, a

stunted type of vegetation which occurs on calcareous soils, where the porous limestone increases greatly the natural dryness of the climate (Plates VIII. and IX.). Each of these three formations demands separate consideration.

The Mediterranean forest, despite its evergreen character, resembles the forest further north in the fact that the species



FIG. 9.—The Evergreen or Holm Oak, one of the most characteristic trees of the Mediterranean region.

represented are few and are social. In other words, the trees tend to occur in what are, in forester's language, almost pure stands. A contrast with the more northern forest is, however, shown in the fact that the trees usually stand well apart from each other, and, despite this fact, there is but little undergrowth. This is of course a result of the scarcity of water. Among the more important forest

trees are the following :—the evergreen or holm oak, with its rather small leaves, dark green above and covered with a greyish felt below (Fig. 9) : the cork oak, similar in characters but with a greatly thickened bark, is commoner to the west than to the east : the maritime pine is very characteristic, especially to the west, and is distinguished by its more rigid needles from the Aleppo pine, which originally predominated to the east ;

PLATE VII



Mediterranean pines.

both are now extensively planted: the beautiful stone pine, whose umbrella-shaped crown so frequently appears in Italian views and whose seeds are edible (pignons), sometimes forms extensive woods: the cypress, so often planted, is native only in the eastern Mediterranean; these are the most important trees of the lower grounds. On the higher the Spanish chestnut and even the beech appear, while still higher, especially in the northern part of the region, any of the more familiar conifers may occur, *e.g.* larch, spruce, Scots pine, and so forth.

Extensive tracts of forest are not very common in easily accessible parts of the Mediterranean region, but at the eastern end of the Pyrenees, *e.g.* near Perpignan and also on the Spanish side of the border, there are considerable forests of holm oak and also of cork oak. In these woods there grow a considerable number of shrubs, mostly of wide distribution in the Mediterranean region, and therefore to be found round most of the favourite tourist resorts. Of these the following may be specially mentioned: Christ's thorn (*Paliurus*) is a favourite hedge plant; it occurs, for example, abundantly above Riva on Lake Garda. *Paliurus* may be recognised by the wicked-looking double thorns at the base of the leaves and the curious flat disk-like fruits. Related is the evergreen buckthorn (*Rhamnus*), with leathery leaves and red berries, turning black as they ripen. A plant rather like olive, which is common in the oak-woods as well as in the maquis, is *Phillyrea*, a shrub with narrow leaves and inconspicuous flowers. Very common, especially in Spain and Portugal, is the Kermes oak, which, it is interesting to notice, sometimes attains to the height of a tree, but is more generally a low-growing shrub. This is not an uncommon feature of Mediterranean plants, and is one of the facts which suggest that the region is, broadly speaking, unfavourable to the growth of trees. An interesting analogy is found in the mountain pine, which is very abundant in the

eastern Alps, and is generally a prostrate, scrambling shrub, but at times becomes a forest tree. When trees occur near the forest limit it is an advantage to them to be able to live as shrubs when the conditions make upright growth impossible.

The Kermes oak, like so many of the Mediterranean plants, was once important in the life of the people. It feeds an insect quite similar to the cochineal insect, from which a dye can be obtained used both for colouring leather red and for woollen fabrics. A lacquer can also be made from the coloured substance. The great development of the trade in aniline dyes has made it unprofitable to extract the cochineal from the Kermes, and the trade has practically died out, like that in the other great Mediterranean dye, Tyrian purple. It is, however, of interest to emphasise the fact that the Mediterranean plants once yielded a number of products necessary for civilised life, so that in the early days the region was self-supporting.

Two other useful shrubs of the oak forests are species of *Pistacia*, of which a third species yields pistachio nuts. The two named are *Pistacia lentiscus*, the mastic tree (Fig. 6, p. 61) and the terebinth or turpentine tree. The former is excessively common. It has pinnate leaves, with no terminal leaflet, is strongly resinous in smell, and the unopened pollen-bearing flowers are bright red in spring and contrast vividly with the green leaves. The female flowers grow on a different plant, and are inconspicuous, though the ripe fruit forms a red or black berry. The plant yields mastic, obtained especially from the island of Chios. It is worth note that though generally seen as a shrub it is capable of growing to the size of a tree.

The turpentine tree is deciduous, and its shiny leaves have an odd leaflet at the end, making them resemble a small ash leaf. The fruit is the size of a pea and is red. Cyprus turpentine is obtained from the tree, which predominates

in the eastern Mediterranean, but this is of little commercial importance as compared with the product obtained from the maritime pine, especially in France, this being another illustration of the tendency for true Mediterranean products to lose ground before those of higher latitudes.

We have already mentioned the *Cistuses* (Fig. 7), whose large white, yellow or pink flowers resemble superficially those of the wild rose. The plants are generally strongly resinous, and have their leaves carefully protected against drought by hairs, by the habit of inturning the edges, and in other ways.

Other curious forms are the everlasting (*Helichrysum*), of which one species forms a densely-branched, grey shrub with a powerful smell, described by Strasburger as being like wormwood and liquorice mixed. In summer the plants bear their drought-resisting, and therefore 'everlasting,' flowers in dense masses. Various kinds of brooms are common, especially the Spanish broom (*Spartium*), from which a fibre is obtained, used in making rope and even a coarse kind of cloth (Dalmatia), with its almost naked branches and terminal bunches of yellow flowers. We have already mentioned the rosemary and lavender bushes, and thyme also occurs. Through the bushes twines a slender asparagus, and

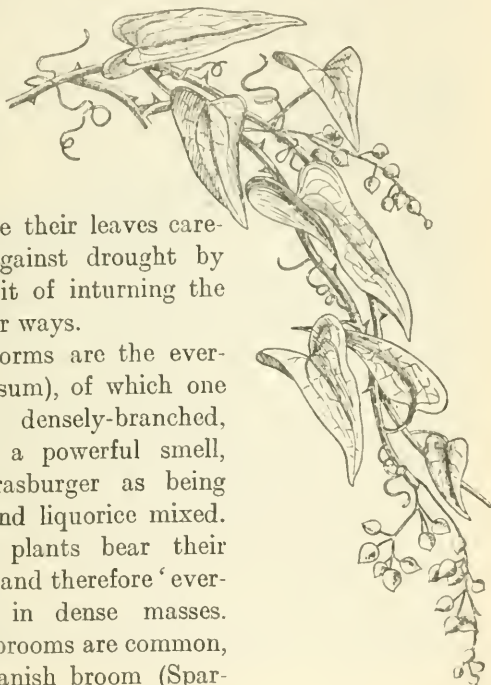


FIG. 10.—The Rough Smilax (*Smilax aspera*), a prickly creeper common in the Mediterranean region.

the coarsely-spinous true *Smilax* (Fig. 10), not the misnamed plant of our greenhouses, scrambles over ground and bushes alike, with its heavy load of dull red berries at the end of the branches. Its relative, our butcher's broom, is also common, and the strongly scented jasmine occurs, if somewhat rarely. The trees and bushes found in the cork oak forest are similar to, but not quite identical with, those found in the holm oak forest. In each case we have a *plant association* with a dominant species and associated forms.

Where the forest trees are absent and the ground is covered only with shrubs and herbs, we have, as already stated, the typical maquis, Italian *macchia*, which is still to be found in parts of the Riviera, and is especially well developed in Corsica. All the shrubs we have mentioned reappear in the maquis, and with them arbutus, myrtle, the evergreen oak as a shrub, the wild olive, many kinds of bush spurge, the tree heath, near streams the beautiful oleander, a number of brooms and their allies, some very spiny, with many herbaceous plants. All these, however, need not be expected in a particular area of maquis, for in the maquis *formation* a considerable number of *associations* occur (cf. p. 67).

In its fully developed form the maquis is an almost impenetrable thicket, the numerous spines and thorns together with the powerful resins and tannins being a protection against the attacks of goats.

Where it thins out owing to the poor and rocky soil we find the bushes relatively few in number, though not differing greatly in kind, and so scattered that the bare rock appears between; this is the garigue (Plates VIII. and IX.). In spring the ground is more or less carpeted with short-lived plants, among which we may mention asphodel, bell hyacinth, orchids, vetches, cyclamens (flowering earlier than the others), flax, blue pimpernel, various kinds of convolvulus, both in bush and creeping forms, and so forth, the list being taken from notes of a spring walk at Capri. In this limestone island

PLATE VIII



A slope on the island of Capri. The terracing is very characteristic of the Mediterranean region. The trees are olives. Note also the prickly pears, the thin soil, with outcropping limestone rock. The plants mentioned on p. 90 were growing on this slope.

characteristic garigues may be easily observed, and there are still, high up on the limestone cliff, and therefore, it is to be hoped, safe from the most energetic tourist, a few specimens left of the dwarf Mediterranean palm. This is the only member of the palm family which is native to the Mediterranean region, and it is now largely exterminated.

With these notes and with the help of the books mentioned on p. 96, it should be possible to get a general idea of the chief characters of the native Mediterranean plants. But we must note that almost all the plants named have to be sought on more or less uncultivated ground, and are therefore only seen by energetic tourists with some interest in botany and some technical knowledge. The traveller who most often drives, or confines himself to parks, gardens and promenades would not regard any of them as characteristic. Indeed, generally speaking, the student of native Mediterranean plants requires more perseverance and endurance than he whose interests lie in the direction of 'alpines.' In the region generally the cultivated crops are, as a rule, so valuable that they must be carefully protected against intrusion, and as open pastures are rare, and the uncultivated ground generally very rough and inaccessible, a good deal of zeal is required to carry on extended observations. In the more popular resorts, however, there is often an extraordinary wealth of cultivated trees and shrubs, and those who have not the energy or the opportunity for extensive wandering may glean much of interest from a study of these.

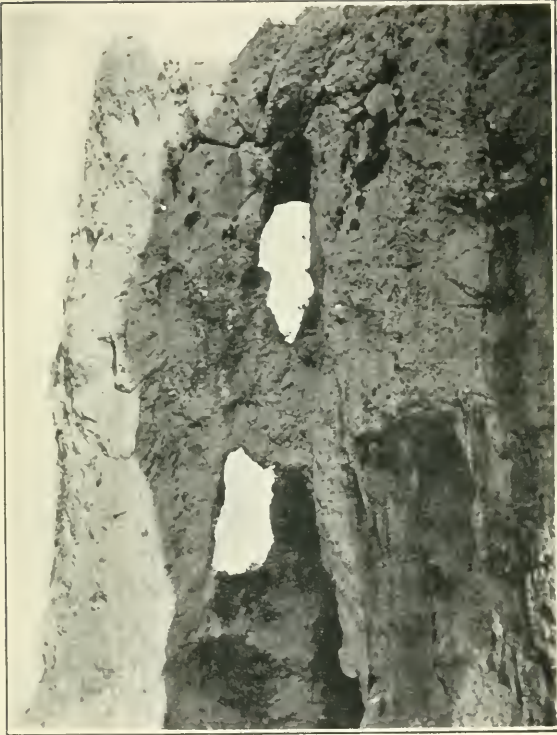
The great difficulty in regard to them is that it is often difficult to obtain specimens or to find out the names even when specimens are obtained. Many botanists of modern type would say that the name is of small consequence. No doubt this is true, but there is a certain inconvenience in calling a plant 'the beautiful purple flower that we saw in the garden of the new villa at the corner of the street.' Not only is the length a disadvantage, as compared even with

a very barbarous Latin name, but also the number of people with whom one can discuss a plant so named necessarily remains strictly limited.

In these circumstances Strasburger's book mentioned at the end of the chapter is of great assistance, and the prudent traveller will not omit such sources of information as botanic gardens, notably the ancient one at Padua and the other at Montpellier, and the labels or the attentive gardeners at the great show places, *e.g.* at the Hanbury garden at La Mortola, those on Isola Bella and Isola Madre on Lake Maggiore, the somewhat disappointing Villa Pallavicini at Pegli near Genoa, and so forth. The flower market also at any of the great resorts is always worth a visit, and many interesting specimens can be picked up there. For wild plants, of course a flora is the most useful aid.

We cannot mention here a tithe of the common cultivated plants of the Mediterranean health resorts, but a few of the most familiar may be named. In the Riviera towns the so-called pepper tree, with ash-shaped leaves and clusters of red peppery berries is almost the commonest street tree. It comes from South America and contains an astringent resin in large amounts. If the leaves are soaked in water they appear to wriggle about owing to the way in which this resin pours out. Palms are so abundant that they are generally associated with the region, the date palm, with its huge pinnate leaves being specially common; only the dwarf palm is, however, native, all the others are introduced. The oranges and their allies, the agrumi, as they are called in Italy, are also not native, and in Italy generally, despite Goethe, the orange has a distinctly limited distribution. Even in the vicinity of Naples the trees require protection in winter. The two other trees of Mignon's song are native, but the noble laurel, the Lorbeer of ecstatic German tourists, owes its abundance to the fact that it is extensively planted. As a native plant it is not common. Parenthetically one may

PLATE IX



A limestone cliff on the island of Capri; a few of the plants of the garigue manage to live in the interstices of the rock.

remark that though it is a handsome shrub, with its scented leaves and the whitish flowers sometimes present on the same twig as the fine purple fruits (Fig. 11), yet the tourist is scarcely



FIG. 11.—Sweet Bay or Noble Laurel, showing flowers and fruit on the same spray.

justified in bursting into song — at least in public places — on the first sight of it in its Mediterranean glory. It should be taken for granted that all civilised people do 'know the land' and have no desire to have the question put to them,

as has happened several times to the writer, by casual travelling companions !

Among the introduced plants of recent importation, recent that is as compared with the orange, are the splendid North American agaves, popularly called aloes (Fig. 1), which ornament every rocky surface, and bear huge seed-spikes, and the Australian eucalyptuses (Fig. 12), now very widely planted,



FIG. 12.—*Eucalyptus globulus*, an Australian tree very commonly planted in southern Europe, especially in the Mediterranean region. The curious capped flowers are characteristic, no less than the strong scent.

and of great interest in spring, because of the way in which the curious cap falls off the flowers and allows the innumerable fluffy stamens to expose themselves to wind or insect. Eucalyptuses are markedly drought-resisting, and it is interesting to note that their leaves change in character as the plants grow older, and the branches are thus more fully exposed to the sun and drying wind. Some also

of the numerous acacias of the Riviera are of Australian origin. The acacias generally show some interesting adaptations to enable them to withstand drought, and are worth careful study on this account.

The prickly pears, which are now so widely spread and have become wild almost everywhere, are of American origin. Their insipid fruits can be bought in the markets as Indian

figs (fichi d'India), and in summer time their cactus flowers are seen on the sides of the curious spiny 'racquets.' No less than the agaves, the prickly pears are drought-resisting; they are indeed in origin desert plants, hence the way in which they have thriven in the Mediterranean.

Among town trees in addition to those mentioned, one should not omit the nettle tree (*Celtis*) which is abundantly planted, *e.g.* in the streets of Naples, and figures largely in the literature of Provence, where it is common. In spring in Naples and the vicinity one finds the tree leafless but bearing its catkin-like flowers. Later it becomes clothed with its elm-like leaves, easily recognised by the fact that they are unequally developed at the base, and have one side more toothed than the other. The little fruits hang down singly from the branches, and are at first green, and later become brownish black. They are about the size of a small cherry, and are sweet to the taste when mature. They are eaten in Spain, where the tree is much planted, and also in Greece, where they were well known to the ancients. The tree is native to the Mediterranean region, but owes its present abundance to planting. It extends beyond the limits of the area, but only there reaches a great size.

Much more beautiful are the species of *Catalpa*, with large delicate leaves, white, sweet-scented flowers, and later long, hanging pods. They are very favourite garden trees in the moister regions of the Mediterranean and in the more sheltered parts of Central Europe, and may be seen at their best on Lake Maggiore. Somewhat similar in appearance is the splendid *Paulownia*, the only tree in the snapdragon family, which, as a *tour de force*, has been made to grow in Scotland, and is abundant in Paris, but is most at home in regions at once warm and fairly moist, and without much wind. There are some beautiful specimens in Lisbon, where the great masses of purple flowers can be seen in early spring,

opening before the leaves. The fruits are a very curious and decorative kind of capsule which split to allow the small winged seeds to escape, and are sticky to the touch. The tree is a native of Japan and is not drought-resisting in summer, so that it can only be grown in the damp parts of the Mediterranean region. Another beautiful flowering tree often grown in towns is *Sophora*, a graceful pinnate-leaved form which produces its bunches of greenish-white flowers in July or August, and belongs to the same family as the laburnum. It is one of the ornaments of, for example, the streets of Genoa, and is also abundant in Geneva, so that it is not exclusively Mediterranean. The pods are jointed and are abundantly produced. We must also mention the Judas tree, which often occurs as a shrub, its dull crimson flowers, 'reddened with the betrayer's blood,' forming sheets of bloom on the hillsides near the railway between Naples and Rome in spring, but it also in places grows to the size of a large tree. In Lisbon, for example, it is extensively planted, and travellers who, on their way to or from Geneva, have to change trains at Culoz will notice a very fine specimen near the railway station. The Judas tree is easily recognised by its rounded, heart-shaped leaves, unusual in a member of the peaflower family, and by the way the flowers seem to burst from the bark of the twigs. The pods are not dissimilar to those of the laburnum. Finally, we must note that as the conifers are drought-resisting, the more delicate forms are very extensively planted in the region, one of the most interesting being the Norfolk Island pine, a curious species of *Araucaria*, which forms a noble tree of striking appearance, and then presents little resemblance to the pot plants common in conservatories here.

REFERENCES. Of the numerous books on the flora of the Mediterranean, relatively few are in the English language. Very useful is Strasburger's book, translated as *Rambles on the Riviera*. It can sometimes be picked up second-hand, and its illustrations are very

helpful. Some of those given here are based in fact upon them. More recent is Alban Voigt's *Die Riviera* in Junk's *Natur-Führer*, an inexpensive and handy volume, giving many details in regard to the commoner plants, native and cultivated. A general account of Mediterranean vegetation will be found in Schimper's *Plant Geography*. For the traveller in the region a general book on plants is useful owing to the number of introduced trees and shrubs; the two volumes of a small old-fashioned book called *The Treasury of Botany*, edited by Lindley and Moore, will be found of great value. Much more modern but less complete is Willis's *Flowering Plants and Ferns* in the Cambridge Natural Science Manuals. A Flora is necessary, and it is advisable to take Bentham and Hooker's *British Flora* for the numerous incidental notes on exotic plants, and the excellent tables for identifying the common orders. Bonnier and Layens' *Flore Complète de la France*, an inexpensive book, contains brief descriptions of most of the Mediterranean plants.

Among other foreign books, mention may be made of Philippson's *Das Mittelmeergebiet*, with a general account of the region; of Maximilien Sorre's *Les Pyrénées Méditerranéennes*, with excellent descriptions of the vegetation of evergreen oak-woods; and of Willkomm's *Grundzüge der Pflanzenverbreitung auf der iberischen Halbinsel* in Engler und Pruden's series called *Die Vegetation der Erde*. Many of these give references to books suitable for further reading.

CHAPTER IX

MEADOW, WOOD, AND PASTURE IN THE ALPS

‘Where woods and winds contend.’

IN very sharp contrast to the plant formations of the Mediterranean area are the woods and pastures of the Alps. Not only are the kinds of plants present quite different, but the Alpine formations have been on the whole far less altered by man. It is also generally much easier to make a detailed study of their constituent plants than of those round the tideless sea, for they are for the most part above the level where cultivation can be carried on, and the methods of soil utilisation employed rarely interfere with free access on the part of the general traveller.

A point of resemblance between the two types is that since in both cases the plant formations closely reflect the characters of climate and surface, both are associated with well-defined types of human society. In not a few places, as on the Riviera, at the eastern end of the Pyrenees, on the south side of the main Alpine chain, especially to the east—the Mediterranean and mountain plant formations approach one another closely, and in these regions we have the contrast between two social types at its sharpest. To a certain extent at least there is even a contrast in race between mountain and Mediterranean folk, and much of the history of the two regions is due to the existence of a line of contact between two types of vegetation, two modes of human life, two races of men, the line of contact stretching almost through the breadth of Europe in our sense.

Mountain vegetation, no less than that of the Mediterranean, has been the object of innumerable investigations, the reasons being in part the same in the two cases, for both are markedly tourist regions. Indeed a complete list of published memoirs would be even longer in the case of the Alps than in that of the southern area, for the Alps and other mountains are chiefly visited in the summer season, when even the busiest have some leisure, and, for the energetic northern folk, they are also within easier reach. The result is that both the study of the region as a whole and that of special areas has been carried to a high pitch, and many refinements of terminology have been introduced. We shall limit ourselves here to a mere outline of results, laying stress on those facts which can be observed by the casual visitor to the Alps. Though the description is based upon the Alps, it is generally applicable to the other mountain regions of Europe. The special characters of the different chains are beyond our scope.

We have already pointed out that in Switzerland deciduous forests have a somewhat limited distribution, and the country generally lies well to the east of the Atlantic, so that the summer heat tends to be great (cf. p. 49). The result is that most of the tourist resorts, except those on the lakes, lie in the belt of coniferous woods. The higher ones lie often near the upper margin of the woods, as for example Arolla, and, we may add, the Riffelalp, though this is but a dependence of Zermatt. More generally the village with its huge hotels lies in a little basin, from which rise on all sides steep banks with dark fir-woods. The result is that all the climbs and the longer walks lead steeply up through the woods, and beyond them to grassy shelves and slopes. Those who know the Alps at all have only to shut their eyes to see again the steep winding path, to feel the scent of the resinous firs and pines, to catch glimpses of the great snow peaks through the clearings in the wood, to hear the plashing stream, to picture the rocks and undergrowth, the open spaces where the straw-

berries grow, the brooding silence and mystery which to the imaginative people the glades with a whole population of nymphs and dryads, of fairy, fabulous monster and witch. There are days too when the chill mist lies heavy in the valley, and one climbs painfully up the slimy path, beneath the steady drip of the tall trees, with the feeling of oppression ever growing deeper till the wood and the mist seem to thin simultaneously, and one passes in a moment from the dank gloom to the open, to see faint ghosts of mountains appearing. A few steps more, and one is out upon the alp and into the sunshine, surrounded by a sea of snow-clad peaks which have no contact with base earth, but rise, like saint or Madonna, from the level sheet of cloud which conceals the whole valley from view. Such an experience—and it is no infrequent one—enables the traveller to appreciate to the full the contrast between the two great plant formations of the Alps—the coniferous wood and the alpine pasturage.

Often, as we have just said, the contrast between wood and alp is sudden and striking. There is not only a change in the vegetation but also in the slope and the nature of the surface, and the fact that the alp has almost always a cluster of cheese-making sheds or chalets, often, at least in Switzerland, accompanied by a little inn, while the wood is without sign of human life, accentuates the contrast. 'The place where we had our lunch' is always for the mountain traveller an area of great significance, and if the geographer expresses the matter in more stilted phrase, what he means fundamentally when he says that the forest repels settlement is that the alp is a more suitable place to sleep or feed in than the damp wood.

In other cases the contrast is less sharp (Plate X.). One mounts through the wood and finds the tall firs and pines giving way to prostrate mountain pine mingled with green alder; still higher this belt again perhaps yields to one where the mountain pines are few, and great masses of alpine rhodo-

PLATE X



Near the tree limit on Mt. Revard, above Aix-les-Bains.
The upper slopes form pastures, or alps.



dendron expose their bright flowers and rusty leaves. Or, again, the trees separate from one another, and rise from a sea of berry-bearing bushes, such as blaeberry or cowberry; or, yet again, the valley becomes rocky and difficult, and the vegetation is represented by scattered bushes and tall herbaceous plants, such as the magnificent Pyrenean columbine, which raises its beautiful blue flowers and luxuriant fern-like leaves at the side of the trickling streams, in company with rank-growing composites, like blue alpine lettuce and the pink *Adenostyles*. In such cases, though the contrast between the climb up the valley and the open alp at the top remains vivid, the limit of the wood is much less clearly defined. According to many botanists, the upper limit of the wood has in such places been shifted downwards, either by human or natural agency, or by both in combination, and the zone of bushes is the equivalent of the Mediterranean maquis, that is, it represents a belt which has been once covered with trees, and could possibly be again afforested. Again, that is to say, we find that where trees are approaching their natural limit very little interference will turn the balance against them, but when they disappear their accompanying undergrowth persists.

It is interesting to note that at the margin of the Alpine wood, as in the Mediterranean region, the goat is a great forest destroyer. In the Alps goats are kept in large numbers as milk producers, and as the richer pastures are reserved for the more valuable and more fastidious cows, the goats must pick up a living where they may, and as they destroy seedlings and young conifers, as well as nibbling the bushes, they serve to prevent natural regeneration. Nor are their owners averse to extending, where they can, their pasturages at the expense of the wood. Many investigators believe that the presence of alpine rhododendron at a particular spot means that forest was once present here.

The elevation at which tree growth ceases in the Alps has been the subject of numerous investigations. It varies very

greatly with exposure, the nature of the soil, the latitude, and the nature of the mountain region considered, for isolated mountains have a lower tree limit than those which occur in groups. The subject need not detain us here, though it is a point upon which it is always interesting to make observations when visiting the Alps. It will be noted then that in the case of valleys running east and west the limit is very different on the two sides. That side which faces south should have a higher limit than that facing north, but in point of fact one often finds that the side with the southern exposure is bare of trees, because it is sufficiently warm for cultivation to be carried on at a great elevation, while the other, colder side, is clothed with trees. The Romanche valley, near the village of La Grave (Plates XI. and XII.), is a very striking example, but the phenomenon is common in both the Alps and the Pyrenees, and in many places the local dialect contains two—quite untranslatable—words, of which the one is applied to the side of the valley facing the sun which is cultivated, and has practically all the habitations of the district, while the other is applied to the wooded, uninhabited, uncultivated and chilly, shaded side. The land on the two sides of the valley has, naturally enough, quite a different economic value.

The number of kinds of trees in the coniferous woods of the Alps is small. The most widely distributed, especially at the lower levels, is the spruce, whose heavy foliage and hanging cones are familiar to all travellers in the region. Our Scots pine, sometimes in a special variety (*e.g.* in the Engadine), occurs, but rarely predominates, over large areas. The larch is frequent towards the tree limit, and in parts of Switzerland and in the eastern Alps the beautiful Cembran or Arolla pine (see Frontispiece), with its edible seeds and clustered needles, occurs. Where it is found it generally gives rise to a wood-carving or furniture-making industry (*e.g.* in the Grödnertal), as its soft wood is easily carved.

PLATE XI



The southward-facing slope of the Romanche valley near La Grave. This slope has been completely deforested, and the consequent deep ravining of the land is well shown. The soil is cultivated where possible, and the presence of the villages should be noted. The opposite slope, facing north, has practically no houses, and is forest-clad.

A very interesting species is the prostrate mountain pine, which is absent in most parts of Switzerland (though present in the Engadine), but in the eastern Alps forms a zone above the woods proper. It can grow upright as a forest tree, and does this, for example, in the Pyrenees and parts of the Alps, but the curious prostrate variety forms a dense mass of interlacing branches, lying along the surface, and thus resistant alike to wind and snow, but forming an almost insuperable barrier to human progress, as any one who has scrambled down a steep slope clothed with the tree will testify. Mingled with the prostrate pine, as already stated, bushes of green alder occur, and both are of great importance in preventing landslips on very steep slopes, owing to the way in which they bind the surface.

In the woods grow many interesting plants, especially the berry-bearing shrubs common on moors in our own country. Their fruit is but little used in Switzerland, or at least is rarely found on hotel menus. In Tyrol, on the other hand, the plant which we call cowberry yields the *preisselbeere*, which appear so frequently in the form of compote as an accompaniment to many meat dishes. Such dishes recommend themselves strongly to persons of an economical temperament, for the one order supplies both meat and pudding! The compote has the further recommendation that it is usually composed of fresh fruit, whereas the others which make such a noble show on the card in mountain inns generally turned out to be parboiled bottled fruits, whose apparent variety is more than counterbalanced by the fact that they all taste exactly alike, and this taste is chiefly negative—one feels that a duster, if boiled long enough, would acquire a similar nothingness.

Less familiar to us than the species of *Vaccinum*, like cowberry and blaeberry, are the shrubby honeysuckles, of which there are several kinds, and their ally, the interesting little *Linnæa borealis*. This is an inhabitant of Northern Europe,

whose presence in a few localities in Scotland and northern England and in parts of the Alps is a result of the Ice Age. In Switzerland the plant is rare and local, and there is an entertaining story of a royal personage with botanical tastes who, in the course of an elaborate tour through the Alps, proposed to conduct a personal search for the plant. Fortunately, however, the major domo knew his duty, and the plant was carefully inserted in advance in a spot where the royal lady could find it without damage to garments or temper. In the eastern Alps it seems to be not uncommon; not far from Sölden in the Oetztal, for example, one may find its slender trailing stems with their evergreen leaves making a carpet through the fir-woods, and producing in July a profusion of the delicate pinkish-white twin bells, which droop so that the pollen is not damaged by rain.

Junipers are also common in the woods, and, where the canopy is more open, there are splendid patches of flowering plants: the taller gentians, monkshood, mountain arnica, lilies and orchids, the quaint little wintergreens (*Pyrola*), pink *Saponaria* and white *Silenes*, speedwells and many other plants, some familiar and some strange, but not for the most part showing any great contrast in form to our woodland flowers.

Where the upper margin of the wood is fringed by a belt of bush, many of the plants of our drier moors and heaths reappear, with some strangers. Thus the two kinds of blueberry, cowberry, cranberry, bearberry, and so forth, are very familiar; the mountain azalea is not a very uncommon plant of Scottish moors, but the two kinds of Alpine rose or rhododendron and the abundance of the mezeleon, bearing its bright red berries in summer, are features novel to the botanist from Great Britain. In the bush region, or in the more open parts of the woods, we may find great sheets of *Dryas octopetala*, another relic of the Ice Age, not uncommon in northern Scotland, and parts of Ireland and N. England,

PLATE XII



Another view in the Romanche Valley, near La Grave, showing how the ravining due to deforestation is encroaching upon the cultivated lands. Cf. Plate XI.

as well as in Scandinavia. It is a small prostrate plant with shining leaves, woolly beneath, white, rose-like flowers and feathery fruits.

Let us turn next to the pasture lands, the real glory of the Alps, but only seen in their splendour by the tourist who can visit the region in early summer. Ruskin, true to his Calvinistic upbringing, ascribed the fact that most tourists visit the Alps in full summer, and so miss the glories of the meadows, to original sin ; but most of those who have their bread to earn find that it is due to causes beyond their control. Those to whom an early visit is possible may welcome the following note as to dates, which is quoted from Christ's *Pflanzenleben der Schweiz* :

' Mistakes are often made as to the time of culmination of the flowering period in the Alps. In full summer it is only the highest regions, those near the snow-line, which show wholly unwithered sheets of bloom. June, close following upon the time of the melting snow, is the blooming time of the lower and even of the higher Alpine plants, and he who has not looked upon this living carpet in the first freshness of its youth, has no conception of the splendour and extent of this world of bloom. For Schynige Platte, June 11 ; for Pilatus, June 18 ; for the Simplon plateau, June 20—these are the critical periods, though they may be retarded by bad weather for from eight to fourteen days. If you can seize the right moment there is nothing in the world comparable to this truly intoxicating loveliness. The large flowers, standing close to one another, actually conceal the lowly, small-leaved plants, so that the green is but half-seen through the glowing colours of the blossoms, among which one walks with hesitating steps. The tender rose of the mealy primrose and of the cushion *Silene*, the cold white of the anemones, the bright burning yellow of the hawkweeds, the deep burnished copper of the *Bartsias*, the equally deep but fiery blue of the gentians whose heavy clusters cover the ground, and,

above all, the velvety purple of the fragrant violet (*Viola calcarata*), which blooms in countless numbers—these form the chief tones in the glowing carpet, which is besprinkled with countless dewdrops glittering like diamonds. On the Simplon to these flowers are added the rare adornment of the snow-white rosettes of *Senecio incana*, with its orange flowers, the deep blood-red of the houseleeks and *Pedicularis*, the purity of the Alpine lilies (*Paradisia*), the purple and gold of the alpine aster, the woolly grey of the edelweiss, the deep yellow of the *Androsace* and the blue of *Eritrichium*, which rivals the azure sky of the southern Alps in the soft intensity of its colour.'

The traveller is fortunate indeed who can see this glory in its prime, but even the late comer, if he be willing to climb, may see some traces of the spring splendour, and, if the general effect be less striking, he may enjoy a perhaps intenser pleasure in the detailed contemplation of the last representatives of the bright band. Even in August one may find, at least in a late season, solitary bells of *Soldanella* unfolding on damp patches from which the snow has just cleared, and these delicate fringed cups, with their graceful droop earthward, are in themselves a great joy. But in that month one must be content with an occasional bloom of primula and anemone, culled with care from a waste of feathery fruits or swelling capsules—and seek consolation on the lower ground in the scarlet of the barberry fruits and the glorious orange of the buckthorn berries among the silver foliage—sights which the June traveller cannot hope to enjoy.

But where are the splendours which Christ describes to be sought by the June traveller? There are, broadly speaking, two main kinds of alpine meadows. In the open basins of the valleys, on the gentler slopes, within the zone of the fir-woods, but in parts where the wood does not exist or has been cleared, are to be found the hay meadows. Here the

PLATE XIII



BASIN WITH GORGE ABOVE IN THE VAL DE BARNES, SWITZERLAND. Note the hamlet placed on the cone brought down by the right-hand stream. The surrounding clearings are *mayens* or spring pasturages, the basin (altitude nearly 5000 feet) being above the limit of cultivation.

grass and flowers grow tall; here in autumn one may see the peasants, often the women, laboriously spreading the manure which replaces the substances carried off in the hay; here in summer, in June, July, or even August, according to the position and the season, one sees the whole family toiling in the blazing sun at the hay-making, or on the days of pouring rain the men and women still patiently cutting the grass, hoping that a bright to-morrow may yet dawn.

These meadows are generally fenced, either with a permanent fence or with bars of wood which can be removed once the precious crop is cut. Between the fences run the narrow stony lanes which lead to the chalets, up and down which the peasants clatter in their sabots or pattens, and the tourists and their guides in their nailed boots. Here also one may see the patient donkey, all but concealed by the load of hay, steadied on its precarious downward journey by a ragged urchin who hangs to its tail. If the path be somewhat less narrow and less steep, one may see that ingenious vehicle which is a narrow two-wheeled cart on the upward journey, and a sledge on the downward one, the unused wheels running behind the loaded sledge as it slips over the cobbles, polished by the tread of many feet. As he toils beneath the mid-summer sun the peasant has ever before him the menace of the day when valley and slope will be alike drowned in snow, and his cherished hay is the only means he has of feeding his beasts. Therefore wherever he can reach the grass, and wherever it can be carried after cutting, by man or beast or sledge, to his cattle sheds, there he makes hay.

But above the fir-woods there comes other pasturages, snow-covered till late in the season, yielding a dense growth of nutritious grass and herbs which never reach a great height, separated from the valley below by slopes too steep for the carrying of the grass, even could the short stocky growth be cut—these are the upland pastures, not safe from a snow-covering even in full summer, but furnishing abundant food

to cattle, goats, and the fewer sheep for a longer or shorter period of the year. These are the true alps, and here and on the rocky slopes above grow the most gorgeous, the most characteristic of the alpine flowers, those which only to the gardener deserve the name of alpine, those with the typically large flowers which, as Christ says, seem to conceal the small leaves. It is these especially which in their form and structure show most markedly the effect of the mountain habitat.

Before speaking of a few of the most striking forms, let us note in a word or two the relation of hay meadow, wood, and alp, as one may see all three in almost any Alpine valley.

Let us suppose that, as often happens, we are leaving one of the main valleys to travel up a lateral one. In most cases we find that at first the road, whether carriage road or mere track, winds steeply upwards through fir-woods, generally some distance from the stream, which may be heard thundering through a rocky gorge far below. If the road be practicable for vehicles it takes great curves, always cut off by short cuts for pedestrians, and even if it be a mere mule track, there is generally a distinction between the route taken by the loaded animals on the upward journey, and that taken by the walker going light on the downward journey.

As we climb upwards we have time to note the characteristic woodland vegetation. Soon, however, the slope eases off, and we enter a basin, where the stream runs tranquilly between meadows, and the walls of the valley recede, the fir-woods receding with them. Beyond the basin the valley again rises steeply, and another basin follows in due course. Almost any of the Alpine valleys will show this phenomenon, on a smaller or larger scale, with greater or less definiteness. Sometimes the basin contains a beautiful lake, often the intervening steep stretch shows splendid waterfalls and rapids, but in essence this alternation of gorge and basin, or, as the French say, of landing (*palier*) and rapid, is characteristic of river valleys whose general slope is steep (Plate XIII.).

In the Alps the phenomenon has been accentuated by the recent passing away of the glaciers of the Ice Age, but it is not wholly a glacial phenomenon.

At the head of the valley various conditions occur. Sometimes, as at Zermatt, the last basin holds the highest village, and seems to be directly overhung by the glaciers, whose milky torrents foam down the mountain sides to form or join the main stream. In such a case access to the valleys at the other side of the chain is only possible over glacier passes. In other cases, as happens in the case of most of the famous Alpine passes, the last steep slope leads to a wide grassy plain, bearing one or several lakes, bitterly cold and wind-swept, cut off from the valleys at both sides by slopes of great steepness. Often there is a very uncertain water-parting at the summit, one stream rising from the lake, and the other from the hillside not far away. Beside the summit lake there is generally a hospice, where one tries to warm one's chilled hands and feet, before the diligence starts on its jolting way down to the fertile valley beyond. Almost any pass—the Mt. Cenis, the little St. Bernard, the San Bernardino, and so forth—will show in varying form similar conditions.

Now let us consider in a little more detail the characters of the different sections of such a valley journey. As we walk up the steep stretches through the woods by the short cuts, we find it difficult to resist the temptation to push through the brushwood to have a nearer view of the roaring stream. In Switzerland the existence of this desire in the mind of the ordinary tourist is generally recognised by the shrewd native, and so we find that paths are cut, steps and staircases arranged, seats provided and so forth, so that—at of course a small outlay—the finest part of the gorge is accessible. There we can note how the water is cutting down through the solid rock; in the summer flood we can hear the rattle of the stones swept along the bottom, stones which eat out the deep pot-holes: in technical

language, we see the river at its work of erosion. The steepest bit of the road, the finest gorge, are generally just before we reach the basin, for the water has been dammed back by a bar of hard rock (the *verrou*, as the French call it), and it is this damming back which helped to form the basin above. In the basin we see no rock at the sides of the stream, only deposits of silt and stones. The basin owes its prime origin to the existence of softer rocks, easily worn away, and the river there no longer shows its erosive but its depositing function. If there be no lake, the ground near the stream is likely to be more or less marshy. It grows lush grasses and reeds. As we pass away from the stream we come to drier ground, but still ground where the native rock is covered by a deep deposit of silt. The basin is the natural site for the village, though, if the valley be narrow, this tends to be placed on the slopes above its floor, to escape the accumulation of cold, stagnating air in winter. Part of the reason why the village is placed in the basin is that here, as compared with the steeper slopes above and below, there is often land fit for cultivation. Whether or not it bears cereal and other crops depends upon the elevation, the exposure, the local climate, and also on social conditions. Originally the lower villages at least were more or less self-supporting and grew cereals for their own use. With the opening up of so many of the valleys to tourists, the natives tend to specialise more and more upon the pastoral industry, and to use the once cultivated fields for hay crops.

Such meadows are carefully manured, are irrigated if need be in summer, and are fenced. They grow many kinds of grasses. Among the grasses we see many composites, tall umbelliferous plants, many kinds of campanula and speedwell, vetches and clovers, the bright blue sage, the taller gentians, especially the yellow gentian of medicine. In autumn also these meadows are purple with the autumn

colchicum, while the rare spring visitor will see the spring crocus in equal abundance.

The glacial shelves high up on the valley walls, and the similar shelves and passes at the heads of the valley are likewise grass-grown, but their flora is different. Here there is no depth of soil, for the surface has been scoured by ice and only a thin stony deposit intervenes between the surface and the underlying rock, except where some special cause has led to a greater local accumulation of fine glacial silt. But up here erosion is at its maximum, and the streams of summer, the snow of winter (always dust-loaded), are continually renewing the fertility of the shallow soil. Here therefore no manure is necessary; the soil is enriched by the droppings of the pasturing cattle, and what is removed from the ground in the cheese carried down to the valley is renewed by the forces of nature.

Nevertheless the pastures require careful management; they must not be over-grazed, for if the surface-covering be once destroyed the soil is washed away and it may be impossible to renew the turf; in the drier regions, as in the Valais, they must be irrigated with fertilising glacial water in summer, and stream regulation may have to be carried on to minimise destruction by torrents. The lower pastures also must be protected by belts of wood which help to prevent destructive flooding.

In these high pastures the plants never reach a great size. The intensity of the insolation checks vegetative growth, and height growth would in any case bring increased danger of frost; the plants are therefore 'stocky' in habit, and, as compared with their allies on the lower pastures, contain far less woody matter. They form therefore a far more nutritious food for cattle than those of lower levels. As the soil is scanty and shifting except in crevices it is an advantage for the plants to have long tap roots, but these go down to layers of soil which are very cold, and where it is therefore

difficult for the plant to take up water. Therefore the alpine economise water as much as possible; they tend to be hairy (edelweiss, glacial anemone), or to have fleshy leaves (houseleeks and alpine *Linaria*); they have a characteristic tufted or cushion mode of growth (cushion *Silene*) which prevents loss of water, and diminishes also the risk of damage from snow; their leaves are nearly always small (cf. p. 61). Finally, the brilliant flowers are partly due directly to the bright light, are partly a common feature of drought-resisting plants (cf. p. 62), and are perhaps partly necessary to attract the few insects of the heights. The fact that the plants are all low-growing and lie close to the soil, makes those of the pastures which lie on steep slopes difficult to walk upon, especially in dry seasons. Many of the 'edelweiss accidents' are due to this fact, the incautious tourist venturing without properly nailed boots on grassy slopes too slippery for the footing to be regained after a slip.

We cannot attempt to give a list even of the most characteristic of the high alpine; they are best studied on the spot. But we may notice that edelweiss, rare in North Switzerland, is common in the south, save where it has been rooted up, and is generally found in company with alpine aster; the smaller gentians, *e.g.* the snow gentian, are as frequent on the heights as their larger allies in the lower meadows; anemones are abundant, the glacial anemone extending to great heights; many forms of primula, especially the alpine one, and the mealy primrose, *Androsaces*, the tiny *Globularia*, *Soldanellas*, the cushion *Silene*, the saxifrages and houseleeks, and the purple and yellow alpine *Linaria* are all of common occurrence.

Those are happy days when one wanders over the high pastures, picking these and many another treasure; now scrambling over the moraine down to the border of the glacier, now lounging by the edge of some tiny lake, floating the cups of blue gentians over the mirrored snow peaks, or

listening with half-shut eyes to the distant tinkle of the cow-bell, or laying down the law to one's companions with more strength of conviction than detailed knowledge in regard to the name of this or that peak, or the correct route up each. Where is joy to be found on earth if not here in this splendid, undefiled air, with all the glories of sky and mountain around one?

REFERENCES. There are a great number of Alpine floras, and those who do not care to burden their luggage by carrying a book out, can generally pick up some one or other of these in the chief resorts. A very handy little book of small size is Dalle-Torre's *Tourist's Guide to the Flora of the Alps*, translated by Alfred Bennett, which slips easily into the pocket. Bennett's own book, *The Flora of the Alps*, in two volumes, with coloured illustrations, is useful but rather bulky. One of the best general books on the plants of Switzerland, though like those already mentioned it is a little old-fashioned, is Christ's *Das Pflanzenleben der Schweiz*, with some useful maps. More modern and much more detailed is Dr. Rübel's *Pflanzengeographische Monographie des Berninagebietes*, which gives information in regard to a much-visited region, and has a copious bibliography. Schröter's *Das Pflanzenleben der Alpen*, and the small book, by the same author, called *Taschenflora des Alpen-Wanderers*, with good illustrations, should also be mentioned. Dr. Norbert Krebs' *Laenderkunde der Oesterreichischen Alpen* gives some details in regard to the vegetation of the Austrian Alps, as well as in regard to many other matters, and has also an extensive bibliography. The alpine of the Pyrenees are discussed in Sorre's *Pyrénées Méditerranéennes*, already mentioned.

CHAPTER X

MOORS AND HEATHS

‘An acre of barren ground ; long heath, brown furze—anything.’

So far we have shown that the traveller in Europe is especially fortunate in that there those tracts of land which are largely uncultivated, and therefore bear more or less their original vegetation, are characterised by a considerable variety of plant formations, and it is, of course, such uncultivated regions that botanically-minded tourists chiefly visit. Thus for spring and winter holidays he has before him the somewhat infrequent evergreen forests and the more abundant maquis and garigues of the Mediterranean region ; summer gives him opportunity to study the remnants of the original European forest, as represented by deciduous woods in the lower grounds, and coniferous forests on the higher ; in summer also he can study the splendours of the mountain flora, with its double interest of adaptation to present conditions, and reminiscences of past ones, when the plants of Central and Northern Europe, like the animals, alternately advanced and retreated with the fluctuations of the ice. There remains one other kind of formation, not yet considered, which occurs over wide stretches of land, and, since its presence involves the assumption of poverty of soil, these stretches also are more or less available for the purpose of the tourist. This type is that of moors and heaths, which occupy a large area in north-west Germany, especially in Schleswig-Holstein, Hanover, Oldenburg, also in Jutland, in

PLATE XIV



Pine and Moor—the Conflict.

Belgium and Holland, in parts of northern and western France, as well as in England, Ireland and Scotland.

These tracts of land are now in process of being studied from the standpoint of ecological botany, and it is rather unfortunate that the words which the botanists employ have another sense in ordinary speech, while the matter is further complicated by the fact that the dictionary equivalents of the French and German words used to denote moors and heaths, do not precisely represent the plant formations as they occur in nature. We shall treat the subject here in the simplest way possible, omitting minor formations, such as the English fens, and all the subtleties of nomenclature based upon the predominance of particular plants in a moor or heath.

