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**THE TEACH YOURSELF BOOKS
EDITED BY LEONARD CUTTS**

THE USE OF GEOGRAPHY

**in the
GEOGRAPHY
Section**

**Prepared under the special
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**PROFESSOR FRANK DEBENHAM
Cambridge University**

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THE USE OF GEOGRAPHY

By
FRANK DEBENHAM
O.B.E., M.A.

*Emeritus Professor of Geography
Cambridge University*



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A GENERAL INTRODUCTION TO THE SERIES

IN planning a series of volumes to be called *Teach. Yourself Geography*, it was necessary for me, as Editor, to choose between alternatives, and I want you to understand why I made the decision I did and what we have set out to do.

It would have been possible to adopt the delightful, and very successful, method used by the English Universities Press historians, who present each volume in their series as the story of a period based upon the life of a great man. Our geography series might well have had the pattern of a Place and its People for each book until the world was covered. The result would have been a new series of Regional Geographies which, though useful would have been mainly descriptive in character and not fundamental to the subject. They would have been a loose pile of stones rather than a masonry structure keyed together to make a building.

Now, geography was described by one of its greatest recent exponents as not so much a subject as a point of view. With that in mind, I decided it was better to take the other alternative : to lead readers to the top of the mountain, whence they could get that view, rather than just *give* them a series of peeps at individual parts of the landscape.

In my key volume, I set out to provide the incentive for that climb, outlining the route and giving a general idea of the prospect at the summit. The title of the book is *The Use of Geography*, and if interest, contentment and an increased power of judgment are sufficient rewards, then geography is useful indeed. You will find I have dealt mainly with the structure of the subject and its aims, with hints as to the ways and means of achieving some part of it: an understanding of Place in all its bearings. My chief object was to show that geography is for everyone, and that it is full of interest at every stage, and that it is a practical subject.

The four companion volumes concern themselves more closely with technique—if such a formidable word can be used to describe the approach to each of the divisions into which

geography can be conveniently separated for the purpose of study.

Thus Mr. Peel's book deals with the physical background ; those aspects of air, land and water which, quite independently of man, affect the environment in which we live, and which are almost, but not quite, beyond our control. He points the way towards learning about the inanimate world around us, and his treatment of this branch of the subject is as thorough as the length of the book will permit.

Mrs. Anderson in her *Biogeography* deals with the animate side of environment, culminating in the highest of the animals, Man himself. In some ways she is opening up a new development of Geography, or at least a new focusing point, for you will find that she emphasises the biological influences which constantly affect man for good or ill and which have in large measure determined where and how he lives; why he varies so much in appearance, and even in character. Her vivid style is well suited to such a fresh viewpoint. If this book is a study of man as an animal living under essentially the same biological controls as other animals, then Mr. Thatcher leads us to consider man as a highly organised social being with trade between places and peoples as a dominating control.

He calls his book *Economic Geography*, "an experiment." Each of these volumes is an experiment—and certainly if it is an experiment to take an apparently intricate subject like this and reduce it to a lively simplicity by talking to his reader as he might at his own fireside, then we could do with many more such experiments. Even such a forbidding subject as the Mechanism of Exchange can become absorbing when chatted about by a kindly tutor possessed of a cheerful pessimism and an infinite understanding. The case for Economic Geography rests very safely in his hands.

Finally, the geographer must look back as well as forward if he is to study fully the interaction between Place and Man. The geographies of the past are in some respects the most powerful influences which mould the geography of the present. Miss Mitchell deals in a scholarly way with these in her *Historical Geography*. Because it is a new line of approach she has to spend some time in explaining what it is and is not. The rewards are great, for when rightly understood there is some-

thing peculiarly fascinating in tracing the Past in the Present, in viewing Place, whether on parish- or country-scale, as determined very largely by what has happened before. This volume should put Historical Geography very firmly on its feet as an integral part of the subject as a whole and one which any reader can share in and profit by.

Lastly, I should like to explain that this series is a combined effort. One of the reasons for selecting the authors from my own staff was so that we could work together as a team. Yet even frequent consultation is not in itself sufficient to achieve agreement and a common point of view, and it is as much the personality of my authors as their knowledge that is responsible for the unity we hope will appear in the separate volumes of this series. I am, in fact, proud to introduce to the general reader these members of a staff who have made my duty easy not only as Editor, but in the more arduous capacity of running the large department of which they form a part.

FRANK DEBENHAM

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CHAPTER I

THE PHILOSOPHY OF PLACE

IN a world grown accustomed to specialisms and specialists, we can no longer use grand, comprehensive names such as Philosophy or Natural Philosophy to describe our studies; yet, for purposes of planning and organization, we must formulate boundaries to our subject, provided we understand that these boundaries are artificial and to some extent unreal. I will, then, define geography as the Philosophy of Place; and I think that those who consult the five books in this series will decide that geography is indeed a philosophy—that is to say, the pursuit of wisdom with respect to Place.

It is my first task to show that the pursuit of this wisdom with respect to Place is based on certain innate tendencies in the human mind. In some degree we are all geographers and half of us are explorers by nature. There is a fundamental urge in us to go somewhere and discover what is there. If we cannot go ourselves, we find someone who has gone, and we ask him what he saw and what he thought of it. Whether we call it desire for knowledge or mere curiosity, this impulse is

almost universal in sage or savage, child or grown-up. We might even call it instinctive, since it is certainly shared by animals. The puppy or the young lion will venture each day a little farther from the kennel or the lair, gingerly exploring his wonderful new world by sight, sound and smell, and then, by some unknown process, recording, assessing and relating the sensations in its brain. Human beings have gone one step farther, in that they have the power of narrating these adventures.

The broad substratum of geography is therefore instinctivg, a natural and powerful interest in the whereness of things; a desire to acquire a sense of Place. Let us be content for the moment with that simple statement and not follow the example of those erudite geographers who prefer to call it the^Study of Spatial Relationships or the Investigation of Human Environment.