Moors and most heaths have this in common, that the surface soil consists of peat, or, as it is called botanically, acid humus, whose presence again indicates that the oceanic climate is present in its extreme form. Wherever we have peat we find that there is a high rainfall, evenly distributed throughout the year, and a small range of temperature. The summers are cool and wet, the winters mild and wet, and long spells of frost and drought are alike unknown.

Obviously, however, this is not the whole story, for this climate reigns to a greater or less degree over practically the whole of Ireland and the whole of Scotland, and these countries are far from being uniformly covered with peat. We shall return in a moment to the question of what determines the origin of peat, so far as this is known. Meantime let us note what the botanists regard as the distinction between heath and moor. Heaths occur over poor sandy and gravelly soils, on the surface of which lies a layer of peat, varying greatly in thickness but never so deep that the underlying gravelly or sandy soil fails to assert its influence upon the plant life. In patches on such heaths we generally find hollows where the peat has accumulated to great depths, and there the

prevailing heather of the heath proper is replaced by other plants, or occurs mingled with them. Such patches approach the moor type. In the western parts of the British Isles, especially in parts of the western Highlands of Scotland, there occur, interspersed with less repellent formations, large tracts of true moor, that is of regions where there is a deposit of peat so deep that the nature of the underlying rock does not affect plant life. In such regions a 'tussock' growth of plants, *e.g.* of cotton grass, dwarf sedge and dwarf rush, is characteristic; heather, though generally present, does not predominate; areas of quaking bog occur, and the surface is difficult to traverse and difficult to utilise in any fashion whatever—such regions are botanically typical 'moors.' It will appear from this description that botanically the ordinary 'grouse moor' of Yorkshire or of the eastern Scottish Highlands (*e.g.* of Perthshire) (Plate XV.), with its predominance of heather, is a heath and not a moor, though it may be intersected by patches of true moor. This botanical use of the terms is based upon the German use. In southern and midland England a heath is generally regarded, in popular speech, as a stretch of open ground covered with heather, or oftener perhaps with whin or bracken and their associates, but always dry enough to walk upon with comfort, the dryness being due to the thinness of the layer of peat, and the porous nature of the underlying rock, which is often sandstone. As the similar tracts in the north of England and in Scotland are wetter and have a deeper layer of peat, there is a more or less tacit understanding that a moor is wet, as compared with a dry heath. The botanists, as we have seen, wish to impose a fresh significance on the top of this popular one. Whether such a refinement can persist in face of the popular use is a little doubtful, but it is important, from several points of view and especially in connection with afforestation, that the fact should be realised that there is a marked contrast between the more or less uniformly heather-covered

PLATE XV



The Moor triumphant.
Note the alders at the margin of the stream.

areas, underlain by a relatively thin layer of peat resting upon a poor porous soil, and those other tracts where heather does not predominate and may even be absent, and a dense continuous mass of peat separates the growing plants from the underlying soil or rock.

The distinction is of course one of degree, not of kind, for though the botanist indoors may say concisely that a particular region is heath if the underlying sand or gravel is affecting the life of the plants, and a moor if their physiology is influenced by the peat alone, yet in the field he knows perfectly well that it is, at least as yet, not always possible to say in every case which of the two conditions prevails. The matter is further complicated by the fact that in some of the heaths of south-east England there is practically no peat at all, and the heath formation is due only to the poor sandy soil.

Now let us turn to the difficult question of the cause of peat formation. Under ordinary circumstances dead plants or parts of plants decay rapidly after death, and mingle with the other constituents of the soil to give the whole a dark colour. The process of decay liberates substances which are necessary for the growth of new plants, and there is thus a connection between the fertility of the soil and the amount of this 'mild humus' present. Ordinary garden soil is full of such decayed vegetable matter, and all who have dug a garden bed (or seen it dug, but the phenomenon is then less impressive!) know what a difference there is between the dark, fertile surface layer and the paler, less fertile sub-soil where vegetable matter is scanty. The process of decay is chiefly effected by certain bacteria, which can only thrive where there is plenty of air and some lime salts. Therefore our garden beds are constantly stirred and dug to allow air to enter, and, if lime salts are deficient, dressings of lime are applied. Thus, the process of decay is not, as we used to think, spontaneous, it is a phenomenon of life. Anything

which destroys or prevents the development of the minute organisms of the soil, prevents that breaking down of the parts of the dead plants which is essential for the growth of most new plants. Peat is in essence partially decomposed vegetable matter, and it tends to accumulate where the conditions are unfavourable to the ordinary soil bacteria, that is, where air and lime salts are absent. Low temperatures assist its formation, for they also check bacterial activity; thus peat is not formed in warm climates. Further, we do not in the general case get peat over limestone rocks, because these yield lime salts and are permeable to water, though there are certain exceptions to this rule, where special causes intervene. The fact has a good deal of practical importance, for if you propose to take a holiday in a district where grouse are rigorously preserved, you will find that it is advisable to pick out a village in a region where limestone predominates, if you can, for here there will be few grouse moors and you will have greater freedom of movement. This is especially true in the Pennines, for instance, for where the limestone predominates cattle pastures occur, and only the bullocks are likely to resent your taking long tramps over the hills. But where peat occurs, and therefore heather, then the watchful gamekeeper lies in wait.

What conditions lead to that absence of oxygen which, next to a low temperature and the absence of lime salts, is so potent a factor in peat formation? The answer is, in brief, the waterlogging of the surface. Part of the reason why peat does not generally form over limestone is that in limestone regions water drains away rapidly and waterlogging does not occur. This may seem absurd when we have just stated that peat often forms, though in thin layers, over sand and gravel, surely porous enough formations. Here, however, a new factor intervenes, for a complicated series of chemical interchanges often takes place which leads to the formation of a hard layer called 'moor-pan' (German

ortstein), often lying a foot or so below the surface, and cutting off the surface layer of soil and the surface water from the porous lower layers. As a result the upper layers are flooded with stagnant water, and peat forms. In such cases, if the moor-pan be thoroughly broken up, and the soil afterwards kept stirred, or trees planted, peat formation seems to cease. The moor-pan, however, is itself at least partially due to climatic conditions, to the absence of sundrying in summer, of prolonged frost in winter.

Another occasional cause of surface-waterlogging is the presence of a layer of impervious boulder clay, which does not allow the surface water to drain away. But these and similar causes do not account for the enormous depths of peat found in parts of the north-west Highlands of Scotland, and it seems fairly certain that these owe their origin to climatic conditions which prevailed at an earlier period than the present—are thus, in a sense, one of the results of the Ice Age. On the other hand, there is very little doubt that parts at least of the heaths of Germany, of south-eastern England and possibly even of certain regions in Scotland have arisen from woodland, largely owing to human mismanagement. They are like the *maquis* and *garigues* of the Mediterranean region, in that they represent areas where man has turned a very delicately poised balance definitely against the forest. In some instances at least, as has been shown in Germany, scientific forestry can restore the vanished woodland, and prevent further peat formation, but so far as is known at present the true ‘moors’ of north-western Scotland, with their heavy, impervious load of peat, represent regions which are in large part destined meantime to resist human efforts at reclamation. If Northern Europe as a whole is a region which has, owing to the gradual passing away of the effects of the Ice Age, been becoming through the historic period progressively better fitted for man’s occupation, these peat-enveloped areas are regions where the ameliora-

tion has not yet proceeded far enough for his purposes. But their incapacity for cultivation and in part also even for afforestation need not mean that they should lie unvisited save by the sportsman; they are, to some extent, fitted to be the recreation grounds of the dense industrial populations further south, to be tourist resorts in the largest sense, and the singularly close connection which exists between their vegetation, the physical conditions, and the types of human occupation which alone are possible, make them admirably suited for study by the inhabitants of a country where the vegetation, the modes of life and of soil utilisation have largely lost their primitive and 'natural' connection with the physical conditions.

If we sum up the general facts as regards the distribution of heaths and moors, we find that within the reach of the extreme type of oceanic climate, the poorer and more porous soils, especially in the more exposed situations, maintain under natural conditions a thin kind of woodland which, owing to human influence, or to slow geological or even climatic change, is liable to disappear and to be replaced by an association of plants very tolerant of infertile soil, of which heather is the more conspicuous member. Among the heather there often appear seedlings or dwarfed plants of forest-forming species, such as birch, mountain ash, willow, and so forth. These, like the dwarfed trees of the maquis, or the prostrate pines of the eastern Alps, represent the last struggle of the forest against unfavourable conditions. Once the heather has established itself, if there be no interference by grazing, periodic burning or drainage, the tendency is always for it to increase its hold, partly because its dense felt of roots, by interfering with the circulation of water, helps to promote the development of raw humus, which is in its turn inimical to forest growth (Plate XIV.). The formation of moor-pan also prevents the re-establishment of forest. But while it is probable that in some cases mismanagement has done

much to promote the growth of heath, on the other hand, the succession of plants in the peat bogs of Scotland suggests that in the past climatic changes, in the direction either of a total increase in rainfall, or of increased uniformity of distribution throughout the year, greatly promoted the growth of peat, and the present predominance of heaths and moors there is thus a persistent result of past conditions rather than of present ones.

We have thus in North-western Europe generally all transitions from the sandy heath with no peat but a covering of heather, to the deep peat bog where the heather is more or less submerged among other plants. The object of the scientific forester is to save, where he can, wood from degenerating into heath, to re-convert where possible existing heath into forest, and, as already suggested, probably also to recognise that in certain localities the time has not yet come when his interference is possible.

Let us now look at heaths and moors a little more closely. Graebner defines a heath as an open region without conspicuous tree growth, where woody vegetation consists for the most part of shrubs and low bushes, and a continuous grass-sward is absent. The absence of this sward makes the grazing poor, the poverty of the soil renders cultivation usually unprofitable, and cultivation is further rendered difficult by the frequent presence of peat, which acts like a poison to most plants.

The predominating plant of the heath is heather (Plate XV.), a low straggling shrub with characteristic small, evergreen, closely crowded leaves, and, as we all know, a gorgeous display of bloom in the flowering season, the splendour of which is apt to conceal the real poverty of the soil from the casual observer. Obviously the plant is drought-resisting (a *xerophyte*), a fact which may seem curious when we remember that it often occurs in damp places. The reason is that the acid humus of the peat makes it very difficult for the plant to absorb

water, and therefore it must economise supplies, for these can only be renewed with great slowness. Further, not only can heather grow on the poorest of soils, but a rich soil is fatal. The plant normally takes in water with extreme slowness, and this absorbed water in natural conditions contains only an infinitesimal amount of dissolved salts; if a stronger solution be presented to the roots, the plant is soon poisoned.

Another peculiarity of heather as compared with woodland plants is its stationary nature. Plants which in summer make no attempt to economise water, like those which form the hardy perennials of our gardens, grow rapidly, but at the same time speedily exhaust the soil around them. In our gardens they require constant feeding, and a periodical 'shift' as the gardeners say; in nature they often display adaptations which permit them to tap each year new areas or layers of soil. Thus many bulbs sink deeper into the soil as they grow older (*e.g.* wild hyacinth), and such plants as Solomon's seal or the perennial sunflowers have creeping rootstocks, so that next year's stem will not occupy exactly the same position as this year's one. This does not occur with heather, for though the individual plants are not long-lived, the new growths spring from the same region as the old. No doubt this is because life is not so fast as in the woodland.

During their growing period herbaceous plants take up food and water rapidly, and soon exhaust their immediate surroundings; in the soil also the bacteria effect rapid decomposition of organic remains. Not only does the heather absorb food substances with great slowness, but the peat contains a large amount of partially decomposed vegetable matter, capable apparently of supplying the heath plants for an almost unlimited period. It seems clear also that there is some form of partnership between the heather and a fungus of simple structure which thrives in peat, comparable to that

partnership with a bacterium which enables plants of the peaflower family to enrich instead of impoverishing the soils in which they live.

Of the companions of the heather, most have evergreen leaves, either small with in-rolled edges, like those of the heaths, or tough and leathery like those of bearberry, cowberry and so forth. Blaeberry (or bilberry or whortleberry) is an exception, for its small leaves are deciduous, falling off in the autumn, at which time they are brightly coloured and add another tone, if a minor one, to the coloration of the heath. But its green stems can carry on leaf functions during the period when the leaves are absent, so that in a sense it also is 'evergreen.'

In the drier moors of Scotland (that is, in the 'heaths' of the botanists) the blaeberry is often abundant, though it does not fruit with the freedom seen on the sunny Alpine slopes. Its ally the cowberry is also abundant, and presents an interesting resemblance to the bearberry, which often covers large areas on the Scottish moors. The resemblance is of course adaptive, that is the result of the fact that both plants are suited to similar surroundings. If the fruits are present it is easy to distinguish the rather pleasant, acid cowberries from the absolutely tasteless bearberries, with their large 'wooden' seeds. If the fruits be absent it is a pretty little test in accuracy of observation to learn to distinguish at a glance between the two. The learned (or the well read!) will reflect that the same difficulty arises for the stranger in distinguishing between the olive and the evergreen oak in the Mediterranean area; between the yellow gentian and the lily-like *Veratrum* in Alpine pastures; between the leaves of *Catalpa* and *Paulownia* in a Mid-European park, and will not fail to draw the obvious deduction. Another example of the same thing is seen on the moor in the resemblance of the crowberry to a heath, except where the black berries are present to point the difference.

Other frequent plants of heaths are the two common true heaths, distinguished by their bell-like flowers from the heather, which has cleft blooms, the curious petty-whin, the mat-grass and its allies of the grass family, sedges, club mosses, Highland cudweed, so oddly reminiscent of the Alpine edelweiss, tormentil, bedstraw, wintergreen, cowwheat, and the common milkwort, the last a trying plant for the uninitiated. It occurs in three colour varieties, blue, white and pink, and the beginner can rarely shake off the conviction that these are three separate plants. The writer has a vivid recollection of a week's botanising, long, long ago, on a moor in the company of a party zealous but inexperienced. When each member of a party numbering some four or five had, with great formality and much introductory self-laudation, presented a specimen of each variety, as an entirely new and remarkable plant, one began to feel that the milkwort rather overdid the variability. It is, however, a curious and complicated flower, and has alpine representatives with the same disconcerting habit as our common British form of looking like anything, except what one expects a milkwort to look like. One Alpine species has been known to be described in the field by persons who prided themselves on a certain knowledge of botany as a dwarf broom, a plant with which milkwort has no connection whatever.

Where the heath merges into wood, juniper is often common, and bracken may also occur, though as a general rule in Scotland bracken occurs outside the heather zone. This is true also of the gorse or whin, common on English heaths but in Scotland occurring outside of the dry moors, and being specially characteristic of the hills built up of basaltic rocks (whinstone), whence its local name. These regions, however, suffer from physiological drought no less than the heaths proper, and gorse shows the usual features of reduced leaves and a short-lived glory of bloom at the most favourable season of its year. In connection with this spring glory

it is difficult to resist the temptation to quote the saying of a Scottish farmer, whose reflections on the subject illustrate the type of mind produced by the natural conditions, no less than the characters of the plant.

He was walking over slopes covered with gorgeous yellow bloom in the company of a lady who expressed some appreciation of the sight. The farmer was meditatively chewing grass, and he glanced round and said seriously—‘Ay, they do say that when Linnæus first saw the whin in bloom he went down on his knees and thanked his Maker.’ Then he spat out the grass vigorously, and added—‘I never thoct anything on’t mysel!’ In other words, he did not consciously despise it, but its æsthetic aspect had not occurred to him as a significant fact.

On the true moors, that is, where the peat is very deep, bog-moss (*Sphagnum*) with its long stems loaded with water, and showing a wonderful range of colour, from pure green to delicate pinkish-yellow, is common in the wettest parts, and is a great peat former. Cotton-grass and dwarf sedges are also abundant, and form the clumps or tussocks on which the plants of heather and heath are chiefly found. Cranberry, cloudberry and bog asphodel with its pale yellow spikes of bloom are frequent. In places, also, the curious sundew, with its leaves fringed with bright red insect-catching hairs, is often common. It generally lives in association with the wet sphagnum patches, and its difficulty in absorbing mineral food is compensated for by its fly-catching powers. The flat pale-green rosettes of butterwort (*Pinguicula*) also occur in such places, and the comparatively large deep blue flowers may be seen rising singly from the centre of the rosette. This plant, which is also insectivorous, has beautiful Alpine representatives, and our common form occurs at considerable elevations there. Almost any plant of the ‘heath’ association may reappear on the typical moors, but one characteristic of wet patches in both has not yet

been mentioned. This is Bog myrtle, a low shrub with fragrant, resinous leaves, bearing catkins in early spring. It often occurs in great abundance, and its fragrance, recalling that of many Mediterranean plants, is an interesting point.

If we now sum up in brief the contents of the preceding chapters, we may say that the most characteristic plant formation of Western Europe is the temperate forest, with its marked alternation between a drought-resisting, leafless winter form, and a water-demanding and water-spending summer form, with abundant and delicate foliage. At the seaward margin, where the climate becomes very equable and very damp; at the southern margin, where it becomes equable as to temperature but dry, especially in summer; at the upward margin, where the wind, the great radiation, the persistency of low winter temperatures, the coldness of the soil lead to the development of a special type of climate—in all these three regions the temperate forest is replaced by a xerophytic type of vegetation, differing greatly in the three different regions, but showing the same tendency for arborescent plants to become dwarfed and then finally to disappear, and for the shrubby or herbaceous plants to develop various forms of protection against loss of water. Within the Mediterranean region in the narrow sense the soil is often very shallow; within the zone of heaths and moor it is naturally poor, and tends, especially in the latter, to be covered or even entirely concealed by a layer of peat, a substance inimical to the growth of all but a restricted number of plants. Finally, in the mountain region the soil is generally shallow, often shifting, but its shallowness is to some extent compensated for by the rapidity of rock waste, which continually renews the substances necessary to plant life. In Western Europe the regions best fitted to the cultivation of plants are first those favoured parts of the Mediterranean region, where the soil is deeper than usual and is fertile,

for here the high temperatures promote plant growth, and then the loess regions of the forest area, and the plains within the forest area from which the woods have been cleared.

Had we taken the Europe of the geography books instead of the Europe of our own definition, we should have been obliged to add another great plant formation to those already considered, that of the steppe, but this we regard as outside our scope here.

In studying any one of the formations described above the tourist should not confine himself to picking out the more obvious adaptations—interesting though this occupation is. Even more important is the fact that all the formations, especially near the margins of their natural habitat, are in a state of constant flux, due in large part to the wearing down or building up of the surface by the ordinary agents of geological change. It is along the lines of natural weakness, as it were, that man intercalates his cultivated plants and domestic animals, and it is one of the most important contributions of modern botany to geographical science that it is emphasising the changeableness of the plant covering, the ebb and flow of plant life with changes in the physical conditions. Thus to the older geological conception of change, so admirably expressed by Tennyson in the well-known stanza, a part of which we have placed at the head of Chapter VII., we have to add the newer botanical one, that forest and moor and grassland shift and change also, chasing one another like clouds across the summer sky.

REFERENCES. For the German heaths the most comprehensive book is Graebner's *Die Heide Norddeutschlands*, with very copious references, in Engler u. Prude's *Vegetation der Erde*. The moors and heaths of the British Isles are considered fully in *Types of British Vegetation*, edited by A. G. Tansley, also with references, and those specially interested in Scottish moors, should consult the recent volumes of the *Scottish Geographical Magazine*, in which a number of papers on the subject have appeared.

CHAPTER XI

THE EARTH AND MAN

‘Necessity ! thou mother of the world.’

IN the preceding chapters, when considering the natural plant formations, we have seen that only in limited regions, and often only to a small extent, do these persist unaltered. Everywhere man has affected the original vegetation, destroying here, adding new plants there; acting sometimes directly, and sometimes indirectly, as by draining the land, by involuntary soil destruction, by soil improvement, and so forth. But while some of these effects are involuntary, or due to unforeseen circumstances, by far the most important are the result of deliberate intention. Everywhere man has sought to make room for his cultivated plants and his domesticated animals, and this has involved wholesale modification of the original formations, which in some instances, as we have seen, can now only be traced with difficulty. The cultivated plants consist in part of native plants improved by human care, but retaining the adaptations which fit them for the climate of their habitat (*cf.* the olive of the Mediterranean region); in part also of introduced plants, brought from parts of the world having some climatic affinities with the districts where they are now grown (*cf.* the potato, now so widely grown in North-Western Europe, but a native of the cool, moist climate of the slopes of the Andes). As successful cultivated plants must of necessity show such fitness for the climatic and other conditions under which they are grown, we find that, to a certain extent, the diversity

of the natural plant formations of Western Europe is reflected in the diversity of the cultivated plants of the different climatic regions, and their characteristics in those of the latter.

For example, in the Mediterranean region the short-lived herbaceous and bulbous plants of the maquis are replaced on cultivated ground by such cereals and other annual crops as can grow without any great heat, but demand moisture. Such crops occupy the surface for the cooler but rainy half of the year, and are reaped in spring. In summer, save where irrigation is possible, land utilisation takes the form chiefly of a kind of gardening, fruit-bearing trees, especially the vine, the olive, the Citrus fruits, and so forth, being extensively cultivated, and being so arranged that they afford a succession of crops. Thus the peaches and apricots and similar fruits ripen in August; the grapes and chestnuts in September or October; the olives in November. Often the short-lived cereal crops occupy the same ground as the trees, and the traveller will not fail to note that the corn, or the vegetables, or the forage crops like lupin and lucerne, growing among the trees of the olive grove is the equivalent, from the point of view of physiological botany, of the anemones, the bell hyacinths, and the cyclamens seen among the wild evergreen oaks.

Obviously then again, except where irrigation is possible, while water-demanding plants can be grown in the Mediterranean area in the cooler season, perennial plants must be those capable of resisting the drought of summer, and plants which demand at once much heat and much moisture, like rice and sugar-cane, cannot be grown unless water is artificially supplied.

Further, as rich pasture does not exist within the Mediterranean region proper, save at great elevations, and pasture generally is scanty, the pastoral industries will not predominate in the lowlands, and cattle especially will be generally few. Goats, sheep, and, where oak, chestnut or beech woods

occur, pigs are the most characteristic animals, the sheep chiefly where considerable tracts of elevated land are present.

Let us turn next to those parts of Central Europe where the climate we have called continental reigns. Here cultivated plants must be either short-lived, or, if perennial, tolerant of winter cold. If short-lived, so that the winter cold does not affect them, then the fact that they require a combination of warmth and moisture is rather an advantage than otherwise, for, as we have seen, in the continental climate rain tends to come in summer. Thus a plant like maize, which requires moisture to swell its huge stem and leaves, will flourish better in parts of Central Europe than in the Mediterranean region. Generally, however, this region suffers as compared with the Mediterranean from the fact that plant growth is confined to one part of the year; the cereal crops ripen in summer, and only in exceptional cases is it possible to get two crops off the same land, while the simultaneous growth of two or three kinds of plants, so common in the Mediterranean, is almost unknown here.

Where the plains of Central Europe abut upon the mountain regions, the possibility of cultivation diminishes, and the mountaineer is typically pastoral, feeding his cattle on the rich grassland of the heights.

In Central Europe man has largely destroyed the original forest, starting, as we have seen, from the thinly wooded areas, the motive being the desire to extend the range of his ploughed, cereal-producing fields. But where the oceanic climate reigns to the west and north-west, the very extensive deforestation has not notably extended the zone of wheat. Typically, the oceanic climate is too damp, too sunless for the more valuable cereals, and the inhabitants must grow the more tolerant and less valuable forms, like oats, rye, and barley, with moisture-demanding plants like potatoes and turnips. Even so the farmer finds at present that his constantly watered land is

best suited for pasture, on the low grounds for cattle, and on the higher for sheep.

If we sum up these facts in their simplest form we may say that just as the different climatic belts of Europe have their characteristic native plant formations, so also they have their characteristic cultivated plants and modes of land utilisation. In the Mediterranean region the land bears both short-lived moisture-demanding crops requiring only moderate temperatures, such as wheat, vegetables, fodder plants, and so forth, and heat-demanding but drought-tolerating trees, like vine, olive, etc. In Central Europe, only a portion of the year can be used for plant growth, but then both moisture and warmth are available, and a considerable range of crops, including wheat, is possible. On the oceanic border, and on the uplands, cultivation becomes difficult, save for hardy plants, and there is a continual tendency for pastoral pursuits to predominate.

So far, then, it may seem that the cultivated plants do but emphasise the conclusions which we have already drawn from the natural plant formations—but they have also a deeper significance, for they determine, or once determined, the possible modes of human life within each region. This is a subject which demands some consideration, for the full meaning of the statement is not at once grasped by those who have grown up in a complex and artificial civilisation. To us it may seem as though man had an almost infinite power of modifying the conditions under which he lives, and yet there is no doubt that those conditions first made him.

Let us elaborate this point a little. Most of us are, or were in youth, probably more or less susceptible to the charm of the kind of book best represented by *Robinson Crusoe*, but also—if on a very different level—by that edifying work *The Swiss Family Robinson*. Wherein does this charm lie? It may be, as some psychologists tell us, that part of our joy in the descriptions we find in these books of life in trees or caves is due

to the fact that our far-off ancestors made the great discovery that in such places could safety, shelter, warmth, even an elementary form of comfort be found. So deeply, they tell us, has the emotion aroused by this epoch-making experience interpenetrated our souls, that the appropriate stimulus from outside will cause it to flood our consciousness with something of its first freshness. On this view we obtain in reading *Robinson Crusoe* something of that primeval gladness which he of the Early Stone Age felt when his cavern had been safely blocked at the mouth, and within, in the red glare of the fire and of the smoky torches, he was safe from the terror which walks by night, and from the known and unknown dangers which lurk in the gloomy forest.

But surely there is more in it than this—more even than a pride in human ingenuity, a swelling consciousness of our own resourcefulness! When we follow the rise of Robinson Crusoe's stockade, or track, with a delicate avoidance of the didactic father's moralising, the progress of the Robinson family from destitution to the time when most of the resources of civilisation proved within their reach, do we not feel that we are following, in as it were an epitome, the history of the human race, are climbing the tree of social evolution, are becoming conscious of fundamental facts? Do we not all of us feel that the castaways are not 'playing fair' when they find in the too-useful ship necessities which they ought to have contrived from the contents of their wonderful islands? Do not unsophisticated country people still feel a little shame in 'buying in a shop' some article which in a more virile or less sophisticated age would have been home-manufactured? Do not all observant travellers point out that the first sign of racial decay is the replacement of the products of native arts and crafts by imported factory-made goods?

Perhaps this may seem rather obvious, but in point of fact only within the last few years have geographers dis-

covered that man is, always and everywhere, in some sort a Robinson Crusoe, using as he can what lies within reach of his hand. He and his environment act and interact; his societies and institutions no less than his material possessions bear the mould of the physical circumstances under which they first arose, and, since human intelligence works everywhere along somewhat similar lines, and human needs are everywhere more or less the same, he accomplishes everywhere approximately similar ends by diverse means, means which reflect the physical conditions under which he lives, and from which the conditions can be reconstructed and interpreted.

In a sense of course this is a commonplace, but a forgotten commonplace brought afresh to men's minds has all the glory of a new discovery—indeed a greater glory, for by definition it must make a wider and more immediate appeal than a discovery, which has always to win a slow and grudging acceptance.

How did this commonplace come to be lost sight of? With the industrial revolution, and the resultant enormous development of means of communication, the bonds of space and time with which man had always been fettered seemed to be suddenly loosened. When he could flash his will over the world at large, when he could travel with the swiftness of a bird, when his railway trains and steamships could annihilate space, the entire dependence of groups of human beings upon their immediate surroundings seemed to be gone for ever. In earlier days he must build with the materials at his hand, for no others were, broadly speaking, obtainable; he must depend for food upon what he could catch, rear or grow, or he must starve, and necessarily, therefore, his mode of life varied with the climate and physical conditions, and was determined by them. But with the industrial revolution this old dependence seemed to be gone, more especially in countries like our own, where its effects

have been most marked. Throughout the length and breadth of the British Islands the articles of daily use are not those which are the natural products of the region, but those which can be obtained from the utmost ends of the earth, in exchange for our cotton goods, machinery or coal. We live, as it were, no longer on a definite patch of the earth's surface, by whose characters all our activities are controlled, but in a dreamland, and are served by the dusky djinns of the coal mine. That this, the condition into which all living men and women have grown up, is a specialised and not a primitive one, is an obvious commonplace, but one nevertheless which till recently had been forgotten. The human geographers, or anthropogeographers as they love to call themselves, are in the act of re-discovering it, and their emphasis on what ought to be, but has ceased to be, the obvious adds at least a new interest to travel.

Let us look at one or two examples to illustrate the point. In the valleys the Swiss peasant builds himself a chalet of wood, because this convenient building material lies within easy reach. He builds it with overhanging eaves and balconies, for wood must be stored at hand for winter fuel, and further, as the mists often hang low for days in the valley, he wants a place where late crops may be sheltered from wet, and yet exposed to the drying sun when it breaks at last through the clouds. Though at times he must toil from dawn to dusk, there are other periods of the year when he has superabundant leisure, and therefore his house and its furniture may be more or less elaborately carved. But if the same peasant wishes to build a new cheese-making shed high up on the mountain side, he uses not wood but stone, with rough slabs for roofing material. Why? Because no trees grow at this elevation, and he himself is the only transport animal who can overcome the difficulties of the ascent. Wood he must carry to heat his milk, but he will not needlessly load himself with building material when

PLATE XVI



One of the 'black houses' of the Hebrides. Such houses are dark or almost dark, and are often shared by human beings and cows in common. The chimney is a 'modern' improvement. The original black houses had no exit for the smoke, which was supposed to filter through the thatch of the roof, this being later used as manure for the croft. Note that the house is constructed of the materials nearest at hand, utilised in practically unmodified condition.

(Photo by Mr. H. Hodgk.)



Old and new type of houses in the Hebrides. In such cases the old black house (here without a chimney) is kept for the cattle, and there is generally free internal communication between the two compartments. The new house is not built of local materials.

(Photo by Sir Leslie Mackenzie.)

the stones which nature supplies can be made to serve. Further, since the hut is not a permanent dwelling-place, but is used only for a short period of the year, he will waste upon it no needless labour — it will be built to serve its immediate purpose and with no other end in view.

Turn from the chalets and cheese-making huts of the Alps to the more remote parts of the Scottish Highlands with their rude dwellings. Wood is here scanty, stone abundant; the cottage, if so it may be called, is built of rough stone, is thatched with the too-abundant heather (Plate XVI.); its inner walls are lined by an ammonia-containing deposit given off by the burning peat in the centre, a deposit which the frugal peasant scrapes off at intervals and uses to fertilise his little croft. Thither also, and with the same purpose, is transported from time to time the discarded thatch, easily replaced by a new one. Here is an adaptation to the natural conditions as close as that of the chalet. But the Swiss peasant has not lost his hold on his surroundings; he has shared in the general rise of prosperity in his country. He may alter his methods, change a little his mode of life, but on the whole he merely increases the number of his possessions, or improves their quality, without greatly altering their nature. The Highlander, on the other hand, has for the most part lost his original relation to the natural conditions, and this is shown, oddly enough, in the character of his new dwelling. The son in Glasgow or in Canada sends money home to the old folks, and it is used not to adapt the old dwelling to modern needs, but to construct a new one (Plate XVI.), harled and whitewashed, roofed with corrugated iron, ugly, staring, probably not more healthy than the old, and without any trace of that natural fitness which made the thatched cottage 'picturesque' against its background of rocky slope and heather-clad hill. Indeed the staring ugliness of the new house shows that the economic problem here has been evaded, not faced; that no longer is there a natural interrelation

between inhabitants and surroundings—they are but pathetic paupers in a land that once was theirs.

Turn next to the food of the two men. The Swiss peasant eats rye bread. Why? Rye is the natural cereal of the thin soil, the extreme climate of his native valleys. Further, the meal has the power of retaining its moisture for a long time; the 'black bread' is baked only at long intervals. The peasant's life involves incessant migration from valley to spring pasture, from spring pasture to high alp, from alp to the arable land far below. It is therefore essential that his staple food should be one which can be kept for long periods, periods during which the operation of baking would be difficult. Supplemented by cheese and milk, the product of his flocks, it is a factor in his mobility.

Originally the Highlander's staple showed the same relation to natural conditions. The cereal oats is fitted for a damp, sunless climate, and it is exceedingly tolerant of a peaty soil, so poisonous to many plants. Though the meal cannot be baked into bread, yet cooked in flat unleavened 'cakes' on a girdle, or boiled into porridge it forms an excellent article of diet, and we note that both modes of cooking are well adapted to the open peat fire in the middle of the floor—the primitive mode of heating the cottage. When the whole social economy of the British Isles was upset with the rise of the factory system, the Highlander, though after a considerable interval, took to eating wheaten bread like the rest of the community.

But white bread is 'bakers' bread,' was never a natural product, and we have the, at first sight, curious anomaly that while it is not uncommon to find bread baked at home in parts of England, where the eating of wheaten bread is an old-established practice, in the Highlands, as indeed in Scotland generally, the ability to bake bread is a rare accomplishment; not because it has been lost, as in parts of England, but because it was never acquired. Scones, oatcakes, 'barley

bannocks' and so forth may be baked at home if the baker's cart fail in the Highlands, but not bread. A pretty little illustration is furnished by the comment of a Scottish country body who had been to Yorkshire, and 'liked England fine—nice ovens and that,' the oven being a rarity in her native village.

Perhaps we may complete the picture by pointing out that when the mountain peasant in Central Europe becomes a town-dweller he eats wheaten bread, if he can. But no sooner is the habit established than sentiment—a nostalgia for his mountains—makes him long for the food of his fathers, and to satisfy his longing 'echtes Bauerbrod' appears in the shops. The travelled politician, with the muddled-headedness of his tribe, seizes upon this fact, and regardless of the perfectly plain truth that the inhabitants of Western Europe take wheaten bread as their staple when they can—and are probably justified on physiological grounds in so doing—endeavours to demonstrate that 'black bread' is always a luxury, and not fundamentally an indication of poverty. In Lowland Scotland now and in England oatcakes are a luxury, but the attempt to induce a Highland servant girl to eat them in place of white bread would be fraught with speedy disaster!

The point which we are striving to make clear is then that under 'natural' conditions all human groups show a close relation to their immediate surroundings, and must originally be self-sufficing in so far at least as the essentials of life go. In the industrial parts of Western Europe generally, and more especially in Great Britain, owing to the early development of the factory system and the enormous magnitude of the overseas trade, this original relation has been largely lost. Not only this, but with us, even more than on the continent of Europe, though the phenomenon occurs there also, those groups which have preserved more or less their original dependence on their immediate surroundings, are poor and depressed, as exemplified, for instance, in the

Scottish Highlands and in western Ireland. Thus we have come instinctively to consider them as 'backward' while we regard ourselves as 'advanced.' There is no doubt that this judgment is partly an illusion, and recent developments, *e.g.* in 'Celtic' literature in Ireland, have helped to show that in much that is essentially human such groups stand higher than those which have grown rich by supplying cheap cotton cloths and Birmingham goods to the world, and have at the same time grown so poor in greater possessions.

It is one of the tragedies of the civilised world at the present time that, just as the upheaval of the Alps brought disturbance to the stable lands to the north, so the rise of the industrial nations has shaken the non-industrial civilisations to their foundations, has turned what they regarded as their wealth into poverty, their old glory into their shame. But we have to remember that had man been a witness of the rise of the Alps, as he was a witness of the devastation of the Ice Age, he must have thought that here at least was a disaster whose horror was unredeemed. Yet from both these great crises sprang the possibilities of human civilisation as we know it. So may we hope in that great social disturbance which we call the industrial revolution some future good lies hidden. Meantime our immediate purpose is to trace, as it is revealed in agriculture and land utilisation, some indication of what civilisation in Europe was before, like some of the mountains of the Alps, it ceased to have roots in mother earth; to trace also some of the processes by which the non-industrial nations are seeking to readjust themselves to changed times.

CHAPTER XII

VINEYARD, OLIVE GROVE, AND GARDEN : THE OLD CONDITIONS AND THE NEW

'I went down into the garden of nuts to see the fruits of the valley, and to see whether the vine flourished and the pomegranates budded.'

THE cultivated plants of a particular locality, we have suggested in the previous chapter, show necessarily some adaptation to that particular area, are in some sort a reflection of it. But this is not to say that the crops of a district represent the only ones which could be grown there. Often this is very far from being the case. What determines the farmer's selection of certain crops out of all those which the climate permits him to grow? We shall devote this chapter to an attempt to answer this question.

Primitively, it seems clear, no region can be permanently inhabited unless it yields to its inhabitants the great necessities of life. We must here interpret primitively as meaning—before the development of trade and adequate means of communication, for obviously there are now many permanently inhabited regions which yield almost none of the necessities of life. We need not go so far as the goldfields of Western Australia, or the nitrate deserts of Chili in search of examples, for the hospices of the high Alpine passes, the meteorological stations of many isolated hills, *e.g.* of the Säntis, are familiar cases, to say nothing of the artificially sterilised towns.

Further, not only the region in the broad sense, but in at least the more primitive types of communities, the family

group tends, as we have seen, to be self-sufficing. The aim of the early agriculturist, that is, is to produce first of all, so far as he can, sufficient to provide for the needs of his household. One of the most important of these needs is, obviously, food. In Europe at least, some cereal almost always forms the basal food supply, but the particular cereal employed depends upon the climatic and other factors dominant in the district. The same statement applies of course to all other needs—the constituents of the clothing, material for house-building, fuel, and so forth. We thus arrive at the conception of a number of regions, in each of which a special mode of life exists, dependent upon the products of the region, natural or artificial.

But the family group can rarely be the highest unit. In the general case it is itself a unit in a larger grouping, whose members have common needs. These common needs must be satisfied ultimately by the surplus crops. Obviously it matters very little whether, as in parts of the Alps, the husbandman puts in so many days' work on the roads, paths and irrigation channels in the year, or whether, as is more generally the case, he submits to a levy which pays the wages of special roadmen, etc. In both cases his working days on his land must result in a yield greater than that necessary to support him and his household during the working period. Thus we must not think of even the simplest type of community as producing only enough for the needs of its working members and their households. There must necessarily be a surplus.

In the simpler cases, however, the surplus must be regarded as primarily for the use of the surrounding district. In addition to its agriculturists the community will normally contain a number of non-agriculturists, including craftsmen of various kinds, who must be supplied with the necessities of life out of the surplus products. But their mode of life does not differ notably from that of the agriculturists from

whom they have arisen. They eat approximately the same food, wear similar clothes, and so forth, and thus constitute a local market. Similarly, other charges on the husbandman, such as rent, taxes, and so forth can be met by the sale of surplus products in the adjacent market, and minor variations in climate, elevation, soil, etc., will always stimulate local exchange.

To take an example, the peasant in the tributary valleys of the Rhone in the canton Valais in Switzerland grows the vine and some fruit in the warm lands close to the main valley. Rye and vegetables, with flax, hemp and so forth, he cultivates in the fields at higher levels. The pastures, which constitute otherwise unutilisable land, supply the needs of his flocks and herds, and each household or family group possesses or rents lands at the various levels, so that each is approximately self-sufficing. The forests supply material for house-building and fuel, the surplus yield of the flocks, itself due to the abundant summer growth of grass on the high pastures, is disposed of to give the small amount of money required for the essential outlays, and is for the most part sold to a more or less steady adjacent market.

This condition of balance, more or less preserved in the Valais, has been badly shaken in many other parts of the mountain regions of Central Europe, more especially at those levels and in those regions where the conditions are less favourable to the pastoral industries, and yet the cultivation of the more valuable crops is difficult and precarious.

An interesting example, which has been recently the object of a special study by a French geographer, is found in a part of the southern Jura, the tract cut off from the main chain by the river Ain, and called Revermont, that is, 'the mountain slope.' The region faces the plains of the Bresse, and owed its prosperity once to the fact that here, as contrasted alike with the higher slopes of the mountains, and with the heavy clays of the low ground, the vine could

be cultivated. Fertile tracts are rare on the slope, but each family group in the older days possessed enough land to yield food for the household and the beasts, and had in addition a vineyard. In the first place this vineyard yielded wine for the needs of the family; secondly, owing to the special circumstances, it supplied the demands of the surrounding districts, where the cultivators could not produce the crop. Thus the vineyard yielded a 'money crop.' But the wine is not very good, and the local market accepted it largely *faute de mieux*, because difficulties of communication, local dues and other causes made it impossible to obtain the more prized sorts. The devastation caused by phylloxera precipitated a crisis which had been long impending. The population which had, as it were, been confined to its mountain originally by local protection, once all barriers were removed flowed like a stream from the slopes with their blasted vines down to the more fertile plain, leaving deserted dwellings and even villages as a monument to earlier conditions.

In this case the diminution of population within a limited area has been very striking, rising, it is said, to 57 per cent. in the case of one commune. The people who remain are turning more and more to pastoral industries, which will, it is believed, bring back ultimately some of the lost population to the denuded lands.

But if the particular example is a very striking one, we have to remember that the phenomenon in more or less marked form is all but universal in Western Europe. Primitively, let us repeat, the husbandman is self-supporting, and such money as he requires is obtained by the sale of the surplus of the crop which he can most easily produce, or for which there is the greatest demand. This surplus must generally, though not always, be got rid of in a local market, whose original advantage was its steadiness. Obviously then any great improvement in the means of communication,

which permits the local market to be supplied with the better or cheaper products of a distant region, must be a disaster to the primitive type of husbandman, a disaster whose magnitude is measured by the extent and rapidity of the change. Now, as we have seen, within the last hundred years or so there has been a revolution of the first importance in methods of communication, and simultaneously a great development of new and often highly fertile lands; the necessary result has been to modify greatly the forms of land utilisation in all but exceptionally isolated areas.

How could the husbandman adapt himself most naturally to the changed conditions? We have seen that Western Europe is a region where, within a small area, we have a great variety of climates and of surface. It is also a region where agriculture has been carried on for a prolonged period, and where there is an accumulated mass of knowledge and tradition relating both to methods and to local conditions. An obvious possibility then is for the agriculturist in any given area to abandon his primitive form of cultivation and to devote himself, either largely or exclusively, to certain particular crops for which his land is peculiarly fitted, and for which a ready market is obtainable.

This is the condition to which in our own country we are all, more or less, accustomed. The average farmer, large or small, does not produce crops which are primarily related to his own needs; his primary crops are money crops, so literally that sometimes his children starve in the midst of plenty. We still talk, or at least the novelists do, of the rich cream and milk to be got 'in the country.' Those who have lived in the country know that the poor man's child there has far less opportunity of tasting milk than his brother of the slums, and malnutrition, both in child and adult, is a not uncommon phenomenon.

In the Channel Islands the cultivators are extraordinarily skilful and industrious, but it is said by school teachers there

that the children are often insufficiently fed, for the grapes, the tomatoes, the early vegetables, and so forth, produced on the holding are far too valuable for home use, and are luxuries, not necessities. Thus every particle of food may have to be bought, and that in a district where rents are very high. The writer well remembers a visit made to Guernsey in spring, when a member of the party naïvely instructed the landlady that early vegetables were to be a feature of the daily menu. The landlady's first efforts proved a disappointment and the bill a most unpleasant surprise, so that she was constrained to give the visitors an elementary lesson in political economy by pointing out that the vegetables were grown for the London market, and were practically unobtainable retail in the island.

The conditions in the Valais and in the Channel Islands may be said to represent two extremes, the money crop on the one hand, as contrasted with the crop fundamentally for home consumption on the other. In Western Europe generally it is more common to find intermediate stages.

The point which one has to keep in view is that everywhere in Europe agriculture has been disturbed by the industrial revolution, the disturbance having been here greater and here less. Everywhere therefore one can observe traces of the past, indications of lines of future development, and much of the interest of the subject lies in the following up of the two tendencies.

Broadly speaking, one may say that remnants of old conditions are seen where a multiplicity of crops occurs. In the valleys of the Alps one may find small patches of cultivated ground, where rye, flax, hemp, beans, lucerne, hay, and other crops occur in small quantities within a limited area. This is certainly a primitive condition. A similar multiplicity of crops occurs generally within the Mediterranean area, where, owing to the special conditions, several crops, as we have seen, may occupy the ground at the same time.

Starting from the conditions suggested in the Alpine valleys we have divergence in two main directions. In the central plain of Europe, where the conditions are uniform over large areas, the tendency is to concentrate upon one crop to which wholesale methods can be applied. Examples are the vast areas given to sugar-beet in north France and parts of the German plain, the great fields of turnips in parts of England, of barley in beer-producing districts, and so forth. This is a condition to which we are so much accustomed that its strangeness fails to strike us.

In other words, the tendency in Central Europe and in the less mountainous parts of the north, in correspondence with the uniform soil and climate, is to concentrate upon a few crops grown on the large scale. In the Mediterranean region and on the southern slopes of the Alps the climate varies much within small areas, and the conditions of soil and surface also vary. Here the original multiplicity of crops is more or less preserved, but the more prosperous regions take advantage of local peculiarities of soil or climate to produce, by intensive methods and in small amounts, crops which are difficult to grow and command proportionately high prices. Thus even in agriculture there is a contrast between the plains of the industrial centre, with their steam ploughs, steam threshers, and generally their complicated machinery, and the ancient south, with its load of tradition, where the women superintend the delicate operations of silkworm breeding, while the men toil in the sun in their tiny patches of cherished earth, painfully terraced out of the blazing hillside.

But we must not overstrain the contrast, for where in Central Europe uplands occur, as in Burgundy, the Middle Rhine valley, and so forth, there the laborious methods proper to sloping ground reappear, and further, the special conditions which prevail in those great 'wens,' the modern cities, give rise to a ring of intensive cultivation round the

town, which sometimes, as in the case of Paris, attains great width. Conversely, the presence of vast uniform plains in certain parts of the south, *e.g.* the Plain of Lombardy with its extensive rice-fields, gives rise to the mid-European type of cultivation, and causes Milan to be a mid-European rather than an Italian town.

The wholesale production of a few crops, the intensive cultivation of a considerable number of special plants, these are the poles between which agriculture in Western Europe swings, under the compelling influence of the new lands across the sea, brought within reach by modern steamboats. Where the conditions of climate are relatively unfavourable to both, the tendency is to concentrate upon the pastoral industries, the compelling influence here being the great demand for meat on the part of the industrial populations, and the supplies of feeding-stuffs poured in by the new nations. The study of the resulting unstable equilibrium is one of absorbing interest.