"We must confess, however, mat if it *is* an instinct, it is a delicate one, easily submerged by training and civilized life and even by schooling. The keenest natural geographers in the world are children, but in growing up they are apt to lose their interest gradually, as intellect takes over from the senses the burden of training the child to cope with the world in which it finds itself. I can illustrate that point very clearly by referring to the sense of direction that is part of the endowment of all young creatures. The dog with his buried bone, the child with his carefully hidden toy, the

primitive native with his water-hole, all must rely on their senses and memory, in order to find their treasures.

A sense of direction is most certainly an integral part of the larger faculty of the sense of Place. Probably we are born with it, but it becomes atrophied through lack of use. The native finds his way almost unconsciously in a fashion that baffles the town-dweller, who immediately refers it to a sixth sense, lost to himself by the triumph of intellect over mere sense-memory.

I was once with a party of surveyors, making a boundary survey of a cedar concession in the subtropical forests of northern New South Wales, having been guided there by a black boy. The weather was cloudy and there was no way of relating the survey to the nearest places on the map, all of which were more than fifteen miles away. In desperation, just before loading up the pack-horses to return, the head surveyor called the black boy, showed him how to swivel the theodolite so as to point the telescope in any direction, and said to him:

" You fellow point him Wollomombi."

The boy did not look up at the sky or the trees, or stop to ponder, but at once turned the telescope, from which the surveyor read the bearing. A second pointing—to George's Creek—was demanded, supplied and noted, and the party set off in utter disbelief that the boy had even been trying.

Two years later, when the concession was being worked, the same surveyor was able to check the original "fix" by the black boy, and he was so impressed with the agreement, which was within half a mile, that he at once sent all the details to the Royal Geographical Society of London. Obviously the black boy had felt rather than reasoned out the directions he had been asked to indicate.

Trust in the senses dies hard in any growing child and although he will ultimately accept, for instance, the fact that the sun does not really go round the earth, he does regard it as an injury to the senses, and just one more example of having to distrust what he sees and believe what he is told.

We cannot claim that Place is the only object of juvenile curiosity, for History derives similarly from an interest in who people are and what they do, taken back into the past as well as in the present. Later on yet other urges express themselves in the child, even to the cost of a thing, or the value in barter of a catapult or a stamp. These we may presume to be the beginnings of Economics.

THE APPROACH TO GEOGRAPHY

In this, the first of the five books in the series, I shall attempt to describe what the "complete" geographer of to-day sets out to do, what he aims at, and how the various aspects of Place intertwine with each other.

If it is true that geography is, after all, a point of view, an interpretation, then we should be able to teach ourselves the subject, since we already have an outlook of some kind and need only to broaden it by training ourselves in certain techniques.

Let us first consider three common types of geographer. They can be compared to the trio in the good but entirely apocryphal story of the Englishman, the Frenchman and the German, who were each asked to produce a monograph on the elephant. The Englishman bought a battery of rifles, organized an expedition and went out and shot elephants all over Africa. The Frenchman packed his lunch-basket and went every day for two months to the Zoo, where he studied elephants. The German armed himself with a number of tomes, locked himself up in his study and conjured up elephants from his inner consciousness. Preserving a truly international outlook, perhaps we should say that all were wrong, yet each was right in some degree.

The Englishman in the story can be likened to our first class of geographer, who is so keen on the practical field-work that he is apt to consider it an end in itself. He makes his map or measures his river-flow or counts his industrial workers or traces his ancient roadways, and leaves it at that. He has shot his elephant and is rather proud of having done so, forgetful that dead elephants do not tell us much.

The second type of geographer is the one who is liable to dodge the field-work or, at least, to leave it

entirely to the surveyors, the engineers, the geologists and the officials who compile social science statistics. If he is a student of human geography, he is liable to rush round a country gathering guide-books and hearsay information for a few weeks and then write a text book on the country. If he is a physical geographer, he will stroll along a curious shore-line, explaining it in vague terms such as :

" Here is a cliff, so there must be undercutting; here is a shingle spit, hence there is deposition."

He will not inquire into the mechanism of the erosion or accretion. He approaches his elephant in comfort and with precautions, and he is not going to worry about counting its teeth or measuring its tail; but he does at least go and look for one.

The third type of geographer—the German of the anecdote—considers that perspective is lost by a close personal view, and he prefers to get his facts from books and maps and lists of statistics. He is skilful at abstracting the essentials from them and will write you a geography of the world without even leaving his home town. At his worst he is a mere compiler; at his best he may make deductions and correlations that would never occur to the traveller. His elephants are interesting and carefully thought out, but they are apt to be dummy elephants.

The reader may well object to these strictures and say that one cannot travel everywhere or measure everything ; that life is short and one must

do the best one can in the time available and with what special bent one may possess. He is quite right there, but there is a middle course, even with elephants. The doctrine of perfection would be for each man to visit elephants in their proper surroundings, then to study them at the Zoo and finally to consult other people's conception of elephants from books, and weigh all the evidence by earnest thinking.

That, at all events, was the practice of the greatest geographer of recent years, the late Sir Halford Mackinder. He travelled wild countries and climbed mountains, he read widely and conversed with specialists, and then he thought deeply over all he had seen and heard before he wrote his deductions.

INTERPRETING THE FACTS

Facts may be part of the answer to any geographical question, but they are not all of it, any more than the main dates of a monarch's reign are a complete record of history. The What and the Where can be answered directly enough if one has the soiree of facts ; the Why and the How have to come from deductions made from the facts. The acquisitive mind, the sponge type, is a very good mind in its way and well worth having for the satisfaction it gives, but it should also be a reasoning mind, taking delight in deducing consequences from the facts, and ceaselessly correlating them.

Discontent with the mere amassing of facts as an end in itself began to make itself evident in the latter half of the nineteenth century. It was, perhaps, most prominent—or at all events, most vocal—in the field of biology, particularly as it led to heated discussions with theologians.

Man was searching for an interpretation of the facts he was gathering in embarrassing array from all natural sciences; he was endeavouring to find a meaning for the infinitely complex systems under which matter, occupying Place, seemed to be regulated. It was a demand for rationality, as distinct from man's feeling of a divinity, that underlay this quest. He was prepared to accept a Supreme Power that created matter, but he asked that matter, once created, should behave according to some ascertainable law. He had no longer an inclination to explain facts by reference to the supernatural or to the whimsies of a vacillating Creator.

So, in the laboratory first, the scientist sought an explanation for the odd happenings in his test-tubes, the biologist then devised theories of Natural Selection, and the economist began to study the man-made systems of trade. What was missing was a co-ordination of those sciences in terms of Place, a study that would interpret the findings of these subjects as a whole, as applied to the surface of the world on which man lived.

That, and nothing less, is the full task of the geographer: to interpret the facts of distribution,

to correlate the life of man with his environment, to explain the interaction of human and natural agencies. It would be easy enough were it decreed that no one could be a geographer until he was forty years old and had become a useful scientist, a fair historian and a competent economist. Then, and not till then, could he fully assess the natural resources of Place, appreciate what men have made of these resources in the past, and plan what could be done with them in the present and the future.

This, however, is not an argument against geography ; it merely post-dates accomplishment. The full task of the geographer is too mighty for anything approaching finality and only intellectual giants such as Mackinder and Alexander von Humboldt can attain even partial success. Yet we can all take part in it. We are all geographers in some degree, and we can fit ourselves to join in the search for wisdom with respect to Place, in the hope of arriving at some measure of understanding.

Hence these five books.

CHAPTER II

THE HISTORY OF GEOGRAPHY

THE innate tendencies on which the pursuit of wisdom with respect to Place is based are really quite primitive ones, and, at the risk of being historical rather than purely geographical, I think we should review the steps by which historic man has pursued that wisdom—in other words, sketch the evolution of geography through the ages. We must not be surprised if we find that the name meant different things in different ages, nor should we be too disappointed if we come to the conclusion that in essentials—or perhaps I should say outlook—we have not advanced so very far beyond the stage we had reached with the flying start given us by the Greeks.

We may begin with the very first step in geography: how to record where a thing is. The primitive hunter and gatherer of the Stone Age probably rarely needed to share his knowledge of the whereabouts of game. If he did, he could do it by pointing. Yet there came a time when his descendants, wishing to describe the relation of several places to each other, thought to make a rough model or even a drawing on sand. This

was really a very remarkable advance, because it demanded the conception of an imitation in miniature ; yet it was a natural one, since children of all times and all races delight in reducing grown-up objects to their own scale in their toys and games. We have very few examples of either the early or the primitive maps, just as we have few of the geometrical diagrams of Archimedes—and for the same reason: that either they were drawn on smoothed sand, or they were composed of sticks and stones temporarily grouped or fastened together.

Those stout-hearted explorers of the wide Pacific, the Polynesians, fashioned charts out of strips of bamboo, with shells tied on to represent the islands, and were using these at much the same period as the Mediterranean Greeks and Egyptians and Phoenicians were tracing sea routes on parchment or papyrus, together with a periplus, or account, of the capes and bays to be reached with the aid of these early charts. Sea charts came before land maps for the fairly obvious reason that land travellers, from Hannibal down to Marco Polo and later, were always able to ask the way of the local inhabitants, whereas the sea voyager had need of all his triple-bronze courage, for there was no information to be had, once he was at sea.

Even at the present day, the inhabitants of Africa, central Asia or any other trackless part of the world are no more anxious than were the

Roman legionaries to know the exact route from one place to another, for they employ a local guide. What they do want to know is the duration of the journey, since that affects the problem of food and water. The primitive native speaks, therefore, of a distance as so many days' travel, while the Roman idea of a map was one with miles marked on it, but without any attempt at putting places in their correct relative positions. It was only when land had a real value, such as on the delta of the Nile or the mines on the Upper Nile, that people began to consider making a map as we now know it.

That is the reason why, at the time of the conquest of Mexico, the way from Portugal to the West Indies was much more adequately shown on paper than was the way from London to York. Indeed the real incentive to make land maps came rather from interest in places than from any need to find the way from place to place. So we come to the period when the geographer of the day was concerned more with filling blank spaces with portraits of potentates or succinct remarks such as, "Here is much rhubarb," than with any representation of permanent features. Dean Swift was not merely indulging his acid humour when he wrote in 1700:

" So geographers, in Afric maps,
With savage pictures fill their gaps,
And o'er unhabitable downs
Place elephants for want of towns."

Yet this picturesque phase in the evolution of maps was natural and very valuable, for it ushered in a new and modern use of maps, a use that even now is not fully appreciated. A map tells a story; it is a most complex form of shorthand, saving pages of descriptive text. Not only does it show the relative position of places and features; it also may give a considerable amount of information as to the details of such places and features.

But maps are only one of the manifestations of the geographical instinct, and they were less satisfactory than story and song for recording where events occurred. Thus the explanation of a physical fact, such as a mountain or an island, as being due to the deeds of supernatural ancestors is a frequent theme in primitive folk lore. For some parts of the world, we have had to deduce the evolution of a geographical sense from legends and songs handed down by word of mouth. We have pieced together entirely from songs the discovery of New Zealand by the Maori peoples, and our classical scholars have given us a good idea of the earliest geography of the Greeks by interpreting it from Homer.

When we collect such evidence from our knowledge of the various "civilizations" that we distinguish by name—Sumerian, Egyptian, Minoan, etc.—we are astonished at the picture that our first clear story shows. We find that even in what we are wont to call the dawn of civilization, men

were already viewing the phenomena of nature in much the same way as we do now. The study of classical thought has a most sobering effect on geographers as well as on philosophers, in proving to them how little real advance has been made, except in technical developments, in all those twenty-five centuries.