As an example of the lines along which observation may be profitably directed, we shall discuss here the conditions which prevail in the Mediterranean region and its margins, under both primitive and modified conditions.

As a starting-point we can scarcely do better than give a quotation from Philippson's *Mittelmeergebiet* dealing with the plants grown in the region, though this involves a certain amount of repetition in view of what has been already said in regard to these plants.

Philippson says 'they' (that is, the cultivated plants of the region) 'are either such plants as complete their growth and come to maturity in the rainy season, or are woody plants, organised, in one or other of the ways already described, for the endurance of the summer drought. But in the course of thousands of years man has added to these indigenous forms a great number of cultivated plants, brought from the mountains or from foreign lands, which exhibit the

peculiarity of needing the heat of summer to mature, but are yet unable to tolerate its drought. To these exotics it is necessary to supply by artificial watering during the summer season the necessary moisture which the heavens deny to them. To the first group, which can also thrive in arid regions, belong the most important food plants and others which from the earliest times have served as the basis of human society in the region. To the second group, that of the introduced forms, belong for the most part luxuries and plants of technical importance which, though they may have become of great importance in agriculture, yet cannot be counted as absolute necessities. The three most important and earliest-grown plants of the Mediterranean region are the cereals (barley and wheat), the olive and the vine, none of which requires artificial watering in the Mediterranean region. . . . Bread, wine and oil remain up to the present day the most indispensable constituents of the diet of the inhabitant of the Mediterranean, except where Islam has brought about the prohibition of wine. Bread, together with some vegetable flavouring-matter, especially onions or garlic, often enough constitutes the whole dinner of the poor man; wine is the people's drink, not as with us a luxury. Olive oil takes the same place as butter with us; it supplies the fat necessary in a complete diet, for meat is eaten very sparingly or not at all. Further, it is used with almost every cooked dish, and is eaten raw with salad or even with bread.'

Salad, we may say here in order to complete the account of Mediterranean man's diet, plays a far more important part than with us, an importance which it has also, of course, practically throughout France. But while in France, with a generally abundant rainfall and fertile soil, lettuce, endive and similar salad plants are grown everywhere, in Italy a variety of substitutes, generally unpalatable to the foreigner, are much employed. Dandelion is a favourite, and the author has a vivid recollection of once, during a stroll in the Alps,

emerging on a pasture where were many huts used to house the Italian workmen engaged in constructing some one or other of the high mountain railways. It was near the midday meal hour, and a diligent workman was busy with a penknife scouring the pasture in search of dandelion. Even Nebuchadnezzar, one would suppose, would have found such a diet scanty at an elevation of seven thousand feet or so, but the persistence of a national taste under such changed conditions was interesting.

Philippon goes on to point out that in the fact that the three essential kinds of plants can be grown in the Mediterranean area without artificial watering, this region has an advantage over Egypt, Mesopotamia, and so forth, where no cultivation is possible without irrigation. The contrast, as he indicates, is well brought out in the verses in Deuteronomy, 'For the land, whither thou goest in to possess it, is not as the land of Egypt whence ye came out, where thou sowedst thy seed, and wateredst it with thy foot,¹ as a garden of herbs: but the land whither ye go over to possess it, is a land of hills and valleys, and drinketh water of the rain of heaven: a land which the Lord thy God careth for; the eyes of the Lord thy God are always upon it, from the beginning of the year even unto the end of the year.'

The last clause is slightly exaggerated, for the land of Palestine is far from drinking water of the rain of heaven throughout the year, but the general contrast between the Mediterranean and true arid lands is well brought out.

Let us turn for a moment to the land of Egypt 'whence ye came out,' and note the crops there. In Egypt there is virtually no rain, but the ebb and flow of the mighty river affords a natural means of watering the land. The flood occurs from about August to November, and during this time much land is under water, and therefore useless. The

¹ That is, by raising water from the irrigation channels by mechanical means.

areas above water level yield small crops of maize, rice, millet, and so forth, not of very great importance in the peasant's economy. As the water drains off, however, in the autumn, he is able to sow on the moistened land his essential crops, especially food crops, such as wheat, barley, peas and beans, clover to improve the land and feed the oxen and asses used in ploughing, with flax for clothing—generally the crops required for home use. Where conditions are favourable a margin for export, notably of the cereals, is yielded. But great prosperity does not come until perennial irrigation can be employed, that is, until it is possible by means of dams and barrages to water the land in summer, during the period of low Nile. Where summer crops are grown cotton predominates, and cotton is purely a money crop, the object of whose cultivation is the obtaining of money for the payment of taxes, etc. Thus, employing our previous phraseology, we may say that the Egyptian peasant carries on a primitive form of agriculture during winter, for then he grows plants primarily for his own use, and a specialised form in summer where perennial irrigation is possible, the summer crop being chiefly grown for a distant market, and having no immediate significance in the life of the cultivator. Incidentally we may note that it was only with the utmost difficulty that he was taught by his masters to devote attention to the cotton crop, for he has all the agriculturist's aversion to change.

Turn now to the Mediterranean region. Here conditions differ only in that the winter rainfall generally suffices for the growth of cereals, this winter rain replacing the soaking which the lands of Egypt receive in the old method of basin irrigation. In summer the majority of crops can only be grown with irrigation, but the Mediterranean peasant again gains in that two of his plants, the vine and the olive, as we have seen, will prosper without irrigation even in summer.

Now the winter crops do not normally yield any consider-

able margin for export. Greece and Italy now, as in classical times, cannot produce enough wheat for their own use, and only in specially favoured parts of the region is there any considerable excess of this crop. On the other hand, the vineyards and olive groves throughout the region generally yield a surplus after local demands are satisfied. For olive oil outside the area the demand is but moderate, for in colder climates its place in the dietary is taken by the more digestible fat contained in butter. Wine, on the other hand, constitutes a valuable product of Mediterranean lands. Even in regard to it, however, we have to notice that the most prized sorts are for the most part produced outside the actual Mediterranean area, for the high winter temperatures there render it difficult to store the wine, and prevent it from maturing properly. Still, with all reserves made, we have to accept wine and olive oil as among the more important surplus products of the Mediterranean husbandman. The wine trade in its turn brings, especially in the west, a considerable trade in cork, due to the prevalence of the cork oak there (p. 86).

Both vine and olive, however, are liable to a variety of diseases, which cause great loss. In regard to the vine it is of interest to note that while, as we have said, the product of the highest commercial value is obtained outside the Mediterranean area, and in places where the plant is nearing its natural limit of growth, it is just here that the damage done by phylloxera has been greatest. It is sometimes stated that it is true of cultivated plants in general that the finest product is obtained where the particular plant concerned is approaching the natural limit of its distribution. Thus, we are told, the finest wheat in the world is produced in those parts of Canada where the cultivation of the plant is just possible in a normal season; Scottish strawberries are maintained by the local market gardeners to be infinitely superior to those produced across the border, and so forth.

Such statements require always to be accepted with caution, for the persons making them have often an economic motive at the back of their strength of conviction—though a cynic might say that all very strongly held convictions have such an economic basis. But the case of the vine is interesting, for it seems to shed some light on the basis of truth which underlies the assertion.

Obviously if a plant is growing in a region which is near its natural limit, it requires to be grown with special care, and further, as the risk of failure is always within sight, it is only worth while to grow the finest sorts and these only where the situation is specially favourable. The yield of wheat per acre of the wheatfields in eastern England is greater than that in the wheat zone of Russia. But before putting this fact down exclusively to the superiority of the Englishman, we must bear in mind that the English farmer does not grow wheat except where he can get a very high yield—it would not pay else to try the crop.

Where human ingenuity is directed for a prolonged period to one problem, such as that of getting in eastern France crops of grapes suitable for the finest wine, then we find that almost marvellous results are obtained—but there is always a menace behind. Fundamentally the cultivator is building a sand dam against the ocean, and his barriers are always liable to collapse; in other words, plants growing near their natural limit are excessively liable to disease. The same thing is true of course of animals—witness the silkworm disease in southern France.

In consequence phylloxera has caused the greatest damage rather on the borders of the Mediterranean zone than within it, though even within the area its effects have not been negligible. Its ravages have made it necessary for the farmer to have a second line of defence to fall back upon.

As we have already indicated, he has always grown a number

of the more delicate fruits, either with artificial watering, or in the damper regions without this. Many of these yield a surplus available for export. Here, however, various conditions have to be considered. The market must necessarily be a fairly distant one, for save in the vicinity of large towns, and very large towns are infrequent in the Mediterranean region, there will be no general demand for crops which can be produced all but universally. Here, we may note, is another factor influencing the question already discussed, of the value of crops grown near their natural climatic limit. In the case of delicate crops, those growing near the margin of their natural zone have the great advantage of being close to a non-producing region, and therefore close to a possibly valuable market. The lemon gardens on Lake Garda represent a crop which, owing to specially favourable conditions, can be grown north of its natural zone; the extra care necessary in producing the crop is probably compensated for by the proximity of the market furnished by the adjacent non-lemon-producing regions.

Since the market for southern fruits is generally a more or less distant one, the two most important factors which affect the trade are necessarily the ease and rapidity with which that market can be reached, and the keeping qualities of the product. The fruits can be considered under three headings:—those which are perishable in the fresh state; those which can be readily dried or preserved; those which, owing to the hard shell or coat, have great keeping properties.

Into the first group fall such fruits as peaches, apricots, pears, the thin-skinned varieties of grapes, and so on. Such fruits can, as a rule, only be grown with a prospect of success near the consuming countries, and near main through routes. Further, the fact that they have to compete against the finer products of glasshouse cultivation in the north tends to keep down prices. Two regions which will occur to most travellers as eminently fruit-producing are Provence and the area

round Meran and Botzen (*cf.* p. 57). In both cases the proximity to great through routes is striking.

As regards the second group, the Mediterranean climate, with its dry summer, is eminently suited for the drying of fruit, and raisins, currants, and figs may be named as fruits of Mediterranean origin, highly prized by the more northern nations. The Mediterranean monopoly of these is only now being threatened in America and elsewhere. As to other methods of preservation, apart from the interesting case of the tough-skinned grapes of Valencia, packed in the cork dust which is a by-product of the cork industry of Spain, the great home of the cork oak, the most obvious preservative is sugar. Of more recent origin is the use of cold in the form of cold storage. Let us take the latter first. The presence of cold storage chambers on the large liners makes it possible to transport perishable fruits over long distances by sea (Cape plums, etc.). In the United States of America similar cold storage chambers are carried on trains, and render possible the transport of perishable commodities by land. To a small extent this formerly occurred in Russia; in Western Europe it is as yet very slightly developed—a fact which must diminish the market for Mediterranean fruits.

Sugar as a preservative is relatively little used within the Mediterranean region, a fact of great interest. It is, to the writer's mind, one of the most curious sights of the Riviera towns to see in the shop windows jars of Dundee marmalade, and to reflect that while those towns have orange trees growing in their streets, and sugar in abundance in northern France and Northern Italy, the smoky city on the northern Firth must import its sugar, its oranges, and even, if from a much shorter distance, its coal.

The causes seem to fall partly into human and partly into economic geography. Countries like Great Britain, especially in its northerly parts, which are poor in fruits and not natur-

ally well-suited for bee-keeping, are great consumers of foreign fruits when they can get them, and also of sugar. The long association of Britain with the West Indies, the great sugar-producing region of earlier days, not only gave cheap sugar, but also led to the establishment of the habit of using sugar both to preserve the fruits of summer for winter use, and to correct the acidity of those of the home-grown fruits which had scarcely sun enough to ripen. In continental Europe, on the other hand, especially towards the south, fruit was too abundant to render sugar very necessary, and the fruit could, owing to the climate, be very readily dried for winter use. Further, till beet sugar was available, sugar was dear. Thus jam-making, and the stewing and preserving of fruit with the help of sugar took but little hold, and has never acquired much. The curious result is that at the present day in the British Isles enormous amounts of 'canned' fruits, brought from far across the seas, are consumed yearly, while in Northern Italy, if one may judge from appearances, huge quantities of, for example, peaches, are wasted yearly because the home market is easily satiated, and the quality of the product is not sufficient to permit of the transport of the fresh fruit further afield.

As exceptions, however, to the above statements one must note the extensive fruit-bottling of the Botzen district, and the crystallised fruits of the Riviera towns—the latter trade being of small dimensions.

Of the third group of fruits—those which without any particular process of preparation bear transport to a distant market—there are many examples. Oranges, lemons and the citrus fruits generally, pomegranates, the carob, used chiefly for cattle food, and a very important article of export from Cyprus, many kinds of nuts, such as almond, pistachio, chestnut, etc., and so forth, are all important; but it is to be remembered that in regard to these competition from other parts of the world with similar climates is beginning to be

severe, for such fruits can be easily and cheaply carried from the uttermost ends of the earth.

What other products can Mediterranean man specialise in? Cotton, sugar-cane and rice are generally excluded by reason of the want of water during the hot season, and the difficulties of irrigation on the large scale. In the Plain of Lombardy, however, where water is abundant and irrigation easy, rice is grown extensively and is a very profitable crop.



FIG. 13.—The Black Mulberry, whose leaves, like those of the White Mulberry, are fed to silkworms in the Mediterranean region.

Of more general importance is the mulberry for silkworms. The climate is in this case not quite suitable, for the want of summer rain prevents the mulberry producing the same amount of leaves which it does in the wetter climates of China and Japan, where the rain comes in the hot season. On the other hand, silkworm culture can be well carried on in conjunction with vine-growing (note how often vine and mulberry are found together). The vine demands, even

in the Mediterranean region, continuous and laborious care, and is grown generally on small holdings. Silkworms similarly are a small holders' crop, for at certain seasons of the year they demand the minute and laborious care of trained persons, and this at a season when farm crops also require labour. Thus silkworm rearing can rarely be carried on with success by hired labour. As in China and Japan, the work of the women members of a small farmer's household is essential for success.

Finally, the existence in the region of this tradition of laborious care (despite the common notion that the people of the Mediterranean are all idlers, whose only object is to sit in the sun and do nothing), has led to the development, wherever the conditions permit, of the cultivation of early flowers and vegetables for the northern market. This is, of course, so far as flowers go, best studied on the Riviera, where the winter population of northern idlers has a twofold effect. First of all it supplies a considerable local market, and second, it leads to the development of an admirable train service, which permits the local products to be carried to the north in the most rapid and efficient way possible.

Two regions where the cultivation of early vegetables is carried on with great skill are Malta and Algiers. Malta owes its pre-eminence to its position on a great ocean highway, which makes it an important port of call, and thus ensures easy transport of its products to the dense industrial populations of the north and centre of Europe. Algiers is similarly connected by a good service of boats with France, and at Marseilles can tap one of the great railway arteries of Europe.

Let us illustrate these general statements by a glance at a particular area where old and new conditions to some extent still co-exist. This is the old French province of Roussillon, that is, the region near the eastern end of the Pyrenees, which centres round the old-world town of Perpignan and is fully described in Dr. Sorre's book, mentioned on p. 97.

Here the climate is dry, and the lands fall into two categories, those which can be irrigated, and those where this is impossible. The former have been greatly extended at the expense of the latter, but the distinction still remains. Originally both kinds of lands were self-sufficing, though there has always been a marked difference between the economic value of the two. In the non-irrigated lands the three Mediterranean crops—the vine, the olive, cereals—are possible, and lucerne can also be grown. In the earlier days, however, the farmer had much difficulty with his cereal crops. Generally wheat and barley could only be raised once in two years on any plot, and during the intervening year the land was allowed to lie fallow, and was grazed by sheep brought down from the mountains, whose droppings enriched the land. The yield was always small, even on this wasteful method, and though the efforts of the administration were persistently directed, in earlier times, to encouraging the cultivation of wheat and barley, these efforts met with but little success, and the acreage of unirrigated land under the crops has steadily declined, and, in recent years, with great rapidity.

The olive also does not flourish well, and an attempt to introduce the mulberry for silkworm culture did not succeed. On the other hand the vine flourishes admirably on the dry slopes, and yields valuable wine. Thus on the dry lands the tendency has been to concentrate upon this one crop.

The irrigated lands are far more productive, and at a minimum yield two crops per annum. In addition to barley and wheat other cereals, such as maize and millet, can be grown, and beans, which play an important part in the local diet, are extensively cultivated. Forage crops are also grown, and it has always been a custom to set apart a small area as a garden, originally to satisfy local needs. The vine can also be cultivated, and produces very abundantly, but the resultant wine is not of so high a quality as that of the

dry slopes. After the phylloxera crisis, replanting was first carried on on the low ground, and the too abundant vintage of rather poor wine which resulted played its part in inducing the wine troubles of the south of France some years ago. On the other hand, the watered lands are admirably suited for market-gardening, and can supply to the Paris market 'primeurs,' especially artichokes and asparagus, which in point of time come in between the products of Algiers and those of Brittany. In addition to the early crops of vegetables the gardens produce fine fruits, and the garden land yields a constant succession of crops throughout the year. It seems therefore as if the most profitable mode of land utilisation in this region lies in devoting the unirrigated slopes to the vine, the irrigated plains chiefly to the intensive cultivation of early vegetables and southern fruits. As yet, however, the railway service is not sufficiently specialised to enable the gardeners to be sure of finding an outlet for their crops. But the region is a good example of one in the act of abandoning a precarious self-sufficiency for crops of economic value.

Generally we may say that the Western European's most effective response to the competition of overseas lands is by specialisation, by the use of all his skill, by a delicate appreciation of the possibilities of every natural region.

The traveller who journeys from Central Europe into Italy is always struck by the contrast between the vineyards north of the Alps, with their pruned and staked vines, laboriously sprayed for phylloxera, separated by patches of bare soil kept hoed and weeded, and those to be seen in parts of Italy, where sometimes the great sprays swing from one thorn-bush to the next, across a field devoted to another crop, and alternating with clipped mulberry trees, and at others the plants are grown pergola-fashion (Plate XVII.), sometimes with minor crops of vegetables beneath their shade. In a sense the contrast may be taken as one between

PLATE XVII



Vines grown pergola-fashion near Domo d'Ossola. This method is characteristically Italian, as contrasted with that adopted in France and Germany.

the old and the new, the easy and the difficult. The laborious method is the reply of the old world to the spendthrift new. The farmer of the golden west squanders recklessly the stored treasures of his fertile lands, with no thought of the tomorrow; he of Europe responds oftentimes by bending yet deeper over his cherished plot, which has fed his fathers through long ages, and has been transmitted by them to their sons enriched and not impoverished. It is to him, in the long run, we cannot doubt, that the inhabitants of the new lands must come to learn how to make good the errors of their tempestuous youth.

REFERENCES. The books named at the end of Chap. VIII. mostly deal with the subject of this chapter also. Brunhes' *La Géographie Humaine* discusses several aspects of the general subject, and Prothero's *English Farming, Past and Present*, should be read to appreciate the transition between primitive farming in England and the present specialised type.

PART II

SPECIAL: SOME TYPICAL REGIONS

CHAPTER XIII

WHERE SHALL WE GO ?

‘ Whither shall I turn,
By road or pathway, or through trackless field,
Up hill or down, or shall some floating thing
Upon the river point me out my course ? ’

READERS of *Little Dorrit* will remember how Mrs. General countered the elegant Miss Fanny's objection to the ‘inconveniences’ of the Great St. Bernard, by saying:—‘But, like other inconvenient places, it must be seen. As a place much spoken of, it is necessary to see it.’ To which Miss Fanny returned that she had not the least objection to seeing it. Now for persons of this type, the question of what places it is most interesting to visit does not arise. The problem is settled for them by outside influences, and they will probably rejoice that as Switzerland is now excluded from the list of the superior person, who must replace it by the Rockies or the New Zealand Alps, the hardships to which the elder Miss Dorrit objected need no longer be faced. For others, and especially for those who have a superabundance neither of money nor of leisure, the question is important.

As factors in the decision in any particular case we have of course always to recognise the season of the year, the time available, the character and training of the individual and so forth—all points which each must consider for himself. But it seems worth while, before considering, in a little detail, a few of the more commonly visited parts of Western Europe, to suggest a broad general classification of the regions within easy reach, and to give some notes on the conditions to be

expected in each, in order to help the inexperienced to make a judicious choice.

Perhaps the first point to realise is that the character of a region, from, as we may say, the standpoint of human geography, depends upon the persons who usually visit it. Is this a hard saying? The point at least is simple enough. The tourist, by definition, stands apart from the social—in the broad sense—life of the places he visits, for when he becomes a part of the community there, he ceases to be a tourist. Thus, in the general case, he is introduced into an artificial community provided for his benefit. It would be an exaggeration to say that many travellers visit Italy without ever speaking to an Italian, but we must still remember that they are far more likely to hold conversations with persons whose presence in any particular locality is due to the tourist traffic, than with truly native inhabitants of the region. If this be true, then it follows that the tourist's community in any region will reflect the character and nationality of the majority of its tourists. Further, generally speaking, the wealthier the tourist the broader will be the barrier between him and the true life of the neighbourhood. Some prince, of more than common thoughtfulness, is credited with the lament that he could never see the towns of his native land as they really were, but only bedizened with bunting and bedecked with flags in his honour. To some extent all tourists suffer in the same way, but the poor man has at least the satisfaction of knowing that for him the bunting is less in evidence than for the others.

We have to remember also that on the whole the standard of comfort—or, if you will, the mean income—is higher among English-speaking people than it is among others, so that when many English-speaking people visit a locality it tends to be dearer and more 'spoilt' than regions less favoured. The invaluable Baedeker rarely fails, when occasion offers, to insert the useful note 'English Church Service during the

season' under the head of general information. One good general classification of holiday resorts on the continent is based on the presence or absence of this note in the guide-book. The chaplain may be harmless enough, but when one adds his wife and daughters, the faithful devotees and the atmosphere which accompanies the Englishman's religion, the result is somewhat trying; a Catholic's God has at least the advantage that he can be worshipped in common by the speakers of any tongue. The Catholic religion has the further advantage that no particular form of dress is imposed upon the worshippers, whereas attendance at the English service even in an Alpine inn is impossible, for one sex at any rate, without the possession of kid gloves and a fashionable hat.

Where, then, there is an English Church service, there many English are to be expected; prices, in the words of Baedeker, will have an upward tendency; the English language will be extensively used by the staff of the hotels, afternoon tea will probably be obtainable, and the food will approximate towards that to be obtained in English hotels, local dishes being scarcely represented.

All regions greatly frequented by the English tend to approach this condition, and one factor in the success with which the Swiss prosecute the tourist industry is their skill in eliminating from the environment of the tourist everything likely to strike him as strange or 'unEnglish.' The writer once heard a young English journalist, a man of much education and not without humour, express in the clearest and most concise manner his views on the subject of the Swiss. He came to Switzerland, he said, to see the mountains, not the Swiss, and he objected strongly to the presence of the latter in his vicinity. Some Swiss, he admitted, were necessary; one must have railway officials and porters, also hotel servants, guides, cobblers and the like; the existence of any other kind, he said, seemed to him an impertinence.

This feeling, rarely put so clearly, has made the Switzerland of the tourist what it is. Not that the Swiss have eliminated themselves; far from it. You may find them in Zurich, if not in Lucerne; in Geneva if not in Montreux; in the huts if not in the 'first-class hotels.' But broadly speaking Switzerland is divided into two parts, the Switzerland of the Swiss and the Switzerland of the English, and one may go for twenty years in succession to Grindelwald—as some people do—and never be aware of the existence of the former.

But if the Englishman and his wife do not show to the best advantage abroad, this effect of tourist on surroundings is far from limited to them. All types of tourist act in a similar fashion, though the effect in every case is diverse.

Thus places chiefly frequented by French tourists have very well-marked characters. The French are strongly social, and not as a rule given to very active exercise, this being especially true of the women. Thus in the Pyrenees, in the Dauphiny, in those parts of Savoy which are not in effect Swiss, one finds quite similar conditions, which, as a rule, render the localities unsuitable for active English people. Thus scattered hotels are somewhat infrequent, the tendency being to have well-peopled health resorts, with band, casino, and promenade, separated from each other by unpeopled parts of the country. Paths are not generally numerous, but on the other hand, especially in the Pyrenees, there are often excellent carriage roads.

Again, and the statement is true of France generally, the cooking is usually better than the accommodation, and yet, when prices rise with the influx of English visitors, it is the rooms rather than the meals which are put up. The reason is rather curious. In France generally the local population frequently dines at the inn; thus if the innkeeper raises the prices of meals to pay for the extra trouble and expense which result from English ideas of comfort, he risks the loss

of local custom. To make the foreigner pay extra for his room is an obvious way out of the difficulty; another is to bring the wine card to foreigners, while for natives the local wine is 'compris.'

Before the war, English-speaking tourists with no superfluity of wealth and a love of climbing and walking found the Austrian Alps cheaper and more suited to their tastes than either the French or the Swiss, for the love of mountain excursions is widespread among Germans and Austrians of moderate means, and partly by organising themselves as the German-Austrian Alpine Club, with a membership which approached one hundred thousand, partly by sheer weight of numbers, they contrived to keep their glorious mountains as a heritage for the moderately well-off, and by hut-building and path-making have made them accessible to the ordinary good walker, who comes in his thousands. Thus those to whom economy is a consideration will find that it is an advantage to pay the heavier railway fare for the journey further east, in order to profit by the cheaper living there. But the English Church Service and all that it signifies is not always obtainable!

The subject of the connection between the characters of a locality and the customers for which it caters chiefly might be further elaborated, but what has been said is sufficient to indicate that the point should always be kept in view when a free choice of a holiday ground can be made.

As this chapter is especially intended for the inexperienced, one other general caution may be added—beware of 'local colour' in a frequented tourist region of any kind! When it takes the form of goods, the probabilities are that these have been 'made in Germany,' or in Birmingham, according to circumstances; when they occur as local peculiarities of dress, of custom, and so forth, it is well to recollect that such things, like dwelling-houses, generally become picturesque when they have ceased to be fully functional, not

before. So long as a custom, a tradition, a habit is really significant in the life of a people, it tends to lie beyond the reach of the casual tourist; not until they are dead can such things be made a show of. Western Europe as a whole is highly conventionalised and 'quaintness' should always give rise to suspicion.

One may add a further warning of which we all stand in need. Beware of making broad deductions on the basis of the casual observations of the traveller; strive always to remember that you are seeing through a glass darkly. The writer remembers listening, through an interminable meal in an Italian pension, to a lady from Boston, who was explaining that there is no home life in 'Yurope.' She had spent ten days in London and a week in Paris, and knew that neither in England nor in France did the home exist; people spent all their lives in hotels and cafés. Before the first feeling of contempt died down to unutterable boredom (for the thesis was very fully elaborated), one had time to remember that though it seems at first sight impossible that the tyranny exercised by the British family could escape the most casual observer, yet the statement in so far as it refers to the French family would still be accepted by quite a number of 'travelled' English people. Nevertheless the position has been maintained, with some show of logic, that the bonds against which the English youth and maiden rebel so fiercely are silken threads compared with those which the son and daughter of the French household must wear, till circumstances enable them in their turn to bind the activities of a new generation. Be that as it may, the obvious reply to the Boston lady is that she did not see the home either in Paris or in London because its doors were closed to her. Not many of us, be it remembered, can see through a stone wall.

At the same time we have to admit that it is human nature to attempt to do it, and the writer cannot hope that the

following pages are devoid of too hasty deductions of this kind. Few of us can see all there is to be seen, and see it without prejudice and without illusion. But at least one general conclusion seems justifiable. If you insist everywhere upon 'comfort,' you will necessarily carry your native atmosphere with you wherever you go, and it will prove but a distorting medium through which to see your new surroundings. Without accepting in its entirety the Calvinistic position that discomfort is good for the soul, there seems reason to believe that the power of enduring it philosophically is part of the equipment of the serious traveller.

If we suppose that this tincture of philosophy is present so that a free choice of holiday resorts is possible, what points have next to be considered? One would naturally wish, other things being equal, to obtain in the course of successive holidays a firsthand knowledge of the different natural regions of Europe whose peculiarities we have discussed in the first part of this book. What does this involve? At a minimum it means visits to mountains and uplands, to the plains with their teeming life, to that South which is in so many ways apart from the rest of Europe. Let us elaborate each point a little.

To see, in the Europe of our sense, true mountains and the associated phenomena, we must almost necessarily visit the Alps. The Caucasus are beyond our scope, and while certain mountain phenomena can be observed in the Pyrenees, the Sierra Nevada, the Atlas, yet, for a variety of reasons, the early visits at least must be made to the Alps. Such visits should include not only the central chain with its high peaks, glaciers and eternal snows, but also the characteristic marginal lakes, preferably those both on the north and south sides of the chain.

What one would hope primarily to gain from these mountain visits would be an increased knowledge of physical geography, of the agents which are continually moulding the

surface of the earth. In the Western Alps, as already suggested, the life of the people, save in its broadest outline, is likely to elude the visitor's grasp. Only if he or she is very well prepared beforehand, and thus able to disregard the irrelevant and unreal, to pick out the significant, is it possible in the course of a short summer holiday to appreciate the effects of mountain life on the inhabitants. In the Eastern Alps matters are a little better, for the people, often very isolated in their longitudinal valleys, are strongly individualised, have, on the whole, kept their ancient customs more jealously than the Swiss, and, except on the main tourist routes, are still more or less a people apart.

The best preparation for mountain holidays is, according to the taste of the visitor, to read the copious English climbing 'literature,' beginning with Leslie Stephen's *Playground of Europe*; or to attempt to master some part of the enormous recent output of books on the origin and structure of the Alps, which is largely though not exclusively in German; or to devote attention to the still somewhat scattered studies which have been made upon the human geography of the region, which is specially interesting because the 'backward' mountain peoples have still roots in Mother Earth in the sense which we have given to this phrase in Chapter XI.

From the standpoint of human geography the uplands show, generally in less marked form, somewhat similar features to mountain regions. That is, there tends to be a closer connection between modes of life and the natural surroundings than in the case of the plains. Historically, however, upland regions are often more interesting than the mountains, on account of their closer connection with the plains. Certain aspects of physical geography also can be as well studied here as in the mountains. In most cases upland regions are most conveniently studied in connection with the plain tracts with which they are politically connected. Those which are most likely to be visited by the tourist are

the Highlands of Scotland and the high ground on the west of Great Britain generally; Norway, which despite its glaciers and snowfields is an upland and not a mountain region; the middle Rhine, the Ardennes, Brittany and so forth. Of these the Scottish Highlands and the middle Rhine are perhaps the most important.

To the student of human geography the plains of Central Europe are of course supremely important, and as some one or other of them must be crossed to reach the Alps or the south they are of easy access. What is here the minimum for the systematic traveller? One must certainly, first of all, see Paris and some of the French cathedral towns of the north and north-west. One should also make a flying visit to Belgium and Holland, and a German town or two may be sandwiched in on the way to and from the Alps by those who do not wish to make a special tour in Germany.

This brief list brings out one point at least about the plains—that as compared alike with mountain and upland their chief interest is in the works of man. We are specially fortunate also in that the part of the Mid-European plain which is separated from us by the narrowest stretch of water is that from whose people we have most to learn. One may lay it down as an axiom that no able-bodied person who can collect together the fare from England to France should neglect to visit Paris, and the further north in Great Britain the individual was born, the greater is the need for his making the journey. To attempt to point out the contrasts between English and French at this time of day, or to balance the virtues of the one race against those of the other, would be foolish and futile, but that a real contrast exists no one can deny. Perhaps, however, in view of widespread prejudices, it may be well to state that one contrast, which the candid cannot fail to observe, is French seriousness as compared with our frivolity. For this reason the first visit to France should if possible be made in youth, when even the Briton

has some inkling that art and literature and life have their serious side. Candid youth may hope to learn also that when this deep-seated seriousness is present it is possible to be gay on the surface ; while, on the other hand, solemnity of demeanour, so common on our side of the channel, may be an indispensable cloak if there is only emptiness within.

If the scandalised tourist reply that the seriousness of the shops in the rue de Rivoli is not what strikes the Puritan most, the answer has been already given in the beginning of this chapter. The Parisian knows well that the average tourist comes to Paris hoping to be shocked, and he supplies the improprieties required in abundance. If the tourist thinks this is the whole of Paris so much the worse for him. But let him strive to remember that this is the capital and the real centre of life of a people with a living literature, a living art ; a people to whom the world owes all recent great advances in modes of locomotion, and the yet greater achievement of being able to look unafraid upon things as they are.

Since the French are first and fundamentally a literary people, the best preparation for a visit to their country is to acquire some knowledge of their literature. The country has natural beauties no doubt, it has many historic monuments of great interest, but the primary importance of the land must always be that it has moulded the people into what they are. One wants, therefore, so far as possible to look at the land through the eyes of its inhabitants. Geography, especially human geography, has in France a great number of adherents, many of whom are men with much power of literary expression, but apart altogether from the works of these it is needful to be steeped in the literature of the country. One should not visit Provence without having read and re-read Daudet ; Lorraine should have been seen through the eyes of Colette Baudoche and her lover before the eyes of the flesh rest upon it ; the quais of Paris lose half their significance if one does not know how Monsieur

Bergeret and the Abbé Coignard loved them and walked upon them ; does not the very essence of provincial France distil from some of the pages of Maupassant ? Perhaps also one should not dare to visit Chartres without having seen it first through the eyes of the hero of *La Cathédrale*, even though that gentleman's concern for the salvation of a singularly worthless soul may seem excessive—but then the author of his being was not French by birth !

In short, to visit France with profit one must keep in mind constantly that its primary interest lies in the fact that it is peopled by Frenchmen and Frenchwomen, and strive to lose no possible opportunity of learning something about them. A point of some interest, it may be noted in passing, is that while the women are certainly as highly individualised as Englishwomen, even since the days of the latter's awakening, yet the course of social evolution here has been quite different—a fact which may be studied alike in the literature and on the spot.

The plains further to the north have other tales to tell. In the Low Countries one may see something of what prosperity meant to the burghers of an earlier day, whose wealth depended upon a monopoly of a valuable overseas trade ; something also may be seen of the effect of agelong human conflict with the forces of nature, and its results alike upon man and the surface. Finally, the contrast between Dutch art and the earlier Italian art of the Renaissance is so striking that it can scarcely fail to be noticed, even by the most inexperienced person, if he has seen both.

As to the last heading in our outline classification, the South, we have already emphasised the marked contrasts which it offers to the north and centre in climate, in natural vegetation, in cultivated crops. It only remains to be added that it has produced, especially at certain periods and at various places, fine flowers of human skill and inspiration which it were to miss half the joy of life not to see, should opportunity

offer. The minimum perhaps here is Florence as a means of studying the Renaissance, and Provence for its Roman remains, the latter if Rome be not possible. Indeed, in any case, the old-world cities of Provence afford probably the best introduction to the great empire with its mixture of savagery and splendour, for the ruins rise from the midst of the somnolent towns near the Rhone with an impressiveness which one perhaps loses in the busy modern city of Rome, with its jumble of periods and ideals. One finds, it may be added, also in the towns of Provence the dust, the dirt, the disregard of elementary sanitary precautions, which seem to the northerner who has not seen the pit villages of his own island so eminently southern.

In the chapters which follow we shall consider successively the Alps in their various aspects and regions; volcanic phenomena as illustrated in the district round Naples; that anomalous region between the mountains and the sea which we call the coast *par excellence*—the Riviera; the Scottish Highlands as a type of Uplands; and, finally, some plain regions with their towns. In all cases the treatment is meant to be suggestive only, and has no claim to be regarded as comprehensive—the object is to open vistas rather than to describe scenery.

CHAPTER XIV

THE REALM OF SNOW AND ICE : ESSENTIAL FEATURES OF THE ALPS

‘ Ehre sei Gott in der Höhe !
Er hat die Berge so hoch gestellt.’

THE Alps proper extend in an irregular curve from the Col d’Altare on the Gulf of Genoa to Vienna, a distance of some 750 miles. They fall naturally into a western and an eastern section, which are more or less markedly contrasted with each other. The Western Alps form a great arc of a circle, rising steeply from the plain of Piedmont and curving round till they acquire a north-easterly direction, to end approximately along a line extending from Lake Constance to Lake Como. Beyond this line the chain is continued in a wider but lower segment, with a general north-eastern direction, which dies away close to the Danube in the vicinity of Vienna. We shall call this part the Eastern Alps, as contrasted with the Western section, but it should be noted that it does not wholly correspond with the Eastern Alps of popular speech. The line we have drawn, as the map shows, throws the Alps of the Bernina group, that is the mountains of the Engadine, into the Eastern Alps. Now the Engadine belongs politically to Switzerland, while the rest of the Eastern Alps are, broadly speaking, divided between the powers of Austria, Italy, and Germany (a small part). In current speech therefore it is usual to regard the line between Western and Eastern Alps as coinciding with the Swiss frontier, so that the Engadine mountains become a part of the former. This

is the classification which Baedeker adopts, the Engadine being included in the volume on Switzerland and not in that on the Eastern Alps. This, it should be realised, is purely a matter of practical convenience, and has nothing to do with the structure of the mountains. Between the Eastern and Western Alps as defined above, there is, on the other hand, a real structural distinction which it seems worth while to consider in a little detail.

Through the Alps generally there runs a band of crystalline rocks, such as granite, gneiss, schists, etc., a band which corresponds generally to the greatest heights, and may be regarded as the apex of that great earth crumple which forms the mountains. In the Western Alps this central axis is, as it were, exposed on its southern side; that is, it arises directly, like a mighty wall, from the plain of Piedmont. In the Eastern Alps, on the other hand, there intervenes between the central crystalline axis and the plains of Italy a broad belt of mountains and hills, built up of rocks laid down in water, especially limestones. Such limestones, for example, form the beautiful Dolomite mountains of Tyrol.

Turn now to the northern margin of the Alps. In Chapter iv. we discussed the Subalpine and Prealpine calcareous chains which fringe the outer border of the High Alps, but, in addition to these, clothing, as it were, the central crystalline chain, there is a belt of calcareous rocks, widest to the east, where it forms important chains of calcareous Alps, but present also in the western segment. Thus we have to think of the long curving chain of the Alps as having its lofty central area, which is built up of crystalline rocks, clothed throughout on its northern margin by a belt of often high Calcareous Alps, while the inner or southern margin has a broad investment of similar character to the east, but towards the west has the central axis exposed owing to the absence of marginal limestone chains. The reason for the distinction we need not consider in detail, but, in broad

outline, it is believed to be somewhat as follows. The mountain-building forces, which acted from the south towards the north, were more powerful in the region of the present plain of Piedmont than elsewhere. Here therefore the earth crumple rose to its highest point, and here, as suggested on p 20, great slices of rock were shoved over the top of one another so that rock masses which lay originally south of the rising Alps came to lie north of them, and some of the mountains along the northern margin of the Swiss Alps, which are built up of rocks of distinctly southern character, represent, as it were, the beds which are missing to the south. In the Eastern Alps the crumpling was less intense, the mountains are not so high, and rock displacement has not taken place on the same scale.

Calcareous rocks begin to appear in the south between Lakes Maggiore and Como, but the most satisfactory line of demarcation between Western and Eastern Alps is that which runs from Lake Constance up the valley of the Rhine to Chur, and then *via* the Splügen pass to Lake Como.

In the Western Alps, as thus defined, it will be noticed that the mountain chain, though lofty and much glaciated, is relatively narrow. The mountains are precipitous alike as viewed from the Plain of Piedmont and from the vicinity of the seacoast in the Maritime Alps ; only towards the north-west do they slope more gently to the Swiss plateau. The Eastern Alps are throughout wider and lower. They reach their maximum width (about 160 miles) in the vicinity of the Brenner pass and Lake Garda, and there advance upon the low ground so as to divide partially the Venetian plain from that of Lombardy. From the plain, however, they rise much less steeply than their western continuation, and in the extreme east, instead of ending abruptly, as do the Western Alps, they slope gently towards the plain of Hungary, from which plain their interior can be reached with relative ease, owing to the long river valleys which lead

from the heart of the mountains to the plain. Northwards also the Eastern Alps slope gradually to the plains of Swabia and Bavaria.

In addition to their structural differences, their greater mean height, their greater absolute height and their more severe glaciation, the Western Alps differ from the Eastern, generally speaking, in the nature of their valleys. With an exception to be noted directly, the majority of the large valleys in the Western Alps are transverse to the main trend of the chain, that is the streams have a 'natural' direction, for they run from the crests of the mountains down the slope of the ground towards the surrounding plains. On the other hand, in the Eastern Alps there are a great number of large valleys which, for a part of their course, follow approximately the trend of the chain, *i.e.* are longitudinal instead of transverse to it. As examples we may note the Inn from Landeck to the vicinity of Kufstein, the Upper Salzach, a part of the Enns valley, the Drave valley, the Mur valley, the Valtellina (Adda valley), the Vintschgau above Meran, and so on. Such longitudinal valleys tend to be more or less isolated, and their predominance in the Eastern Alps is one of the reasons why the people there have on the whole retained more of the characteristics of an earlier period than those of the Western Alps. In Switzerland the multitude of transverse valleys gives relative ease of access; movement can take place from mountain to plain or from plain to mountain with changing conditions, social and economic. We are apt to think of the Swiss as a typical mountain folk, but in point of fact they are largely a manufacturing and engineering nation. The peoples further to the east are much more truly mountain folk, for there less free communication between mountain and plain is possible.

We have said that there is one great exception to the statement that in the Western Alps the large valleys are

mostly transverse. This is the gigantic furrow which runs from Martigny up the Rhone valley, is continued across a low watershed (Furka Pass) into a part of the upper Reuss valley, here called the Urserntal, and then across another watershed (Oberalp Pass) into the Vorder Rhine valley to end near the town of Chur, where the Rhine valley takes a sharp curve. At its extremities this great furrow separates the Calcareous from the Crystalline Alps, but in its centre it runs through the heart of the latter. It passes through the two cantons of Valais and Grisons, and gives to the people of both those cantons something of the aloofness which is common in the Eastern Alps, for, as in the latter, communications with other regions are, or were once, relatively difficult. In this connection we may note that such longitudinal valleys often, as in the case of both the Rhine and the Rhone in the present one, connect with transverse valleys at their extremities, a sharp bend taking place at the connection. In such transverse valleys there are often deep gorges where the river has cut its way through a rocky bar. These gorges may, in early days, offer a considerable obstacle to easy communication, and thus help to preserve the remoteness of the longitudinal stretch of the valley. Both the cantons named, it is interesting to note, did not join the Swiss confederation till the early nineteenth century, a fact which may be directly connected with their geographical isolation.

We have stated above that the Rhone-Rhine furrow at its extremities separates the Calcareous Alps to the north from the Crystalline Alps to the south, but this is only true for its extremities, for near the centre we find that the Finsteraarhorn, and the great mass of peaks near it which lie north of the furrow, belong to the Crystalline Alps. It is worth notice in this connection that the more numerous longitudinal valleys of the Eastern Alps do demarcate, more or less sharply, in certain areas at least, the two types of

rocks. Thus the furrow indicated by the line of the Arlberg railway from Bludenz to Landeck, then the Inn valley from Landeck to Wörgl, and successively the Enns and Salza valleys, cuts off the Calcareous Alps to the north from the Crystalline range to the south, and the Pustertal, the curious valley due to the Rienz, and then, after a low watershed, to the Drave similarly marks the southern boundary of the Crystalline Alps. On the other hand, the longitudinal valley of the Valtellina, though parallel to the boundary, runs entirely within the Crystalline series.

More interesting, however, to the ordinary tourist than the geological composition of the Alps is their covering of snow and ice. A great number of peaks, both isolated mountains and groups, rise above the snow limit—that is, more snow falls throughout the year than the summer sun can melt. The mean snow line in the Alps is about 9000 feet, or, in other words, above this limit, on the average, permanent snow is to be expected. But, owing to the extension of the chain in latitude and longitude, the mean figure affords little guide to the actual conditions to be expected in any particular locality. Latitude affects the question because, other things being equal, the more southerly mountains should have a higher snow limit than the more northerly ones; longitude affects it because, broadly speaking, precipitation diminishes towards the east, and the less snow falls the higher will the snow limit tend to be, the sun's melting power being regarded as similar in the two cases. But precipitation in the Alps is far from depending solely upon longitude, for the extent to which the rain-bearing winds have access to a particular area counts for much. Thus the Valais is very dry and the snow limit there correspondingly high. Further, since isolated mountains are notably cooler than mountain groups the snow limit on them is lower than would be expected from their height. The Säntis, that isolated mountain group which stands between

the east end of the lake of Zurich and the Rhine, is an admirable example. It only reaches a height of 8200 feet and yet bears permanent snow. On the great Mont Blanc group, on the other hand, the line of permanent snow rises to nearly 10,000 feet, and on Monte Rosa to nearly 10,700 feet.

One must not suppose, however, that all surfaces above the limits named are snow-covered. This is far from being the case. Many slopes above the snow line are too steep to lodge anything but a minute quantity of snow. No sooner has the crystalline mantle reached a certain thickness than the force of gravity overcomes the resistance offered by friction, and the whole mass slides downward till it comes to a state of equilibrium on a gentler slope. As the process is constantly repeated, there are usually well-marked lines or channels down which the snow slips in constant avalanches, and it is easy to observe how, even on a slope which seems relatively moderate, rocky points or projections tend—in technical phrase—to liberate avalanches.

The result of the constant slipping is that snow tends to accumulate in regions of moderate slope, more especially in those basins and troughs which are so much more abundant in the Eastern than in the Western Alps. Owing to the continuous pressure the loose crystals lose their envelope of air and become compacted together to form *névé* or *firn*, and from the *névé* a tongue of solid blue ice glides slowly down the mountain, generally to reach a valley, though sometimes the incipient glacier stops short in an ice-cliff from which constant ice avalanches thunder down to the valley below. Existing Alpine glaciers are either such truncated plateau glaciers, or at best mere tongues of ice, valley glaciers, as they are called, occupying valleys far too big for them. The latter, though shrunken and insignificant as compared with their homologues in Arctic regions, or the great glaciers of the Ice Age, nevertheless travel far below the snow line.

Almost all the Alpine glaciers have diminished greatly

within the last fifty years. That which extends farthest down its valley at the present time is the lower Grindelwald glacier, which descends to within 3800 feet of sea-level, or about 5600 feet below the snow-limit in the region. Compared with the conditions which exist, *e.g.* in Alaska, where the glaciers come down to sea-level, this is nothing; but it is yet a phenomenon sufficiently striking to arouse admiration and surprise in the unsophisticated tourist, and to justify the enthusiastic description sometimes given by novices of Switzerland as a country where one may meet a glacier while walking along the village street.