Nearly four hundred years before the birth of Christ, Aristotle was writing :

" Since there must necessarily be some sort of region which stands towards the other pole in the same relation as the region which we inhabit stands towards the pole above us, it is clear that it will have the same fixed order of climatic conditions, including, for example, winds."

In 150 B.C. it was written of Hipparchus :

" Hipparchus in his books well observes that no man, whether lajman or scholar, can get a grip on the requisite geographical knowledge without determination from astronomy."

The geography master of today says much the same thing when he begins by telling his junior class that they must always remember that our world is a spinning ball revolving round the sun.

These are instances of the type of scientific deduction of which the Greeks were capable. Should we be tempted to regard the Greeks as philosophical rather than practical geographers, we must remind ourselves sharply that, in his march on India, Alexander the Great took with

him what we should now call a corps of engineers, the surveyors of which paced every yard of the route and, we may presume, fashioned some kind of map, or list of distances, for their brilliant commander. In fact, the Greeks were extremely competent geographers, even in the modern sense of the word. They were interested in the shape of the earth and its surface features, and in all the natural phenomena we now classify under the Natural Sciences ; they were intrepid travellers at times ; they were surveyors of a sort ; and they were colonizers.

Yet, taking it all round, there was but little geography written down by them, and we may well ask why that was so. If geography was so absorbing a study, why do we have to look for our evidence to poets like Homer, playwrights like Aristophanes, and historians like Herodotus? The probable reason is that these natural phenomena of Place are fairly stable and certainly beyond human control, and consequently, though they are to be considered and wondered at, they lack the consuming personal interest of civics, politics, history, and all the other affairs of unstable man.

Then, as now, the historian could always summon more listeners than the geographer, dealing as he did with human frailties and the infinite variety and unpredictability of human conduct as compared with the dull monotony of natural laws. A river must always run down hill, but a dictator may go in any direction he pleases, and the more

contrary the direction is, the more interesting he becomes. It is to be feared that when Aristotle said that Africa was always producing something new and monstrous, he meant that it was interesting because it was novel. In other words, geographical observations were news as long as they were suspect or apocryphal, but dull stuff when they were purely factual and common knowledge. In this we appreciate the truism that were geography purely descriptive and nothing else, it would be a subject for a gazetteer rather than for a philosophic treatise or an Honours degree.

The Greeks, nevertheless, did succeed in taking geography beyond the descriptive stage, a feat that is only now being repeated, two thousand years later. They were able to see farther than the bare facts of Place, and to embark on deductions, correlations and useful analogies ; they were never satisfied with mere lists of capes and rivers, exports and imports, as were our geography teachers of a century ago—and less. Theirs was a golden age of geography, just as it was of philosophy; and in its way, as glorious an age of discovery as that of Bartholomew Diaz and Christopher Columbus, sixteen centuries later. Even while Alexander the Great was making his military and geographical expedition to India, another Greek, Pytheas, was breaking through the fog of deception spread by those able but secretive navigators, the Phoenicians, and voyaging (in 33b B.C.) far beyond the

bounds of human settlement as then understood—and, indeed, far beyond the bounds of human credulity as seen by later critics.

We should be especially interested *in* Pytheas, this Greek from ancient Marseilles, for he was the first to tell anything like the truth about our own islands. On the whole, he gave us a good character: thrifty islanders living in a damp climate, using great barns for drying and threshing corn, although, perhaps, a little over-fond of drinking mead.

This wonderful civilization of the Greeks, then, produced in a century or two a geography complete in almost every branch. They developed it so quickly because they were intensely interested in the world beyond their narrow, wine-dark seas; and their eagerness to know sprang, in the main, from a virile intellectual hunger. Occasionally they dreamed of conquest and produced an Alexander to show the world it could be done, but it was not with them such an abiding urge as it was with the later Romans. Theirs was a broad-minded sort of development, quite different from the close-fisted type of the Phoenicians. Steadily fostering trade, they threw off colonies from the parent state; and geography was a living subject, not just a means of acquiring more wealth or wider dominion.

As the focus of power gradually passed westward to the Romans and Carthaginians, the inner

light of Greek geography faded; the philosophy of the subject was dimmed by the motive of profit and conquest. Certainly there were still famous Greeks trying to show the true light to the Romans—a Strabo to write down all that was then known of geography, a Ptolemy to round off the mathematical geography of his predecessors and formulate a system that was to assist the navigators of the future—yet, on the whole, the Roman saw the world beyond his boundaries as a source of wealth, a field for exploitation and, if necessary, for absorption. To him, the important part of a term of office in a distant province was the triumph of his return; the long line of slaves winding through the streets of Rome, bearing the treasures and curiosities of the conquered country. The leader himself would not sit down and write a description of the countries he had marched through, or if he did—as did Julius Caesar—it was a military treatise, shrewdly practical as to the nature of places and peoples, but far from being the *Philosophy of Place* that Greek writers tended to produce.

The greatest service of the Romans to geography was their road-making, and we can only regret that, being engineers rather than map-makers, they left posterity to find out for itself, by digging, how they lived and where they went. As province was added to province, the empire became top-heavy, and the famous legions began to withdraw from the outlying territories, leaving little

behind them but their roads, which gradually disintegrated. Because they were not geographers at heart, they did not write and think about the countries they had seen, had conquered and had then deserted, so there is hardly any record of their stay.

A DREARY PERIOD

And so we come to what we choose to call the Dark Ages. Though, while Southern Europe was crumbling, Western Europe was beginning to stir and achieve some local unity, there was none to describe it except an occasional Christian monk such as the Venerable Bede ; few to interest themselves in countries out of their reach except an occasional king such as Alfred the Great. In the East, there was vague talk of a new prophet, Mahommed, and a new God, fiercely fanatic and militant, and still vaguer hints of masses of people in far off Asia, pressing slowly westward, following the surges of Goths and Visigoths, Vandals and Huns and Magyars, who had already choked the life out of the Roman Empire.

Historians may one day give us a complete explanation of the reasons for these ceaseless stirrings of peoples, this confusion of aims ; but even without that, we can see that it was no time for intellectual geography or for open-minded explorers.

Yet the Mediterranean was still an open sea, **and** men were moving over it and beyond in stouter

ships and with more certainty and skill. We turn to them at this stage to discern what little there was of practical geography and discovery. The pilots of the Mediterranean were beginning to make sea charts and to feel their way out to the nearer islands of the Adantic. Step by step, the Norsemen were pushing across the North Atlantic to Iceland, to Greenland and then to North America itself.

Perhaps there is something in the maritime life that induces silence. The merchant mariners of the first millennium after Christ have told us nothing of what they saw or how they found their way. They did their job, but wrote little about it. We know they had maps ; by the fourteenth century they had very good ones indeed—the Portolan charts : but what they were like is gone with the dust into which most of them have fallen.

If the practical geographer, the navigator, was too inarticulate to leave us record of his ways and means of travel, we should expect better things of the Church, whose duty it was at least to be studious and vocal. But here again we are disappointed ; we find little of the interest in Nature or in Place that was so characteristic of the Greeks. The point of view of the monastic type was as narrow and allegorical as their maps, which did not attempt to set out the features of the real world, but were crude, symbolic pictures round a central Jerusalem, filled in with any old travellers* tales of

headless men or monsters to embellish the outskirts. In justice, one must add that the makers of these maps were not necessarily ignorant or stupid. They were merely making pictures for their teachings. But clearly they were not interested greatly in the world outside their cloisters.

It was a dreary period as far as geography was concerned, and the subject was not much more than a vague background for historical or doctrinal teaching. While popes quarrelled and the Roman Empire was becoming Holy in name but not *in* practice, there was no progress in the general sense,, except by individuals, in the study of the world as a whole.

Geography had not yet shaped history, but it was heading in that direction and dimly preparing to fill the mental horizon of Europe with new discoveries and fresh worlds for conquests. For the medieval adventurer, there was but one way open for distant travel: the east. To the west there was a trackless and interminable ocean ; to the south were the deserts of North Africa; to the south-east was the hostility of fanatic Arabia; but to the east there was no sea to bar the way, and only semi-arid wastes and nomad tribes under some degree of discipline.

The way was led by the missionary and diplomatic element in the form of delegations from the Pope. These were headed by friars and at least two reached the court of the Great Khan. Close on their heels

came the ostensible trade mission of the Polos. This amazing family of Venetian merchants twice slipped through the corridor still open to the East, though shortly to be closed by Islam and by the break-up of the Mongol Empire. When the younger Polo returned after living for twenty-seven years in the heart of Cathay, the western world, proud of its own development, promptly dismissed most of his story as fabulous ; it was too much of a shock to hear that Cathay had roads, a postal system of a kind, an economic union and a regulated overseas trade.

As the medieval iron curtain came down on the land route to the East against a now thoroughly curious western world, attention was directed to the possibility of going round by sea, and the torch was passed to Portugal. Under the directive force of a prince of that country who is now known as Henry the Navigator, motives were soon found. There was the Church, anxious to extend Christianity and to find out what had become of its missing Nestorians and Prester John. There was power, as represented by the rulers, jealous of empire and anxious, as always, to hear what other rulers were planning. Finally and most persistently of all, there was trade, now organized as never before, eager to re-establish the flow of luxury spices from the East, recendy taxed almost to extinction by the holders of the Red Sea.

Besides the motives, there were now the means

for such expansion. Ships were now large enough to carry stores and water for a long voyage. Compasses, quadrants and rough astronomical tables facilitated navigation, and there was gunpowder to force a passage should it be challenged.

THE GREAT AGE OF DISCOVERY

Thus, by the beginning of the 15 th century, the stage was set for the Great Age of Discovery, which produced a sudden, vast, even unwieldy expansion of knowledge, carried out almost entirely by sea. In little more than a century, men had reached the spices of the East, they had discovered the Americas, and they had crowned these feats by the greatest of all for sheer persistence : the circumnavigation of the world in 1519. All the land masses except Australia and the Antarctic Continent were now known.

Of western geographical knowledge on the very threshold of these discoveries, we have a summary in the form of its first large globe, which was made at Nuremberg by Martin Behaim in 1492, It embodies all that was current belief at the time, mixed with doubtful history and undoubted fiction. Marco Polo was believed at last and heavily embroidered. Behaim's globe must be the classic example of a production that became out of date and useless within a few weeks of its making, for Columbus stultified the efforts of the patient German

cartographer by returning with a new world in his pocket, a world that grew with each succeeding voyage and is entirely missing from Behaim's globe.

The contrast with the century before is so striking that we should examine it. Geography became exploration, acquiring an emphasis that was to endure for at least three centuries. We cannot follow the swarm of adventurers in their exploits, but we can consider whether they were geographers in the Greek sense of the word. Few of the leaders were earnest seekers after knowledge. They were chiefly anxious to win their sovereign's favour by their achievements and thereby gain promotion and wealth, always wealth. Some who were high-souled in the beginning—Columbus himself, perhaps—could not stand the strain of success and applause. However much their chroniclers strove to persuade posterity otherwise, their triumphs ruined them as men. Exploration became synonymous with exploitation, and the search for gold was usually the prime motive of any expedition—a far more fundamental one than curiosity.

Official expeditions were usually accompanied by black-cowled priests, fiercely determined to win souls for Christianity, by force if persuasion failed. With grand hypocrisy, they held that, once baptized, the bodies of the saved were of so little consequence that they could be put to work as slaves or even executed. Nevertheless, amongst this brotherhood there were certain priests, cast in a gentler mould*

who recorded their impressions of the lands they visited. Similarly, amongst the traders and super-cargoes who were taken by the leaders to gather wealth for their sovereign, after deducting due commission for themselves, there were a few who had eyes for more than the details of their profession and wrote of what they saw. Indeed, as one reads the chronicles of travel collected by Richard Hakluyt, one receives the impression that the truest geographers of the age were the practical-minded traders whose aim was to find new sources of trade and not to ruin them by cruelty, dishonesty or harsh missionary fervour. It was their attitude that was largely responsible for the beginnings of colonization that hesitantly followed the first explorers, in the main for the same reasons as moved the Greeks in founding their colonies over a thousand years before.