The glacier ending or snout gives rise to a turbid rapid stream, generally arising from an obvious ice-cave, though often it is difficult or impossible to reach the snout owing to the masses of loose *débris* piled up around it. The tourist's first introduction to a glacier is thus more generally obtained after a toilsome climb up a steep valley till an opportunity occurs to clamber down its precipitous rock wall, at the bottom of which lies the shrunken ice-stream, bordered by its great wall-like moraines. As each glacier normally has its bordering moraine, the junction of two glaciers gives rise to the phenomenon of a median moraine, admirably seen, for example, on the Gorner glacier at Zermatt or on the Aletsch glacier—the typical text-book example. The other more obvious characteristics of a glacier, such as the crevasses and ice falls; the great crevasse or *bergschrund* which marks the spot where the stationary firn passes into the moving glacier; the glacier 'mills,' down which water carrying stones whirls ceaselessly; the frequent occurrence of streams of water or of tiny lakes on the surface of the ice; the glacier tables and the small stones which, instead of standing on an ice pedestal like the 'tables,' are sunk into the ice—all these are described so fully in all the ordinary text-books, and can be so readily seen during the ordinary easy glacier expeditions, that we need not discuss them here. The distribution of the glaciated

surfaces in the Alps, on the other hand, is a less familiar subject, and is worth special note, for it has a bearing on the question of the part of the Alps which it is most profitable for those interested in glacial phenomena to visit.

The glaciated area is more extensive in the Swiss than in the Austro-Italian Alps. According to calculations which are only approximate, some 800 square miles are covered by ice within the boundary of Switzerland. In the Eastern Alps, excluding, however, the Bernina region, which is included in the above figures, only some 635 square miles of ice occur.

As the Calcareous Alps occupy so large a part of the surface in the Eastern Alps generally, it is interesting to compare the glaciation of the Crystalline and Calcareous belts. In the Eastern Alps in the wider sense (*i.e.* including the Bernina region) the total glaciated area reaches about 703 square miles. Of this total no less than 682 square miles fall within the Crystalline Alps, while the remaining area of 21 square miles is almost equally divided between the north and south Calcareous Alps. Thus the general conclusion is that to see glacial phenomena at their fullest development we must go to the Swiss rather than to the Eastern Alps, and further that it is, as we should expect, the central rather than the marginal belts of the mountains which are most fully glaciated.

Coming more to details, we may notice that in Switzerland two areas stand out predominately as regions of intense glaciation. These are the part of the Pennine Alps between the Col de Fenêtre and the Monte Moro Pass, and the region of which the Finsteraarhorn forms the centre. In the former region about 220 square miles of surface bear glacier ice, in the latter some 190 square miles. To reach the Pennine glaciers one has a choice of resorts ranging from Fionnay below the Col de Fenêtre to Saas Fee below the Monte Moro, but the predominating village, which for some people overshadows all others in this belt, is Zermatt. The preference is so far justified that within easy reach of this township

one may enjoy probably a finer glacial panorama than anywhere else in the Alps, and two of the glaciers, the Gorner glacier and the much smaller Findelen glacier are, in certain parts, 'safe' for guideless parties whose members have common prudence and some slight experience of ice—no glacier is safe for persons without these qualifications.

The Finsteraarhorn region is most easily reached from Grindelwald, though its largest glacier, the Aletsch, which is also the largest in the Alps, is best visited from the south, from Belalp, the Eggishorn or the Rieder Alp, the hotels of the first two being great favourites with English people.

In the Eastern Alps the most highly glaciated regions are the mountains of the Oetztal and of the Ortler group, though the largest glacier is to be found much further east in the Hohe Tauern group, at the foot of the Gross Glockner. The Oetztal mountains can be visited from a number of villages in the long valley, *e.g.* from Sölden or Vent. For the Ortler one has a choice of the north-west side, with Sulden and Trafoi, or of the south-east side with Santa Caterina, charmingly described in Leslie Stephen's *Playground of Europe*. In the above short list we have omitted the glaciers of Mont Blanc, which, though relatively small, are of easy access. Chamonix is here the most popular centre.

The existing glaciers, as already explained, though they still cover a considerable area, are pigmies as compared with those of the Ice Age, in regard to which we must say something. Before doing this, however, a word about present shrinkage may be advisable. Glaciers are now subjected, in almost all parts of the Alps, to very careful and exact measurement, but this is due to a comparatively recent interest in the subject of glaciation in general, and exact figures are available for short periods only. It is, however, quite certain that for a period of unknown length, which seems to have ended in about 1855, the glaciers of the Alps advanced notably. Between that date and certainly the

year 1909 they displayed a very marked and continuous retreat, which left bare tracts of ground that had previously been ice-covered. Since 1909 there has been some, but not very definite or satisfactory, evidence of a slight advance, in the case of a few glaciers, and of a cessation of retreat in the case of some others. It is possible that a period of notable advance may be approaching, but as to this nothing definite can be said meantime. What it is, however, important to realise is that one must not conceive of the glacier ice of the Alps as having steadily and uniformly diminished since the Ice Age; there have certainly been minor fluctuations, possibly due to the existence of minor climatic cycles. Further, one must not hastily assume that an exposed glaciated surface has been bare of ice since the passing away of the Ice Age, its exposure may be quite a recent phenomenon.

Turning now to the conditions which existed in the Ice Age, we have to remember that whereas Scotland and the greater part of England were at that time drowned beneath an ice-cap, Central Europe was only glaciated to the extent that the enlarged glaciers of the Alps streamed far further out upon the plains than they do to-day—there was no ice-cap. Laborious research seems to have established that the snow-line lay some 4000 to 4250 feet lower than at present, bringing the mean down from about 9000 feet to some 5000 feet, while in special places it lay even under 4000 feet. This was apparently due not to a great increase in precipitation but to a lowering of the mean temperature by from 9° to 5.5° F. Its effect on the forces of erosion was the same as adding some 4000 feet to the present height of the mountains, *i.e.* was equivalent to an uplift. The consequence was that the valleys were piled high with ice, which rose over their walls in many localities and streamed down valleys on the opposite side of the mountains, so that the ice-parting came to lie to the north of the present water-parting. Further, the valley glaciers extended far out on the plains, and

left there a load of coarse and fine débris. As they descended from the north slope of the Alps the great glaciers could no longer be contained in their own valleys, but united together to form expanded tongues of ice such as are to-day to be found in Alaska (see Fig. 14). These great ice tongues spread out upon the plains, and within them were included the present sites of Salzburg and Kufstein, of Schaffhausen, Zurich and Berne. On the south slopes, on the other hand, the glaciers remained separate from one another, but the individual glaciers extended far out on the plain so that, for example, the Etsch glacier filled up the present Lake Garda and, broadening out into a fan beyond the southern extremity of this lake, left in front of it that mass of morainic hills and mounds among which the battle of Solferino was fought.

These old glaciers have modified greatly the surface of the Alps and the adjacent country, and some of the modifications produced can be readily observed by the ordinary tourist. An important point to realise is that the valleys of the Alps are, in technical language, preglacial, or, in other words, that before the Ice Age they existed in the position in which they are now found. But the great glaciers which flowed down them during the period of greatest glaciation, combined with the roaring torrents of the interglacial periods, greatly modified their form. The chief changes thus produced, some of which are of much human importance, are—the modification of the heads of many valleys to form ‘kare’ or cirques; the deepening of the main valleys, which causes numerous waterfalls to arise where the side valleys join the deepened main valleys, which again gives rise to abundant water power; the smoothing of watersheds due to the way in which arms of the great glaciers overrode the sides of valleys, this smoothing having been of great importance in the formation of the Alpine passes, large and small; the marked accentuation of the basin and gorge arrangement of ordinary river valleys, apparently due to the



View of Sion in the upper Rhone valley to show the dissected rocky bar, the parts of which form the two castle-crowned hills. The glaciated valleys of the Alps show all stages in the dissection of such bars.

(Photo by Wehli, Kitzbühel, Zurich.)

junction of tributary glaciers with the main one, which renders the valleys much more suitable for human habitation and thus makes their exploration easy; the excavation of rock basins or the blocking of valleys with morainic matter, which leads in turn to the great development of marginal lakes, often of great beauty; finally, a minor but striking feature, due to the accentuation of the basin and gorge arrangement, is the occurrence of rocky bars across the Alpine valleys, the bars being often dissected so that isolated rocks arise, which have been in the past of strategic importance, and are often crowned with ruined castles (Plate XVIII.). Of these the first only has no apparent human importance and may be discussed here; the others will be considered in the next chapter when we treat of some typical regions.

Cirques in the Alps are armchair-shaped notches lying below the summit ridges of mountains, which are sometimes empty of ice, or contain small cirque glaciers, or form the gathering ground and point of origin of valley glaciers. The last was their condition during the Ice Age, so that functionally a cirque is the head of a glacier-containing valley. But not all glaciers in the Alps now head in cirques. They are far commoner in the Eastern than in the Western Alps, and in the former are recognised in local speech ('*kare*'), just as the equivalent structure is recognised by the inhabitants of the Highlands of Scotland both in its English form of *corrie* and in the Gaelic form of *coire* (Plate XXV.). Into the numerous interesting points connected with cirques we cannot enter here—something more must be said in the chapter on the Highlands—but the cause of the difference between the Eastern and Western Alps is interesting.

A cirque is in origin a modification of the funnel-shaped depression in which streams tend to rise in mountains of smoothed and rounded form. According to the views of many, perhaps most, geographers, the effect of glaciation is to convert these wide open depressions into the steep-sided cirque, whose side

and back walls are continually eaten away by the action of frost, owing to the way in which the moving ice carries off frost-riven débris and thus leaves new surfaces for attack. The ice itself owes its origin to the way in which snow tends to collect in these valley heads, into which it slips from the slopes above. If we suppose, therefore, that a glaciated mountain region during the Ice Age had, before the onset of cold, such a rounded or, as it is called, a 'subdued' form, the tendency would be for the heads of the glaciers to eat out deep notches in its sides, generally more prominent on the shaded (north) side than on others. If a number of such notches developed they would gradually approach one another as they increased in size, and lateral erosion would give rise to steep ridges between the successive notches, while erosion at the back of each cirque would tend to turn the original rounded summit into a ridge or *grat*. If, on the other hand, a mountain region prior to severe glaciation had already sharp ridges and arêtes with no wide depressions in which snow could accumulate, the characteristic cirque would not appear. It is believed that the Western Alps, before the period of great glaciation, had generally peaked and ridged forms. The effect of glaciation was to accentuate this, but, in the general case, it made the development of cirques impossible. In the Eastern Alps the forces of erosion had, before the Ice Age, worn down the peaks and ridges and arêtes, and their activity was slackening, for the mountains were largely protected by a covering of their own waste. The ice gave to the eroding forces a new tool, with which new and deeper etching has been done, the *kare* being a stage in the graving process. In the Highlands, as we shall see later, the smoothing, and rounding of forms, and the formation of a protective covering of rock waste, had proceeded far further, and when the ice came it could for the most part only dig out corries in the smooth mountain sides, giving one the curious present combination of sudden precipice and smooth grassy slope.

CHAPTER XV

THEN AND NOW IN THE ALPS

‘Consider how this habitable earth, with all its rock-built mountains and flowery plains, is for ever growing and perishing in eternal birth and death—consider how the winds and lightnings, and storms of rain and hail, and flooded rivers and lashing seas are for ever cutting, mining, gnawing away, confringing, colliding and comminuting the hills and the shores, yea, and the sites of high-domed cities—until every mountain shall be brought low and every capital city shall lie deep “at the bottom of the monstrous world.”’

A GREAT part of the charm of the Alpine valleys of the Central Chain, as we have said in various forms, is due to the effect of glaciation, old and new. Here we see the splendid blue ice of to-day hanging high above the valley, there the effect of past ice in smoothing, in wearing away, in transporting—in all its manifold activities. The existing glaciers help us to interpret the work of the magnificent glaciers of the past; the effects produced by the past ice-rivers enable us to realise what the present ones are doing, unseen by us, to their rocky beds, to appreciate the work of the *firn* far up on the mountain side. Past and present act and react; the *marmites* of the Gletschergarten at Lucerne are for the novice a call to the Alps; to the sun-burnt returning tourist on his homeward journey they are no less absorbing, for they complete the picture he formed when he stood at the edge of a great crevasse and heard the water roaring in a spiral down into the heart of the ice, saw the stones which it carried down to the depths. Let us try to elaborate the lesson afforded by

glacier garden and glacier by taking an imaginary journey in the Ice Age, followed by one over the same ground to-day.

According to one estimate, which is little more than a vague approximation, some 20,000 years have elapsed since the last series of Ice Age glaciers began to retreat up their valleys. How long the preceding glacial period, which according to one widely accepted view was the last of four separate periods, endured we have no means of ascertaining. Let us imagine ourselves, however, some 25,000 to 30,000 years back in time, with a zeal for glacier exploration. It is perhaps needless to remark that there is no evidence that human beings with such tastes existed in this period. Outside the glaciated area early man at this time was hunting the reindeer, mammoth or rhinoceros with the help of stone javelins which, after long ages of striving, he had learnt to make with much skill and some delicacy. On the shores of the Mediterranean, as at Mentone, he was devoting his hours of leisure to carving in bone and ivory and to the making of shell amulets and so forth, with, we may reasonably suppose, no thought of the man of the future who was to spend life and wealth in toilsome exploration of Arctic glacier and polar ice-cap.

Let us suppose, however, that some strayed reindeer hunter, of roving propensities, found himself, some 30,000 years ago, near where the town of Olten now stands. What would he see if he stood here, facing up the valley? A quotation from a modern explorer probably fits the case with some accuracy:—' Hoping to see the pass close at hand, I beheld instead only the interminable valley slowly bending round and stretching away. If it had been desolate before, it now became of a yet more dreadful desolation, surpassing anything I ever saw or imagined. No view could be more simple. In the midst was a river flowing between banks of ice; on either hand long slopes of naked *débris* stretched up in unbroken sweep to a straight hill crest just edged with

snow. There were no buttresses, hardly any gullies, no precipices, or emerging rocks, and no peaks above. The whole thing bent round in a slow curve. "Here indeed," I thought "Nature ends." The worst feature in the view remains to be mentioned; it was a wall of ice that blocked the valley's head, presumably some great glacier we should have to surmount.'

The quotation is from Sir W. Martin Conway's *The First Crossing of Spitsbergen*, and the party were in the act of crossing from one side of Spitsbergen to the other. They hoped to find a low pass at the top of the long valley up which they had come, and instead found the appearances described, due, as they soon found, to the fact that a lateral glacier had crept across the pass, and was discharging water down both sides of what should have been the watershed.

All the elements in the view of our Stone Age man were much larger; let us try to analyse them in a little detail. If, however, the details seem fewer than some would like, we must remember that our far-off ancestor's forehead was low, and his powers of observation and deduction probably small!

Standing at Olten we are looking over his shoulder up the Aare valley, which runs here from south-west to north-east between the Jura on the one hand and the foothills of the Alps on the other. Here then we stand on a part of the Swiss high plain, which, even to-day, is in winter often drowned in mist for days together while the sun shines brightly on the heights. In the far-off days of which we are speaking we cannot doubt that the mist was denser and more persistent, so that our reindeer hunter would be fortunate if he caught occasional glimpses of his surroundings, as the wind chanced to drift the mist curtain this way or that. Around him certainly was a dreary waste of stones and mud, mingled with ice and snow, traversed by swift turbid streams, carrying great loads of débris as they roared down all the surrounding slopes. If some more stable heap enabled him to rise above

the general surface, he would see in front of him, some twelve miles away, a great wall of ice, such as Sir Martin Conway saw, but infinitely greater, from which many streams arose. This, could he have foreseen the terminology of future geographers, he would have recognised as a mighty arm of the huge Rhone glacier, turned north-east out of its proper course, and sending water *via* the Rhine to the North Sea, instead of draining, like the present insignificant Rhone glacier, only to the Mediterranean Sea (Fig. 14).

If, in disgust at this great mass of ice, he turned to his own left he would see there, even nearer to him, the manifold lobes of another great glacier, formed by the union of the ice of the Linth and Reuss valleys, and concealing the future sites of Zurich, Zug and Lucerne. It likewise would be sending many streams to the Aare. Suppose he decide to advance up the valley to the south-west, in the hope of finding there some means of exit to the shores of the Inland Sea.

Some twelve miles of a weary struggle over the moraine-encumbered plain brings him, as we have seen, to the snout of the great valley glacier, which on the one side is jammed against the Jura, so that it rises high up the slopes of these mountains, and on the other lies against the lower slopes of the hill called the Napf. The snout of the glacier slopes steeply upwards to a height of some hundreds of feet, and our hunter will have something of a tussle before he is able to scramble up this to the glacier surface proper. He will be wise indeed to keep well round to his own left, for here the slope of the snout is gentler. Once he has reached the surface he will find the slope comparatively easy, and he will probably be able to see far across the glacier, which some seven miles from its extremity reaches a width of fourteen miles—a width which is enormous when compared with the existing Aletsch glacier (rather over one mile at a similar point) but small compared with the Beardmore in the Antarctic, which is some twenty miles wide at its exit from the mountains. The

surface of the glacier is arched, the higher part of the arch lying towards the Jura, for here the ice is thickest.

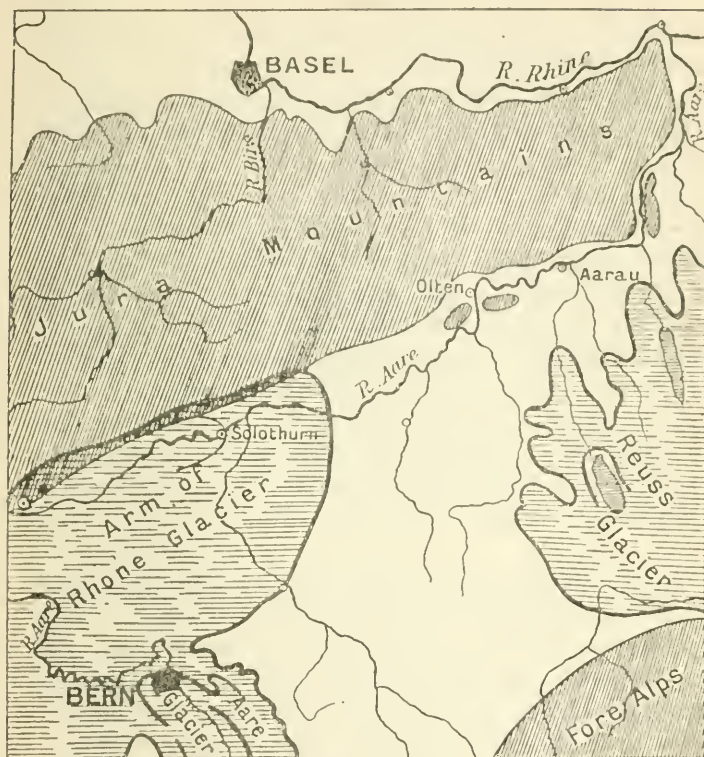


FIG. 14.—Sketch-map of a part of the Swiss plateau or plain, to show its probable appearance during the last glacial period, as deduced from the existing terminal moraines. To the right is seen a part of the Reuss glacier with which the Linth glacier united, to the left the eastern arm of the Rhone glacier which was joined by the Aare glacier. During the last glacial period, as explained in the text, there was apparently an ice-free area between the ends of the two great glaciers.

(In part after Penck and Brückner.)

Suppose our hunter toils bravely onward up the slope of the glacier, what will he see? South-westward stretches the

upper part of the huge ice-river, which becomes increasingly wide as he loses it in the mist, till it attains in the far distance a maximum width of some twenty-five miles, and this, be it remembered, is but one arm of the great Rhone glacier. Further, since we know that the ice was thicker than the highest of the hills of the plain (*e.g.* higher than Mt. Gibloux, which reaches nearly 4000 feet), we know that no nunatak, such as those which occur at the margin of the Greenland ice-cap, pierced the crystal covering, no rock peak broke the swelling dome of blue ice. Nothing but ice then stretches away infinitely from our hunter in the south-west.

But as he plods up the great ice slope a new feature draws his attention to the left. Here, at a point which marks the future site of the town of Berne there enters a tributary glacier, great indeed by our standards, but not by his, for it is only some eight miles wide where it spreads out at its exit from the side valley. This is the Aare glacier, dammed back and rendered insignificant by the greater arm of the Rhone glacier, but nevertheless an ice-stream of much importance.

Unlike the main glacier, which spreads out over a comparatively wide surface, the Aare glacier runs in a somewhat narrow valley, at whose side ice-free areas appear. Here, therefore, our hunter could leave the ice without great difficulty for uncovered land. Let us suppose, however, that, bent upon solving the problem of ice-stream relations, he resolves to follow the Aare glacier up its valley, in order to penetrate to the heart of the Alpine chain. His adventures there we may summarise very briefly.

We cannot be quite sure what he would see as he ascended the Aare glacier above Berne, for this would depend upon the era of his visit. If it was towards the end of the last glacial period, it seems certain that the not inconsiderable hill of the Belpberg (nearly 3000 feet high) protruded through the ice as an island of rock, and divided the glacier into a right

and left arm. At an earlier stage, however, this hill was completely drowned in ice.

As our traveller advances past this point he finds before him a glacier-filled valley, shaped like a funnel, widest near what will be in ages to come the town of Thun, and narrowing from this point towards the plain. As he advances to the south-east, he notes that the main glacier bends away at an angle, taking a nearly eastward direction. On his right there enters a small tributary glacier, occupying the future Simmental, and a much larger one, which runs parallel with the main Aare glacier for a time before uniting with it, and joins the latter at almost even grade. This is the Kander glacier, fed by the Blümlisalp and Wildstrubel groups, and occupying the important valley which in our later days contains the Lötschberg railway.

Let us suppose that our reindeer hunter, with some perception of its future importance, elects to follow this tributary glacier, and so traverse a valley which thousands of years afterwards will carry many joyful winter sportsmen to the village of Adelboden.

As our traveller, however, has no thought of future triumphs on sledge or ski to distract his mind, we may credit him with a little more thoughtfulness than some present-day tourists, and believe that he often turns as he ascends, to gaze at the great glacier behind him. If he does so he will be struck by the immense mass of ice piled up in that part of the valley where future tourists will find the lakes of Thun and Brienz, a mass due to the fact that practically all the Oberland is sending its quota of ice into that narrow valley. Doubtless it will occur to him that that great mass of ice, thickened by the junction of so many tributary streams, must be having a great effect upon the valley floor. He will notice also as he rises the huge wall of moraine which separates for a time the Kander glacier from the main one.

Without stopping to discuss the further sights of the

Kander valley, we may follow our guide up to the future site of Kandersteg, now buried deep beneath the ice, and watch him as, keeping a southerly direction, he avoids the upper extremity of the main valley, and climbs wearily up the steep ice-slope which conceals what we know as the road to the Gemmi Pass. His long climb brings him to near the head of the Lämmern glacier, and here, like many travellers since, he stands to take in the marvellous view of the Pennine Alps, as seen across the great Rhone valley, now filled with an enormous ice-river. But while tourists to-day must thereafter descend the multitudinous curves of the steep Gemmi path, our traveller finds that an arm of the Lämmern glacier has crossed what should have been the watershed, and flows steeply down to join the great Rhone glacier far below.

Here, therefore, on the summit, we have ice flowing two ways : northwards to melt ultimately in order to supply water to the Rhine, or southwards to join the Rhone glacier. Let us suppose that our hunter, wearied of his upward plodding, elects to glissade down that wayward arm of the Lämmern glacier, and thus find his way to the Rhone valley. Let him now follow this great glacier downwards, where will he find himself ultimately ? Below Martigny the great glacier swings round, changing from a south-west to a north-west direction, and as he approaches the region where Montreux will come to be placed, the tendency will be for him to be carried onwards in the same north-westerly direction with one great arm of the glacier, which sweeps on till its path is blocked by the Jura, and it is forced to swing round to the north-east, where it forms that great glacier with which we started.

If he avoid this arm, the other, the south-west arm, will carry him past where Geneva will later arise and so into the rift of the Lower Rhone valley. If both arms claim his attention successively, he will arrive finally at the conception

of the end of the Rhone glacier as a hammer-like structure, the handle of the hammer lying up the valley to end at Martigny, and the two parts of the head lying, the one against the Jura till, as we have seen, it melts away near Olten, and the other, also jammed against the Jura, extending past Geneva and so beyond our ken. The whole of the site of Lake Geneva, he will thus perceive, lies within the ice, and the angle between the two parts of the lake indicates the region where the two arms of the glacier diverged.

Now let us repeat this long journey to-day as an example of a simple Swiss tour. We arrive from the north at Basel, and decide to travel to the Valais *via* the Gemmi Pass. The railway takes us through the Jura to Olten on the Aare, and from Olten along the eastern slopes of the Swiss plain to Berne, likewise on the Aare. If *we* have taken the shortest route, the Aare obviously either does not share Euclid's views on the question of what constitutes the shortest distance between two points, or has abandoned all thought of this. Has our reindeer hunter any light to cast upon this preliminary problem ?

His experiences at any rate serve to draw our attention to the fact that the Aare so far as Berne, like the streams of the Alpine foreland to the north-east of this river, flows generally in a north-westerly direction, that is, down the slope of the ground. On the other hand, the rivers lying to the south-west of Berne flow in directions from north to north-east, because they are, as it were, dragged into the hollow left by the great arm of the Rhone glacier. This glacier, we saw, was thickest near the Jura. There it has left a specially deep furrow, parts of which are occupied by lakes Neuchâtel and Biemme, while the narrowed north-eastern end carries the Aare from Biemme to Brugg, the river here being like the Danube to the north of the Eastern Alps, a collecting river, gathering up the Alpine streams. The Aare has been

artificially diverted to Lake Biemme, but apart from this diversion it is obvious that there is a curiously circuitous tract between the two parts of its course, that is, between its north-westerly course to Berne, and its north-easterly one beyond the diversion. The reason is that its preglacial course north-westward over the plain was blocked by moraines left by the great glaciers, and after the passing away of the ice it had to dig out for itself a new channel. Beyond this moraine-blocked region it reached the great funnel-shaped valley left by the arm of the Rhone glacier and was drawn into this.

From Berne we next follow the Aare valley up to Thun, but if time permit it is well to make a *détour* to climb the Belpberg, at once a fine viewpoint and a region of great interest.

The view we need not take time to describe; the interest lies in the fact that, as already stated, at one period the Aare glacier split in two parts to the south-east of this hill, which thus formed an 'island' in the midst of the ice. But it will be noted that above the mountain the valley is wider than it is at this point, and further that the map suggests that there was once a belt of rock across the valley at this narrowed region. In other words, the mountain of the Belpberg is all that remains of a rocky bar which once stretched across the Aare valley, the sides of the bar having been worn away. The fine castle-crowned rock which stands up at Arco near the head of Lake Garda is another example of the same phenomenon, and we have in the Alps all stages in the dissection of such rocky bars (Plate XVIII.).

From Thun we may take railway or steamboat to Spiez on the beautiful lake, and we note that the lake occupies a part of the region where the ice lay thickest. If partially dammed by moraines at its lower end, it is apparently also in part due to the fact that the ice with its load of stones and sub-glacial streams wore away a hollow in the floor of the valley. The

Kander river now debouches into the lake at Spiez, but this is due to human interference; in earlier days it ran along the side of the lake and joined the Aare below its exit, as the Arve joins the Rhone below Lake Geneva. We note that the Kander valley slopes down gradually to lake level, while the Simmental is separated from the main valley by a steep slope, a 'step,' through which the river has cut a defile. This is believed to be due to the fact that the Kander glacier, owing to its size, lowered its valley floor to approximately the same extent as did the main glacier, while the small Simmen glacier, partly owing to the way in which it was dammed back by the main glacier, wore away its valley floor but little, so that the main valley is 'overdeepened' as compared with the 'hanging' side valley. Though only slightly marked here, the phenomenon is very striking in many other parts of Switzerland.

One other point is very noticeable. At what is now the upper end of the lake of Thun the Lutschine glacier joined the Aare glacier, the two being of approximately equivalent size. There must have been tremendous ice-pressure where the two streams joined, and we note that the lake occurs just below the junction. A little lower, as we have seen, the great Kander glacier also brought its load of ice into the crowded valley. There is not always a lake in such a position as this, for lakes are short-lived structures always tending to become silted up. But we cannot too soon appreciate the fact that basins in Alpine valleys, whether they contain water or not, generally occur near points where once there was a junction of glaciers. Further, below the basin there is often a bar (German *Riegel*), as if, after the tremendous struggle and consequent increased rapidity of movement and of erosion which occurred when two or more large glaciers had to accommodate themselves to a single valley, there ensued a quieter stretch where erosion was at a minimum.

Before we leave the valley of the Aare it is difficult to avoid

a glance at another interesting phenomenon which occurs higher up. We find that always when the valley down which an Ice Age glacier was travelling took a sudden curve, it was difficult for the glacier to accommodate itself to the change of direction, and it showed a tendency to continue its original direction. Thus below Meiringen the Aare glacier found it difficult to bend round to occupy the valley in which Lake Brienz now lies, and in the struggle, as it were, it contrived to send an arm over the valley wall, an arm which smoothed out the region we now call the Brünig pass. We could travel from Thun by lakes Thun and Brienz and then *via* the Brünig to Lucerne, and then, though we had never touched the Alps proper, we should yet have seen much of the action of past ice. Incidentally we may notice that the great north-east arm of the Rhone glacier, which we have described so fully, is another example of the tendency of the Ice Age glaciers to continue moving in the same straight line, even though the valleys in which they lay curved.

We shall not discuss the valley of the Kander in detail, though it offers much of interest; probably most tourists will traverse it by train up to Kandersteg. This village lies in an interesting example of a basin due to the union of glaciers, though the basin has been cut in two by a landslip not far below the village. The path to the Gemmi, again, is a beautiful example of a hanging side valley, for the glacier which once traversed it was insignificant compared to those which streamed down from the Blümlisalp group. The Gemmi pass, with the beautiful little Daubensee, we have already explained as due to the bifurcation of the Lämmern glacier, and we must not forget to notice the wonderful portal, whose door-posts are the Daubenhorn and the Plattenhorn, between which the intrusive ice-tongue found its way by the Dala valley to the Rhone valley. The Dala valley was overdeepened by its own glacier, a far more important ice-

stream than that tributary which diverged from the Lämmern. Thus the Gemmi pass hangs high above the basin in which the Baths of Leuk lie, and the route from the one to the other lies down the precipitous Gemmiwand, that wonderful cliff over which the swift lightning plays in the sudden summer thunderstorms.

But as the arm of the Lämmern was to the Dala glacier, so was the latter to the Rhone glacier, and therefore just as the Gemmi pass hangs high above the Dala valley, so in its turn does the Dala hang high above the Rhone valley.

The Fates are kinder to us than to the men of the Old Stone Age in that locomotion is much easier. When we reach the Rhone valley at Leuk, therefore, let us turn, not down the valley to the lake, but up toward its head.

The shape of the main valley is very striking. Whereas river valleys in general have walls which converge towards the bottom, that is, are V-shaped, this valley is broad at the base, or U-shaped, a phenomenon common in glaciated valleys, and ascribed to the action of the ice. Further, the walls are very steep, and over these steep walls the 'hanging' lateral streams tumble in waterfalls, oftentimes used for the generation of electricity. To this rule there are only two notable exceptions. The Visp and the Dranse both enter the Rhone valley by comparatively gentle slopes, such as those which occur when tributaries in non-glaciated regions join a main stream. The reason is the same as that already given for the Aare valley. That is, both the Visp valley and the Dranse valley in glacial times contained very large glaciers, which had, apparently, a marked deepening effect; there is therefore not that want of concordance between main and side valley which occurs where their respective glaciers were of very unequal dimensions.

One other feature of the Rhone valley may be noted, though we shall consider it further in a moment in the case of the Visp

valley. This is that above the steep wall which rises from the present valley floor there lies a region of much gentler slope, which forms, as it were, a terrace on the mountain side. This terrace is a common feature in the Alps, being admirably seen, for example, in the Lauterbrunnen valley, and on it health resorts are often placed. It is believed to represent the preglacial valley floor, and on this hypothesis the distance between its edge and the present stream level represents the 'overdeepening' due to ice.

Let us now suppose that we have reached Visp, where we may turn up the valley of the same name, noting as we pass Stalden the entrance of the Saas valley, which once carried a glacier roughly equivalent to the Visp glacier, so that the two valleys now join approximately at grade. As we travel up the valley also, we notice the usual alternation of basin and gorge, the basins, however, being here small, for no noticeable tributaries joined the great glacier till we reach the relatively wide trough at the valley head, in which Zermatt lies. A very obvious feature, on the other hand, as we ascend, is the presence of a sloping shelf high above the present valley wall, a shelf on which, in the lower section of the valley, an almost continuous row of hamlets stands, among which Törbet and Emd are conspicuous. The valley owes its relatively high population to the possibility of utilising those sloping terraces for pasture or cultivation.

The basin in which Zermatt lies must obviously be correlated with the numerous surrounding glaciers, now sadly shrunken, which once united to form the great Visp glacier.

Let us suppose that we arrive at the village of Zermatt in clear weather. One of the first disappointments will certainly be that, of all the mountains which we know surround it, only the Matterhorn can be clearly seen. The others stand back from the valley, rising above a sloping terrace to reach which we have to surmount the steep containing wall of

the basin. This means a climb of not less than 1500 feet in whatever direction we choose. Now all visitors to Zermatt want to see the mountains, but not all want to climb 1500 feet every day—or any day—to see them, and the prudent Swiss has taken cognisance of the fact. One part of the sloping shelf, that which has the double advantage of facing the splendid pyramid of the Matterhorn and of having a sunny exposure, bears the large hotels of the Riffelalp and the Riffelberg, can be reached by train, and offers every advantage the English tourist can desire, including a glacier within easy reach. Far less pretentious is the little inn at Findelen, but the part of the shelf here is of great interest, for it bears the loftiest rye-fields in Switzerland, and its blooming meadows are carefully irrigated from the slopes above. The Schwarzsee hotel occupies another part of the shelf, and we probably need not labour further the point that its Ice Age glaciers apparently overdeepened the Zermatt basin by about 1500 feet, and that in consequence, extending upwards from this height above the valley, we have remnants of the sloping preglacial valley floor, whose *débris-strewn* surface produces fine pasture, and, in favourable spots, even corn crops.

Almost any other Alpine valley will show the same thing, with varying clearness. The overdeepening is singularly obvious, for instance, in the Val de Bagnes, near Fionnay, where at an elevation of some 2000 feet up the steep slopes seen in Plate XIII. there occurs a high terrace with a very rich alpine flora. The absence of side-valleys here makes the region suitable chiefly to two classes of people:—First, those content to sit in the woods at the bottom of a well, so to speak, and second, those who can face with equanimity a climb of well over 2000 feet before they can go for a walk. But it is a charming place, none the less!

Finally let us tear ourselves away from this sunny Valais, with its dry climate and endless irrigation channels, and return homewards *via* the Grimsel pass, in order to take a

glance at the upper part of that Aare valley whose lower reaches we have discussed so fully. As we travel from Visp to Brig we note that here took place once the junction of the Rhone and Aletsch glaciers, a fact which must have some bearing upon the origin of that great basin which stretches from Brig to Martigny, within the Rhone valley.

At the head of the valley we must spare time for a glance at the existing Rhone glacier, so shrunken as compared with its former magnificence, must also not fail to note that the Grimsel, the pass which takes us over into the valley of the Aare, has been worn out by an aberrant branch of the old Rhone glacier, which pushed over into the Haslital. Down this valley we must hurry, noting only in passing the beautiful clearness with which the gorge and basin effect is shown, and stopping to admire the wide basin of Innertkirchen, and its causation in the converging valleys, once glacier-carrying. Further, we must leave the coach in order to inspect in detail that most perfect example of a rocky bar which blocks the basin below, and has at one side a now functionless notch and at the other the marvellous Aareschlucht, where the river has cut down a stupendous narrow gorge through the obstruction. To appreciate the meaning of this barrier is to find it easy to understand all those stages from the complete bar to its last remnant in the isolated hill or hills left in the middle of an open valley (Plate XVIII.), stages which one can trace in the valleys from one end of the Alps to the other.

Nor must we forget to notice that while the ice of the old days had its fullest erosive effect in the basin and its least at the site of the bar, running water to-day is reversing the process; for it deposits alluvium in the basins, and thus renders them more suited to human occupation, and, with the help of its load of fine waste, wears down a part of the bar which blocks its progress into a deep gorge, and ultimately tends to reduce the originally continuous barrier into the

condition of an 'island hill.' Thus running water is smoothing out the irregularities left by the ice.

The gorge traversed, we must hasten on to Meiringen to catch our train for Thun or Lucerne and home, only glancing at the Reichenbach fall as a splendid example of one of those falls due to the overdeepening of the main valley, here, as so frequently in Switzerland, harnessed for the use of man. And so home with, let us hope, some increased knowledge of ice, past and present.

REFERENCES. The best description, in English, of recent views as to the origin of the Alps is that in James Geikie's *Mountains: their Origin, Growth and Decay*, 1913. Suess's monumental work, translated as *The Face of the Earth*, should also be consulted, but, save for specialists, it is very stiff reading. For the Ice Age see James Geikie's *The Great Ice Age*, third edition, 1894, and the two massive volumes of Penck and Brückner's *Die Alpen im Eiszeitalter*, 1909; the descriptions in the chapter just ended have been taken chiefly from this book. Hobbs' *Characteristics of Existing Glaciers*, 1911, discusses many of the points connected with the action of ice from, broadly speaking, the standpoint which has been adopted here, while Bonney's *The Building of the Alps*, 1912, takes the position that ice does not erode, and in many other respects also deviates from the views usually held by geologists. Two little books, both belonging to the *Sammlung Göschen, Landeskunde der Schweiz*, by Hermann Walser, second edition, 1914, and Sieger's *Die Alpen*, second edition, 1914, cost only a few pence each and contain much interesting information. Krebs' *Länderkunde der Österreichischen Alpen*, with its annotated bibliographies, will be found exceedingly useful in regard to the Eastern Alps, and treats also the general subject to a certain extent. The Alps have so copious a literature of their own that this list might be extended almost indefinitely, but one other book with bibliographies may be mentioned for the benefit of those to whom French is easier reading than German. This is de Martonne's *Traité de Géographie Physique*, second edition, 1913, with a full account of glaciers and glaciation.

In regard to maps the Swiss school atlas mentioned on p. 46 has some good plates of parts of the Alps, but for detailed study the topographic maps of the countries concerned are of course essential.

Details can be found in the better class of guide-books dealing with the special regions.

Space has not permitted of a treatment of the interesting problems of human geography which arise in the Alps. Krebs deals with these to some extent, and there is an interesting little local guide-book, called *Das Val d'Anniviers*, by Dr. Jegerlehner, which gives a good account of conditions in the side-valleys of the Valais. For man in the Ice Age reference may be made to *Man and his Forerunners*, by Buttel-Reepen, translated by Thacker, 1913.

CHAPTER XVI

HILLS AND VALLEYS IN THE DOLOMITES

‘He putteth forth his hand upon the rock; he overturneth the mountains by the roots. He cutteth out rivers among the rocks; and his eye seeth every precious thing. He bindeth the floods from overflowing; and the thing that is hid bringeth he forth to light.’

As a contrast to the High Alps, where, to the average observer, the most obvious features are the snow and ice of the present and the effects of past glaciation, let us take a part of the lower Calcareous Alps, for here the rocks make the most insistent appeal.

The great limestone precipices of the Calcareous Alps are almost everywhere an imposing characteristic, but that particular part of them called the Dolomites, where to splendid cliffs we have added bizarre towers and pinnacles of wonderful beauty of colour, may be regarded as the most striking. Further, we are fortunate in having, in addition to many modern books of varying merit, in Gilbert and Churchill's *Dolomite Mountains* a book which, in combination with great seriousness and sobriety of statement, exhibits that joy in exploration which is the breath of life to a book of travel. Theirs were early days also, when the Dolomities were ‘unclimbable,’ and when, we may be sure, the ladies whose identities were so decorously concealed beneath their initials wore costumes as unsuitable for active locomotion as the heart of man could conceive, so that the crossing even of the Seiser alp was not accomplished without some heroism. The book is one which should be read as a

first introduction by every visitor to the region, and some amusement may be derived—of course on an ‘off-day’—by the philosophically-minded, while lying on a sunny hillside, by reflecting on the contrast between those days (the early ‘sixties) and the present. Now, on a fine day in full summer, even the higher passes, whose crossing was an adventure of the first magnitude to S. and A., possibly attired in crinolines and thin elastic-sided boots, are traversed by an almost ceaseless stream of walkers, mostly of German speech. Old and young, grandpapa and grandmamma, honeymoon couples, fathers and mothers with young children, gay bands of youths and maidens—all shoulder the rucksack in the early morn, and march briskly onward to forgather in those innumerable huts with which the flowery alps are sprinkled, there to eat a modest lunch and start off once more.

All over the hillsides run the club paths, along which the cheerful pedestrians stream, and one has the satisfaction of knowing that these bands of walkers are laying in stores of health and strength for the coming worktime, and are yet not interfering with such economic use of the land as can be made by the inhabitants. Since, further, prices in the huts and elsewhere are kept down to their probable means as members of the great class of the moderately well-off, we realise that they are not demoralising the local peasants as the shooting tenants in the Highlands of Scotland demoralise their keepers and beaters by scattering immoderate largesse. In the Dolomites, the visitors do but furnish an additional market for local produce without causing any great disturbance of the local economy. It is difficult to avoid a feeling of admiration for the countries which supply this ceaseless stream of stalwart walkers, and a pang of regret that the representative of the Tyrolese club paths in the Highlands is to be found in those often well-made but largely unused roads which run far up into the hills, but are almost always marked ‘Strictly private: trespassers will be prosecuted.’ No doubt



The Western Margin of the Dolomites: The Sehlern from Klobenstein. In the foreground is seen a part of the porphyry plateau with its rich vegetation, while across the intervening valley rise the steep precipices of the Sehlern, the flat summit of the mountain being just indicated. To the left, in the distance, is seen a portion of the Langkofel massif.

(Photo by Wechli, Kiehlhorn, Zurich.)

the problems concerned are complex, but it seems difficult to doubt that it is better that in mountainous countries the hills should be freely open to those members of the adjacent communities whose work must be carried on in smoky towns, under relatively unhealthy conditions, rather than that, as is so largely the case in Scotland, the townsfolk should be confined in a narrow valley, while the glorious uplands and hills on either side of them should be, as it were, fenced off from them, and protected by 'Trespassers Boards,' on the ground that they are best utilised as playing-fields for the governing classes, or for wealthy Jews and Americans.

But this is a digression. Let us consider the first point of importance—where are the Dolomites? Fortunately they are well defined. Take a train from Innsbruck over the Brenner—an afternoon train if you are wise. As you approach Botzen the rays of the sinking sun will strike full upon the splendid precipices of the Schlern, picking out the gullies and outposts, and you say to yourself—Behold the Dolomites! for those precipices mark the *western* edge of the Dolomite region (Plate XIX.).

Suppose, instead of travelling all the way from Innsbruck to Botzen, we had turned off at Franzensfeste and travelled along the Pustertal to Toblach. Here a narrow valley opens southwards which gives us glimpses of the strange limestone mountains, and the walk from Toblach to Schludersbach will afford views of the most bizarre perhaps of all the Dolomites, the three fangs of the Drei Zinnen. Thus the Pustertal, in which runs the river Rienz, marks the *northern* boundary of the Dolomite region.

Once again, had we been coming from the south, *e.g.* from Venice, the way many travellers choose, we could have ascended the valley of the Piave, for this river marks in part the *eastern* boundary of the Dolomites, and by turning off from the main valley near Pieve di Cadore we could reach Cortina, the great centre of the region. Finally, by as-

ending a certain distance up the Brenta river, which flows through the Val Sugana and forms the *southern* boundary of the Dolomites, and turning northwards we could have reached San Martino, another great tourist centre. Thus, to sum up, the Eisack and then the Etsch (Adige), the Brenta, the Piave, the Rienz form, broadly speaking, the boundary valleys of the Dolomites.

So far we have defined the region topographically, by its bounding valleys, but it can also be defined structurally. The Dolomites consist of a basin-shaped area with an alternation of calcareous and non-calcareous rocks, bounded to the north by the Crystalline Alps of the Hohe Tauern and Zillertal, on the west by the porphyry plateau of Botzen, on the south by that outlying part of the Crystalline Alps which forms the Cima d'Asta, and on the east by the low Calcareous Alps of Venetia. The area so defined has been elevated as a block, with but little disturbance of the strata, which are often nearly horizontal. Thus the folding so characteristic of the Western and Central Alps is practically absent. As we shall see in a moment, the characteristic isolated appearance of the hills, most marked in the western Dolomites, is the result of the rapid alternation within the area of beds of different characters. But before proceeding to this subject let us take a general view of the region, to note its relation to the surrounding mountains.

If the entrance to it is made from Botzen a day should be spent there, and this will permit both of a brief survey of the town, including probably the purchase of more fruit than is good for the tourist, and a visit to Oberbotzen by means of the electric railway. This little line passes through the orchards and vineyards of the lower slopes, and then through woods and meadows to the open plateau above, with its hotels and innumerable summer residences, embowered in roses. The view from here (height 4000 feet) is very fine (cf. Plate XIX. which shows the view from

Klobenstein, the next village), but the energetic walker will make the further climb on foot through woods and over long hot slopes to the little inn at the summit of the Rittnerhorn (7420 feet), crowded daily with sightseers in the summer months. Here there is a wonderful panorama spread out. Facing westwards one has a great circle of snow-clad mountains in front of one—a circle which is also visible from the top of almost any of the Dolomite mountains, whose constituent groups are named by the guides from those summits in a rapid monotone, which one soon learns to associate with a brief sojourn on a windy and chilly *Gipfel*, where space seems at a minimum. Hohe Tauern, Zillertaler, Stubaitaler, Oetztaler Alps, Ortler group, Brenta, Adamello, Presanella groups, says the guide on such occasions, and the tourist repeats devoutly, Presanella; let us go down. But on the Rittnerhorn, where a guide is very far from necessary, and one has long leisure before the 'thrawn' Fräulein comes to the execution of one's order, it is possible to name the peaks down to the most insignificant. Having first done our duty by these giants of the Crystalline Alps, let us turn eastward to the consideration of the lower but nearer Dolomites.