An interest in geography was awakened, too, in the nations who were taking part in these great doings. It developed first in the French and the English, although they had not been the pioneers in the field of exploration. From sovereign to serf, there was a desire to hear the tale of the returned traveller and to marvel at its strangeness, or, by expressing doubts, to spur him to go adventuring again. There is a great deal of truth in the suggestion that the real geographers of the Great Age of Discovery were not the explorers themselves, but the shrewd thinkers at home who analysed their experiences, correlated their discoveries and pub-

lished discourses, either to prove a geographical theory or to promote further exploration.

Keeping pace with the voyaging, the instruments of geography had vastly improved ; the methods and means of navigation, the maps, the knowledge of currents and winds and sea-lore of other kinds. As these practical aids increased, the fear and superstition of Columban sailors rapidly disappeared and gave place to a matter-of-fact attitude to new voyages. Divine guidance and care were still appealed to, but they were supplemented by better means of carrying water and food, and keeping powder dry.

At this point, we may note the westward trend of practical interest in discovery. While land travel to the East had been the only outlet, Greece and then Italy had held the field in exploration. As maritime ability increased, the torch passed to Spain and Portugal. But when the Americas had been fully discovered and passage to the East had become almost a commonplace, the English began to catch up the Latins and ultimately to lead, though in constant competition with the French and the Dutch.

The most natural explanation, yet only a contributory one, is that the English were forced to use the sea, and any threat of invasion made them cultivate seamanship still more assiduously, till it became almost second nature to them. A second reason, which was cumulative, was the freedom from actual invasion, however often it was threat-

ened. The English had more time to think, and a more settled atmosphere in which to live, than the continentals, who had to keep armies to watch the frontiers, and note each swing of temporal power in the nations round them. In Elizabethan England, there was a certainty of tenure and a pride in their native land, both notable aids to geography. The sense of Place had become keener; it was better defined and more measurable in terms of maps and descriptions. Geography had come to be assumed a part of common knowledge, so that Shakespeare, like Aristophanes, could make jokes about it in his comedies and be confident that his audience would understand them.

If geography reached the theatre in this way, how much more deeply did it penetrate the court, the city and the academic centres? Queen Elizabeth's court became the planning centre of a hundred expeditions and was in itself a sort of prototype of the Royal Geographical Society of the future. The city was behind a great number of these expeditions and adopted for the promoters the happy tide of "Merchant Adventurers," which indeed they were, in a double sense.

An entirely new light was turned upon maps by those whose interests were academic, either by inclination or by training. The genius and skill of map designers like Mercator, Hondius and Blaeu in the Low Countries, and Sanson in France, took the Portolan charts of the Mediterranean and the

re-discovered maps of Ptolemy of Alexandria, and re-drafted them into what is practically the present-day style. Mathematicians like Edward Wright of Cambridge turned their attention to the problem of projections : how to portray without distortion the features of a spherical world on a flat surface. Practical navigators like John Davis devised new instruments, such as the backstaff, for finding latitude at sea, and Leonard Digges invented the early form of theodolite for surveying land. England led in the construction of large-scale maps of the countryside, the pioneers being Christopher Saxton and John Norden ; but France caught up and surpassed us in the 18th century. Records of travel were attended to by Richard Hakluyt and his successors, who, by printing them, carefully saved narratives for posterity.

Geography had once more developed and broadened into something approaching the standard of the early Greeks. Technically it was much superior, being helped, in particular, by the invention of printing; but geographers were still apt to be satisfied with description and rarely entered into the fields of philosophy. Interest in the position of things quite dominated inquiry as to why they were there. It was, too, an age of vivid individualism, when it was not thought strange that a writer should claim that he had completely solved the problem with which he was concerned. The delightful yet arrogant claims of Digges are an

example, as when he prefaces the description of his plane table with :

" An instrument of such perfection, that no manner altitude, latitude, longitude, or profunditie can offer it selfe, howsoever it be situate, which you may not both readily and most exactly measure."

It was recognized, however, that a narrow individualism could be a hindrance to the advance of knowledge, and this found expression in England after the turmoil of the struggle between King and Parliament. The creation of the Royal Society in 1662 "for the improvement of natural knowledge" encouraged co-operation as well as competition and was largely responsible for the great advances made in the next century.

If curiosity is the very foundation of geography, then discussion is its outward expression. In Greece it was in the market-place that "some new thing out of Africa" was always being related and discussed. In Rome it was in the forum or the court-yards of the patricians. In the Columban age it was the port whence the ships sailed, the results being carried, suitably embroidered, to the patron's mansion or the Royal Palace. In Elizabethan days it was in the court itself that a practical Drake and a bluff Hawkins could meet and argue about the new discoveries with scholars like Raleigh, idealists like Gilbert and even poets like Spenser. At the time of the Restoration, the centre of such debate shifted from the court, finding its formal

home in the Royal Society, and its informal home in the tavern and, later, the coffee-house. Samuel Pepys frequently refers to "a very good discourse on affairs" with his friends over a drink. This he carefully distinguishes from a party, when women-folk were present, which he describes as "mighty merry," but without good discourse to record. These were the forerunners of the clubs of the next century, when geographical topics took their turn with politics and philosophy, business and social chatter.

THE CHANGING PATTERN OF EXPLORATION

Discovery was still the most attractive feature of geography, with curiosity as handmaiden to profit. While England was occupied with her disputes between King and Parliament, the Dutch had been consolidating their East Indies trade, discovering Western Australia by chance, and finding a new way round South America. The Dutch East India Company, however, was a profit-making venture and, like the Phoenicians of old, was inclined to be secretive about its discoveries.

Having restored their monarchy, the English began to resume their incursions into the seas variously claimed by Spain and Holland. These can only be called filibustering expeditions; they had to be disowned by the Government if too many cities were sacked. A leader might return in public with his plunder* to be hailed as a stout

soldier-captain, or slink home to Bristol, to be accused of piracy, according to whether a state of war existed or not.

This period, at the end of the 17th century, was the heyday of the buccaneers, amongst whom was one of the most picturesque geographers of all time, William Dampier. Indeed, if curiosity be the main-spring of our science, then this pirate-hydrographer was the most assiduous geographer since the time of Pytheas, for he became a buccaneer "more to indulge my curiosity than to get wealth" and always chose those freebooting expeditions that would take him farthest afield, "which," as he wrote, "was always very agreeable to my inclinations." Those inclinations took him almost as far as it was possible to go in those days, and had he been a better commander, or his crew more worthy, he would have been seventy years ahead of Cook in disclosing the real Australia.

The wide Pacific was now the main theatre for both exploration and treasure. Curiously enough, it was usually called the "South Seas," though the greater part of the voyaging was done in the tropics or in the northern hemisphere.

The last of the "plunder" expeditions was an official one: Lord Anson's in 1740. The intriguing narrative of this venture, written by Richard Walter, chaplain of Anson's flagship, *Centurion*, shows better than most the navigational difficulties of expeditions at that time.

Latitude being easy to find and longitude the very opposite, the usual way to reach a small island was to make for the right latitude, but well to the east or west of the objective, and then to sail east or west as the case might be. Anson had much trouble in sailing round the Horn and lost account of his longitude.. His ship was ridden with scurvy, that terror of long voyages, and he was losing up to ten men a day, so he took the risk of sailing directly for the island of Juan Fernandez.

When he arrived at the latitude of Juan Fernandez, he concluded—correctly, as it finally turned out—that he was to the east of it, and for two days he sailed westward. Then, fearing he was to the west of it, he turned round and sailed eastward until, to his dismay, he sighted the mainland of Chile, a hostile country, and had to turn once again. The delay of twelve days caused by these manoeuvres cost him the lives of eighty men.

This tragic result of inability to find longitude was but one of a series of cases that induced the Government to bring in a bill "for providing a publick reward for such person or persons as shall discover the Longitude." The outcome was the Board of Longitude, which continued for over a century and paid out more than £100,000. It came under much criticism from 18th-century authors and wits. Even the famous Newton, when asked to advise on methods of finding the longitude, could not forbear from saying he would

do so " if at any time it should be lost." Nevertheless, the problem was solved, the solution being a chronometer or time-keeper that could carry Greenwich Time accurately on a ship. The prize was won by a Yorkshireman, John Harrison.

Lord Anson's voyage was one of the first of the fully accredited expeditions to the Pacific, and the natural step was to follow it with others, the object being discovery and science rather than booty. No sooner was the object clearly proclaimed than the right man was found to carry it out: Captain James Cook.

In discovery, it is just as important to have the right planners at home as the right leader in the field, men who will complete the work and organize fresh ventures to fill the gaps in knowledge. Sir Joseph Banks, companion of Captain Cook on his first Pacific voyage, was such a man, and his influence over geography during his long life was immense. Though he was primarily a botanist, his interests covered all sciences and all parts of the world. No expedition of his time was deprived of his support, no scheme of colonization mooted without his advice. To him, almost as much as to Captain Cook, do we owe the fusion between exploration and science that we now take for granted. Moreover, as President of the Royal Society for no less than forty years, he was able to insist on the analysis of the results of exploration, which is just as important as the field work itself.

The man who penetrates new country is an explorer, but he is not a geographer until he comes home and thinks hard about what he has discovered, analyses the observations he has made, and correlates them with others.

Banks lived to see Cook's pattern of exploration followed by a host of others—La Perouse for France, Bellingshausen for Russia, Parry and Franklin for England—but the greatest geographer of them all was Alexander von Humboldt, who may justly be called the founder of modern geography. His actual travels were in Mexico and the north of South America in the first few years of the 19th century, but his writings covered a wider field, and it was he who first stated clearly for geography what Darwin was to carry out for biology.

How broad the term "geography" was to Humboldt can be seen from his stated aim, which was "*to elucidate a science of which we as yet possess scarcely the outline, and which has been vaguely denominated Natural History of the World, Theory of the Earth, or Physical Geography*." He boldly declared that geography was a Study and not merely a Description. Like Darwin, he was a most assiduous collector of observations, yet he was able to see them merely as the groundwork for study, the materials for an intellectual structure of far greater significance to man than the collection itself. He almost decries too profound research into "the special facts," lest it confuse the real

issue, which, for physical geography, he declared to be "to recognize unity in the vast diversity of phenomena."

AWAKENING OF PUBLIC INTEREST

But the study of geography, whether as exploration or cartography or merely "the use of the globes," was still the preserve of the wealthy. Its practice was carried out mainly by societies or the Government. Popular interest was gingerly sought, yet as often rebuffed. It was largely an affair of learned—or not so learned—gentlemen meeting in their handsome libraries. Surrounded by globes and books of travel, pictures and trophies, they would discuss and promote theories as to the attainment of the North-West Passage, of the North Pole, of the sources of the Nile. The diaries of Lady Franklin disclose such meetings, often somewhat formal to our modern taste, but eager enough, despite gentility.

Behind all this fervour for exploration and the attainment of goals, there was, as the columns of their newspapers reveal, a solid backing of public interest in Place. It blossomed during the Napoleonic wars and was quite naturally the central feature of the societies that fostered geography, among them the African Association, which was founded in 1788 and later merged with the Royal Geographical Society, itself a development of a semi-private group called the Raleigh Club.

Throughout the 19th century, the Royal Geographical Society functioned as the patron society of exploration, promoting some expeditions itself and lending its prestige to others. Occasionally it found itself out of harmony with explorers who declined to be patronized, and it did not always choose the best men to lead its more official ventures. Nevertheless, its service to the growth of modern geography were immense and lasting, and the emphasis it gave to discovery can hardly be said to have done harm, though it did delay to some extent the development of other aspects of the subject.