We are standing on a part of a great porphyry plateau (see Fig. 15) which extends to the east of the Adige, on both sides of the Eisack. This is an ancient lava flow, of great extent, dating back apparently to the Permian period, when there were also active volcanoes in Ayrshire in Scotland. This great lava flow now forms an undulating surface, of considerable mean elevation, on which the hills, such as the Rittnerhorn, are mere humps, that hill being 'rewarding,' as the guide books say, only for its view, for the actual climb is merely a trudge over grassy slopes, with little to distract attention from the heat and the toil. Into this undulating plateau narrow but deep valleys have been cut; one, the Eggental—(der enge Tal)—is called narrow *par excellence*, but all have to a greater or less extent the same character,

and therefore access to the Dolomites from Botzen is relatively difficult. The Dolomites themselves, which are the feature of the eastern view, rise up in the towers, pinnacles and

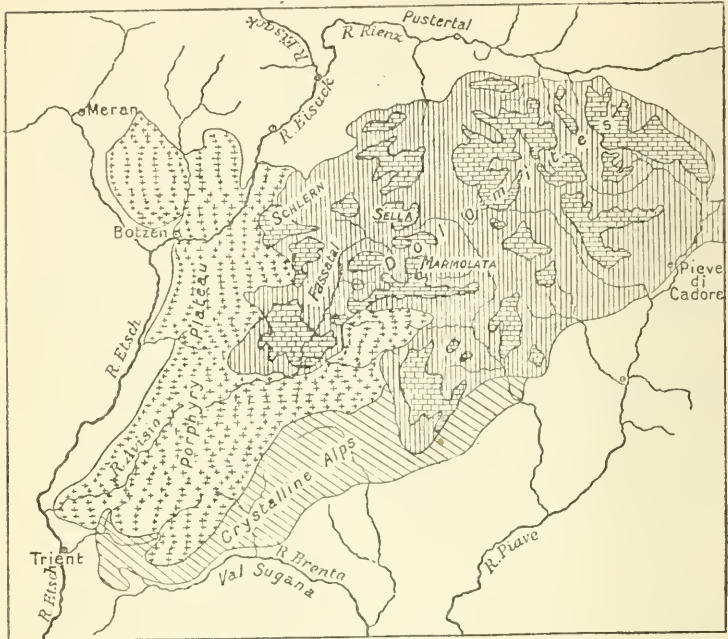


FIG. 15.—Geological Sketch-map of the Dolomite Region.

(Modified from Krebs.)

The Dolomite region proper is shown by vertical shading, while the mountains within it are indicated as limestone islands rising from the surrounding softer beds. The bounding river valleys, broadly speaking, are the Etsch, then the Eisack, the Rienz (Pustertal), Piave, and Brenta (Val Sugana). To the north of the Pustertal, not shown on the map, lie the Central Crystalline Alps, but an isolated part of these appears to the south of the Dolomite region, as shown, forming the Cima d'Asta. The western boundary is the porphyry plateau of Botzen, shown by crosses. To the east, not shown, lie the Calcareous Alps of Venetia.

massive blocks, on which so many epithets have been lavished, from the eastern edge of the plateau, their edges having been cut and gashed by the agents of erosion. Rather closer obser-



The Sella Group, from near the Sellajoch Hospice. The stratification of the Dachstein limestones forming the upper part of the mountain group is well seen to the left, and also the flat shelf due to the outcrop of the softer beds at the summit of the lower unstratified limestone. Note the contrast between the smooth undulating alp with its rich pasturage, and the massive limestones, fretted into towers and pinnacles at the margin. See p. 218, and compare Frontispiece.

(Photo by Kilophot, Wien.)

vation will show, even from this distance, that they spring, often with great abruptness (see Plate XX.), from undulating grassy areas, which constitute the famous *alps* of the region. Although the whole Dolomite region, as we have seen, has been elevated as a block, yet the fact that the constituent rocks are diverse, and react differently to the forces of erosion, gives rise on the one hand to fantastic peaks (built up of calcareous beds) and on the other to pastures. The pastures are partly due to the outcrop of non-calcareous sedimentary beds, and partly to that of beds of tuff (consolidated volcanic ash) and similar types of rock, the result of submarine volcanic eruptions at the time when the calcareous beds were being laid down.

Before we leave the summit of the grassy knoll which has supplied us with these facts, let us consider one other question—how are we to reach the Dolomites from the vicinity of Botzen? As we have seen, they seem to break off sharp at the eastern edge of the porphyry plateau, and that plateau is gashed by narrow valleys. These valleys afford the most obvious, though not the easiest access to the region. That most frequently chosen is perhaps the Eggental, which leads by a picturesque and steep route to the Karersee, close to the wonderful Rosengarten group. From here the Fassatal is easily reached. Another route, very picturesque near its head, leads up the Tiersertal, the road here ending at Weisslahnbad, whence some fine paths enable the active traveller to penetrate into and cross through the heart of the western Dolomites.

Much easier but longer is the road which descends beside the Adige to Auer, and then crosses a low watershed to reach the long Avisio valley, which, under several names, runs far up into the heart of the Dolomites, to end as the Fassatal. This route forms a part of the great Dolomite road from Botzen to Cortina, and is the only one open to motor-car traffic. Finally, further to the north, the Grödnertal, on the

margin of the Dolomites, permits of fairly easy access to the foot of the Langkofel, which we may regard as the centre of the western Dolomites.

By whatever route we choose we may expect to find ourselves ultimately somewhere near the base of the Langkofel, and thus for the first time surrounded by Dolomites, instead of merely viewing them from the outer side, as we did from the Rittnerhorn. The first feature which strikes us, and that which has a considerable bearing upon the popularity of the region with walkers, is, if one may put the point without paradox, the vicinity of the mountains to the valleys. The members of a certain school of British climbers are accustomed to speak of the Dolomites with great contempt, as fit only for the aged and infirm—as mountains which one can stroll up between breakfast and lunch. The statement, despite its obvious exaggeration (for the Dolomites contain some excessively difficult peaks, long held to be impossible), has some basis of truth in it. Thus the distances are certainly short, the change in the character of the scenery, as compared with the Central Alps, very rapid, and yet, owing to their great steepness, the mountains are highly impressive. In a very short space of time one may rise from a flower-bespangled alp to a crag absolutely devoid of vegetation. We have already stated that this is due to the alternation of calcareous beds with non-calcareous ones; let us, however, clear away a few misconceptions in regard to these before elaborating the point.

Dolomite (from Dolomieu, a French geologist) is the name applied to a rock which, instead of consisting mainly of carbonate of lime like an ordinary limestone, contains also carbonate of magnesium. It is harder than ordinary limestone, does not effervesce with cold acid, and has some other characters which need not detain us. Not all the limestones of the Dolomites consist of 'dolomite'; the region is rather one in which dolomite occurs than one in which all limestones

appear in the dolomitic form. Further, it seems fairly clear that the dolomitisation was a chemical change which took place after the formation of the limestone; the difference between the two is not due to a difference of origin, but to the absence in one case of a subsequent change which took place in the other.

Now it is possible that some of those isolated mountain blocks which stand up sheer from the surrounding alps represent the remnants of coral reefs, built up in comparatively shallow water off the shore of an old land mass which lay to the north. On the floor of the shallow sea volcanic eruptions now and again broke out, killing the corals and other lime-secreting organisms, and leading to the deposition of sheets of fine volcanic mud. Elsewhere also streams entered the shallow sea and laid down deposits of land-derived mud and sand, which similarly rendered particular parts of the sea unsuitable for animal life. The consequence is that the deposits change greatly in character over short distances, and when, long ages afterwards, the old sea bottom was raised to the surface, the forces of erosion acted in a selective fashion, wearing away the softer non-calcareous sedimentary beds and the volcanic tuffs, and acting far less rapidly on the calcareous beds. Thus, according to one view, some of the existing mountains represent the remains of coral reefs, dissected out by wind and weather from the beds in which they were once buried.

According to another view, that phenomenon of overthrusting which certainly occurred in other parts of the Alps also occurred here, and the calcareous beds represent, not rocks formed in the position where they occur, but blocks which have been shoved over the underlying beds, and have thus come from a distance. The discussions which have arisen over this question do not concern us here, but it is well to have a little clearness on the coral reef affair. No scientific view holds that the present form of any Dolo-

mite mountain is *directly* due to its origin as a reef on the sea-floor, a position which finds extreme statement in not a few popular books on the region. Further, at most only some of the mountains are regarded as of 'reef' origin, these lying chiefly to the west.

That traveller is fortunate who, having descended from the public motor at the Falzarego Pass to see the view, does not find among the group of his fellow-passengers a clergyman, blue with cold but didactic to the death, and convinced that duty calls him to tell all who will listen of the marvellous work of the industrious 'coral insect,' who, cell by cell, built up these towering mountains from the deep sea-floor. The 'coral insect' is as mythical as the unicorn, and its survival in literature is due only to its usefulness to journalist, politician and parson. Strive, therefore, to get rid of your early conviction that it not only lives but that it once sat down on the floor of an azure sea, in order to construct the Cinque Torri as a means of furnishing a livelihood to these of the peasants of the Cortina valley who are sure-footed and steady of head, and to impart a telling illustration to sermon or article.

Now let us note the actual composition of the beds of which the Dolomites are composed, for this has a direct bearing upon the appearance of the mountains. Reducing the succession of beds to its simplest form, we may say that we find at the base tuffs, shales, marls, etc., with the volcanic element largely predominating to the west and diminishing to the east.

Above this lies the Schlern dolomite, a massive dolomitic limestone which is unstratified (*i.e.* shows no or very few bedding lines), and is apparently a reef formation (but see p. 215). In any case the point of importance is that it does not form a continuous layer, but occurs in great blocks, the limestone masses passing horizontally into detrital beds. It is much thicker to the west than to the east.

Above this lies a layer of shales and marls forming what

are known as the Raibl beds, which weather rapidly to form extensive screes. Above the Raibl beds, and far more prominent to the east than to the west, lies what is known as the Dachstein limestone, which is sometimes, but not always, dolomitic. In contrast to the Schlern dolomite this limestone is stratified, that is, there are well-marked bedding lines, and in consequence it weathers to form straight-edged precipices, and tends to give rise to broad plateau-like summits, not towers and needles like the Schlern dolomite. Further, instead of occurring in blocks of limited extension, like the Schlern dolomite, it once formed a continuous sheet, and thus the mountains in the regions where it predominates are less isolated than in those where the Schlern dolomite prevails.

The whole area, be it remembered, has apparently been elevated *en bloc*, but the elevation has been greater to the west than to the east, or else the strata had an original tilt in this direction. To the west therefore the Schlern dolomite predominates, with at best a thin layer of Dachstein limestone on its summit. To the east the Dachstein predominates, and we have a resulting well-marked contrast between the different types of Dolomites.

If this account seems needlessly geological, let us take a few typical peaks to show what light it casts upon their structure and form. We may begin with the Schlern (Plate XIX.), which is a very disappointing or a very attractive mountain according to one's standpoint. Seen from near Botzen, as already noted, it displays splendid precipices and towers, and there are several ways up it which offer at least minor excitements. If the tourist adopt one of these routes, he will eventually emerge upon a broad sloping plateau, grass-grown, rich in flowers, including some wonderful primulas, but as a mountain summit lacking in incident. On that wide plateau he will find the extensive Schlernhäuser, and within them the motley crowd whose presence is an indication that some

routes up present no notable difficulties. When he has strolled from the huts to the summit, however, he will obtain fine views of those precipices which first drew his attention to the mountain, and will note that the summit rocks are bare stratified Dachstein beds, as compared alike with the unstratified Schlern dolomite which forms the western precipices seen on Plate XIX., and the grass-covered tuffs which form the slopes towards the Seiser alp. Further, near the summit the Raibl beds appear in their usual position below the Dachstein, though they do not form so obvious a structural feature as in the case of the Sella group (see below). Thus, to sum up, the Schlern owes its flat top to the appearance of the Dachstein beds at the summit, its precipices on the west to the unstratified Schlern dolomite, its slope towards the surrounding alps on the other sides to the way in which the reef of which it is composed thins out, towards the regions where copious deposition of volcanic beds took place.

Now contrast the Langkofel group, in some ways the most beautiful of the Dolomites. Here, except for the Plattkofel, which from one side presents no great difficulty (though it is not a pure tourist's mountain like the Schlern), all the peaks are difficult, the Fünffingerspitze very difficult. All are composed of the unstratified Schlern dolomite and rise like peaked and pinnacled icebergs from the smooth green pastures around. Only on the extreme summit of the higher peaks, the Langkofel and Grohmann Spitze, is there a little cap of Raibl beds, which have no noticeable effect on the form of the mountains.

We may add that those who do not wish to climb may obtain a good idea of the constituent rocks of the group by ascending, preferably from the south, to the Langkofeljoch, crossing this pass to the Langkofel Hütte, and then descending to the Grödnertal by the beautiful Confinboden with its copious springs and lakelets. Starting from the Sellajoch,

the ascent is made over sedimentary beds, decomposed to form extensive screes to the jaws of the pass, where we penetrate the dolomitic masses, and then descend to volcanic tuffs, which floor the alps of the Gröden valley.

Now let us turn to the Sella group (see *Frontispiece* and *Plate XX.*), so imposing from almost any point of view. Its summit forms a plateau, above which the individual peaks do not project greatly, but the special feature, and one which adds greatly to the scenic effect, is the fact that the bounding precipices of the plateau are interrupted, practically round the whole area of the massif, by a wide shelf. This shelf, by giving the eye something whereby to measure distances, adds much to the impressiveness of the group. Above it the limestones are stratified, hence their tabular appearance; below they are unstratified and break at their edges into towers and pinnacles. In other words, the upper beds are made of Dachstein dolomite, the shelf is due to the easily-weathered Raibl beds, and the lower precipices, the base as it were of the great earth block, are built up of Schlern dolomite.

Those with some taste for rock-climbing can form an admirable picture of the structure of the group by starting from the Sellajoch, and, after crossing the grassy alp, ascending by means of the Pössneckerweg with its iron steps and wire ropes the sheer cliff of the Schlern dolomite. Just about the time when the occupation of clinging like a fly to the surface of a precipice begins to pall, one emerges upon a shelving platform, where drinks are the order of the day. After a rest and the replacement of kletterschuhe by boots one continues over the platform, with no climbing and but little change of level—this is the shelf made by the Raibl beds. After a time a fresh series of precipices rise above the jaded climber. These, however, are not high, and they are easily surmounted, partly because of the stratification. Soon one emerges upon the snow-clad summit level of the massif,

with a gorgeous view around, and a great half-circle of peaks stretching before one, which show but little difference of height. Half-circle is perhaps scarcely descriptive, for the circle would be complete were it not that the deep valley called Val Lasties has, as it were, cut down the mountain wall at one place, and opened a deep gash in the centre of the circle, so that one may compare the group to a gigantic saucer with a broad wedge-shaped piece knocked out of it. Owing to the depth of the valley we must keep along the rim of the saucer in order to reach the other side of the group till, opposite our point of entrance, we come to the Boéspitze, the highest peak of the massif.

This journey will confirm in us the view that the presence of a surface covering of Dachstein rock in a Dolomite massif tends to increase the amount of surface at summit level, *i.e.* to produce plateau-shaped mountains. As this formation predominates generally to the east, we have a contrast between the fantastic peaks, *e.g.* the Rosengarten and Langkofel groups, of the west, and the broader summits of Tofana, Sorapis, Cristallo, and so forth, in the east.

But this is not quite the whole story, as a couple of examples will show. Thus the Marmolata, which has a very steep southern wall, and a gently inclined northern one, is built up of Schlern dolomite, not, as one might suppose from its shape, of Dachstein beds. On the other hand, the Drei Zinnen, the curious Cinque Torri, the fine peak of Croda da Lago, the Becco di Mezzodi, and so forth, despite their peaked and pointed appearance, are built of Dachstein limestones and dolomites, as one may learn from their marked stratification. But here, in contrast to the west, where the peaks are perhaps isolated coral reefs, the pointed appearance is due to the dissection of a once continuous bed of limestone.

The Drei Zinnen, those blunt pyramids rising from a base of weathered rock, cannot fail to attract the attention of the tourist, who even in a photograph can note their

obvious stratification. The mass of scree from which they rise is due to the weathering of Raibl beds, so that the peaks may be said to correspond to the top of the Sella plateau, no underlying base of Schlern dolomite being visible here.

We add at the end of this chapter some notes on books, popular and detailed, which will enable the reader to pursue his studies of the Dolomites further. We have not here dwelt on the wonderful colouring of the region, on the contrast between the bare walls of rock above and the meadow and forest land below, on that between their glowing tints in the sunset light and the dead white snow which covers the summit plateaux and the shelves and ridges, on the stains and markings imprinted by the weather on every precipice, here rusty and ominous, there blackened as though by smoke. All these points have been already dwelt upon in many popular works. The point we would emphasise is that here, far more than in the Central Alps, access to the secrets of the mountain is easy, and the warm deep valleys invite when the mountain peaks are obstinately veiled in mist. Further, few regions are so well calculated to arouse an interest in geology, and few offer so much scope for collecting, whether the interest lie in fossils, or in rocks and minerals. Finally, unless tower and ridge are to be assailed with the help of guide, one has here a delightful sense of freedom in wandering over the flowery meadows; dipping down the steep gullies where the dry torrent bed affords so convenient an access that ladders are actually fastened from block to block in what must be the fairway of the stream in flood-time; turning up promptly for meals at the huts to find and greet the chance acquaintances of yesterday; daring greatly one day, not without secret trembling, and another spending long hours tossing pebbles into the brook. If one avoids the larger resorts and the big hotels it is all so simple, so homely, and if a period of the simple life threaten to produce boredom or self-righteousness—its two great dangers—it is so easy

to make a sudden raid upon civilisation, to squander the savings of an economical week in one glorious hour of crowded life—to the accompaniment of an orchestra ('all prices raised during the concert'). A charming region, well-suited to those of simple tastes and adaptability of temperament!

REFERENCES. The more general books mentioned at the end of the preceding chapter discuss the Dolomites as well as the other parts of the Alps (see especially Krebs' book, and Geikie's *Mountains*). Gilbert and Churchill's book, *The Dolomite Mountains*, 1864, has been already mentioned; Miss Betham Edwards' *Untrodnen Peaks, and Unfrequented Valleys* may also be consulted. There are a considerable number of recent English books, mostly dealing rather with history and legend than with geography or geology. Hamer's *Dolomites* may be named among these as giving a simple and unpretentious description of the usual routes. Climbing books on the region are numerous; two may be specially mentioned. Sanger Davies' *Dolomite Strongholds*, second edition, 1896—an entertaining book with remarkable sketches by the author, and blood-curdling accounts of climbs, most of which now rank as very ordinary performances well within the capacity of very moderate climbers—is one of these. It is a good book to lend to your unsophisticated friends after a climbing holiday in the region. The other book referred to is *The Climbs of Norman-Neruda*, edited by May Norman-Neruda, a morbid and depressing piece of work, but one which impresses certain of the features of the mountains upon the mind.

Mrs. Ogilvie-Gordon's views as to the occurrence of overthrusting in *The Dolomites*, to which allusion was made on p. 215, are set forth in a series of scientific papers, presented to different learned societies. Two of these may be specially mentioned, 'The Geological Structure of Monzoni and Fassa,' *Trans. Edin. Geological Society*, special part, 1902-3, and 'The Thrust-masses in the Western District of the Dolomites,' *Do.*, 1909-10. A good general description of Tyrol is given in *Tirol*, by Max Haushofer, in a series called *Land und Leute, Monographien zur Erdkunde*, 1889. This book has some fine illustrations. Finally, the annual volumes of the *Zeitschrift des Deutschen u. Oesterreichischen Alpenvereins* should be consulted. They contain, in addition to articles both upon climbing and upon scientific topics, often beautiful illustrations and fine maps.

CHAPTER XVII

NAPLES AND VESUVIUS : A STUDY IN VOLCANIC ACTION

' Consider farther how the nether fires are daily and nightly forging, in the great central furnaces, new granite mountains, even out of that old worn rubbish ; and new plains are spreading themselves forth in the deep sea, bearing forests now only of tangled algæ, but destined to wave with yellow corn.'

WE have discussed in some detail the origin and characters of those mighty mountain ranges which, with their intervening valleys, furrow the surface of Europe, and shall describe later one example of those regions of worn-down stumps which are all that remain of the lofty chains of an earlier time—a time before yet the earth was ready to serve as the home of land animal or the higher land plants, aeons and aeons before man appeared. Let us now turn from the all but imperceptible movements which built the Alps to another phenomenon, intermittently observable at different parts of the earth, which has impressed man's imagination in a fashion out of proportion to its real significance.

So slow is the process of mountain building in relation to the time during which man has had the intelligence to observe, that the hills have been for him the unchanging and the everlasting, until, only as it were yesterday, he has been able to decipher some part of their complex hieroglyphics, to deduce from an accumulated mass of apparently unimportant details the fact of their changeableness and instability. On the other hand, volcanic action—in essence but a sign

and a symbol, an effect of the great forces which build mountains—has been to him the expression, the true reality of the powers outside himself. Nor has this point of view been wholly without justification. The periodic outbursts of the nether fires, so trifling to the geologist with all time for his province, and the battle-ground of warring species for his field of study, have often been for the ordinary human being catastrophes whose immensity is beyond the range of his powers of expression.

Myriads of men and women have lived and died since a mere handful of them were overwhelmed in that ignoble city on the shores of the Bay of Naples ; but while the earthquakes, the famines, the pestilences which between then and now have wiped out before their time untold numbers of human beings give most of us but little concern, few can wander through the trivialities, the improprieties, the occasional beauties of Pompeii without emotion. Even the crouching dog whose image at the moment of death is to be seen beside those of man and maid gains an unexpected pathos from its surroundings. Perhaps we can always seize a richer joy in life from the thought that at any moment Mother Earth may repent herself of her prodigal giving, may destroy with the same recklessness with which she creates. Or is it only the fact that the city by the sea and some of its one-time inhabitants have, as it were, risen from the dead to enduring life which thrills us ? Is it the perception that their apparent destruction was in essence but a becoming imperishable which satisfies our human craving for permanence ? In any case, while to appreciate the significance of the Alps requires some imagination, to enjoy Naples and Vesuvius we need only our common humanity.

But the very breadth of their appeal means that they have been described times without number, and we shall not therefore attempt to add another to the many existing descriptions—scientific, eloquent or bombastic. We shall

only strive to point out some details which might escape the ordinary tourist, in order to quicken expectation, to fill up possible blanks in the picture, whose background is the clear air, the blue sky, the limestone cliffs, the groves of oranges and lemons, the dark pines.

Let us consider first the elements of the landscape. In the vicinity of Naples, as in Italy in general, the land forms are dominated by the existence of the Apennines, which run through the whole continent, in a general north-west to south-east direction. As we have already seen, the Apennines are a continuation of the earth folds which built the Alps, though in the neighbourhood of Naples, as in parts of the Eastern Alps, it is faulting and local elevation of blocks of land which give rise to the prominent features rather than actual folding.

We saw in the case of the Alps that an essential factor in their formation was the presence of rigid earth blocks in front of the rising folds, against which these folds as it were broke. A similar rigid foreland seems to have existed in the case of the Apennines, but it is now largely submerged beneath the sea. On the coast of Tuscany, in Corsica, Sardinia, in north-eastern Sicily and parts of Calabria, there appear old rocks which are believed to be remnants of an old Tyrrhenian continent, the foreland which once blocked the rising Apennines. In association with the earth movements, during which this continent sank beneath the sea, there broke out here, as under similar circumstances elsewhere, a chain of volcanoes, of which, on the mainland, Vesuvius is the most southern and the only one still active. With the same earth movements, and the consequent instability of the Tyrrhenian Sea, we have to associate the earthquakes which so frequently devastate Sicily and Calabria.

The result of the activity of the mainland volcanoes has been the production, between the Apennines and the Tyrrhenian Sea, of a broad belt of volcanic rocks, of varying characters and fertility. For example, while near Naples

it is to the volcanic beds that the Campania owes its great natural wealth and dense population; on the other hand, the tuffs from the extinct volcanoes of the Alban Hills, which floor the Campagna near Rome, make that broad plain a swamp or almost a desert according to the season, and produce the curious anomaly of an almost uninhabited region close to a great town.

With these broad facts in mind let us turn to the details of the structure of the region round Naples. We have spoken of the general direction of the Apennines, but we must note that just to the south of Naples a long ridge runs out seawards at right angles to the main chain, and forms the peninsula of Sorrento, with the island of Capri at its extremity. The promontory which constitutes the other arm of the beautiful bay, prolonged into the islands of Procida and Ischia is, on the contrary, of volcanic origin, this promontory being the famous Phlegræan or Burning Fields, so-called in contrast to the smooth and fertile plains of the Campania Felice. On these plains, between the two arms of the bay, rises the great steep-sided mountain of Vesuvius, whose internal fires are still burning. The Campania Felice is floored by volcanic beds which were probably thrown out by submarine volcanoes, and even Vesuvius itself seems to have been built up from the sea-floor.

We see then that the landscape round Naples is of exceedingly diverse origin, and its world-famed beauty, in so far as it does not rest on the colours of sea and sky, of orange grove and orchard, is due to the variety of form and structure. The distance from arm to arm of the bay is some twenty miles, and no contrast could be greater than that between the white limestone cliffs (Plate XXI.) and fault scarps of Sorrento and Capri, and the strange craters and mounds of the Phlegræan fields; between the fertile slopes of the flanks of Vesuvius and the bare ash cone (Plate XXII.) and slaggy, absolutely barren, lava streams in its upper region. There

PLATE XXI



Limestone rocks off the shore of Capri.

can be few localities also which offer within so short a radius so great a variety of excursions, from the grottoes, natural arches, perpendicular cliffs and so forth of a limestone region, to volcanoes in all stages of diminishing activity.

If, before proceeding further, one may offer a word of practical advice to the tourist, it would be, if time is available, not to be in too great a hurry to ascend Vesuvius. The excursion, unless the mountain happens to be particularly active, is perhaps always something of a disappointment to those to whom it affords an introduction to volcanic phenomena, and its significance is best appreciated if the Phlegrean Fields have been visited first. Further, there can be no doubt that, especially on a fine day, a somewhat detailed acquaintance with the surroundings increases the appreciation of the view from the summit. It is a mistake to make the ascent before the general lie of the land is understood, at least unless a second ascent is to be made later.

Further, the tourist, especially such as are acquainted with long-extinct volcanic vents like those of Scotland, should be prepared to find the mountain excessively 'untidy.' Indeed particular persons have been known to assert that it was a merciful providence which placed Vesuvius in the vicinity of a city like Naples, for an energetic northern municipality would at once have advertised for tenders for the shovelling of the disfiguring mass of cinders which forms the summit-cone into the sea! Only a people which can contemplate with perfect equanimity heaps of rotten vegetables before its front doors could accept with composure that great mass of slipping, sliding rubbish which here receives the name of a mountain. In spite of its much lower height, Arthur's Seat, which is, of course, not a volcano but only its core, is to many minds a more imposing sight—especially when seen brooding in the moonlight over the sleeping city at its feet—than Vesuvius can be, even when it flames like a torch above the cities of the bay.

2 The reason is perhaps fairly obvious. In the case of Arthur's Seat the temporary, the insignificant has long since been eliminated; the showy but unimportant phenomena which attract the attention of the unphilosophical have died away: what remains is a permanent, an irrefutable testimony to the hidden fires which ultimately make life possible on the globe. One may perhaps, without fancifulness, compare the two regions to a recurrent phenomenon of human life. When one of those great social upheavals occurs which are themselves a testimony of the vitality of human society, the surrounding community mostly adopts one of two attitudes. There are those who are impressed, intensely impressed, by the mere outward expression. For them the dark cloud which overhangs Vesuvius, the appearance of flames in the darkness of the night, the showers of dust and stones, are supremely important. For others the essential insignificance of these phenomena masks the importance of the forces of which they are an indication. Like that superior person, the younger Pliny at the time of the destruction of Pompeii, such individuals, too prone to arrogate to themselves the title of philosophers, continue steadfastly to 'improve their minds' while their world rocks—regard the whole eruption as almost beneath their notice.

The same people, on the other hand, are willing to devote themselves continuously to the study of past social upheavals to which the present seems to them to offer no analogy. Thus many travellers in Italy to-day manifest great interest in the Risorgimento, which, now that it has been accomplished, and has been, as it were, purified by time, has become a phenomenon of interest even to the superior person. To the Austrians of the period, on the other hand, the often futile attempts of the Italians to free themselves seemed as trivial and as childish as did certain equivalent phenomena at home to unimaginative Britons to-day. Alike in nature and in human life the great task of the thoughtful is to strive

PLATE XXII



Near the summit of the cone of Vesuvius, showing the unstable slopes of dust, 'ashes,' lapilli, etc.

to perceive the significant beneath the dust and the triviality of the present.

In order then to realise what lies hid beneath Vesuvius' cloak of dust and slag let us turn for a little to the older, and therefore in some respects simpler, phenomena of the Phlegræan fields.

In the first place we must note that, as already stated, the plains round Naples are floored by volcanic deposits which have been rearranged by water. From these plains rises the conical mass of Vesuvius, built up round one great vent, though the actual form of the mountain has differed greatly from time to time—a point to which we shall return. In contrast to the persistent vent of Vesuvius we have in the Phlegræan Fields a considerable number of volcanic apertures, each of which has had a short period of activity, sometimes, as in the case of Monte Nuovo, limited to one great outburst. Thus while the constant additions which have been made to the pile of Vesuvius have enabled the mountain to resist as a whole the action of denudation, though constant changes of form, especially near the summit, have taken place, the limitation of the activity of the separate vents of the Phlegræan Fields has led to the wearing down or partial removal of the smaller cones which were produced by the separate eruptions. In consequence we have here only ruined craters, volcanic 'cones' so worn as to be apparent only to the trained eye—generally a mass of hills and circular or semi-circular plains or basins, instead of one massive mountain. The identification of the separate foci of eruption is therefore not always easy, and there is not complete agreement among different investigators as to their number. Some twenty-six or so have, however, been traced with some certainty, and a special feature is the way several of the old craters have been, as it were, breached by the sea on their southern or eastern sides. The harbour of Misenum is an example, while the Cape of the same name is but a fragment

of a crater wall left standing. Indeed Naples itself seems to stand upon the site of a long extinct volcano, whose crater wall has completely disappeared on the south-eastern side. According to one view, the range of hills which extends from Capodimonte through St. Elmo to Posillipo, and gives the town so much of its beauty of situation, is the remains of the crater wall of a huge volcano which once stood here.

We cannot attempt here to give an account of the separate volcanoes of the Phlegræan Fields. That to which tourists devote most of their time—the Solfatara—may serve to illustrate their chief features.

The Solfatara, which has been studied perhaps more than any other volcano, is very easy of access, and has even given its name to a stage in the dying out of a volcanic vent. We approach it through an artificially lowered gap in the crater wall, and have then before us, ringed round by a steep rampart, the almost circular crater, giving the impression of perfect flatness, partly overgrown with vegetation, and elsewhere floored with bare white earth. To emphasise the contrast with Vesuvius we must give a few figures.

As we have already stated, the crater wall is breached at the entrance gate, and here it rises only some 65 feet above the flat plain within. Elsewhere the walls reach a maximum height of some 340 feet above the level of the crater, and about 650 feet above sea-level, for the floor of the crater lies only some 300 feet or so above the level of the adjacent sea. Thus the walls, apart altogether from the entrance, vary considerably in height, but show everywhere the characteristic feature of being very steep internally, and having a much gentler slope on the outer side. The diameter of the crater is some 300 yards—it is altogether a toy volcano, a natural model, whose very activity is, as it were, modulated so as to give the inquiring tourist some insight into volcanic phenomena, without any trace of danger or even of discomfort.

PLATE XXIII



The guardian of the pit--Bocca Grande at the Solfatara.

Apart from the shape, the special point of interest is the fumaroles, as they are called—the holes on the crater floor and sides from which water vapour and other gases are given off. Perhaps the most interesting of these lie on the bare part of the floor, which sounds hollow beneath one's feet because of the pores and cavities in the subjacent rock through which the gases rise. As one walks across its white surface little columns of vapour are seen rising into the clear air, specially distinct after rain, or early in the morning before the sun has full power. The guides, each with his inevitable cigarette, stoop down over one of the holes and blow a puff of smoke into it. Immediately from an adjacent fumarole a cloud of white vapour arises. A torch or a fragment of burning wood will similarly increase the evolution of fumes. The phenomenon seems to be largely one of condensation. The escaping gas consists largely, though not exclusively, of water vapour, and the particles of smoke serve as nuclei of condensation, the effect produced being similar to that of a London fog, where vapour condenses round the particles of soot in the air. In the case of the torch, further, the raising of the temperature of the earth increases the evolution of vapour, which condenses in the cooler air.

In addition to the fumaroles on the floor of the crater others occur in its wall, especially in the S.E. angle, where the so-called *Bocca Grande* occurs (Plate XXIII.). This is partially an artificial shaft, from which copious fumes arise, while deposits of sulphur, sal ammoniac, and so forth are obtained.

Without elaborating the description further, we may simply accept the statement that the Solfatara is a dying volcano which has never been really active throughout the historic period, for the so-called eruption of 1198 was probably not more than a considerable overflow of gas, accompanied by earth tremors.

To what does it owe its present form? It is almost cer-

tainly what is known as an explosion crater, and thus helps us to appreciate the present shape of Vesuvius and the changes which that mountain has undergone. At some unknown period in prehistoric time the present site of the Solfatara was occupied by a conical hill, a true volcanic cone. This volcano, as we know from the composition of the present crater ring, threw out ashes, later compacted into tuff, and from it also there welled out lava flows. Then came a period of quiescence, when the chimney of the volcano was plugged by consolidated lava, for the lava of the Solfatara is of the kind which sets rapidly. The plug of lava we may describe as hermetically sealing the subterranean kettle. But within the kettle steam and other gases were continually being generated. In course of time the expansive force overcame the resistance of the lava plug, and the whole top of the mountain was blown into space—not only the lid of the kettle, if we may continue the metaphor, but the whole of its upper segment. The present Solfatara is thus the bottom half of the original cone, the gaping wound at the summit which we call the crater remaining to mark the force of the explosion. Since that great explosion the kettle has continued to emit bubbles which find an easy escape at the surface, and no new catastrophe has taken place. A volcano which presents this resemblance to a burst boiler is said to have an explosion crater, and of this on a small scale the Solfatara is an admirable example.

After this study of a toy volcano we are better prepared to appreciate Vesuvius, where the same thing has occurred more than once, and on a gigantic scale. If we take the precaution already recommended of becoming familiar with that mountain from several points of view before ascending it, these statements will be readily understood.

The most familiar view, perhaps, owing to its constant reproduction, is that from the forum at Pompeii. There we see the steep-sided, rubbly, vegetationless cone, with its

relatively small summit crater, rising from the far gentler, orchard-covered slopes below. To the right in the Pompeii view, and therefore to the east, rises another hill, not at the present time greatly inferior in height to the cone, but separated from it by a wide, more or less flat, valley. This is Monte Somma, and it is easy to observe that it forms approximately a half ring round the present cone, for it is complete on the north and east sides, while to the south and west it is absent. The broad valley between the cone and Monte Somma is the Atrio del Cavallo, which has a general resemblance to a carriage way, though, as we shall see, its floor is far from even.

Note next the slopes of Monte Somma. These are extraordinarily steep on the inner side, that towards the Atrio, but very gentle on the outer side. If the lessons of the Phlegræan Fields have been learnt it will be at once obvious that this shows that the existing Monte Somma is the remnant of a once continuous crater ring, and that the present cone is 'parasitic,' that is, it has been formed on the floor of a vast prehistoric crater. The Atrio del Cavallo is the gap between the base of the new cone and the inner edge of the old crater wall.

Since the great eruption of 79 A.D. Vesuvius has been active, with periods of intervening repose, periods which have been short since the sixteenth century. Before the beginning of our era we have practically no direct information in regard to the mountain, but a considerable number of deductions can be made on the basis of the deposits of Monte Somma. Thus it is believed that the original volcano was submarine, and that there was gradually built up a huge cone, which at the time of its maximum development probably attained a height of 7000 feet, some 3000 feet greater than at present. At some unknown date a great paroxysmal eruption, or a series of such eruptions, took place, and, as at the Solfatara, but on a far grander scale, an explosion crater was formed, the whole

top of the mountain being blown into space. The result was to form the Vesuvius of the early Christian era, with its huge crater, overgrown with wild vines, in which the gladiator Spartacus and his army had a little earlier taken refuge.

When the great eruption of 79 occurred, half the crater ring was destroyed, leaving the other half as Monte Somma, and either then or at a later date a central cone with a summit crater was built up. Subsequent eruptions have greatly modified the central cone, which was considerably altered in shape so lately as the eruption of 1906, and these modifications enable us to distinguish between two main types of Vesuvian activity. These may be best understood by a brief account of the recent activities of the mountain. But before proceeding to this it may be well to note that Vesuvius is an example of what is called a mixed volcano. Some volcanoes eject only fragmentary matter—called dust, ashes, scoriæ, bombs, and so forth, according to its nature. Others, and of these the Sandwich Island volcanoes are the best-known examples, only give forth lava. Vesuvius, on the other hand, produces both fragmentary matter and lava, the former predominating.

With regard to the lava a few words of explanation are necessary. We all of us begin our actual survey of Vesuvius with some vague reminiscences of geography lessons in mind, and most of us are apt to assume that lava comes out of a volcano by a process analogous to the boiling over of a pan of toffee. But the existing cone of Vesuvius, we may repeat, is built up of the loosest, most incoherent material. Anything less like the edge of an iron saucepan than the rim of the present crater can scarcely be imagined. The usual process of lava emission may be regarded as something like the following :—

Suppose we have a toffee pan without a handle, and sink it through one of the rings on the top of the kitchen stove into the heart of the fire. Pile up on the stove round the

opening of the ring a great heap of loose sand, to form a truncated pyramid, with an aperture at the top. Presently the toffee boils over. It cannot spread at once over the top of the stove, for the sand cone stops it, but sooner or later it succeeds in making a rent at some part of the sand cone, and trickles out and down the lower slopes of the cone. The stove-top except at the centre is presumed to be cool, so presently our toffee consolidates and makes little heaps comparable to what are called lava cones. But to make the whole model like Vesuvius we should have to add an incomplete outer ring of solid material. Then the uncovered part of the stove-top between the outer and inner rings would be the *Atrio del Cavallo*, and the heaps of burnt toffee would represent the lava cones which rise from its surface. In brief, in Vesuvius the lava does not generally well over the lip of the crater at the summit of the cone, but finds its way out through fissures in the sides of the loose incoherent mass.

Returning to our model, let us note what would be likely to happen if the toffee oozed out extensively through the loose sand walls. Obviously the sand pyramid would tend to collapse in places, and the sand would fall into the toffee pan below. Suppose this resents the intrusion, and instantly spits out the intruding particles in a hot fountain—here is a working model of Vesuvius.

Now let us turn from the model to the reality. The great eruption of April 1906 was prepared for during some years previously. Thus in 1891 a great rent appeared in the north side of the cone, and from this or its vicinity lava flows occurred during a period of three years. These flows built up the hill now called *Colle Margherita*, which rises up from the *Atrio* and consists practically of nothing but lava—we may compare it to a consolidated mass of toffee. In 1895 another rift appeared on the N.W. side, and for four years lava flowed out from this gap and gave rise to yet another lava hill,

reaching a height of about 500 feet, measured from the floor of the Atrio, and now called the Colle Umberto. This fissure ceased to send out lava in September 1899, and for the four following years the activity of the mountain consisted chiefly in the ejection at the summit of the cone of fragmentary matter which increased its height, the emission not, however, being violent. From 1903 onwards lava flows again began to appear, and minor lava mounds were built up till the great eruption of April 1906, when new lava flows occurred, but the most striking feature was the falling in of the apex of the cone, and the resulting paroxysmal discharge of tremendous showers of dust and ashes, accompanied by larger blocks. The dust covered the whole upper part of the mountain as with snow, and great masses were carried over the lower slopes and plains to the north-east, involving great destruction, with loss of life, in Ottajano and the neighbouring towns and villages. The damage done by the lava streams was less important.

When the cloud which overhung the mountain cleared away it was seen that its summit level had been lowered, by an amount approaching 300 feet, this corresponding to the mass of material disseminated over the surrounding country. Thus we may contrast the two forms of activity displayed by Vesuvius as the ordinary or cone-forming, when the height of the mountain is increased by the addition of new material, and the paroxysmal or cone-destroying, when the summit collapses and is then blown into space as the so-called dust and ashes. Lava flows may accompany both forms of activity. Or we may put the matter in another way, and say that the ordinary form of activity results in the accumulation of material around the volcanic vent, while the paroxysmal eruptions carry much of the material far from the vent, and distribute it over the surrounding regions.

The modes of distribution in the latter case are interesting.

In the first instance the material is carried up to a great height by the force of the explosion, and while in the air it is subjected to the action of wind, which aids in the dissemination, especially of the finer particles. But this is not all. Much of the material of course falls near the vent, and after the last great eruption Vesuvius, as already stated, looked as though covered by a tremendous fall of snow. Now this material was exceedingly loose, and almost at once slipping occurred, compared by observers familiar with the Alps to avalanche formation. Thus the sides of the cone were furrowed by great valleys, down which ceaseless avalanches swept, until the loose material had more or less reached a position of equilibrium. Finally, when the rain came the fine material was turned into mud, called 'water lava' by the natives, which is often excessively destructive to cultivated ground, over which it pours in a flood. The walls which are so conspicuous a feature on the middle slopes of Vesuvius have for their object the protection of the cultivated land from these mud flows. At the same time we must notice that though the immediate effect of the dust on cultivated land is destructive, yet it speedily forms excellent soil, while on the other hand the lava flows, not generally in the case of Vesuvius of very great immediate importance, are excessively slow in decomposing to form soil, and remain for long periods barren and unsightly.

Thus we see that the ordinary forms of Vesuvian activity sterilise only the upper slopes of the mountain, which continually receive small accessions of fragmentary material, in addition to occasional lava flows. Even apart also from the fuming crater those barren upper slopes bear fumaroles from which gases arise. The great eruptions sterilise, either by lava flows or by hot fragmentary material, a much larger area, often at a considerable distance from the mountain summit, and this either directly or by the subsequent avalanches and flows of mud lava. But in the latter case nature

sooner or later repairs her ravages ; the villages are rebuilt ; the prolific population replaces the dead by new births ; new vineyards and orchards flourish on the sites of those destroyed—larger bands of tourists flock to enjoy new thrills. So the eternal processes of birth and death, of destruction and construction, go on. ‘ The quick spring like weeds out of the dead,’ who are speedily forgotten. Time was when Vesuvius was green to its summit, and that time will be again. However overwhelming any individual eruption may be, yet it has scarcely ceased before nature begins once again her ordinary processes of smoothing down hills and filling up valleys. It is these continuous, insignificant processes which are the really important ones ; the splendours of pine-shaped cloud and incandescent projectiles are fundamentally unimportant.

We cannot here discuss further the volcanic phenomena to be observed in Italy. It may be sufficient to say that all those interested in the subject will not fail to stop on their way southward to study the beautiful Alban Hills near Rome, to note the circular lakes, especially that of Nemi, and the wonderful fertility of the slopes of these old volcanoes, whose fires have long since died out, as compared with the almost barren Campagna. Such fertile regions, despite the common belief to the contrary, are not of very frequent occurrence in Italy. Much of her surface is built up of recent mountain chains, not very lofty, it is true, but yet, in the prevalence of limestones, which give rise to difficulties in the water supply, and in that of soft clay beds, which continually slip and do not permit of the establishment of permanent watercourses, very imperfectly adapted to human life. If then the volcanoes of Italy have often spelt disaster to her, they have, we must remember, also brought in certain areas permanent, self-renewing fertility.

REFERENCES. For the general subject of volcanoes, reference should be made to the ordinary text-books of geology and also to

Scrope's *Volcanoes*, an interesting old book, and Judd's work with a similar title. The best modern description of the Phlegrean Fields is that by Prof. de Stefani—'Die Phlegräischen Felder bei Neapel,' *Petermann's Mitteilungen, Ergänzungsheft*, 156, 1907, with descriptions of all the volcanoes. Another paper on the same subject is Günther's 'The Phlegrean Fields' in the *Geographical Journal*, x., 1897.

Almost all geological works give some account of Vesuvius, which has been perhaps more fully studied than any other volcano. A small book called *Vesuv u. seine Geschichte*, by Schneer and Stein-Nordheim (Naples, 1895), should be consulted, especially for its quaint illustrations of the mountain throughout the Christian era; the frontispiece, representing the emotions of certain climbers of an earlier date, is especially fitted to inspire gratitude for the labours of the industrious Cook. The Italian geologist, Mercalli, has written much on the mountain, and some of his results will be found in his general book called *I Vulcani Attivi della Terra* (Milan, 1907). Dr. Johnston-Lavis has also contributed many papers to the literature of the subject; two of his papers, 'The Geology of Monte Somma and Vesuvius' (*Quart. Journ. Geol. Soc.* XL., 1884), and a paper in the *Transactions* of the Royal Dublin Society, reprinted as *The Eruption of Vesuvius in April, 1906* (Dublin, 1909), are especially interesting. The latter has some very instructive photographs. Reference should also be made to two papers by Lacroix on the same eruption in the October and November numbers of the *Revue Générale des Sciences* for 1906, also with excellent illustrations.

CHAPTER XVIII

BETWEEN THE MOUNTAINS AND THE SEA

‘ Son Monaco sopra un scoglio,
Non semino e non raccoglio,
E pur mangiare voglio.’

‘ I AM Monaco seated on a rock ; I neither sow nor do I reap, and yet it is my desire to eat.’ The words might be said of most of the townships along that favoured belt where Monaco lies, and we might add, in the expressive phrase for which there is no good English equivalent, that Monaco no less than its companion towns and villages has a strong desire ‘ to eat well.’ But we must in justice admit that the absence of sowing and reaping is fundamentally due rather to natural conditions than to human wickedness, and that do what it may with intensive gardening, the population along this belt by the azure sea must in the long run chiefly depend upon its wonderful winter climate—its great asset in the market of the world. We have already said something of the characters of that climate, let us now look in a little more detail at the general features of the French and Italian Rivieras.

The Alps, as we have assumed throughout in this book, form a temperature divide, a fact which is borne in upon the northern tourist as his train sweeps out of one or other of the great tunnels, and swings and sways down to the plains through lands clothed first with chestnut, then with mulberry and vine, or even olive. Their apparent importance as a dividing line of climate is greatly accentuated by the fact that their protective influence is most marked at their base,

where also the scenery is naturally picturesque, so that the region is much visited. The shores of Maggiore (in part), of Como, Lugano, and, especially, of Garda, are thoroughly 'Italian' in character, and at certain seasons of the year impress the traveller greatly owing to the contrast of their vegetation with that further north (Plate XXIV.). But we must not forget that beyond the sheltered 'Italian' belt at the foot of the Alps, comes the broad, uniform, 'Mid-European' Plain of Lombardy, which, in its sharp contrast of summer and winter temperatures, in the period of its rainfall, in its adaptation to cereal-growing on the large scale, in the scanty development of trees and in the absence of delicate plants like the olive, is strikingly different from much of Italy proper. Thus not the whole of Italy is Italian in climate and vegetation.

Note next the position of the Riviera. We have spoken already of the great curve taken by the Alps and of the fact that as the Maritime and Ligurian Alps they are practically continuous with the Ligurian Apennines, which begin at the Col or Bochetta d'Altare. Now the Apennines as a whole constitute a far more marked climatic divide than do the Alps, and the narrow belt between the Ligurian mountains and the sea, is, as it were, the concentrated essence of Italy. Here the climatic belts of that country are telescoped upon one another; here at sea-level we have a climate which cannot be found again without travelling south nearly as far as Naples. The Ligurian Apennines, continued into the Ligurian and Maritime Alps, are the northern boundary and the *raison d'être* of that favoured tract which we call the Riviera.

But we must notice, as a reason if not a justification for Monaco's predatory instincts, that the causes which give the region its splendid climate almost necessarily deprive the more favoured spots of much economic value.

Let us develop this statement. The Riviera is a belt of

coast, bent at something approaching a right angle, the eastern boundary of the angle forming the Riviera di Levante—the coast of the rising sun—and the western the Riviera di Ponente—of the setting sun—continued into the French Riviera. Genoa occupies practically the point where the bending takes place, and, as we shall see in a moment, the very conditions which make it a great town and seaport deprive it of the Riviera climate.

What gives the French Riviera and the Riviera di Ponente their favourable climate? In the first place, the hills stand close behind the narrow strip of shore, and these hills are largely bare rock, often limestone rock. The region faces south-east, the prevailing winter winds are westerly. All day long the sun strikes the bare cliffs behind the shore towns, all day long those cliffs reflect back the heat, till the whole place is soaked in sunshine, and the temperature is like that of an English summer. As the sun sinks, and the hot-house effect wears off, the temperature drops with a run, an effect accelerated by the clearness of the air. But before the sun has sunk the pretty ladies and their squires have gone indoors, the band has stopped playing, the gorgeous flowers in the gardens have been carefully tucked up in blankets for the night—the daytime joys are over.

The soft rocks of the coast yield abundant dust, and the rushing motor-cars leave behind them thick clouds raised from the surface of the roads. But during the winter months the rain-bearing winds, warm and damp from the Mediterranean, are chilled as they rise over the coastal mountains, and deposit at times copious but not continuous rain, which lays the dust and refreshes the vegetation. Thus we get the characteristic winter climate of places like Mentone and Nice, warm in the daytime, cool or cold at night, with bright sunshine, clear air, and relatively little wind. As we journey to the south-west, however, beyond Cannes, the greater distance of the mountains from the coast diminishes their power of

PLATE XXIV



An olive grove on Lake Como. Note the characteristic basket on the back of the woman. The vegetation here is Mediterranean in character, while the olive does not grow on the shores of Lake Maggiore.

protection, and the dreaded mistral appears, rendering places like Hyères unsuitable for invalids.

Turn now to the north-east. Here Alassio is practically the last health resort of the Riviera di Ponente, and while both Savona and Genoa have economic importance, to the northern visitor they do not rank as Riviera towns. The reason is fairly obvious. Both owe their importance to the fact that the chain behind each is low enough to permit of free communication with the plains behind. Genoa is bigger than Savona, partly because the easy passes behind it permit of communication not only with the small plain of Piedmont but with the greater one of Lombardy, and the tremendously heavy railway traffic which concentrates upon the town, shows the importance of this free communication. But this very facility of communication means a lower mountain barrier, means the existence of gaps, means that the 'greenhouse' effect is here less noticeable, so that Genoa is colder and much windier than the Riviera towns. It has also more rain, and this for a reason which also affects all the towns of the Riviera di Levante.

Genoa, it will be noted, lies slightly to the eastern side of the bend, that is, on the stretch of coast which runs south-east. Now the winter winds are very generally south-westerly, and thus strike this part of the coast perpendicularly. Thus the air is compelled to rise up the steepest slope, cools quickly and deposits much rain. Therefore Genoa, and with it the whole Riviera di Levante, gets more rain than the western Riviera. In the latter the prevailing winds are oblique, or have a rough parallelism to the coastal mountains. Thus the air rises more slowly, is cooled gradually and deposits less rain on the shore towns. Hence one reason why the eastern Riviera is less frequented than the western is the heavier rainfall, and the somewhat less clear air.

Further, the climate here is not quite so warm as to the west. The hills are lower, they stand a little further back,

and thus the ground slopes up to them more gradually. In consequence the hothouse effect is diminished, and the temperature is lower, though this is perhaps compensated for by the diminution of glare.

One other disadvantage the eastern Riviera possesses as compared with the western. The Apennines behind it, though not high, are wide, and offer little opportunity for communication with the Plain of Lombardy beyond. Thus from Genoa to Spezia no considerable town stands on the coastal belt, and the health resorts have had to be created, as it were, out of small fishing villages, themselves placed where the entrance of a stream gives an alluvial cone and the possibility of a little cultivation, as well as some shelter for fishing-boats. Further, the coast here is very steep and the difficulties of communication between the successive villages considerable—a fact which has checked their growth. Every one who has travelled south by this route knows also how difficult it has made railway construction, as seen by the incessant tunnels.

This brief description may serve to make clear what is meant by saying that the Riviera towns have need to take their climate and their beauties of land and sea to market, have need to sell their charms, for the possibilities of honest work are few. Their forcing-house climate is due to the nearness of the mountains to the sea, to the height of these mountains; therefore there, where the climate is best, is there least opportunity of intercommunication by land, is there least level ground which can be cultivated, are the streams too short to form important valleys. If we keep these facts in mind the possibilities of disappointment will be lessened, the tendency to cheap cynicism diminished. 'From Hyères to the frontier,' said an indignant chasseur Alpin in the train to the author, 'there are nothing but rogues and thieves, and no honest man can live.' Without accepting this position in its entirety, one may admit that the

forcing-house atmosphere does not suit the higher human virtues. One must go to the Riviera for what it can give, and not seek for more.

What can it give to the serious traveller? An almost perfect winter climate, beauty of scenery, due especially to that telescoping of climatic zones of which we have spoken, which brings the snowclad Alps within, apparently, a stone's-throw of rich sub-tropical vegetation, and almost unequalled opportunities for seeing—but not always handling—a very large variety of plants. Almost all the rest is artificial, and much of it depressing in the extreme.

There is, as we have already emphasised, very little level ground, and the difficulties of communication are great. On the other hand, most of the visitors are too elegantly dressed to want to do much, and for individuals to walk would be to suggest that they could not afford to keep motor-cars. Thus to make a health resort, the climate being given, the chief essential is to construct a promenade where beauty and fashion may be conveniently displayed, and to supply a few roads capable of being used for motoring. As the hills were not, in earlier times, utilised in that elaborate fashion which characterises the Alps further north, pasturage being scanty, there are few hill paths, and those in existence are mostly very rough. In the Alps further north, that very complicated system, whereby the pastures of the various levels are used at different seasons, has resulted in the establishment of a series of paths which required no very great modification to be made available for the use of tourists. No such system of paths makes the hills of Liguria readily available to the ordinary tourist.

Further, what cultivable land exists can, owing to the climate, be utilised for costly crops, and therefore careful fencing is required. While at one time the characteristic Mediterranean plants, especially the olive, were much grown, now on the French Riviera at least the land is being increas-

ingly put down to early flowers and vegetables, for which the visitors afford a local market. The constant spreading of this intensive gardening naturally diminishes the amount of land carrying the original Mediterranean vegetation, though this can still be studied on the hill-sides. Further, since the visitors must be housed, much of the relatively level land is required for the huge hotels with their gardens, and the equally large villas with their parks, which, not unnaturally, are always tending to spread over the most beautiful areas. Thus the sensitive visitor will be inclined to say of certain of the resorts that if the region is compared as a whole to a forcing house, his share of the sun has to be enjoyed on what he may not unjustly describe as a narrow band of greenhouse staging, from which he may see the trees peeping over the high villa walls, like plants appearing over the edge of flower pots.

The result is that except, we may repeat, for the opportunities for plant study, which are still great, the serious-minded traveller has not a great deal to look for along the Riviera belt, and he will probably be best advised to travel leisurely right along it, going in by the Mont Cenis and Genoa and returning through Marseilles and Lyons, taking the interesting towns of Provence on the way north.

Of the visitors who stay many are, at least theoretically, invalids, the others are mostly those who make no pretence of having an interest in any branch of geography or natural science. They are of those who travel chiefly for a change of golf, as the working-man is sometimes stated to migrate in search of a change of beer. The author is under the impression that golf is to be obtained at many of the resorts, but speaks here as one without knowledge. If the devotee be unsatisfied, however, he can but travel further, for one may say broadly that the really practical Briton, when he cannot sterilise land by factories or pit-heaps, will always strive to do it by the construction of golf courses, and will, we may be sure, survey the flowery glades of paradise when

he reaches them from this point of view only. Indeed a solemn British guide-book, in describing the glories of the East, which to some minds have stood for paradise, gives a special recommendation to Nuwara Eliya in Ceylon because there, 'among other attractions, there is an 18-hole golf course which is said to be the best in the East.' This great achievement is due undoubtedly to British enterprise, and, one feels, ought to move the poet of empire to thrill the nation with another hymn to duty. If the Riviera golf-courses are relatively inferior it is no doubt because here British organising ability has not full sway.

But this is to wander from the point. If the golf be not all it should be, there is tennis, pigeon-shooting, gambling, surveying the wonders of the deep at the Monaco Oceanographical Museum, and reflecting on the various uses to which man at different stages of his history has put money acquired by means against which his conscience revolts. It is an excellent museum, but it is difficult not to break off one's study of models illustrating the salinity of the ocean in order to wonder if the recent swing of the pendulum away from the late Victorian passion for 'science' as the way of escape from human woes is not partially due to the sad experience that it can be bought, as in earlier times the church was bought; once one built or decorated a church with the thirty pieces of silver, now one endows a lecturer to prove that the great betrayal was based on scientific principles, or can be justified on eugenic grounds.

If these pleasures fail, one may contemplate the sea and listen to the band, but on the whole prolonged residence in the region is unsuitable for the analytical, or the restless of temperament. A winter greenhouse is, after all, best fitted for grossly overfed chrysanthemums or drugged and anæsthetised lilies of the valley.

On the other hand, a somewhat hurried journey along the whole coastline, with occasional stops, not only gives one a cumulative impression of the beauties of land and sea and

flowers, but also helps to emphasise the point already made, that adaptation to the purposes of a tourist resort almost necessarily involves a want of adaptation to cultivation or other forms of utilisation. Thus the wider bays, where a bigger stream, due to the fact that the mountains are not so near the shore, has laid down a larger alluvial cone, are more likely to be given up to market-gardening than to the functions of a health resort pure and simple. At the same time one must not over-stress these facts, for Nice, for example, while to at least a very large extent displaying the characteristic Riviera climate, owes its origin as a considerable town to what we may describe as natural conditions—*i.e.* not entirely to wealth introduced from a distance. Thus it has many of the advantages of Genoa, if on a smaller scale. It has a sheltered port; it has access, though not very easy access, by the Col di Tenda with the plain of Piedmont, and by Digne with the valley of the Durance; it has in its vicinity considerable tracts of fertile land, which can be devoted, owing to the climate, to valuable crops, and of these neighbouring tracts it forms the natural outlet. But the very fact that it is fundamentally an independent and not purely a parasitic city renders it in the eyes of many less suitable as a resort than places like Monaco and Mentone, where there is but little local individuality to interfere with the pleasures of the stranger. Places are like human beings, when they make it their one object to serve the senses of strangers, it must needs be at the sacrifice of individuality—they necessarily sell their souls as well as their bodies. One must admit also that the northerners who are the purchasers—whether really rich or only pretending to be—do not show their best qualities as sojourners by the tideless sea.

REFERENCES. As we have seen, the chief geographical interest of the Riviera is found in its flora, and for books relating to this reference should be made to p. 96. The other specially interesting feature, the climate, is fully discussed in Hann's book (p. 58).

CHAPTER XIX

AN UPLAND REGION : THE SCOTTISH HIGHLANDS

‘ Farewell, green fields and happy groves,
Where flocks have ta’en delight.’

WE have now considered the great chains of Central Europe and their margins under various aspects, with a view to bringing out the present features of their surface and the causes of these. But since in connection with the Central Alps we emphasised chiefly the past and present effects of ice, it may be well to repeat here, with renewed emphasis, some of the points in regard to structure which were briefly mentioned in the earlier chapters.

We have seen that the Alps consist of a great variety of rocks—crystalline, sedimentary or modified sedimentary and volcanic. Whatever their composition, however, they owe the fact that they are mountains to earth movements. Certain regions, like the Dolomites, consist of almost horizontal strata, elevated *en bloc*, and then dissected by the forces of erosion into sharp-peaked or pyramidal mountain masses, some of which, like the Cinque Torri, are themselves in the act of being worn away—are like ruined buildings at a disused pithead, which will shortly crumble down to grass-grown mounds. Others, like the Matterhorn, the Mythen near the shores of the lake of Lucerne, the Great Spannort at Engelberg, and so on, are the result of overthrusting on the gigantic scale—are the dissected remnants of rock-slices which have been pushed over obstructing earth-masses, and have come to lie far from their point of origin in the crust. Others

again, like the Säntis Mountains, are directly due to folding, the great crumples of which that mountain group consists being obvious on its sides. In short, the Alps owe their elevation above the surface to what are called tectonic causes, though they owe the details of their form to erosion. They have not, since the geologically recent period of their origin, been worn down to base-level, and, as we have seen, the levelling forces are now acting upon them with prodigious activity.

As contrasted with the Alps and the mountain ranges of which they form a part, we have in Europe, as already seen, a number of upland regions, which are in origin the much dissected and redissected remnants of far older mountain chains. Of these we shall take the Highlands of Scotland for somewhat fuller treatment. These Highlands have, as we shall see, great beauty and much charm, but—and we should be clear on this point—they do not show typical mountain scenery. One sometimes hears it said that it is absurd for thousands of the inhabitants of Great Britain to seek the Alps every year, for there are splendid mountains in their own country. The reply is that there are no true mountains in the British Islands: nothing but mountain stumps, ‘rejuvenated’ as the American geographers say, so as to present some resemblance to mountain forms, but lacking all the splendour and vigour of youth. To seek mountain form in the strict sense in the Highlands is to court disappointment.

After this brief introduction let us turn back to Fig. 2, p. 19, and consider the broad lines of the structure of the Highlands. In the extreme north-west of the mainland of Scotland, as well as in the Hebrides, there exist at the present day areas floored by a very hard and much worn rock called, from the Island of Lewis where it is very abundant, Lewisian gneiss. The regions in which it occurs are exceedingly barren and, except where other rocks occur, undulating and featureless.

It is believed that this is an exposed remnant of the first land-mass of Europe. A similar kind of rock occurs in eastern Canada, and also in Sweden and Finland (see Fig. 2), suggesting that in the earliest times of which we can form a conception, a land-mass lay to the north and north-west of what is now Europe.

But this is not the only type of rock which occurs in north-west Scotland. In Sutherland, where much of the surface is formed of the barren, undulating, monotonous gneiss, there rise up in certain places steep-sided conical or pyramidal mountains, of which Suilven (Lochinver district) is a good example. These mountains are built up of red sandstone, called the Torridon sandstone from its abundance round Loch Torridon, and resemble the Dolomites described in the last chapter in that their beds lie almost horizontally. As the capping of Torridon sandstone is found on a number of separate peaks (Suilven, Coul More, Coul Beg, Stac Polly, etc.) which rise from the plateau of gneiss, it seems reasonable to conclude that the sandstone once constituted a uniform covering, and has been removed in certain places by denudation, while being left in other regions, which now form hills. In some places in the north-west, on top of the Torridon sandstone we find beds of white quartzite and other rocks of later date, but still belonging to a very early period of the earth's history; that in which many of the rocks of North Wales were laid down, hence called Cambrian. The conclusion drawn from the presence of these two kinds of sedimentary rocks (that is rocks laid down in water), is that the rivers of the ancient land surface to the north-west carried down quantities of débris to the sea, on whose floor the sandstones and the overlying quartzites, grits, and limestones were laid down. How far these beds extended over the present Highlands we do not know. All the next stages are indeed obscure, for, apparently during the period called Silurian, a great chain of mountains was ridged

up over what had once been the sea-floor to the south of the old land-mass. As in the case of the Alps, the crumpling force in Scotland acted towards the north-west, and just as the earth blocks in middle Europe stemmed the great earth waves when the Alps arose, so the old land-mass to the north-west acted as a breakwater to the earlier waves. Again, much as in the Alps, owing to the existence of this obstacle, overthrusting occurred ; for since the folds were blocked by the resistant upland in front of them, they bent over, and the beds were thus inverted, so that lower lie on the top of higher ; they are also reduplicated, because upright folds become horizontal. At the same time great sheets of rocks were carried over the crest of the obstacle, and came to lie far from their region of origin. During the folding, crumpling and overthrusting the rocks in the Highlands lost their original characters, whatever these were, and became converted into schists and similar rocks, and, as in the Alps, volcanic eruptions took place in connection with the great earth movements. In the Southern Uplands the folding was less intense, and the rocks preserved more of their original characters, so that their age can be determined.

The great range of mountains which arose in this fashion is called by Suess the Caledonian range, and, at the period of its maximum development, it stretched not only through Scotland but also through western England into Wales and likewise involved the greater part of Ireland. The same chain was apparently continuous across what is now the North Sea into Norway.

Beyond the period of the origin of the Caledonian range we do not need to follow the geological history of Scotland ; the point of importance is the great age of this chain, which is infinitely older than the Alps. In its prime it was doubtless a towering and magnificent range, with peaks and needles, glaciers and snowfields—all the attributes of a true mountain chain. But the forces of erosion have acted upon it for

countless ages, and probably not once but more than once has it been worn down to base-level. It has also been fractured and faulted, the line of the Great Glen in Scotland and the boundaries of the Midland valley indicating lines of breakage in the earth's crust. Long, long ago, therefore, the Caledonian range lost all the characters of a true mountain range.

But though new earth-folds have never re-formed on the site of the old, movements of elevation and depression have taken place. If a mountain chain remain for a prolonged period above the surface of the sea, the forces of erosion at first act upon it with great rapidity and then gradually slacken, till the final result is a monotonous, undulating surface, whose rivers have all but done their work. If such a tract be again raised some distance above sea-level, then the rivers re-acquire volume, speed, and thus power to erode and transport, and the cycle recommences. If the process be repeated more than once then all the softer rocks will in course of time be removed, so that even after the recommencement of a new cycle only rounded forms will tend to be produced.

Now before the onset of the Ice Age the Highlands of Scotland—the only part of the site of the ancient Caledonian range which we shall consider—were in the midst of such a renewed cycle. An ancient monotonous plateau had been uplifted and was in process of being dissected anew, the dissection having taken place to a greater extent to the west than to the east, no doubt because of the greater rainfall there. The mountains were undulating and were all of approximately the same height, this marking the elevation of the old plateau from which they were being carved. The valleys were wide and open, the constituent rocks uniform over wide areas.

What did the ice do? In the period of greatest glaciation the whole land surface and part of the sea-bottom

was covered with ice, nunataks (see p. 194), if they existed, being few and far between, and confined to the west. During such periods the work of the ice must have been chiefly the smoothing of the surface in the higher region, transporting débris to the lower regions, and, owing to the load of stones or grit in the under layers of the ice, assisted perhaps by the sub-glacial water, hollowing out basins in the underlying rock, especially where the ice debouched from higher ground to lower, or where several streams of ice converged. But for the most part, during the maximum glaciation, the effects, whether of erosion or of deposition (boulder clay), must have been best marked outside the Highland area.

In the later stages, however, there seems little doubt that separate valley glaciers existed, which headed in cirques or corries and then flowed down valleys, much as glaciers do in the Eastern Alps to-day. These later glaciers seem to have produced a marked effect on the surface. They modified the upper regions of the mountains, where they converted the old valley heads into cirques (Plate XXV.); they altered the valleys, turning the old V-shaped river valleys into U-shaped ones, giving rise to lake basins, smoothing watersheds where they over-rode them because their own valleys were too small to hold the mass of ice, laying down great piles of morainic matter, and so forth.

Thus to the general tourist, the most interesting points about the Highlands must be, first, the indications of the old plateau, seen especially in the vast extent of undulating surface, lying at a considerable height above sea-level; second, the frequent appearance towards the summit of the hills of extraordinary steep-sided cirques which sometimes approach one another at opposite sides so that peaks and arêtes are produced; third, the peculiar characters of the Highland valleys, glens as they are called, with their often steep walls, their lakes, their waterfalls, their great moraines, and so forth. It is the combination



View in Glencoe, showing a typical Highland corrie hanging high above the over-deepened valley.

(Photo by the Geological Survey.)



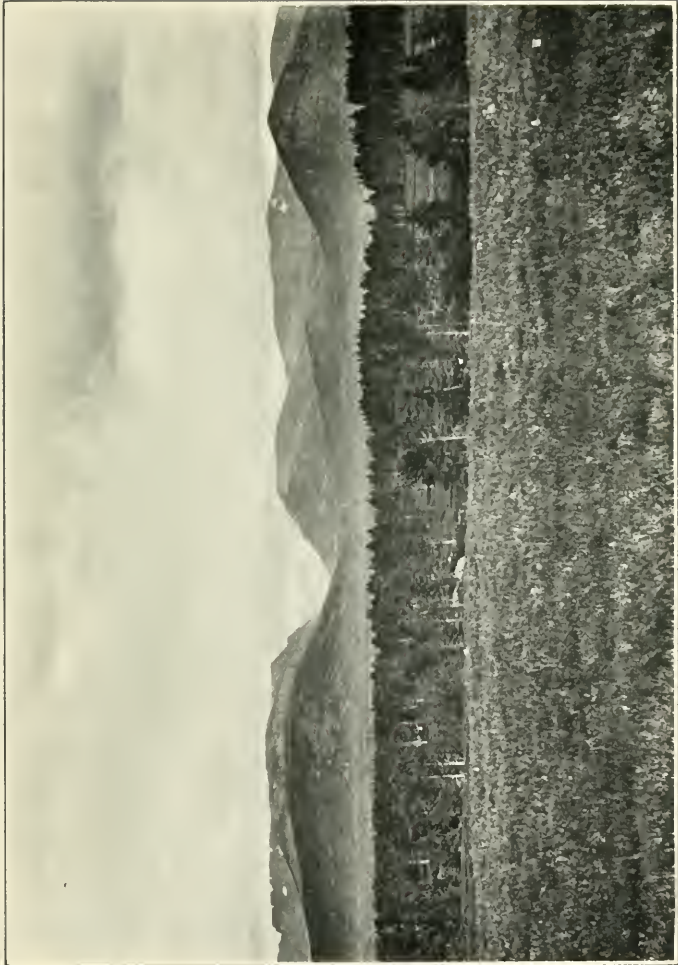
of these three different types of scenery that give the Highlands their special features. One result is that photographs give but a very imperfect notion of their beauties, for the mountain corries and the glens can rarely be included in the same view, and comprehensive views are apt to seem dull because they tend to show neither glen nor corrie, but only undulating slopes. This again leads to the fact that the most popular photographs are those which include woodland, most abundant in Perthshire and the Dee valley, or water effects, and such photographs give an incomplete conception of the scenery as a whole. Geographically, we may repeat, the interest of the Highlands comes from the co-existence of remnants of two stages of erosion, and to appreciate this one must know the region both from above and from below, must combine a number of separate impressions. The 'prettiness' of Perthshire, which is so apt to be regarded by the stranger as the best the Highlands have to offer, is not distinctively Highland.

To get a real grip of their topographical peculiarities one should visit not only some part of the eastern plateau, with its very moderate dissection, but also some part of the western region, where dissection had proceeded much further before the ice came, and where the effect of the ice was often to carve out the summits into something which closely resembles mountain peaks, and to turn the valleys into deep, steep-sided glens, characterised by their lateral waterfalls, their rapid brown streams, and their beautiful lakes.

For the eastern region the Cairngorms (Plate XXVI.), or perhaps still better the Lochnagar district may be recommended. In climbing Lochnagar one ascends, at least from the Loch Callater side, by long slopes not much more than gentle, and one has all round an interminable expanse of rolling country, rounded and smoothed by ice, but essentially a plateau and not a mountain region. As one reaches the summit plateau of the White Mounth and, somewhat dis-

illusioned, strolls onward to reach the cairn which marks the undistinguished summit, one suddenly finds oneself overlooking a huge steep-sided corrie, holding a lake on its floor, having magnificent buttresses running out from its sides, and showing altogether a splendour of rocky scenery for which the long trudge up has given no preparation. 'This,' in the famous words of Agassiz on another occasion, 'is the work of the ice,' and this also is what gives the Highlands half their charm. A further investigation of the valleys which trench the great plateau so abruptly will reveal here also the effect of the vanished glaciers, for many of the features which we noticed in the Alpine valleys—the shape, the valley lakes, the hanging lateral valleys, the smoothed cols and watersheds, the morainic mounds—are present here as they were there.

Of the western region the island of Arran, where in the Goat Fell region the old plateau is deeply dissected, and its summit levels eaten back on all sides to peaks and ridges, or the Cruachan *massif* and the neighbouring hills near Loch Awe, or the hills round the upper end of Loch Lomond all form good examples. These western hills should if possible be visited in winter, for the sudden appearance of exposed rock at their summits, after the slow climb up the snow-covered slopes, is then especially striking. Mists generally hang over the tops, increasing the apparent height. The way up is over grass or heather sprinkled with snow, generally high above the deep, steep-sided glens with their fringe of alder and rowan, and as the mists drift about above one has vague glimpses of what seem to be terrific precipices. Though these are not generally quite so terrible as they seem, yet it is rare in the case of the higher mountains not to find some real climbing necessary near the summit, involving in winter step-cutting and the forcing of a passage through chimneys or gullies. In summer, on the other hand, most of the hills are readily accessible



View of the Cairngorms from the vicinity of Rothiemurchus Forest. The photograph shows very clearly that the mountains of Scotland have been carved out of a plateau. Note that the hills have approximately the same height, and have rounded and flowing contours. A nearer view would show the effect of the small corrie glaciers in producing cirques and precipices comparable to those shown in Plates XXV. and XXVIII. Thus the ice has had a double effect; the continuous sheet of the maximum glaciation smoothed the general surface, the small glaciers of the periods of diminishing glaciation accentuated surface sculpture near the summit levels.

(Photo by the Geological Survey.)

by one route at least, though it often happens that other routes afford scope for fine climbing, in the most literal sense.

There is indeed much of geographical significance in the history of Scottish climbing (and the same applies more or less to climbing in the English Lake district or in Wales). It is in the first place a development out of Alpine climbing; necessarily so, for most of the hills, as we have said, present little or no difficulty in summer, and in the earlier days no one tried them in winter. Now Alpine climbing involved in the early days, and still involves, *natural* difficulties. Many of the mountains are difficult to climb by any route, and climbing skill was first acquired in the overcoming of these unavoidable difficulties. Later, of course, difficult routes were sought and employed because of their difficulty. In Scotland, on the other hand, for the most part climbing in the technical sense is comparable to an attempt to reach the attic storey of a house by scaling the spout, in place of using the staircase. But the point is that it is because of the recent effects of glaciation that some of the hills can be made to offer difficulties to those in search of them.

The matter may be illustrated by reference to the conditions exhibited by Ben Nevis (Plate XXVIII.). This, the highest of our British hills, is fundamentally a mere mountain stump, offering, by one route, so few difficulties in the ascent that a motor-car has reached the summit plateau, though scarcely in what one would describe as a functional condition. On the other hand, the precipices which flank its huge corries offer rock climbs of great difficulty, and even the ordinary tourist, who can employ, if not a motor-car, at least a pony for the journey up, may enjoy from the top minor thrills in the contemplation from above of the great crags and the snow-filled gullies, for Ben Nevis keeps some of its snow in sheltered places throughout all ordinary seasons.

On the way down also the tourist may note an admirable

example, on a small scale, of an ice-smoothed watershed, for the little loch called Meall an t'Suidhe occupies a flat saddle, resembling on a small scale the saddles which form the great Alpine passes, and though it now drains to the north, its position is such that one would expect it to drain to the south. Innumerable examples of the same kind of thing, on varying scales, are to be found all over the Highlands, for the roads and railways nearly all take advantage of such planed-down cols, where the actual watershed is often due to the cone laid down by a lateral stream, debouching on the nearly level ground at the summit of the pass (see p. 309).

Not very far from Ben Nevis also one may see in the famous parallel roads of Glen Roy the remains of a condition which still exists in the Alps. These curious terraces mark old lake levels, for the outlet of the Roy valley was blocked by ice, and the water dammed back in this way formed a lake, the lake level being determined by that of the possible outlet at any period, *i.e.* by that of the lowest col not blocked by ice. This was not always the same, and thus the lake water stood at different heights at different periods, the 'roads' marking the levels at which it stood for a long period of time. In the Alps the same phenomenon is exemplified in the Märjelsee, which periodically fills and empties. It forms in a side valley which opens into that in which the Aletsch glacier lies, and the glacier thus prevents the escape of the water of the lateral valley. What may be described as a later stage in the same process is seen in the Allée Blanche, the valley which lies on the south (Italian) side of Mont Blanc. Here the Lac de Combal, now in process of filling up, is formed by the blocking of a valley owing to the moraine which the Miage glacier has spread out in front of its own snout. In these cases therefore so far is it from being true that it is enough to see the Highlands without seeing the Alps, the truth is rather that one cannot understand the Highlands without having seen the Alps. Further, as the Eastern

PLATE XXVII



View on the island of Arran, with Holy Island in the distance, showing a part of the island where dissection of the surface is not obvious.



Alps show better than the Western that stage of corrie glaciers which seems to have been so important in moulding the Highlands, they should be specially studied by those who wish to understand Highland conditions.

We shall not attempt here to describe the chief beauty spots of the Highlands. Information in regard to these is easily obtained, and the hints given should enable the tourist to concentrate attention upon the subjects of most geographical interest. But a few general matters must be considered.

First, in regard to the season of the year to be chosen for the visit—in June one has long, light nights, with no true darkness, and greater freedom of movement than during the shooting season. There is also a reasonable probability of fine weather then, but southerners should remember that June is spring in the Highlands; in the earlier part of the month cold is to be expected, and there may be still a good deal of snow on the higher mountains. The more fertile parts, especially Perthshire, show in this month all the beauties of an English spring.

August is likely to be wet, and here, as elsewhere, is the most crowded month. In September the weather is on the average drier and the beauty of colouring—the dying heather, the gorgeous yellow and brown of the fading bracken, the glow of the scarlet rowans against their own yellowing leaves, with the blue of the blue-bells and the purple of the scabious as relieving notes—is at its height. At this time of year, in a favourable season, there is a beauty and a charm in the Highlands which is not perhaps appreciated as it should be. Even so relatively commonplace a stretch of road as that from Fort William to Ballachulish, on a still September day, is, to the author's mind, far more beautiful than the famous Corniche road in the Riviera. The loch and the sky are no doubt of a less intense blue, but where does one get on the shores of the Mediterranean so satisfying a breadth

of colour as that of the uniform moor vegetation, where such sudden and unexpected charm as each little burn displays when, with its fringe of trees, it dashes through the rocks of its tiny gorge on its way to the still inlet? Surely also that fine inlet, broad enough for wonderful colour effects, especially as the tide swings this way or that, yet narrow enough to add the charm of distant hills and moorland slopes to those near at hand, has a beauty which the limitless, tideless sea has only in its bays. If the villages also cannot show the wealth of exotic vegetation of the villas on the Inland Sea, yet even here the mildness of the climate is shown by the evergreens, the fuchsias, the flowering shrubs, even the roses of the gardens. So far to the north, so near the highest mountain we have to boast of, would one have expected so varied a list of charms?

Finally, to know the Highlands well one must visit them also in winter, when their hills are for months crowned with snow, and the low clouds hanging over them give height and mystery. If one happens to be favoured with bright frosty weather—a somewhat infrequent occurrence—the hills have in winter a charm which equals, if it does not surpass, that of the Alps. The days are so short—one leaves the hotel in the dark of the morning and returns to it in the gloom of early afternoon—that the few hours in the bright sunshine and the crisp air on the hill seem to shine like jewels in their dark setting. To be off the hill before it is dark is the highest ambition of the winter climber, and then one must stumble, useless ice-axe in hand, over the puddles on the homeward track by the aid of the precarious light of an Alpine lantern. But this darkness seems to make the glow of the achievement shine the brighter, and as one makes out the faint gleam amid the thicker gloom which indicates the position of the village, it is to feel convinced that the people there have dwelt all day long in the valley of the shadow, while for those who had the wisdom to seek the mountains a great light shone.

But there are other days, it must be admitted, when one approaches the hotel and the hope of tea with different feelings! Days when those who are troubled with a conscience debate all the long homeward way whether or not it is justifiable to drip on the drawing-room carpet for a period long enough to permit of the drinking of at least three cups of tea, or whether good-breeding demands that the consumption of that much-needed beverage should be postponed until such time as one has ceased to play to the life the rôle of a half-drowned kitten.

To put the matter in plainer words, you may, on a winter visit, have practically continuous rain, and then the gloom on the hill will be even greater than that in the valley. Further, strange as it may seem to the uninitiated, the late winter offers less probability of suitable climbing weather than the earlier part. Sometimes there is superb winter weather in October; it may be hoped for in November, December or even January. February and March are less hopeful, and both the latter month and April are often very stormy, and the snow is likely to be deeper, softer, and to offer greater obstacles than earlier in the season.

One other word—as compared with the Alps the Highlands suffer greatly from the imperfect adaptation of their inhabitants to the art and craft of hotel-keeping. This is partly due to the ferocious individualism of the Scot, which makes the rendering of personal services to others for money a matter abhorrent. In the Alps one pays guides relatively highly, for each individual guide has had, among other things, to get over the natural human fear of danger and of high places. One pays the Scotch hotel-keeper highly, not because of what he gives, but because he has had to overcome his native reluctance to serving strangers. The fact that a large part of the Highlands is given up to sport, together with the results to which we have already alluded, also brings about an inflation of prices. A sportsman in the

Highlands is by definition a man of considerable means, and in some of the Highland hotels, if the visitors are not all owners or tenants of deer forests or grouse moors, they are expected, like Mrs. Blimber in a somewhat parallel case, at least to pretend that they are. Further, the fact that sportsman do not visit the country in the depths of winter renders it often difficult to get accommodation then, except as an 'obligement' and at a tariff which must limit the number of guests.

The writer has an old-time recollection of a winter day with a climbing party, which began with getting up in the cold darkness of some impossible hour, followed by a journey by train to a hotel whose manager had been previously warned of the arrival of a breakfastless party. One hour and ten minutes that party waited, with what patience they could, in a chilly parlour, while the leisurely staff concocted breakfast, finely served at 8.30 with an air of deep injury at the untimely hour. Among various suggestions thrown out, with due humility and modesty, during that interminable period of waiting, was one that any form of breakfast would be acceptable, however simple. But this suggestion was very coldly received by the manager, who said that it should never be said that a party coming to his house could not get a proper meal! What he meant was that he would serve no meal for which his Calvinistic conscience would not permit him to charge half-a-crown, a sum which each member of that unhappy party duly paid up, as soon as its more impatient members had permitted the others to swallow a few mouthfuls of food to the accompaniment of a fevered calculation of times and distances. But it was a good day, with fine practice in step-cutting up a short iced slope! In the Alps in the following summer a cheerful but weary *Wirthin* in a mountain hut, engaged at 9 o'clock at night in supplying suppers, accepted, with no perceptible diminution of her cheerfulness, the suggestion that she should supply five breakfasts at



S.E. buttress of Ben Nevis, a precipitous granite cliff which owes its present shape to the effects of the Ice Age.

(Photo by the Geological Survey.)



three o'clock the following morning. The outlay for each breakfast,—they were simple, it is true—including the tip, amounted only to coppers. The two incidents indicate that there are other differences, besides the geological ones, between the two regions.

There are indeed those who say that it is possible to save the fare to the Alps out of the difference between necessary hotel bills there and in the Highlands. For, be it remembered, while in the more frequented parts of the Alps the tourist may pay almost anything—both in the upward and downward direction—in hotel bills, in the Highlands the localities where he has a choice are relatively few, and the prices almost invariably high in proportion to what is given.

But we must not stop on this note, for a really successful visit to the Highlands, in winter or in summer, is worth what it costs. One good result of the careful game preservation also we must mention. At least in winter one may be almost sure, if a hill of any height is climbed, of seeing the most characteristic animals of the region. Red deer are abundant and may be observed at close quarters. The mountain hares, pure white or oddly mottled with white and brown, recalling patches of snow on the ground, are always in evidence. Among the birds pure white ptarmigan with their curious feathered feet, grouse, blackcock—to name only those most frequently seen, are rarely wanting, and one should not fail to note that on Scottish mountains even the grouse cry—'Go back, go back!'

REFERENCES. A complete list of books on the geology and geography of the Scottish Highlands would be long. We limit ourselves here to a few typical examples. The student will naturally begin with Sir Archibald Geikie's *Scenery of Scotland*, third edition, 1903, and will use with it the same author's *Geological Map of Scotland*, with descriptive text, second edition, 1909, as well as the separate sheets of the Geological Survey and the *Memoirs* which accompany them, especially the important memoir on *The Geological Structure of the North*

West Highlands (1907). The sheets of the 1-inch Ordnance Survey are also indispensable, and the author's small handbook called *Ordnance Survey Maps* (1913) may be of some use in the study of these. Bartholomew's *Survey Atlas of Scotland*, second edition, 1912, should also be consulted. In Vol. I. of Murray and Pullar's *Bathymetrical Survey of the Fresh-water Lochs of Scotland* (1910), there is an article by Drs. Peach and Horne on the Scottish Lakes, which contains much interesting geographical matter. The details so necessary to the tourist may be sought in Baddeley's *Scotland*, two parts, 1908, or in the *Handbook for Travellers in Scotland*, edited by Penney, ninth edition (1913). The climber should consult the pages of the *Scottish Mountaineering Club Journal* and the *Club Guide*, and many useful articles will be found in the volumes of the *Scottish Geographical Magazine*; among these special mention may be made of Sir Archibald Geikie's article on the 'History of the Geography of Scotland' (vol. XXII., 1906). For more general points Mackinder's *Britain and the British Seas*, second edition, 1907, should be used.

CHAPTER XX

CITY AND PLAIN IN FRANCE

‘The busy hum of men.’

It may seem that in the chapters immediately preceding we have forgotten that the proper study of mankind is man, have laid too much stress upon physical conditions, too little upon the features of the earth considered as the home of man. Let us rectify this error by a consideration of the plains of France which, perhaps more than those of any other European country, show the attractive influence of level fertile land. They show this with especial clearness owing to the alternation of upland and plain, or, more accurately, owing to the way in which the interrupted high ground encircles the lower, so that just as the streams converge from the uplands to the plains, so human beings, following the natural lines of communication, drain towards the lower ground, and establish there their towered cities, while at the same time the gaps in the ring of uplands make relations with the lands beyond them easy.

We have spoken already of the general structure of France. The accompanying sketch-map (Fig. 16) summarises the facts already given, and may serve as a basis for a discussion of some of the facts of human geography in the country. We note that the original land-mass from which France took origin is the Central Plateau, composed of the oldest known rocks (Archæan) and forming the nucleus round which younger beds were laid down. Owing to its isolation and to the relatively unfavourable conditions, it is to-day not densely

peopled, and its characteristic inhabitant is the round-headed, *dour* Auvergnat, the antithesis in most respects of the light-hearted Frenchman of popular tradition. To the

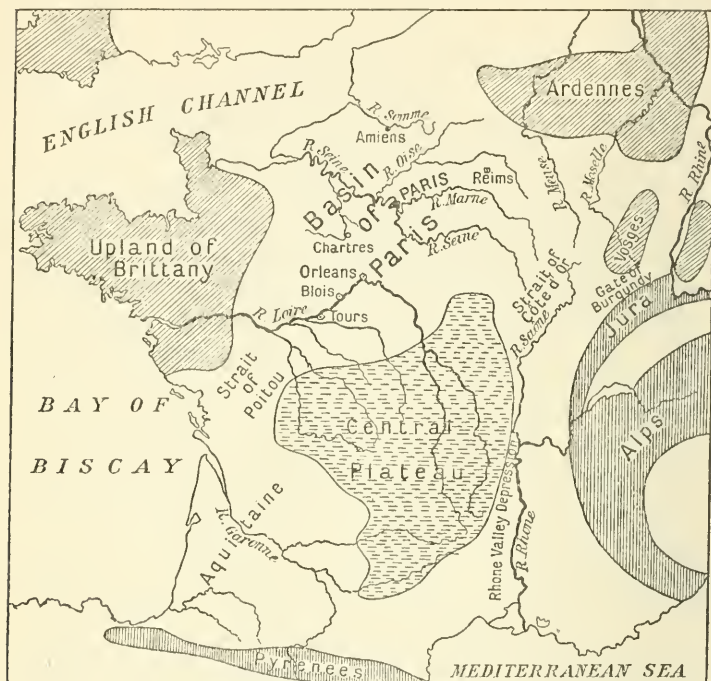


FIG. 16.—Sketch-map showing the structure of France.

The Central Plateau is built up of the oldest known rocks (Archæan); the uplands of Cornwall, Brittany, the Ardennes, the Vosges, are fragments of the originally continuous Armoric chain, while the Jura, Alps, and Pyrenees are recent folded mountains. Note how the structure of the country tends to cause its life to become concentrated within the Basin of Paris, while at the same time giving considerable independence to the region here marked as Aquitaine, and to the plains of the Rhone Valley depression (Provence, etc.).

north-west and north-east of this central *massif*, but separated from it by what have been once and again arms of the sea, lie the fragments of the now discontinuous chains of moun-

PLATE XXIX



Canal in Amcey, one of the Subalpine towns of France. The canals communicate with the lake, the town being placed on the plain at its north end.



tains, which at one period stretched from south-west Ireland through much of Central Europe. One fragment of the chain called Armorican forms the upland region of Brittany, which, as the sketch-map shows, is structurally continuous across the channel with the plateau of Devonshire and Cornwall. Another fragment of a chain of similar age appears to the north-west as the Ardennes, while the Vosges, as we have seen, are but a broken fragment of a dome once continuous across the present Rhine valley with the Black Forest region; this dome in its turn is a fragment of a broken chain called the Variscan mountains, which stretched originally far to the east. These fragments of the Carboniferous mountain chains, then, form the second element in the structure of France.

The third element is ³ marginal only. The Pyrenees, the Jura, the Alps, are all, as we have repeatedly emphasised, recent folded mountains; they advance but little on French soil and so form parts of its boundary rather than one of its constituent elements. The towns within the mountain zone are largely, but not exclusively, health resorts. We have already given Annecy (Plate XXIX.) as an example.

Thus we have outlined the skeleton of the fair land of France. Its prosperity is due to the fact that the water which once lapped the lower slopes of the uplands and mountains alike has left copious deposits of silt, sand, gravel, and so forth, which have hardened into the rocks which now floor the lowlands. If we may continue the former metaphor, France is not a gaunt skeleton, as is, for example, such a region as the western Highlands of Scotland. Her outline is due to the underlying bony structure, but those bones are clothed with living tissue.

Let us turn then to this fourth ⁴ component element, the fertile plains which feed her people. More than once the sea broke against the north-west margin of her central mass, and at the same time turned Brittany into an island. With

the withdrawal of that sea we have a wide, mostly fertile, plain, whose centre of life is now Paris, so that to the whole region we may give the name of the Basin of Paris. Of the characters of this Basin we need only say now that the successive incursions of the sea left behind first limestones and clays of Jurassic age, then Cretaceous beds, and finally the very diverse Tertiary deposits, of which some were laid down in lakes (see p. 278). Let us note, however, in more detail, the geographical relations of the Basin. To the south-west the Central Plateau advances towards the uplands of Brittany, but without meeting them. To the gap between the two the name of the Strait of Poitou has been given—in order to indicate that the belt of plain here is due to the former presence of the sea, that is, to the fact that Brittany was once an island. Here then no notable obstacle prevents free communication between the Basin of Paris and the second great French plain, that which separates the Central Plateau from the sea to the west, to which, by extension, the name of Aquitaine may be given. We must not omit to note in this connection that the relative narrowness of the 'strait' concentrates roads, railways and also towns within a similarly narrow belt.

Turn next to the south-east. Here a somewhat less easy route—for it crosses the Côte d'Or—enables the Basin of Paris to communicate with the long narrow belt of lowland which fringes the valleys of the Saône and the Rhone. This—the Côte d'Or Strait—has been of enormous importance in the history of France, for it forms the most direct line of communication between the Basin of Paris and the Mediterranean Sea, that is, between the civilisations of the north and of the south. Its centre of population is of course Dijon.

Three other broad belts of lowland through which the Basin can communicate with neighbouring lands remain to be mentioned. To the east no great obstacle prevents free communication *via* Nancy with the Rhine valley, and so

with Germany and Eastern Europe. Much lower and easier is the belt of plain which, following the line of the Oise and the Sambre, runs north-east and so permits of free access to Belgium and Holland, or conversely, as we have seen, permits invasion to those who regard not treaties. Finally, to the north-east, across the sunken Strait of Dover and the Channel, free communication is possible with the plain of Eastern England, the narrow belt of water being the only notable obstacle.

Thus the Basin of Paris is the heart of France; upon it converge routes and therefore influences from north, south, east and west. But this very freedom of communication, if it makes for civilisation, brings with it also an element of risk. It was not by chance that at times when it has seemed as though France as a world power was in its death throes the government has taken refuge in Bordeaux. The plain of Aquitaine, with less free access to surrounding regions, is for this very reason somewhat better protected, and if it cannot provide a suitable site for the capital of a world-power, yet can give a cradle—a function of limited but yet of temporarily great importance.

Let us note in a word or two the significance to the traveller of to-day of the various routes which, as we have seen, converge upon Paris. The Côte d'Or route, as we saw in Chapter II., carries much of the Swiss traffic, the Riviera traffic, and a considerable part of the Italian traffic. The traffic from the south-west of France and from Spain passes through Orleans, and thus reaches Paris through the Strait of Poitou. To the north-east a number of routes communicate with England across the plain, so that the traveller from England may land at Calais, Boulogne, Dieppe or Le Havre as he pleases. The Oise valley leads through Brussels to the north; and we have already discussed (p. 30) the direct route to the north-east which leads the traveller from Paris through Nancy to the Rhine valley.

Thus, owing to the peculiar advantages of its position, Paris is the centre of the railway system of France, and therefore the centre of its life, to an extent beyond that to which London—though a greater city—is the centre of the railway traffic of Great Britain. This is a fact which will be borne in upon the traveller who aspires to know something of the remoter parts of the country, or even upon him who attempts cross-country journeys. A curious little example is to be found in the badness of the service between places so near together as Rouen and Chartres. Chartres commands a river valley which drains direct to Rouen. In earlier days the communication between the two towns, as one would expect from their relative position, was easy; a Roman road connected the two places, and at the time when the great cathedral was built the inhabitants of Rouen were not only zealous in the promotion of the work, but are said to have actually participated in it in large numbers. The impression left upon the tourist who travels by train between the two towns to-day is that a period of centuries has elapsed between the time when he quits the delicate tracery of the cathedral and that at which he sees the busy city by the Seine. Paris, greedy of influence and power, tends to suppress, so far as she can, direct intercommunication between her daughter cities, a fact well seen in her converging railway lines.

To what geological causes does the Paris Basin, with Paris as its natural centre, owe its attractive influence upon routes and population? To answer this question we must take a general survey of the region. The fundamental fact is that this Basin, like that of London and of Belgium, is a region which, in geologically recent times, but at various periods, has been flooded by the sea, and in it sea-water has laid down a variety of beds, mostly forming soft, easily decomposed rocks. Many of these rocks break up to give rise to fertile soil, but at the same time they change in character over short distances, and thus yield a variety of types of

landscape and of products—a condition directly favourable to human activity.

The Highlands of Scotland, and parts of the Central Plateau of France, are unfavourable to human life not only because they consist of old, hard rocks, decomposing to form at best a thin, poor soil, but also because, owing to the prolonged period through which they have been exposed to the denuding forces, only rocks of, roughly speaking, few types have been left. The great advantage of the rocks of the Basin of Paris, as also of those of the London Basin, is that they are varied enough to supply many different needs. Here we have calcareous rocks giving admirable building material; here cement-yielding beds; here fertile loams; here forest-bearing gravels; here dry limestone slopes well fitted for the vine, and so forth, through most of the gamut of human needs. Most, but not all, for that special condition which has, within the last century, brought fabulous wealth to parts of England is only scantily represented on the margin of the Basin of Paris. In other words, only to the north does coal occur, and since the industrial revolution coalfields in the opinion of the world have been a more desirable possession than the golden wheat lands which have always been France's pride. The fact that her coal is not very abundant, and not very accessible, has thus diminished in recent years the relative importance of Paris and of France.

The geological characters of the Basin of Paris must next be noted. We have spoken of the general similarity between it and the London Basin, for both contain rocks of the period called Tertiary, while the surrounding beds are Secondary. But in Tertiary times the two Basins were apparently not continuous. Across what is now the Strait of Dover, it seems clear, the London Basin was once continuous with that of Belgium, but this large Basin was separated from the arm of the sea in which the Paris beds were laid down by a ridge which represents a buried part of the Ardennes upland.

At the north-western and western edge of the Ardennes region we find coal measures, the coal further west being buried beneath younger beds, so that Belgian coal is worked at great depths. The same beds are continued across the Strait of Dover, for coal occurs in Kent, also at great depths. This line along which coal occurs, then, represents the old ridge which once separated the Tertiary Basin of Belgium and London from that of Paris, and the present undulating country of Artois, which forms the boundary of France and Belgium, is thus a geological as well as a political division line. It is the fact that the two lines do not exactly coincide that gives North France coalfields, for the Belgian beds extend beyond the political frontier, and are worked within French territory, with the result that Lille, Roubaix and the surrounding towns have a manufacturing industry.

We have thus demarcated the Basin of Paris from that of London and Belgium—let us note next its special features. These are fundamentally very simple (see Fig. 17). The Basin, we have seen, is incompletely ringed by uplands. On travelling from the uplands inwards towards Paris as centre one crosses beds which become progressively younger. Outermost, resting on the old rocks of the uplands, comes a ring of Jurassic beds, like those which run in a broad belt through England from north-east Yorkshire to Dorsetshire. Next comes the chalk, like that of southern England. Finally, forming the centre of the Basin are Tertiary beds—loams, sands, gravels, limestones. On the seaward side the Jurassic ring is incomplete, so that the traveller from England, by whatever route he approaches Paris, crosses the chalk, which forms the characteristic scenery near the coast, save where limited areas of Jurassic beds appear.

But this arrangement does not represent the primitive one. It will be noted that the Jurassic beds are exposed close to the uplands. Now it is just in this position that the rivers have the greatest erosive force, for here their

valleys are steeper than elsewhere. The present arrangement is therefore a result of erosion; the oldest beds are exposed close to the hills because here wear and tear has been greatest, the youngest beds remain towards the centre



FIG. 17.—Geological sketch-map of Northern France to show the structure of the Basin of Paris.

(1) Clays, limestones and sands forming the Tertiary beds of Hampshire and the Paris Basin. (2) Chalk, grits and clays forming the Cretaceous beds. (3) Oolitic limestones, etc., of Jurassic Age. (4) Ancient rocks of the Central Plateau, Brittany, Cornwall, and Devon, crystalline or sedimentary.

because here erosion has been least. If the meaning of this statement has been grasped it will be easy to realise how it is that the harder strata of the Tertiary deposits present escarpments on their outer margins. The process of strip-

ping off surface beds takes place from the periphery towards the centre, and therefore while the rivers flow from the margin to the centre, the escarpments face—not towards the centre—but outwards to the periphery. In detail these escarpments are often important in connection with the site of towns. In approaching the centre of the Paris Basin from the north or east they give the Tertiary beds the appearance of forming a scarp island rising from the surrounding chalk.

There is still another interesting result of the Basin arrangement. Broadly speaking, fertility in the Paris Basin increases from the margin towards the centre, and the marginal Jurassic beds especially tend to produce the accessories of civilisation, such as wood and wine, rather than prime necessities, such as wheat. But the Basin arrangement and the direction of flow of the rivers promotes easy communication, and therefore large towns tend to arise where navigable waters meet, for these waters have been flowing through districts yielding varied products. Paris is fundamentally the junction of the Marne and the Seine, while the Oise unites with the main stream not far below the town. One should not omit to notice also that all the more important tributaries join the Seine above Paris. Thus it is the centre towards which the varied products of the Basin, themselves determined by the very varied rocks represented, drain by the natural routes of the rivers, and in addition to this initial importance it has the wider one, due to that convergence of great routes of which we have already spoken.

One should note also that it is only by making a sudden turn that the Loire avoids the Seine and the Paris Basin. It seems tolerably certain that at an earlier stage it was one of the factors of a greater Seine, and the sharp bend to the west was a later development. Fundamentally the advantages of position which Orleans possesses over Paris are not very great, or were not very great until the develop-

ment of the northern countries. Like the Seine also, the Loire has its series of historic towns determined in similar fashion by the junction of zones of different structure and products.

To discuss in detail the *raison d'être* of the important towns of the Paris Basin would be impossible, but we shall take as types and examples the three great cathedral towns which attract especially the attention of the tourist—Amiens, Reims and Chartres.

Let us begin with Amiens, which is nearest to us, and is placed in Picardy. The first point is that it lies in the chalk belt, but the chalk is not the determining factor in the mode of land utilisation practised. This is because it does not crop out at the surface, but is covered by an often thick bed of a loamy soil similar to the loess of which we spoke in Chapter VI., which is easy to plough, fertile, and forms nearly level plains. This soil has for centuries borne crops of wheat; now sugar beet has become also important. But though the direct importance of the underlying chalk is not very great, indirectly it affects human life markedly. The loess—like loam—is highly permeable to water, and this is also true of the chalk beneath, so that the region tends to suffer from want of water, and isolated habitations are rare, because a domestic water supply is often only obtainable from deep wells, costly to dig, and therefore not constructed by isolated families. Local variations, especially the outcrop of sands, attract villages, and the presence of trees around them emphasises the presence of water-bearing beds.

But we must not forget that the rainfall is considerable in this oceanic margin of France. The water absorbed by the porous chalk must sooner or later come to the surface. As in other similar regions, therefore, the rivers, instead of beginning in small trickles of water, spring full-formed from the hillsides, and run in wide valleys, far larger than the present streams. Of such the Somme, on which Amiens

stands, is an excellent example. Owing to the way in which it is fed by springs from the chalk it is extraordinarily constant in its flow, a fact taken advantage of in the extensive use of water-power at Amiens. Further, the present stream-bed has a very gentle slope, and the river meanders over the wide, flat valley floor, dividing into many branches as it passes through Amiens, and causing the marshy valley to offer the maximum of contrast to the dry hill slopes above. The origin of the valley marshes is interesting. No chalk is absolutely pure, and the water, acting through countless generations upon the rock, has dissolved away the carbonate of lime but left a clay-like deposit, which has been carried by tributaries and spread over the valley, thus caulking, as it were, the natural fissures of the chalk which forms its floor.



FIG. 18.—A Stone Age implement of the Acheulean type, showing the characteristic sharpening of the point.

(After *Buttel-Reepen.*)

In an earlier era, apparently during an interglacial period, when melting ice to the north supplied the rivers with abundant water, a larger Somme carried down great deposits of gravel, gravel which the present constant sluggish stream could not move. At this period Early Stone Age man lived in the district, and his relics are found in those old river gravels. The stone implements found here, instead of being merely lozenge-shaped, like those of the epoch immediately preceding (Chellean), were sharpened at the extremity. Such implements are called Acheulean (Fig. 18), from the fact of their being found near the Abbey of St. Acheul at Amiens, and the sightseer may find some additional interest in the thought that here some unknown genius lived and died, to whom in his daily warfare with rhinoceros, elephant and cave bear—a sadly unequal

struggle—there came the brilliant idea that a sharpened stone had more penetrating force than a blunt one.

The reason which determined the actual site of Amiens on the river Somme is not perfectly clear, but it is possible that at the time of its foundation the tides came up to near this spot, so that it may be an example of a city at a tidal limit (*cf.* London, Newcastle-on-Tyne, etc.). Another advantage which it possesses is that the valley here has an outcrop of firm rock on which the cathedral is built.

Apart from its cathedral, the tourist will find in his survey of Amiens several points of geographical interest. Its *pâtés de canard* recall the fact that the marshy valley still lodges much game, and remind us of what has been said above of the clay deposit on its floor. Similarly the market gardens surrounded by water, which are one of the sights of the city, owe their existence to that constant flow of the river of which we have already spoken. A river liable to periodic inundation would render such a mode of land utilisation impossible. The cotton manufacturers depend partly upon water-power, partly upon the ease with which raw material can be imported, and the relative proximity of coal (p. 271). The cathedral may be said to owe its origin to the wealth produced by the cornfields of the loam-covered plateau. In brief, the position of Amiens is due to the fact that in a fertile country where water is deficient large settlements must be placed in river valleys. In this case the width of the Somme valley has been a specially favouring cause.

Reims as regards situation affords a marked contrast, for the stream upon which it stands is insignificant, though it is connected by canal with the Aisne and the Marne. The importance of the town lies in the fact that it is situated near the junction of the wine-producing chalk of the Champagne country, and the varied Tertiary beds, which produce wood on the sands, excellent building material (*cf.* the cathedral) from the calcareous strata, and the possibility of a great

variety of crops. Even more than this, however, Reims is a crossing-point of routes. Till it was in a sense suppressed by Paris it lay on the natural route between Champagne, Burgundy, the Middle Rhine valley and the Low Countries, all regions with special products upon which a system of exchange could be based. The cathedral here, therefore, may be said to be built from the profits of trade.

The vicinity of Chartres, on the other hand, shows a certain resemblance to the region round Amiens. The town is the natural centre of the fertile region of Beauce, whose grain brought the local wealth which enabled the cathedral to be built. Beauce is floored by limestone beds—a resemblance to Picardy—but the limestone is here of Tertiary date, having been deposited in a lake at that period, the lake into which the Loire once drained. Fortunately, however, as in Picardy, though to a less extent, a covering of loam lies upon the limestone, and gives here also great local fertility. The land is thus abundantly grain-producing, and, as in Picardy, the difficulty of obtaining water causes the habitations to cluster about special areas, separated by wide, uniform wheat-fields. Around this fertile region are belts where an almost sterile clay rests upon chalk, and the wheat-lands then give place to forests, *e.g.* in the direction of Evreux and Blois. To the inhabitants indeed the term Beauce implies grain-producing, and the name is applied in a fashion which on the map appears erratic, to villages where this type of soil prevails. In essence the region is a plain. Beneath the thin layer of loam material for building and for road-making is easily obtainable, communication is easy, but the uniformity, the absence of trees and of streams, give monotony to the landscape. But just as the clays to the north-west and west bear timber, so also do the sands to the south in the vicinity of Orleans. This encircling forest gives the region a natural boundary, and made it early of political significance. As in the case of Picardy the larger settlements

were naturally associated with the appearance of rivers, and Chartres on the Eure is comparable to Amiens on the Somme.

The fact, not unfamiliar to the tourist, that the country people bring their children at the harvest season to place them under the protection of the famous Black Virgin of Chartres is full of significance in the history of the region. Beauce is a natural unity, a grain-producing land encircled by forest and marsh ; in such cases the emotions engendered by the corporate life tend to associate themselves with a central shrine, which is at once their expression and their fount. To the market the peasants bring their corn ; in the cathedral they express and renew the feelings which make continuity of human life possible. The generations come and go, but the despair which the shortness of their duration tends to produce is conquered by the splendours of the cathedral, which is the symbol of the permanent in human ideals, in spite of the ceaseless alternation of birth and death. The child brought to receive the blessing of the great Mother has at best before it but a brief span of life, but the pavement which it treads has been trodden by the feet of countless others in the generations which are gone, and will be trodden by the feet of countless others still to come. Its fathers have sown and reaped and they and their sheaves have rotted into dust, but the cathedral remains, and is in its turn but an image of something greater even than itself or than the creed it symbolises.

Acheulean man near Amiens chipped and sharpened his flints, and his laborious care expressed something more than a mere desire for an efficient weapon. The twelfth-century architects built a church to the glory of a particular creed. The creed may decay, the church may crumble, both may become as functionless as the chipped flints which expressed the aspirations of an earlier race, but the consciousness which they give to each individual of being not merely a short-lived unit but a link in an endless chain—this remains. We may

kneel then with the peasant on that variegated pavement, and forget the creeds in the thought of the continuity of emotion.

If one leaves the cathedral and wanders about the town it becomes obvious that, here no less than at Reims, the predominance of Paris has thrown Chartres into a backwater. Its old importance as a crossing-point of routes has all but disappeared, only its grain remains. The minor manufactures, *e.g.* of wool and of leather, are interesting, for, in accordance with an old custom, the sheep are allowed to feed upon the fallowed lands, and thus sheep farming is combined with wheat.

This description must suffice to give some idea of life in the northern plains of France. In Aquitaine there is another Tertiary basin with somewhat similar characters, while Provence, which we shall consider separately, is of another type.

REFERENCES. Fuller accounts of the geography of France will be found in Prof. Vidal de la Blache's *Tableau de la Géographie de la France*, upon which the foregoing account is largely based. Reference should also be made to the description of France in de Lapparent's *Leçons de Géographie Physique*.

CHAPTER XXI

THE NORTH ITALIAN PLAIN

‘The waveless plain of Lombardy,
Bounded by the vaporous air,
Islanded by cities fair.’

No greater contrast to the Basin of Paris could be imagined than that great plain which stretches from Turin to Venice, from Cuneo round the curve of the Apennines to Rimini, and from Pinerolo along the sigmoid bend of the Alps to the Gulf of Trieste. Yet, despite their contrasts, both contain marvellous examples of urban settlements. It is somewhat curious to note also, that while geologically the Plain of the Po, in itself and in its encircling mountains, is much more recent than the Basin of Paris, yet historically it is far older. On the whole, that is, the splendours of the present are to be sought in the northern plain, of the past in the dead or dying cities of the southern. In both we have stored up the treasures of human endeavour.

Let us note in a little detail some of the contrasts between the two. In the Basin of Paris, as we have seen, a ring of much denuded mountain stumps, separated by open gaps, surrounds a plain whose central and youngest beds are of the age we call Tertiary, girdled about with the clays and limestones of the Secondary period. The diversity of the deposits, the fact that the rivers run across the beds, thus traversing rocks of successively later origin, are, as we saw, factors in determining the origin of towns at points where the products of the different regions are most easily collected

and exchanged. Further, as the surrounding broken ring of mountain stumps is widely interrupted to the north-west, access to surrounding regions is here excessively easy. In the other compass directions also only minor obstacles to intercommunication occur. The net result is that Paris arose as the centre of the Basin at the point where the water routes converged, and has become, to an overwhelming degree, the centre of the land of which it is the capital. France, as a country, is to a very high degree centralised, and as a world power her susceptibility to new ideas is to be directly connected with her easy communication with many lands of different products and characters. The high mean level of her literature is thus the expression of her geographical peculiarities.

Turn next to the great Plain of the Po. It is built up of beds more recent than Tertiary, for it owes its origin to the fact that an arm of the Adriatic was filled up by the tremendous amount of waste which the glacial torrents of the Ice Age brought down from the great glaciers of that period. Now, many of those Alpine torrents are filtered in the lakes which lie at the foot of the mountains. In earlier times all their transported material was spread out upon the sea floor. With minor variations, then, the beds of the plain are constant in character, as well as being soft, unconsolidated, and generally porous.

Again the incomplete mountain ring here—for it is breached to the south-east—is built up of recent folded mountains in which extraordinarily marked erosion is going on. The rocks of these mountains are highly diverse, and among them are admirable building and monumental stones, giving rise, as in the Paris Basin, but more markedly, to a natural tendency for the people of the plain to specialise in architecture and sculpture.

More striking, however, is the contrast in ease of communication. From peninsular Italy to the south the plain is all

but cut off by mountains, though these present tolerably easy passes, and to the north and west—but to a much less extent to the east—the Alps seem to offer a barrier to free communication with surrounding lands. South-eastwards the plain slopes gently to the sea, and at first sight one would suppose that this would be the direction in which its traffic would tend to flow, following the line of the water. A point, however, which must strike the most unreflective tourist, is that while in the Basin of Paris, as indeed in plains generally, running water attracts settlement, here, with some exceptions, it repels. The great city of Milan is one of the few examples of plain cities which have no considerable river running through them. A row of towns, of which Parma and Modena are two, lie along the slopes of the Apennines, avoiding alike the proximity of the main stream and of its great tributaries. Finally, by whatever route one descends from the Alps towards the south-east coast of the plain, the most striking feature of the descent is that the river valley which is utilised near the Alps is left before one travels far over the plain, and coastal towns—Venice, Ravenna, Rimini—avoid the vicinity of the rivers. If the traveller has had previously no very detailed knowledge of the geography of the plain, this fact offers a complete puzzle, and as one settles down to the journey, say from Verona to Venice, one suddenly rouses oneself to say—By the way, what became of the Adige? The Po itself, the Piave, the Brenta, have the same disconcerting habit of disappearing from the cognisance of the tourist, without apparent cause.

Associated with this peculiar character of the routes to the sea, and the want of connection between the streams and the towns, we have the further peculiarity that the greater part of the traffic of the plain does not follow the direct line to the sea, but rather tends to turn southwards, so that the most important junctions of the plain are not ports but Milan, Turin, Bologna, Alessandria. Upon the first two

converge routes from the Alps, the latter are nodes towards which the heavy traffic gravitates before the passage of the Apennines is effected at the two lowest points. The result is that though there is apparently an open road to the south-east, yet the important lines of communication turn away from this easy route, in order to attack the southern boundary chain of the plain. The cause is to be sought in the fact that the western side of Italy has always predominated in the history of the country, and the local conditions on the east are such that the attempts, repeated throughout historical time, to utilise the low ground near the head of the Adriatic as a site for important ports have never met with more than temporary success.

Shelley says of Venice

‘Sea-girt city, thou hast been
Ocean’s child and then his queen,’

but that is because the poet lives in the present. Ocean, like Time, devours his children—Venice is at once offspring, queen and victim.

Strive as he will, man here has been driven from one position of temporary vantage after another, and that traveller will court inevitable disappointment who visits Venice without recollecting that its people have been fighting for centuries a losing battle. One of the great charms of Ravenna, perhaps the most marvellous city of the plain, is that with mournful dignity she has long since acknowledged defeat; her churches with their gorgeous mosaics, her tombs, her relics of a moment of splendid life are sinking steadily and resistlessly into the marshes; that wonderful mediæval monument of Lombardi’s which shows a youth in the majesty of death, the desire to live frozen upon his marble lips, may well serve as her emblem. Beside her Venice, with all its glories of sky and sea, is little more than a painted hag, persistently refusing to face the facts. Titian, with the hand

of an artist and the soul of a huckster, exploiting his talent almost to the last moment of an extended life, was a true citizen of the water-penetrated town.

Let us seek to justify some of these statements by a consideration of the physical geography. As already stated, till the end of Tertiary times at least the present plain of the Po was an arm of the Adriatic, and, with some minor exceptions, its floor is now formed entirely of transported waste, chiefly from the Alps, but partly from the Apennines. Alpine detritus predominates partly because the Alps are higher and steeper, partly because, owing to their snow-cap, their streams flow throughout the year, while those of the Apennines dwindle in the summer drought; but especially because the great glaciers of the Ice Age deployed far down the present plain, spread a great mass of morainic material near their snouts (admirably seen at the lower end of Lake Garda, *cf.* p. 186, and also near Ivrea), and in addition gave rise to huge torrents which carried the finer material far out into the shallowing sea, as do their smaller descendants, the glacial torrents of to-day.

We have said that there are a few minor exceptions to the rule that the plain is floored only with alluvial material. The most notable of these are the beautiful hills called *Monti Berici* and *Colli Euganei* respectively, the latter being well seen as one approaches Padua. These are of volcanic origin. Another notable exception is the block of high ground which rises near Turin, one of whose constituent hills is crowned by the *Superga*. This hill country—called *Monferrato*—is but a part of the Apennines, advancing into the plain, and cut off from the main chain of the Apennines by the valley of the *Tanaro*, the largest right bank tributary of the Po. In regard to it we shall have a word to say directly.

We shall not discuss in detail the characters of the deposits of the plain, beyond pointing out that, as we should expect, the coarser material lies close to the Alps, the finer nearer

the river. The regions where the deposits are coarse suffer from drought, for the water sinks rapidly through the loose beds. In this region irrigation is carried on by a somewhat elaborate canal system. Where the beds are finer, they tend to take on the character of clays, and are thus less permeable. These relatively impermeable beds seem to be continued to the north beneath the coarser deposits, with the result that at the line of junction of the gravels and the clays copious springs appear. The water of these springs can be used with great ease for irrigation purposes, without having recourse to costly canals, and the rice crop of Lombardy largely depends upon this copious outflow of water, which appears along a band called the region of *fontanili*. Owing to the possibility of constant watering here, and the long, hot, continental summer, it is possible to take off several crops from the same land, and the hay crops so obtained help to account for the cheese of the plain (Parmesan, Gorgonzola).

Let us note next the course of the Po. It is obvious that it does not, as one might suppose, occupy the centre of its great valley. Rather does it lie close to the Apennines, so that the southern Apennine streams are mostly short and rapid. The reason becomes obvious on consideration. We have spoken (p. 285) of the great steepness of the Italian side of the Alps. This makes the Alpine streams very swift, and they carry much water. As their gradient changes where they enter the plain, they tend to throw down much of their load, with the consequence that they build up their own valleys, and tend, as it were, to run along an embankment of their own making. The presence of these embankments has the effect of preventing the union of the adjacent streams, for each separate stream builds up a great cone on the surface of the plain. The result is that the main river is pushed far to the south. Note a consequence of this at the western end of the plain. Here, owing to the encircling

mountains, the southern streams carry much water as well as the northern ones. When the Po was pushed south in the vicinity of Alessandria by the cones of the northern streams, the Tanaro was able to eat its way back through a projecting part of the Apennines, to such an extent as to capture the headwaters of a stream which formerly ran from the Ligurian Alps, past Bra, direct to the Po near Turin. The result was to cut off from the Apennines that mass of hilly country spoken of above (p. 285) which forms Monferrato, and incidentally to give the Plain of Piedmont—which thus includes an isolated bit of the Apennines—a more varied and picturesque appearance than those of Lombardy or Venetia.

With this account of the rivers let us turn to the question of why settlements in the plain avoid them. They are rapid, variable, both in their flow and in their course over the plain, and carry much *débris*—contrast the slow, constant, clear Somme (p. 276). Rivers attract when they can be depended upon; they repel when they are variable, for the variability brings with it not only the risk of flooding, but associated with the flooding the possibility, or rather the probability, that fertile land will be ruined by stones and mud, that villages and towns may be swept away or destroyed.

Travel from Cortina down to Venice by Belluno and note the bed of the Piave, far too wide for its summer stream, but through all its width piled up with stones which the might of the foaming flood will transport far down the valley, with sand and mud which will be carried out seaward to be again transported by the marine currents, and so to play its part in silting up some doomed port. Not such are the rivers by whose banks man seeks to settle. Variable though the Alpine streams are, however, the ice and snow of the Alps give at least a summer flow, which the Apennines cannot give. Thus the Alpine streams, apart from their use for irrigation purposes, furnish water power, the power which

is developing the silk and cotton industry of the northern part of the plain, an industry which once depended in part on the peat deposits, themselves a relic of glacial conditions, but now largely exhausted.

But if the rivers are uncertain and dangerous, water is generally abundant, and the inhabitant of the plain has found by long experience that canals are safer than the natural waterways. Thus Milan, though in the midst of a great river plain, is a city which depends for water communication on canals, not on a river. If Turin seems to be an exception to the rule that the towns of the plain avoid the rivers, we have to remember that the Po here, before it has received its most uncertain tributaries, is still manageable. Piacenza, another exception, is at an easy crossing-place.

We must turn next to the coast to consider why all the ports of the plain have had the same history of a period of prosperity and then of permanent eclipse.

The Adriatic has a better marked tide than some other parts of the Mediterranean, but, on account of the interference of the tidal waves with each other, there is only one tide per day. Further, the sea is relatively shallow. The absence of strong tides, the shallow sea, promote the deposition of rock waste, and we have seen that with this the rivers are abundantly loaded. Therefore, as in similar cases elsewhere, notably in the eastern Baltic, banks of sand and silt tend to be laid down off the coast. Such banks, called *Nehrung* in the Baltic, receive the name of *lido* in the Adriatic, and the Lido, so famous as a seaside resort, is but a specially well-developed case of such a bank. The currents of the Adriatic sweep southwards, and therefore the *lidi* grow in the southern direction, and, owing to the transporting power of the waves, they are not limited to the immediate vicinity of river mouths, but tend to form to the south of them. Further, they are not continuous, but have gaps to which the Italians give the name of *porto*, the *porti* being the gates to the harbour beyond.

The harbour, *laguna* in Italian, the equivalent of the *Haff* or haven of the Germans, is a stretch of calm water, sheltered from waves and wind by the *lido* or bank of sand, rich in fish because the turbid water is loaded with food material.

Part of the reason for the wealth of fish is that the calm, silt-floored lagoons are literal sea-meadows. Over their surface grows the sea-grass or *Zostera*, found also in suitable localities off our own coasts, and familiar to the tourist in Venice because it is extensively used as packing for the glass of Murano. When, after the trip is over, one unwinds the long strands from those fragments of precious glass—which never in the cold light of England seem so beautiful as one thought—their slight ‘fishy’ smell brings back all the sights and sounds of the wonderful city, from the insistent ‘Murano, Madama, Murano,’ of the gondoliers, to the faint plash of the oars in the city of silence, and the cooing of the pigeons as they make love in the sunshine, with a true Italian disregard for the fact that the pigeon population is already excessive. It brings back also all that jumble of impressions which Venice gives—the smell of the Grand Canal as the steamers stir its black noisome depths, the green, slimy steps, the suffocating odour of chloride of lime in the narrow *calli*, the baroque churches with their abuse of ornament, the diverse loot which decorates St. Mark’s Square, and, above all, that marvellous effect as one returns from the Lido across the lagoon to Venice in the twilight, and sees all its beauties, backed by the snowy Alps, with its defects veiled in the lovely evening light.

Indeed from those long green fronds the constructive geographer of the modern type could explain for us the whole of Venice. In life they lodge a myriad population of tiny sea creatures, which in turn feed the fish, while the presence of the weed speaks of the steady, ceaseless descent of fine particles of mud which is slowly but surely raising the floor of the lagoon. Ultimately the diminution of depth,

the shift of the shore currents, strive to control them as man may, will block the seaward entrance to the lagoon, will prevent the daily access of the purifying tide. With the loss of the entrance-way the erstwhile haven must lose its function; from a living thing (*laguna viva*) it becomes *morta*, and the mosquito larvæ, no longer destroyed by the constant access of salt water, live and thrive, hatch out into mosquitoes, soon become infected from the blood of some malarial patient, and begin their work of disseminating disease, of rendering a once habitable place a void.

This in brief is the history of every town on that changing shore—shallowed bay; bay cut off from the sea by a protecting sandbank, rich in fish, and offering safety alike from land and sea, from storm and Goth; bay too much shallowed, cut off from the vivifying ocean, with incipient decay of the once flourishing town; and—the last stage—the complete separation of the town from the sea, and the development around it of what we still call fever-breeding swamps, though the swamp *per se* has nothing to do with the fever.

Forgotten Spina; Adria, now more than twelve miles from the sea; Aquileja, still with much to recall its past prosperity, but yet dead before the Venetians conquered it; Ravenna, now laboriously connected by a canal with the sea which has left it to its mournful splendour; Venice, putting a brave face on the blows of fortune, but reduced from the condition of a great city to a pleasure town—all have passed or are passing through the same history, and no human effort can postpone the inevitable for more than a brief period.

Even more pathetic perhaps than that advance of the land upon the sea which is the prime cause of the decay, is a minor accompaniment of the land-building process. The land that is formed seawards is loose, unconsolidated, full of water. As more and more layers are laid down upon the

top of the old a process of compression, of settling, takes place, with the result that the land seems to sink ; buildings slowly bury themselves in the earth. Where the sinking process is unequal and affects the piles upon which the buildings stand, the whole may topple bodily, as did the Campanile at Venice. The buildings of Ravenna, a staid and more dignified town, subside slowly and steadily into the earth.

Among the many thrills of that city surely one must rank high that when custodian after custodian, in each successive building, raises a covering of planks and shows beneath the present floor that other which at an earlier period was level with the surface, points out the water which is sapping the foundations. The gorgeous colouring of the mosaics above, the rising water below ; the echoes of that fierce old warfare between Arian and Orthodox imaged on the walls, the element which quenches all strife below—where can one find a greater contrast ? Especially perhaps at Sant' Apollinare in Classe, where without there is the creaking of the leisurely bullock-carts as they bring their loads of sugar beet to the factory, or carry away the dripping residue, and within the stillness, the emptiness, the soul-satisfying tracery on the ancient sarcophaguses, does one feel the greatness of the victory, the magnitude of the defeat. In the austerity, the restraint of its art Ravenna is unique among the cities of the plain, and like that proud lady, her erstwhile ruler—twice an empress and twice a slave—who was buried sitting in her robes and jewels that after death at least she should be beyond the reach of the blows of fate, so in death is Ravenna a queen. Less fortunate than the city, of which much yet remains, the great queen was burnt within her tomb, and only her empty sarcophagus stands now facing the *Cristo senza Barba*, the Good Shepherd who had not yet become the Crucified.

The creed which made Ravenna's art was not that which filled Florence with pictures of Mother and Child ; its symbol-

ism—of peacock and grapes, of lamb and dove and stag—was passionless and aloof, the art of a people who faced an inevitable doom without fear and without hope. As one wanders through the quiet streets, and notes in building after building the repetition of the symbols of the peacock, which is everlasting life, and of the lamb, which is peace; the absence of imaged material joys and pains, of the whole conception of redemption through innocent suffering; the constant representation of men and women in their prime as against the fevered hope that a new generation may accomplish what the old has failed to do; the dignity of a life which yearns but does not hope—*senza speme vivemo in disio*—we find something which the rest of Italy cannot give. This is another religion from that which has left its mark in the hill towns beyond the Apennines, and if we rejoice that that other religion raised the slave, we have to remember that this was the religion of free men and women. The slave redeemed is still the tainted man, and to us, steeped in the traditions and phraseology of that creed, the older, the conquered faith has something to say.

Do not, therefore, forget to include in your North Italian tour that deviation from the beaten track which brings you to the marshes by the sea, even if it involve facing for a second time the pandemonium which reigns at Bologna in the tourist season.

Venice of course no one is likely to omit. To prevent disappointment, however, those who are intensely interested in Italian art may be recommended to make their first visit to the town precede rather than follow that to Florence or any of the hill-towns, and to realise that above all Venice was always a traders' settlement. In this respect it resembles Milan, but two facts obscure in the existing cities the basal resemblance. Both stand—necessarily as commercial towns—at a crossing place of routes, but while with modern changes in modes of communication the routes which converge upon

Milan have increased rather than diminished in importance, the trade of to-day tends to turn away from Venice. Second, Milan was always without natural defence, or almost so, a fact which to-day facilitates free communication, but which in the old days meant that time and again the town was sacked and burnt. Thus relatively few artistic treasures from earlier periods remain. There is within the town a principle of life which bids it rise again after every conquest, but after each resurrection it has the interest of the present, not of the dead past.

Venice, a natural fortress, has preserved, except against the assaults of time, many treasures almost untouched. But its security has been its ruin. Saved by isolation from the necessity of constant change and adjustment, it has lost the power of assimilation of new elements or new ideas. The two towns may be recommended to the special notice of those who repeat the parrot cry that in human life force, the power of self-defence, is the only safeguard of national or individual life. To have lost the need of constant readjustment, reconstruction, regeneration is to lose the power of continued existence. The makers of Venice fled to the marshes to escape land and sea foes, found security, prospered greatly till in the course of time their descendants found that the safe life had sapped the wellsprings of national character, as the unstable marshes sapped the foundations of their noble buildings. Milan, apparently helpless, besieged, it is said, forty-eight times, sacked on twenty-eight occasions, has arisen greater after every defeat. The South American Glyptodon, armed at every point, has left but its bones for our museums; the tiny lizard, helpless and fragile, suns itself in myriads on every vineyard wall—the timid might, one would think, take some comfort from such thoughts as these.

But they are perhaps irrelevant. Let us note in a word or two some of Venice's advantages and disadvantages.

As regards the first her proximity to the relatively low eastern Alps is of course important, for, especially in early days, before the great railway tunnels were built, the fact gave her easy access to the northern countries, greedy for the products of Italy and the East. For we must note that, despite their height and continuity, the Alps have never been in a real sense a barrier between peoples. Nay, despite their high and difficult passes, in some ways we have to think of them as stimulating traffic. To their presence, as already seen, we have to ascribe some part of the sharpness of the contrast of climate, and therefore of products, between Central and Mediterranean Europe, and it is this contrast which promotes trade. If the Italian has but little inducement to climb the steep wall which bars progress to the north, the inhabitant of the transalpine countries is led naturally up the long river valleys till from the crest he may see—in imagination if not in fact—

‘ the harvest-shining plain,
Where the peasant heaps his grain,’

as well as ‘ the cucumbers and the melons, and the leeks and the onions, and the garlick ’ of this richer Egypt, and from his lusting for these and other joys trade arose. That trade fell at one time largely to the lot of Venice. Further, as is well known, the trade of the East was chiefly in her hands till the discovery of the sea-route to India, and it was that trade especially which enriched her.

Among her disadvantages we have to note that the opposite shore, once the resort of the pirates who harassed her trade, consists for the most part of but a narrow strip of plain—sometimes non-existent—beyond which rise mountains not crossed by any natural trade route. The reopening of the Mediterranean to the traffic of the East with the cutting of the Suez Canal, might, one would suppose, have caused Venice to regain her old splendour, but she is ill-fitted to

PLATE XXX



Gondolas on the Grand Canal at Venice. The Grand Canal is probably the old mouth of the Brenta.

serve as a great modern port (note the position of the railway station), and opposite her lies Trieste, the natural outlet of the centre and south-east of the continent. With this brief description we may leave the Queen of the Sea, only adding that the S-shaped Grand Canal is probably the remains of the old mouth of the Brenta, which was turned away from the city by the Venetians, because they wished to diminish the risk of the silting up of the harbour.

We have left too little space to say much of the other cities of the plain. Turin, placed where the plain narrows, between Monferrato and the Alps, and commanding the Mont Cenis route, is functionally a fortress. One should notice its straight streets, crossing each other at right angles, and the way the Castello forms the natural centre of the town. It is thus primarily of strategic importance (note the road to Genoa, *cf.* p. 243), though of recent years its manufactures have become important. Verona, a most interesting town, commands the southern entrance of the Brenner pass, much as Munich may be said to command the northern. The two towns offer contrasts of great interest, and the Brenner route, with a stop at Verona before Venice is visited, is probably the most instructive way of entering Italy.

The hints given in this chapter in regard to the causes determining the sites of towns may be of some help to the tourist in his visits to the other towns of the Northern Plain, which we cannot discuss here.

REFERENCES. We shall not give here a list of books dealing with North Italy. Their name is legion, and any librarian or library catalogue will give a long list, beginning with Ruskin's *Stones of Venice*, and ending with a picture book published yesterday. As no attempt has been made here to discuss questions of art, and as most of these books deal primarily with this subject, it seems unnecessary to name them here. The most authoritative account of the geography of Italy—unfortunately not very easy of access—is to be found in Prof. Theobald Fischer's *Das Halbinselland Italien*, which forms part (vol. III.

part 2, 2nd half) of Kirchhoff's monumental work called *Unser Wissen von der Erde*, the special volume being part of *Laenderkunde von Europa*. Most descriptions of Italy in books of reference are more or less based upon this account. In the course of his reading the industrious traveller will not fail to plod through *I Promessi Sposi*, which gives a good account of Milan, and some history of the *Risorgimento* should also be included.

CHAPTER XXII

PROVENCE AND TRANSAPENNINE ITALY. THE DEVELOPMENT OF THE TOWN

‘ Qui n’a pas vu Avignon du temps des Papes, n’a rien vu. Pour la gaieté, la vie, l’animation, le train des fêtes, jamais une ville pareille. C’étaient, du matin au soir, des processions, des pèlerinages, les rues jonchées de fleurs, tapissées de hautes lices, des arrivages de cardinaux par le Rhône, bannières au vent, galères pavoisées, les soldats du Pape qui chantaient du latin sur les places, les crécelles des frères quêteurs ; puis, du haut en bas des maisons qui se pressaient en bourdonnant autour du grand palais papal, comme des abeilles autour de leur ruche, c’était encore le tic-tac des métiers à dentelles, le va-et-vient des navettes tissant l’or des chasubles, les petits marteaux des ciseleurs de burettes, les tables d’harmonie qu’on ajustait chez les luthiers, les cantiques des ourdisseuses ; par là-dessus le bruit des cloches, et toujours quelques tambourins qu’on entendait ronfler, là-bas, du côté du pont. . . . Ah ! l’heureux temps ! l’heureuse ville ! ’

THE great plain of the Po which we considered in the last chapter is said by Professor Fischer to link peninsular and therefore Mediterranean Italy to Europe proper. Spain is cut off from continental Europe not only by the chain of the Pyrenees, but also by the fact that behind the barrier lies a relatively infertile plateau land. Spain proper lies far to the south, and the long domination of the Moors emphasises its apartness from the rest of Europe, the fact that in climate, products and civilisation it is Mediterranean—one might almost say North African. In Italy the vast, fertile Northern plain has exerted throughout historical time an attraction upon the peoples of Central Europe which has

enabled them to overcome the difficulties of the passage, has—in a broad sense—germanised the north of Italy, and thus prevented that country from presenting the remoteness of the Iberian peninsula.

Indeed were it not that Central Europe is linked to Mediterranean Italy by the passes of the Alps and the Apennines, and by that wide furrow through which the Saône and Rhone flow, there would be much to be said for the exclusion of the great peninsulas of the Mediterranean from Europe in the strict sense. Greece influenced Italy profoundly, and this influence was sent northwards by the routes we have mentioned—it is to this fact that we owe the double civilisation of Mid-Europe. In Chapter I. we excluded Eastern Europe from our conception of the continent, not only because of its different physical characters, but also because of its aloofness in fact. We include the Mediterranean lands in our narrowed conception of Europe, not that the differences in this case are less—they are certainly as great—but because the two regions have continually reacted and interacted upon one another. Across the lofty Alpine passes, through the great furrow of the Rhone, there has been a ceaseless interchange of products, of ideals, of influences. Italy, the central member of the group of three Mediterranean peninsulas, has been, on account of her position, the mediator between two types of civilisation, the northern and the southern. The swallows which fly now north and now south, along the line of the vanished Tyrrhenian land, symbolise the movement of human ideals.

We have already in Chapter XIX. spoken of the Riviera, having taken it as a region apart, because the towns and villages which the term connotes for most people are in great part pleasure resorts and nothing more, are not natural outgrowths of their surroundings. The French Riviera includes a small part of Provence, but Provence as a whole differs markedly from the sheltered 'hothouse' coastal

strip, and is strongly Mediterranean, if not Italian, in feeling. Indeed it is not too much to say that those who find themselves unable to visit Transapennine Italy may capture more of its atmosphere—actual and mental—in some of the old towns of Provence than in the plains of Lombardy or Venetia. It is for this reason that we include a brief consideration of Provence in this chapter.

What are the special features of these Mediterranean lands? No doubt very varied answers could be given to this question, but, geographically speaking, the flowering of the individual town, if one may put the matter so, is perhaps the most striking feature. In Provence and in the Mediterranean region generally there is a sharp alternation of mountain and plain, the latter being usually small. There is a correspondingly sharp contrast between the rude life of the mountaineer and the intensely civilised life of the townsman, and as the plains are narrow and isolated, and yet often highly productive, and the town-making instinct very highly developed, the individual settlement acquires a perfection rare elsewhere. It is not only that, in earlier days, art flourished in those separate cities, relatively small though they were, as it does not flourish in our great centres; the city itself was a more complete organism than its northern representatives. It was not only market-town and seat of manufacture, of commerce, of learning, of administration; in many parts of Italy, by a curious paradox, the agriculturist is a townsman. If one journeys through the heart of peninsular Italy, say from Florence to Rome, one of the most striking features of the journey is the presence of innumerable little towns on the hilltops, separated by spaces all but devoid of habitations. The inhabitants of these hill-towns are often largely engaged in cultivating the land, and it is characteristic of much of Italy that not only the solitary habitation but even the small village is rare. In Scotland and the north of England one not uncommonly finds the

village reduced as it were to its functional minimum. It may consist of church, school, blacksmith's shop, vicarage or manse, with perhaps a squire or laird's house and a few cottages. Sometimes it is reduced even below this. In Italy, on the other hand, whenever what the French geographers call an 'agglomeration' exists, it tends to be relatively large.

The fact has of course a considerable effect upon the traveller's movements in Italy. Very many of those villages or towns contain magnificent works of art, and it is possible to journey slowly through the country, from one centre to the next, gorging oneself as it were with beauty—primarily, however, the beauties of art. But even were the beauties of nature greater than, as a rule, they are, it would be difficult to study them in detail, for that solitary wandering on foot from hill to valley and valley to hill, which seems so eminently natural to the less socialised northerners, is regarded here as an inexplicable phenomenon—the rucksack is not a passport in Italy.

The causes of the urbanisation of Mediterranean lands are no doubt multiple, and have not perhaps been yet fully analysed. Partly no doubt the people cluster on the hill-tops because of the danger of malaria on the plains below, the steep slopes above diminishing the number of pools in which mosquitoes might breed. Safety from robbers is no doubt also a factor, and political causes in the past have counted for something. We have also to remember that as the crops are mostly valuable in proportion to bulk, and demand a corresponding amount of labour, less land is necessary than when cheaper crops are grown. In other words, a relatively small tract of land round a village will support its population if that land is devoted to vines, olives, mulberries for silk, and so forth, as compared with the amount required to grow potatoes or turnips, and thus the villager who is an agriculturist need not travel a great distance to

his work. It is possible also that race and tradition count for something. In any case the tourist, who is probably a native of a modern type of town, should not fail to notice that since the Italians—after long centuries of practice—have, or had once, practically solved the problem of adapting their towns to human needs, they have no foolish illusions about the superiority of country life. Our towns are for the most part arranged with insufficient regard for human needs except the most material ones, and the consequence is that we most of us cherish the fond delusion that it is our dearest wish to retire into the country and live the simple life, and that it is a sign of degeneracy for country folk to wish to enjoy the conveniences and decencies to be found in the towns. In point of fact the ordinary townsman's desire to live in the country is precisely on all fours with his desire to eat oatcake or *Bauerbrod*, a subject which we discussed on p. 137.

Next to the development of the town, the most striking feature of Provence and Mediterranean Italy is perhaps the climate and associated vegetation. This subject we have already discussed, but perhaps we should note in addition that it is the clearness of the air, the bright sunlight, the recurrent drought, which give rise to those colour effects so dear to the artist's soul, which were also so keen a stimulus to the great artists of the past. Life in towns where free social intercourse was possible; the fact that those towns were natural centres into which many influences drained, constant intercourse being possible across and along a great sea which bordered similar and yet contrasting countries—these were among the conditions which made it possible for the mediæval Italians to enrich humanity with so many priceless treasures.

But a caution should be added. In spite of all its marvels, Italy proper probably almost always comes to the unsophisticated tourist with a shock of disappointment, and for this

reason also it is well to visit Provence before the longer journey is taken. Expectation in this case is not generally raised to so high a pitch and therefore the shock is less, and one learns what to expect among the hill-towns.

There is in Grant Allen's book called *The Woman Who Did*, a few words of description of an English girl's sensations on a first view of Perugia which must represent the feelings of many another, whose careful reading has not prepared her for that sudden sinking of heart which the first Italian town seen at close quarters is apt to produce—for Perugia is no worse than the other towns, and is better than some.

The exact causes of that shock of disappointment are not easy to put into words which will not arouse prejudice, on one side or the other. Those of our towns which are growing are mostly of recent origin, and, fundamentally, have been constructed to supply the maximum amount of labour for the factories with the minimum of initial outlay. They are mostly congested or contain congested areas, and have arisen with great rapidity; all these statements being of course especially true of the coal towns. These facts necessitate an efficient water supply, usually brought from a distance, an adequate system of drainage, and to such subjects, as well as to policing, cleaning, the construction of schools, hospitals, workhouses and so forth, the attention of administrative bodies is chiefly directed. Within certain limits and at a certain level most of our towns are efficiently managed. This kind of efficiency is for the most part absent in the towns of Mediterranean Italy, and the northern tourist, who is shocked by obvious delinquencies, tends to condemn the inhabitants wholesale as shiftless, idle, dirty, and so forth. Closer inspection will, however, show that the town does often provide very adequately for needs of whose existence our municipalities are just beginning to be aware. The traveller who is unutterably scandalised by the condition of a hill-town street should remember that art means leisure,

and that we may suppose that the great art of the past represents in a sense time saved which further north would have been spent in scavenging, not an inspiring occupation at best. The question whether it is better to have a dirty street and a marvellous church, or a spotless street and hideous public buildings is one which each individual must settle for himself, but before condemning the Italians wholesale as idlers, as many British tourists do, one should remember that a long latent period is necessary for the production of works of art, and what looks like idleness may really be germination.

Those who rank cleanliness higher than art should return home through Germany, and note how the people there pay for their really admirably kept towns in the frequent artless barbarity of their monuments, where the conceptions of a child or a savage are presented with the help of all the resources of civilisation. In their towns the Italians sometimes succeed in expressing the highest human emotions in almost perfect form, while the obviously very expensive monuments which decorate beautiful sites in Germany seem designed, like the war paint of primitive peoples, to frighten a possible enemy. Even more depressing, however, than the actual *Denkmal* is the thought that it represents a base ideal become imaged flesh, an ideal which corroded the heart of a people.

But it is difficult to be fair to both parties, and there are moments when 'efficiency,' even of the most blatant type, seems to have its uses; as, for instance, when one finds within an Italian church a notice setting forth the bishop's permission to the faithful to abstain from fasting because of the prevalence of infectious disease (*i.e.* cholera?), and outside on the steps of the same church in the blazing summer sun clear evidence that the town's system of sanitation—if indeed such exists—is totally inadequate to its needs. Again, however, one has to note on the other side that there are villages and hamlets in Scotland as innocent of any form of

sanitation as any Italian or Provençal town, and that the Scot, of whose virtues it is the custom to speak so highly, in his native village often shows that utter shiftlessness of which the Italian is so bitterly accused.

Perhaps on the whole the safest way is first to avoid, so far as possible, making sweeping racial deductions on the basis of a traveller's brief observations, and, further, to extend one's observations over as many regions as possible. There is no surer method of acquiring wide tolerance, and one must not forget that life would lose half its savour if our neighbours had not vices which make our virtues shine the brighter.

With this introduction let us note some of the structural features which have been of importance in connection with the history of Transapennine Italy.

The first point of interest is the reason why the balance of power has always through historical time lain to the west rather than to the east. We have already seen that the east coast, from about Rimini northwards, is low, flat, swampy, and its harbours continually liable to silting-up, owing to the fact that the long rivers, which carry much water, have mountain tributaries, loaded with copious débris, which is thrown down where the main stream enters the sea. From the vicinity of Rimini southwards the coast rises steeply from the shore, and for long tracts is harbourless—Brindisi and Taranto being the only important ports.

Not only is the coast harbourless and difficult of access, it has the further disadvantage that a coastal plain is sometimes absent and when present never wide. Further, since the rivers are short, rapid, and run in parallel disconnected valleys, access to the interior is difficult, and that interior when reached contains no important plains. Again, as already explained, the opposite coastline has but few products to offer. In consequence traffic up the Adriatic has for the most part been directed to the ports of the Po plain, and

so to that plain and to the Transalpine countries, not to peninsular Italy.

As contrasted with the Adriatic coastline, the western part of the peninsula has many advantages. Here the mountains for the most part stand further back from the coast, and what were once depressions between the mountains and the sea have been filled up by the products of volcanic eruptions, *e.g.* at Naples and around Rome, or by the débris carried by rivers, as in the lower basin of the Arno. Further, at this side the rivers are of more complicated structure, the short parallel streams of the east being replaced by branching systems, watering and opening up wide plains, notably those of the Arno and the Tiber. It is these plains which bear many of the most important towns of peninsular Italy, for example, Rome, Florence, and so forth. Not only are these plains in many cases floored with fertile soil, but this part of peninsular Italy faces the rain-bearing winds, and has a heavier precipitation, and on the whole a better climate than the east. Finally, on this side better ports occur, a subject which demands some consideration.

The west coast of Italy generally shows much variation in structure. In Calabria the mountains rise more or less directly from the sea, and good ports do not exist. Further north, in the Gulf of Salerno, and still more in that of Naples, the straight coastline of Calabria is replaced by a region of bays, into which no large rivers open, so that the danger of the silting up of harbours is slight. Here in classical times were the great ports, as well as the towns founded by Greek colonists and strongly influenced by Greek culture, with the result that here, as on the east coast of Sicily, we have often wonderful relics of earlier civilisations. The presence of Sicily also, which again has good harbours, promoted free communication by water at a time when civilisation was water-borne, and in consequence all down these coasts we have monuments indicating the importance of vanished towns,

towns sometimes, like that of Pæstum, represented now only by their temples.

As we pass northwards of the Gulf of Gæta the conditions become less favourable. Here the peninsula is wider, the rivers longer, of greater volume and more densely loaded with silt. In consequence, though the low coastline is generally favourable to commerce, all through historical time the danger of silting up has been present, and, as in the northern Adriatic, many ports have decayed or disappeared. But this is not the whole of the difficulty. As on the east coast the silting up has meant the formation of 'dead' lagoons, cut off from the influence of the sea, forming nurseries for millions of mosquitoes which, soon infected with malaria germs, become agents for the transmission of fever. Leghorn, now an important port, has been rendered healthy only at great expenditure, and the melancholy of Pisa is to be ascribed not only to the fact that, as at Ravenna, the sea has been steadily retreating through historical time, but also (again like Ravenna) to the fever 'bred in her marshes.'

Beyond the mouth of the Magra, in the vicinity of Spezia, we come again to a coast where mountains rise steeply from the sea, where silting up and fever disappear, and we thus pass into the region of the Riviera already described (Chapter XIX.).

As we again travel westwards beyond the coastline of the Riviera, the mountains retreat and we come to the swampy flats in the vicinity of the Rhone, with the possibility of easy access to the interior. Here, again, therefore appear the splendid monuments of an earlier age, and in Arles and Nîmes and the adjacent region we find again some of the beauties to be found round the Gulfs of Salerno and Naples and in Sicily.

Broadly speaking, we may say that the original civilisation along this coast was sea-borne, and its relics are to be found chiefly where convenient harbours exist; where access to

PLATE XXXI



The Arno at Florence in summer time, showing the marginal pools in which the mosquitoes breed; this swampy ground was formerly much more extensive.

the interior is relatively easy ; where fertile patches attract settlement ; where the absence of swamps and of malaria make for healthy conditions, though some of the swamps are of relatively recent origin.

But while the monuments of classical times are to be sought largely, though not exclusively, within easy access of the sea, the splendours of mediæval and Renaissance art are to be sought in peninsular Italy mostly in the towns which ring round the inner plains to the west of the Apennines, and for the most part stand at some height above these plains. In this connection we have to remember that, geologically, Italy is very modern, the Apennines being younger even than the Alps. The surface of the country is therefore altering with great rapidity, has been altering through historical times. The rate of erosion in the soft rocks of the Apennines is very rapid, so that the hills are being worn down, the valleys filled up. Some details in the history of Italy are explicable by these facts. For example, it is interesting to note the relation of Fiesole, on the hill, to Florence, on the plain. Fiesole is the older town, and the original choice of its site must have been partly determined by the fact that it was above the swamps which once covered the ground upon which Florence now stands (Plate XXXI.). In part natural processes, in part doubtless human effort, made it possible for man to descend from the heights, and to build a town in the more convenient position offered by the drained plain.

In many respects indeed Florence is worth the attention of the geographer proper, no less than of those who take any interest whatever in human achievements. It is a bridge town, placed where the river is most easily crossed, and the tourist will not fail to notice how important a part the many bridges play in the beauty of the town. It marks a junction of streams, for it stands on the triangular tract of land between the union of the Mugnano torrent and the

Arno, and is thus easily protected. It marks also a junction of routes, for all the easy passages through the Apennines converge upon the city. It is the centre of a fertile plain, a fact most easily appreciated during that wonderful descent in the train from Pracchia to Pistoia, with its constant brief glimpses of the rich plains far below. At the same time it is a junction town between plain and mountain, for the mountains ring it round closely, and yield marble for its buildings and sculptures, wool for its old woollen industry, and so forth. Again it has, or had formerly, easy access to the sea, and battled ceaselessly with Pisa for its open door. Finally, it commands, through the curious Val di Chiana, the open road to the valley of the Tiber and so to Rome.

Of this valley, so interesting even to the casual tourist on account of its vague and uncertain drainage, we must next say something.

Till the end of Tertiary times a narrow arm of the sea seems to have penetrated the land to beyond Florence, passed down what is now the Val di Chiana to the Tiber valley, and joined the existing sea near the mouth of the Tiber. This old strait thus cut off the present Apennines from an island which lay to the west of them. The strait was filled up by the waste of the Apennines, poured into the sea by the rapid streams which, loaded with detritus, swept down the slopes of the mountains. Thus there arose the plains upon which so much of the life of peninsular Italy depends.

The filling up of the strait did not take place uniformly. In the first place separated masses of water arose, of which the large lake Trasimeno and the artificially reduced lakes of Chiusi and Montepulciano are remnants. Lake Trasimeno has persisted because it lay in a bay off the main strait, and must have been originally deep. Further, not only did the gradual filling up of the original arm of the sea take place irregularly, so that lakes were left, it also resulted in uncertainty of drainage. This is a point of some interest, for a

similar uncertainty, due to a different cause, is common in recently glaciated countries like Scotland (p. 258). There the ice smoothed watersheds, and when the streams began to flow in their old beds after the passing away of the glaciers, there was, near the summit of the old watershed, a swampy area where topographic accidents determined the exact position of the new watershed. Where very steep lateral streams flow into such ice-smoothed valleys, they naturally lose speed, and therefore carrying power, as they emerge from the steep hill-side into the central valley with its gentle slopes. Thus they form large cones, which may become watersheds. In other words, a lateral stream emerging on a low watershed may originally flow to the right in the main valley. At a time of flood, however, it may throw down so much detritus as to block its own path, and thus find an easier path to the left. A constant repetition of the process of deposition may cause a steady shift of the watershed in one direction. This is what has been happening in the Val di Chiana, as we shall see directly.

In the case of the Val di Chiana the lowness of the watershed is due not to glacial smoothing but to the way in which an old arm of the sea has been filled up by land-derived débris. But here also all through historical time there has been constant changes in the watershed, man having assisted the process for his own purposes. The net result has been that the Arno has gained water at the expense of the Tiber, and, since the watershed remains low, communication between Florence and Rome is easy.

Further, the judicious tourist will not fail to note that while the valley of the Umbrian Chiana, continued into that of the Paglia, affords the most direct access to Rome, yet the detour necessary to reach the upper Tiber valley at Perugia is not great, and from here another easy route, possibly also an old arm of the sea, leads past Assisi and Foligno to join the first line near Orte. So slight is the difference that

return tickets give a choice of routes, and the vagaries of the Tertiary sea permit the twentieth-century tourist to visit Perugia and Assisi on his way south and Orvieto on his return to the north, without additional payment.

The actual conditions in the Val di Chiana have varied very greatly since records have been kept, a fact which the guide-book does not fail to note. To describe the conditions in detail would be tedious, but a few words on the causation of the changes, and their significance, may be of interest.

In regard to the latter point one must remember that any interruption of drainage means swamps, and in Italy swamps mean mosquitoes, fever, depopulation. If a region becomes progressively more swampy settlements rise up on the sides of the valley, and there is a period when the cultivators risk malaria in the daytime by attempting to till the wet ground, returning up the hillside in the evening to sleep. If the swampiness increases further the land becomes absolutely waste. On the other hand, when swamps diminish population and cultivation descend towards the valleys.

The cause of the changes in this particular case we have already suggested; let us give a few details. In Roman times the Val di Chiana up to Arezzo drained into the Tiber and was healthy and populous. But the stream draining it ran approximately parallel to the mountains, in an open valley of gentle slope (an old sea bed, *cf.* p 308.). Lateral torrential streams, debouching into this open valley, laid down cones which blocked the flow of the main stream, and cut off its headwaters from the Tiber. Thus upstream swamps were formed, with the consequences already described. The result was to render waste, in the later middle ages, a stretch of land from Arezzo to Montepulciano. But as the watershed constantly shifted southwards, *i.e.* towards the Tiber, in course of time a stream began to flow northwards from the other side of the watershed towards the Arno. Aided by man, this stream increased in importance, drained

the swampy northern part of the valley, and rendered human settlement here once again possible. The watershed has gone on shifting southward, and careful regulation has steadily diminished the amount of swampy land, as well as reducing the area of the lakes of the region, so that the Val di Chiana has become progressively more fertile and prosperous after long centuries of desolation.

Space does not permit of a fuller consideration of the towns of Italy and the causes to which they are due. What has been said should suggest lines along which investigation may profitably be directed, and Fischer's monograph should also be consulted. In regard to Provence also we can scarcely sum up the facts better than by repeating that its easy access to the Mediterranean Sea makes it thoroughly Mediterranean in character.

Both in Provence and in Italy, we may repeat, we have perhaps the most perfect examples available of human settlements; proofs of what man can accomplish at his best. Here the people made the city and the city was the people. That spectacle—so familiar to us—of great communities with their eyes turned always towards a distant centre, where sits the power which regulates their lives down to the minor details of domestic policy, whither their members flee when they can, which controls their taste, their manners and fashions, was not. The individual city was an organism with its own life, its own ideals, its own politics, which were of surpassing interest to its citizens, a region in which reigned that large, free life which Daudet has imaged in the lines which appear at the head of this chapter. Some signs perhaps there are to-day of the dawn of a new civic spirit among ourselves, some appreciation of the dangers, of the disadvantages of centralised government, with its mechanical efficiency, as compared with the splendid wastefulness of life.

All the spring glory of hawthorn bush or apple tree, the

naturalists tell us, is necessary in order that the bees may be induced to bring a few grains of alien pollen ; but one has but to look upon the blooming tree to know that it is false. Life when it gives at all must give in gorgeous handfuls ; it is our efficient machines only that measure grain by grain. Our cities will flower again as they did in the brave days of old by the mighty Rhone or on the hilltops of the Apennines, when they become once again the natural expressions of the life of a locality. Till that day dawns we can only learn what a city should be by visiting those oldtime towns which have been left stranded as an exemplar and a lesson for those who have eyes to see and ears to hear. Those cities are the gift of the Mediterranean world to our civilisation. When at last we come to our strength and are city builders in our turn, shall our success be yet greater ? The future must show, but meantime it were to miss half life's good not to see the splendours of those Italian towns.

INDEX

- AARE, R.**, 33, 41, 42, 191, 192, 197-199.
 Glacier, 193-195, 198, 200.
 -schlucht, 204.
Abbey of St. Acheul, 276.
Acheulean man, 279.
Adelboden, 195.
Adige (Etsch), R., 44, 113, 210-212, 283.
 Glacier, 186.
Adoxa, 65.
Adria, 290.
Adriatic Sea, 282, 285, 288, 304, 306.
Agave, 6, 7, 83, 94, 95.
Ain, R., 33, 141.
Aisne, R., 277.
Aix-les-Bains, 37.
Alassio, 243.
Alban Hills, 226, 238.
Alder, 78, 100, 103.
Allée Blanche, 258.
Alessandria, 42, 283, 287.
Aletsch glacier, 182, 184, 192, 204, 258.
Alps, Austrian, 166, 183.
 Calcareous, 39, 176, 179, 180, 183, 207, 210, 212.
 Central Chain of, 27, 37, 38, 40-43, 169, 189, 210, 212, 214, 249.
 Climatic effects of, 55, 58, 145, 241, 245.
 Crystalline, 179, 180, 183, 210, 211.
 Eastern, 170, 175-179, 181, 183, 184, 187, 197, 225, 254, 258.
 Folds of, 18, 20, 21, 266, 267.
 Glaciers of, 69, 109, 180-88, 258.
 Maritime, 44, 177, 241.
 Passes of, 294, 295, 298.
 Pennine, 183, 196.
 People of, 107.
 Plants of, 60, 67, 76, 77, 84, 89 *et seq.*
 Rivers of, 33, 42, 180, 197, 201, 283, 285-287.
 Structuro of, 38-41, 176, 177, 215, 225, 252.
 Swiss, 177.
 Terraces of, 202, 203.
 Tunnels of, 35, 43, 294.
 Western, 170, 175-178, 181, 187, 210.
 'Alpines,' 67, 105, 106, 108, 111, 112.
Alpine valleys, 186, 187, 198, 199, 200, 201, 204.
Amiens, 28, 275-279.
Androsace, 106, 112.
Anemone, 105, 112, 129.
Apennines, Mts., 18, 21, 22, 225, 226, 241, 244, 281, 283-287, 292, 298, 307, 308, 312.
Aquileja, 290.
Aquitaine, 266, 268, 269, 280.
Archaean rocks, 265, 266.
Arco, 198.
Arctic-alpine plants, 71.
Ardennes, 19, 21, 23, 24, 26, 28, 171, 266, 267, 271, 272.
Arezzo, 310.
Argelès, 81.
Arlberg, 36, 37, 44, 180.
Arles, 31, 306.
Armorican chain, 19, 20, 266, 267.
Arnica, mountain, 104.
Arno, R., 305, 308-310.
Arolla, 99.
Arran, 256.
Arthur's Seat, 4, 227, 228.
Artois, 272.
Arve, R., 199.

- Assisi, 309, 310.
 Atrio del Cavallo, 233, 235, 236.
 Auer, 213.
 Auvergne, 4, 25.
 Avignon, 31, 38, 44.
 Avisio valley, 213.
 Awe, L., 256.
 Azalea, mountain, 104.
- BALLACHULISH, 259.
 Barley, 130, 145, 147, 149, 157.
 Basel, 26-30, 36, 41, 197.
 Bavaria, 41.
 Bavarian Highlands, 19, 20, 23.
 Beans, 149, 157.
 Bearberry, 104, 123.
 Beauce, 278, 279.
 Becco di Mezzodi, 220.
 Beech, distribution of, 74, 75.
 Woods, 77, 79, 81, 84, 87, 129.
 Belalp, 184.
 Belfort, 27, 28, 35, 36, 37.
 Belgium, 171, 270-272.
 Bellegarde, 33.
 Belluno, 287.
 Belpberg, 194, 198.
 Ben Nevis, 257, 258.
 Bergschrund, 182.
 Berne, 28, 35, 36, 37, 42, 186, 194,
 197, 198.
 Bernese Oberland, 39.
 Bernina, Mts., 175, 183.
 Biemme, L., 41, 197, 198.
 Birch, 78.
 Black bryony, 76.
 Black Forest, 19-21, 23, 26, 73.
 81, 267.
 Black wood of Rannoch, 80.
 Blaeberry, 101, 103, 104.
 Blois, 278.
 Bludenz, 180.
 Blümlisalp, Mts., 200.
 Boéspitze, Mt., 220.
 Bog moss (Sphagnum), 125.
 Bog myrtle, 126.
 Bohemian Highlands, 19, 20, 23.
 Bologna, 45, 283.
 Bora, 53.
 Bordeaux, 49, 269.
 Botzen (Bolzano), 44, 57, 58, 153,
 154, 209, 210, 212, 213, 217.
 Boulogne, 269.
- Bourget, Lac du, 34, 37, 43.
 Bra, 287.
 Brenner pass, 36, 37, 44, 45, 57,
 177, 209, 295.
 Brenta, Mts., 211.
 R., 210, 212, 283, 295.
 Bresse, 141.
 Brienz, L., 40, 195, 200.
 Brig, 36, 204.
 Brindisi, 304.
 Brittany, 19, 22, 24, 158, 171,
 266-268, 273.
 Brugg, 197.
 Brünig pass, 200.
 Brussels, 28, 30, 269.
 Burgundy, 145, 278.
 Gate of, 26, 27.
 Butcher's broom, 90.
 Butterwort, 125.
- CAIRNGORMS, Mts., 255.
 Calabria, 305.
 Calais, 27, 28, 269.
 Caledonian Land, 23.
 Mountain chain, 19, 252, 253.
 Callater, L., 255.
 Campagna, 226, 238.
 Campania, 226.
 Cannes, 242.
 Cape Fig-marigold, 6.
 Capodimonte, 230.
 Capri, 90, 226.
 Carboniferous mountain chain,
 267.
 Carob, 83, 154.
 Carpathians, Mts., 18, 20, 21, 73.
 Caspian Sea, 14, 18.
 Catalpa, 81, 95, 123.
 Caucasus, Mts., 18, 74.
 Central Plateau (France), 19, 20,
 22, 24-26, 33, 265, 266, 268,
 271, 273.
 Cevennes, Mts., 21, 22.
 Chablais, 39.
 Châlons, 28.
 Chambéry, 32, 33, 34, 39.
 Chamonix, 3, 184.
 Champagne, 278.
 Channel Islands, 143.
 Chartres, 173, 270, 275, 278-280.
 Chestnut, 129, 154, 240.
 Chiana, R., 309.

- Chios, Island of, 88.
 Chiusi, L., 308.
 Christ's thorn, 87.
 Chur (Coire), 177.
 Cima d'Asta, 210, 212.
 Cinque Torri, 216, 220, 249.
 Cirques, 187, 254.
 Cistus, 83, 89.
 Citrus fruits, 129.
 Climate, 48 *et seq.*
 Continental, 4, 57, 74, 130.
 Mediterranean, 4, 31, 51-56, 75-78, 82 *et seq.*, 153, 242, 243.
 Oceanic, 52, 54, 66, 75, 130.
 Clover, 149.
 Cluse, 33, 36.
 Coalfields, 14, 271, 272.
 Col d'Altare, 175, 241.
 Col de Fenêtre, 183.
 Col de Saverne, 28.
 Col di Tenda, 248.
 Colle Margherita, 235.
 Colle Umberto, 236.
 Colli Euganei, 285.
 Cologne, 28, 30.
 Combal, L., 258.
 Como, L., 175, 177, 241.
 Confinboden, 218.
 Coniferous woods, 74, 79, 80, 81, 99, 100, 102.
 Constance, L., 40, 41, 175, 177.
 Continental shelf, 18.
 Cork oak, 86, 87, 90, 150, 153.
 Corniche road, 259.
 Cornwall, 266, 267, 273.
 Corrie, 257, 259.
 Corsica, 90.
 Cortina, 209, 213, 216, 287.
 Côte d'Or, 27, 30, 268, 269.
 Cotton, 149, 155.
 Coul Beg, Mt., 251.
 More, Mt., 251.
 Cowberry, 103, 104, 123.
 Cranberry, 104.
 Cristallo, Mt., 220.
 Croda da Lago, Mt., 220.
 Cruachan, Mt., 256.
 Culoz, 34, 96.
 Currants, 153.
 Cyclamen, 83, 90, 129.
 Cyclones, 51, 52.
 Cypress, 83, 87.
 DACHSTEIN BEDS, 217-220.
 Dala glacier, 200, 201.
 Dalmatia, 53, 89.
 Danube, R., 17, 41, 42, 175, 197.
 Daubenhorn, 200.
 Daubensee, 200.
 Dauphiny, 166.
 Dec, R., 255.
 Devon, 267, 273.
 Dieppe, 269.
 Digne, 248.
 Dijon, 27, 29, 30, 34, 268.
 Dolomite, 214-221.
 Dolomites, 44, 176, 207 *et seq.*, 249, 251.
 Doubs, R., 26, 33, 36.
 Drac, R., 39.
 Dranse, R., 201.
 Drave valley, 178, 180.
 Drei Zinnen, 209, 220.
Dryas octopetala, 104.
 Durance, valley of, 248.
 EARTH BLOCKS, 20-23, 225, 252.
 Ecological botany, 66, 67, 72, 115.
 Edaphic factors, 66.
 Edelweiss, 106, 112.
 Eggental, 211, 213.
 Eggishorn, 184.
 Eifel, 4.
 Eisack, R., 210, 212.
 Emd, 202.
 Engadine, 102, 103, 175, 176.
 Engelberg, 249.
 England, 23, 49, 56, 67, 74, 76, 115-117, 119, 136, 137, 145, 151, 171, 252.
 Enns valley, 178, 180.
 Eritrichium, 106.
 Etsch, *see* Adige.
Eucalyptus globulus, 94.
 Evergreen buckthorn, 87.
 Evergreen oak, *see* Holm oak.
 Everlastings (*Helichrysum*), 89.
 Evreux, 278.
 FALZAREGO PASS, 216.
 Fassatal, 213.
 Fiesole, 307.
 Findelen, 203.
 Glacier, 184.

- Finland, 23, 251.
 Finsteraarhorn, Mt., 179, 183, 184.
 Fionnay, 183, 203.
 Fir, Douglas, 80.
 Flax, 90, 141, 149.
 Florence, 174, 291, 292, 299, 305,
 307-309.
 Flushing, 28.
 Folded Mts., 5, 21, 22, 45, 225,
 253.
 Foligno, 309.
 Fore Alps, 39, 40, 41, 42, 75.
 Fort William, 259.
 France, 7, 8, 15, 22, 28, 51, 53, 55,
 77, 80, 81, 89, 115, 145, 147,
 151, 153, 156, 158, 166, 171,
 173, 265 *et seq.*
 Franzensfeste, 209.
 Frasnè, 34, 36, 37.
 Freiburg, 42.
 Fumaroles, 231, 237.
 Fünffingerspitze, Mt., 218.
 Furka pass, 179.

 ΓÆΤΑ, Gulf of, 306.
 Garda, L., 42, 44, 55, 84, 87, 152,
 177, 186, 198, 241, 285.
 Garigue, 85, 90, 91, 101, 114, 119.
 Gemmi pass, 197, 200, 201.
 Geneva, 34, 75, 96, 166, 196, 197.
 Lake of, 33, 35, 39, 41, 43, 75,
 197, 199.
 Genoa, 92, 96, 175, 242-244, 246,
 248, 295.
 Gentians, 104, 105, 123.
 Germany, 28, 45, 68, 80, 114, 119,
 145, 171, 269.
 Glaciers, 3, 109, 181 *et seq.*
 Glarner Alps, 39.
 Gletschergarten, 189.
 Globularia, 112.
 Goat Fell, Mt., 256.
 Goats, 101, 129.
 Gorner glacier, 182, 184.
 Grande Chartreuse, 39.
 Gran Paradiso, Mt., 43.
 Granges, 36.
 Grat, 188.
 Great Spannort, Mt., 249.
 Grenoble, 39.
 Grésivaudan, 39.
 Grimsel pass, 203, 204.

 Grindelwald, 166, 182, 184.
 Grisons, 179.
 Grödnertal, 102, 213, 218, 219.
 Grohmann Spitze, Mt., 218.
 Gross Glockner, Mt., 184.

 HANBURY GARDEN, 92.
 Hardt, 26, 28.
 Harwich, 28.
 Harz, Mts., 19, 23, 73, 81.
 Haslital, 204.
 Hawkweed, 105.
 Heather, 116 *et seq.*
 Heaths, 71, 114 *et seq.*
 Hebrides, 250, 251, 252.
 Hemp, 141.
 Hercynian Chain, 19, 20.
 Hohe Tauern, Mts., 210, 211.
 Holland, 29, 68, 115, 171.
 Holm or Evergreen oak, 86, 87,
 90, 123.
 Honeysuckle, 65, 103.
 Hook of Holland, 28.
 Houseleeks, 106, 112.
 Hungary, 21.
 Hyères, 243, 244.

 ICE AGE, 4, 69, 70, 79, 80, 104, 109,
 119, 138, 181, 184-190, 200,
 203, 253, 282, 285.
 Industrial Revolution, 133.
 Inn, valley of, 178, 180.
 Innertkirchen, 204.
 Innsbruck, 36, 37, 309.
 Ireland, 6, 23, 49, 51, 76, 138, 252,
 267.
 Isar, R., 50.
 Ischia, 226.
 Isère, R., 39.
 Isola Bella, 92.
 Madre, 92.
 Italy, 1, 26, 27, 30, 34, 36, 38, 43,
 53-55, 84, 150, 153, 154, 158,
 228, 241, 281 *et seq.*
 Ivrea, 285.

 JASMINE, 90.
 Judas tree, 96.
 Juniper, 104.
 Jura, Mts., 26, 33-41, 75, 191-193,
 196, 197, 266, 267, 431.
 Franconian, 32, 41.

- Franco-Swiss, 32, 33, 41, 141.
 Swabian, 32, 41.
 Swiss, 73.
- KANDER, R., 199.
 Glacier, 195, 199.
 Valley, 196, 199, 200.
 Kandersteg, 36, 196, 200.
 'Kare,' 187, 188.
 Karersee, 213.
 Kermes oak, 87, 88.
 Kitchen middens, 71.
 Klobenstein, 211.
 Kufstein, 178, 186.
- LA GRAVE, 102.
 Lämmern glacier, 196, 200, 201.
 La Mortola, 92.
 Landeck, 178, 180.
 'Landes,' 81.
 Langkofel, Mt., 214, 218, 220.
 Langres, plateau of, 27.
 Languedoc, 75.
 Laon, 27.
 Lareh, 78, 80, 87, 89, 102.
 Laurel, 92, 93.
 Lausanne, 34, 35, 37, 43.
 Lauterbrunnen, 202.
 Leghorn, 306.
 Le Havre, 269.
 Leuk, 201.
 Lewis, 250.
 Lido, 288, 289.
 Liguria, 245.
 Ligurian Alps, 287.
 Apennines, 241.
 Lille, 272.
 Linth glacier, 193.
 Valley, 192.
 Lisbon, 95, 96.
 Little St. Bernard, 109.
 Lochnagar, 80, 255.
 Loess, 69, 71, 73, 77, 80, 85, 127.
 Loire, R., 274, 275, 278.
 Lombardy, 81, 84, 146, 155, 177,
 243, 244, 286, 287, 299.
 Lomond, L., 256.
 London, 3, 4, 48, 49, 55-58, 168,
 270, 277.
 Basin, 271, 272.
 Lorbeer, *see* Laurel.
 Lorraine, 172.
- Lötschberg tunnel, 28, 36, 37, 195.
 Low Countries, 278.
 Lucerne, 36, 41, 129, 157, 166, 189,
 192, 200, 205.
 Lake of, 40, 249.
 Lugano, L., 43, 241.
 Lutschino glacier, 199.
 Luxemburg, 28.
- MAGGIORE, L., 43, 92, 95, 177, 241.
 Magra, R., 306.
 Maize, 130, 149, 157.
 Malta, 14, 18, 156.
 Maquis, 85, 87, 90, 114, 119, 120,
 129.
 Märjelsee, 258.
 Marmolata, Mt., 220.
 Marne, R., 30, 274, 277.
 Marseilles, 156, 246.
 Martigny, 75, 179, 196, 197, 204.
 Mastic tree, 61, 88.
 Matterhorn, Mt., 202, 203, 249.
 Meall an t'Suidhe, L., 258.
 Mediterranean area, 6, 15, 20, 25,
 33, 44, 45, 50, 51, 190, 297-
 302.
 Climate, 4, 31, 51-56, 75-78, 82
 et seq., 153, 242, 243.
 Plants, 4, 60-65, 68, 72, 78, 98,
 101, 114, 126, 129-131, 144-158,
 245, 246.
 Sea, 18, 49, 192, 268, 288, 311.
 Meiringen, 200, 205.
 Mentone, 56, 190, 242, 248.
 Meran, 82, 153, 178.
 Metz, 29, 30.
 Meuse, R., 21, 30.
 Mezeron, 104.
 Miage glacier, 258.
 Midland valley, 253.
 Milan, 36, 55, 283, 288, 292, 293.
 Milkwort, 124.
 Millet, 149, 157.
 Misenum, 229.
 Mistral, 53, 57, 243.
 Modane, 43.
 Modena, 42, 283.
 Monaco, 240, 241, 247, 248.
 Monferrato, 285, 287, 295.
 Montepulciano, L., 308, 310.
 Montpellier, 92.
 Montreux, 166, 196.

- Morvan, 25, 27.
 Moselle, R., 28, 30.
 Moutiers, 36.
 Mt. Berici, 285.
 Blanc, 181, 184, 258.
 Cenis, 34, 37, 43, 81, 109, 246, 295.
 d'Or, 35.
 Gibloux, 194.
 Moro, 183.
 Nuovo, 229.
 Rosa, 181.
 Somma, 233, 234.
 Ventoux, 38.
 Viso, 43.
 Mulhouse, 28.
 Mugnano, R., 307.
 Mulberry, 155-158, 240, 300.
 Munich, 50, 57, 58, 295.
 Murano, 289.
 Mur, R., 178.
 Myrtle, 90.
 Mythen, Mts., 249.

 NAMUR, 28.
 Nancy, 30, 268, 269.
 Napf, 192.
 Naples, 4, 14, 45, 85, 92, 96, 305.
 Bay of, 224, 225-227, 230, 241, 306.
 Nemi, 238.
 Nettle tree, 95.
 Neuchâtel, L., 33, 41, 43, 197.
 Nêvé, 181, 189.
 Nice, 242, 248.
 Nîmes, 306.
 Norfolk Island pine, 96.
 Norway, 16, 49, 51, 74, 252.
 Novara, 42.

 OAK, cork, 86, 87, 90, 150, 153.
 Deciduous, 77-79, 84.
 Holm, 86, 87, 90, 123.
 Kermes, 87, 88.
 Oats, 130, 136.
 Oberalp pass, 179.
 Oberbotzen, 210.
 Odenwald, 19, 23.
 Oder, R., 69.
 Odessa, 74.
 Oetzal, 104.
 Oetzal Alps, 184, 201.

 Oise, R., 269, 274.
 Oleander, 90.
 Olive, 84, 90, 123, 129, 131, 149, 150, 157, 240, 245, 300.
 Olten, 36, 190, 191, 197.
 Oranges, 83, 92, 154.
 Orchid, 90.
 Orleans, 269, 274, 278.
 Orte, 309.
 Ortler, Mts., 184, 211.
 Orvieto, 310.
 Ostend, 28.
 Ottajano, 236.

 PADUA, 92, 285.
 Pæstum, 306.
 Paglia, R., 309.
 Palms, 91, 92.
 Paris, 27, 28, 30, 95, 146, 168, 171, 172, 268-270, 274, 278, 280, 282.
 Basin of, 24, 266, 268-275, 281, 283.
 Parma, 283.
 Paulownia, 95, 123.
 Peaches, 129, 152, 154.
 Pedicularis, 106.
 Pegli, 92.
 Pennines, Mts., 118.
 Pepper tree, 92.
 Perpignan, 87, 156.
 Perugia, 302, 309, 310.
 Phillyrea, 87.
 Phlegrean fields, 226, 227, 229, 230, 233.
 Phylloxera, 142, 150, 151, 158.
 Piacenza, 288.
 Piave, R., 209, 210, 212, 283, 287.
 Piedmont, 175, 177, 233, 248, 287.
 Pilatus, Mt., 40, 105.
 Pine, 80, 83.
 Aleppo, 86.
 Arolla, 99.
 Maritime, 86.
 Mountain, 87, 89, 103, 120.
 Scots, 78, 79, 87, 103.
 Stone, 87, 100.
 Pinerolo, 281.
 Pisa, 306, 308.
 Pistachio, 154.
 Pistacia, *see* Mastic tree.
 Pistoia, 308.
 Pittosporum, 83.

- Plant association, 90, 100, 129.
 Plattenhorn, Mt., 200.
 Plattkofel, Mt., 218.
 Po, R., 21, 42, 283, 286-288, 297.
 Plain of, 281, 282, 285, 304.
 Pomegranate, 84, 154.
 Pompeii, 224, 228, 232, 233.
 Pontarlier, 34-36.
 Portugal, 53.
 Posillipo, 230.
 Pössnockerweg, 219.
 Pracchia, 308.
 Presanella, Mts., 211.
 Prickly pear, 6, 94, 95.
 Primula, 105, 112.
 Procida, 226.
 Provence, 44, 53, 54, 75, 95, 152,
 172, 174, 246, 266, 280, 298,
 299, 301, 302, 310.
 Pustertal, 180, 209.
 Pyrenees, Mts., 18, 81, 87, 98, 103,
 156, 166, 169, 266, 267, 297.
- RAIBL BEDS, 217-219, 221.
 Ravenna, 283, 284, 290, 291, 306.
 References, 45, 58, 81, 113, 127,
 159, 205, 222, 238, 248, 263,
 280, 295.
 Reichenbach fall, 205.
 Reims, 27, 275, 277, 278, 280.
 Reuss glacier, 193.
 Valley, 179, 192.
 Revermont, 141.
 Rhenish Uplands, 19, 26.
 Rhine, R., 17, 23, 26, 33, 41, 69,
 177, 179, 181, 192, 196.
 Middle, 27-30, 145, 171, 267-269,
 200, 278.
 Upper, 179.
 Rhododendron, Alpine, 100, 101,
 104.
 Rhone, R., 25, 26, 33, 35, 39, 43, 75,
 179, 196, 199, 268, 298, 306, 312.
 Glacier, 192-194, 196-198, 200,
 201, 204.
 Ria, 5, 6.
 Rice, 146, 149, 155.
 Rieder Alp, 184.
 Rienz, R., 180, 209, 210, 212.
 Riffelalp, 99, 203.
 Riffelberg, 203.
 Rigi, 40.
- Rimini, 281, 283, 304.
 Rittnerhorn, Mt., 211, 214.
 Riva, 55, 87.
 Riviera, 4, 34, 44, 45, 49, 53-57, 60,
 62, 84, 90, 92, 94, 98, 153, 154,
 156, 174, 240 *et seq.*, 259, 289,
 306.
 Robinia, 6, 81.
 Romanche valley, 102.
 Rome, 96, 174, 226, 238, 299, 305,
 308, 309.
 Rosengarten, Mts., 213, 220.
 Roubaix, 272.
 Rouen, 270.
 Roussillon, 156.
 Rothiemurchus, 80.
 Roy, glen, 258.
 Rye, 130, 136, 141.
- SAAS, 183, 202.
 St. Elmo, 230.
 St. Gothard, 36, 37, 42, 43, 45.
 Salerno, 305, 306.
 Salza valley, 180.
 Salzburg, 186.
 Sambro, R., 269, 287.
 San Bernardino, 43, 109.
 San Martino, 210.
 Santa Caterina, 184.
 Säntis, Mt., 39, 139, 180, 250.
 Saône, R., 26, 27, 34, 268, 298.
 -Rhone valley, 30, 33, 34, 36.
 Saponaria, 104.
 Savona, 243.
 Savoy, 166.
 Saxifrage, 112. ^{10 49}
 Scandinavia, 3, 5, 23, 50, 51, 71. ^{-4 25-2}
 Schaffhausen, 41, 186.
 Schlern, Mt., 209, 212, 217, 218.
 Schluderbach, 209.
 Schwarzsee, 203.
 Schynige Platte, 105.
 Scilly Isles, 55-57.
 Scotland, 5, 6, 23, 74, 76, 115, 116,
 121, 123, 124, 136, 137.
 Highlands of, 79, 80, 119, 135,
 138, 171, 174, 187, 188, 208,
 249 *et seq.*, 267, 271.
 Seine, R., 27, 30, 270, 274, 275.
 Seiser alp, 207, 218.
 Sella, Mts., 218, 219, 221.
Senecio incana, 106.

- Serbia, 75, 84.
 Sheep, 129.
 Sicily, 18, 45, 75, 85, 305, 306.
 Sierra Nevada, 18, 169.
 Silene, 104, 105, 112.
 Silkworms, 151, 155-157.
 Simmen glacier, 199.
 Simmental, 195, 199.
 Simplon, 35-37, 43, 105, 106.
 Sixt, 81.
 Smilax, 89, 90.
 Soldanella, 106, 112.
 Sölden, 104, 184.
 Solfatara, 230-233.
 Somme, R., 275-277, 279.
 Sophora, 96.
 Sorapis, Mt., 220.
 Sorrento, 226.
 Spain, 19, 20, 22, 51-53, 95, 153, 297.
 Spanish broom, 89.
 Chestnut, 87.
 Spessart, 19, 23.
 Spezia, 244, 306.
 Spiez, 198.
 Spina, 290.
 Splügen pass, 177.
 Spruce, 80, 87, 102.
 Stac Polly, Mt., 251.
 Stalden, 202.
 Stanserhorn, Mt., 40.
 Strait of Dover, 269, 271, 272.
 Strait of Poitou, 268, 269.
 Strasburg, 28-30.
 Strawberry tree, 76.
 Stubaitaler Alps, 211.
 Sub-Alpine chains, 39, 176.
 Sudetes, Mts., 73.
 Sugar, 153, 154.
 -beet, 69, 145.
 -cane, 155.
 Sulven, Mt., 251.
 Sulden, 184.
 Sundew, 125.
 Sutherland, 251.
 Sweden, 23, 49, 251.
 Swiss plateau, 75, 177, 193.
 Switzerland, 39, 41, 75, 79, 166, 175, 178, 182, 183, 203, 205.

 TANARO, R., 285, 287.
 Taranto, 304.

 Terobinth or turpentine tree, 84, 88.
 Tertiary rocks, 268, 270-282.
 Sea, 285, 308, 310.
 Thun, 36, 195, 198, 200, 205.
 Lake of, 40, 195, 199, 200.
 Thuringenwald, 23.
 Thyme, 89.
 Tiber, R., 305, 308-310.
 Tiersertal, 213.
 Toblach, 209.
 Tofana, Mt., 220.
 Törbet, 202.
 Torridon, L., 251.
 Toul, 30.
 Trafoi, 184.
 Trasimeno, L., 308.
 Tree-heath, 90.
 Tree of Heaven, 6.
 Trieste, 281, 295.
 Turin, 43, 281, 283, 285, 287, 288, 295.
 Turnips, 130, 145.
 Tyrol, *see* Dolomites, 103, 176.
 Tyrrhenian Sea, 225.

 UPPER SALZACH, 178.
 Ural Mts., 14.
 Urserntal, 179.

 VACCINUM, 103.
 Valais, 111, 141, 179, 180, 197, 203.
 Val de Bagnes, 203.
 Val di Chiana, 308-311.
 Valencia, 153.
 Val Lasties, 200.
 Vallorbe, 35, 36.
 Val Sugana, 210.
 Valtellina, 178, 180.
 Variscan Mts., 267.
 Venetia, 177, 287, 299.
 Venice, 37, 209, 281-284, 287-294.
 Vent, 184.
 Veratrum, 123.
 Verona, 42, 44, 283, 295.
 Vesuvius, 1, 4, 224, 226-230, 232-238.
 Vienna, 41, 48, 175.
 Vine, 9, 129, 131, 141, 149, 150, 151, 155, 157, 158, 240, 271, 300.
 Vintschgau, 178.

- Violet, 106.
Visp, 202, 204.
 R., 201.
 Glacier, 202.
Vistula, R., 69.
Vosges, 19, 20, 23, 25-30, 33, 73,
 81, 266, 267.
- WALENSEE, 40.
Wales, 23, 251, 252, 257.
Weisslahnbad, 213.
Wheat, 69, 70, 130, 147, 149, 150,
 151, 157.
White Mounth, 255.
Wildstrubel, Mt., 195.
- Wine, 150, 151, 157, 158.
Wintergreen, 104.
Wörgl, 180.
Wurtemberg, 41.
- YONNE, R., 27.
- ZERMATT, 99, 109, 182, 183, 202,
 203.
Zillertaler Alps, 211.
Zostera, 289.
Zug, 192.
Zurich, 36, 41, 42, 166, 181, 186,
 192.
 Lake of, 39, 40.

Printed in Great Britain by T. and A. CONSTABLE LTD.
at the Edinburgh University Press

UNIVERSITY OF CALIFORNIA AT LOS ANGELES
THE UNIVERSITY LIBRARY

This book is DUE on the last date stamped below

JAN 9 1980

JAN 7 1943

SEP 8 1943

REC'D MLD

MAY 6 1964

REC'D LD-JRD

NOV 11 1977

REC'D LD-JRL
ORION
LD/JRL MAY 31 1989

MAY 31 1989

EA



3 1158 00230 0308

UC SOUTHERN REGIONAL LIBRARY FACILITY



AA 000 675 765 2

D921
N42

UNIVERSITY of CALIFORNIA
AT
LOS ANGELES
LIBRARY