In the latter part of the century, it was being realized that exploration in the sense of great discoveries was coming to an end, there being little left to discover. The Polar Regions had blank spaces on the map and there were gaps in Central Asia and New Guinea, but elsewhere the general features of the world map were known. The fine frenzy of discovering new rivers and ranges of mountains was subsiding for lack of blank spaces where they might occur, and exploration had to satisfy itself with the close study of the partly known, rather than the rapid unveiling of the completely unknown.

Coincident with, but not dependent upon, this disappearance of the objects of exploration, there was a growing realization that a geography that merely described what existed was not very satis-

fyng. The subject was passing through a stage common to all field sciences when the discovery and classification of facts are seen to be lacking in real value. It was not by any means a sudden change, for as far back as Humboldt and Livingstone, to mention only two, it was comprehended that to find a new area was but the beginning of the story. One needed to explain its features, correlate it with other areas, understand its inhabitants, and generally fit it into the world picture.

The really great explorers of the 19th century were not satisfied with the adventures of travel and the thrill of a new discovery, strong motives as they always were. For instance, in David Livingstone's account of his missionary travels there is comparatively little expression of satisfaction at the feats of travel he performed, but a great deal about what might be done to improve the well-being of the inhabitants. More striking still is his wish that he were more of a scientist, so that he could explain the plateaux and the drainage, the natural resources and human history, of those unknown regions.

If the explorers themselves were beginning to see that there was more in the study of Place than just putting Place on the map, those who stayed at home were even more conscious of something missing in the general curriculum of knowledge. They saw innumerable searchers in every field of science, amassing facts, labelling them and putting them

away neatly enough in separate rooms in their own intellectual museum. Someone, they said, ought to be compiling cross-references, to possess a key to all these rooms—or better still, there should be no doors at all. There has been, they said, a sufficiency of classification. Let us now begin to see what it all means.

There had already been rebels who refused to recognize any closed doors : biologists like Darwin and Huxley, who did not hesitate to use all science and all philosophy to find a pattern, a scheme in the development of living things. In geography, too, there was a dissatisfaction with mere description of places. There was a knocking down of unreal partitions, an attempt to relate the physical facts, to seek signs of interdependence and perhaps even a causal connection between them.

Prominent in this intellectual revolution was Friedrich Ratzel, Professor of Geography at Leipzig, in the latter part of the 19th century. As the apostle of Determinism, by which he meant that man was the creature of his environment, or indeed the victim of it, he preached a faith that we can no longer follow. He saw rigid laws where we recognize only correlation and interdependence; he wrote "inevitable" where we would prefer to read "avoidable" in the relations between man and his physical surroundings. He has had brilliant followers, even to the present day, but modern geographers as a body have declined to subscribe

to this general theory that man is at the mercy of geographical influences, that "all is predetermined and the soil is dominant." Yet though we now revolt from such rigidity and prefer to believe that destiny is at least within reach of our mastery, we must recognize Ratzel's influence in broadening the basis of geography.

Less dogmatic, but still with a deterministic message, was the contribution of an earlier worker, Frederic LePlay of France, who felt that he had found laws relating social organization with environment. His framework was more elastic than Ratzel's, for he was ready to ring the changes on his three concepts of Place, Work and Folk, allowing that Place was not immutable, but could be influenced both by the Folk who lived there and by the Work they practised.

Both these authorities, Ratzel originally a zoologist and LePlay a mining engineer, helped to bridge the gulf that was tending to form between physical geography and geography applied to man, sometimes called human geography. Their colleagues and successors, especially in France, consolidated this assertion of unity by reaffirming the value of regional treatment, which means, in essentials, the study of physical and human factors together, but by regions, preferably natural regions. This division of geography as a study was first recommended by Ptolemy, who called it chorography.

Regional geography is considered by many to

be the final aim of modern geography, whereas others regard it not so much as a development of geography as a useful way of splitting up the surface of the earth for intensive study. In so far as modern regional geography is based on natural rather than political regions, it is still not a new aim.

The excellent series of monographs on parts of France, produced by a number of brilliant French writers, focussed a great deal of attention on the constitution of a region, and it permitted very thorough study of what its great exponent, Vidal de la Blache, called "the relation between geographical conditions and social facts," since the study was applied to small areas. Yet one is inclined to ask whether regional geography on those terms is anything more than following the example of the physical and biological sciences in splitting large fields of study into smaller ones.

Nevertheless, the emphasis on regional studies proclaimed by the French School was valuable in that it led almost automatically to the concept of the interrelation of Man and Place, a sort of two-way determinism, giving Man freedom to influence Place within limits that are gradually being extended. Moreover, the close contact of geography with Natural Science was being extended to include Social Science. Nothing could be more natural than the appreciation of the effect of a community on the place it occupied and *vice versa*. Sociology romped into prominence and swayed geography

in yet another direction, sometimes in so embarrassing a way that geographers were apt to call themselves sociologists and forget their physical geography.

There were signs, therefore, of geography becoming unwieldy, if not actually bloated, with its tendency to adopt other subjects rather than merely to overlap them.

GEOGRAPHY BECOMES A UNIVERSITY SUBJECT

At this stage—that is to say, in the last quarter of the 19th century—a group of people mainly centred on the Royal Geographical Society succeeded in persuading academic authorities in England to follow the lead of the Continent and establish geography as a subject in the university curriculum.

This development, while natural enough, was not universally welcomed. Not only was there divergence of opinion as to the content of the subject, and an awkward reluctance to define it, but there was also a tendency to focus its activities along those special avenues in which its early teachers had been trained.

We may glance, with some profit, at the kind of arguments raised against this Cinderella of subjects, for they have some weight even now, and will assist in establishing in our minds what it is that geography sets out to do.

The most famous teacher of that time, Dr. (later Sir Halford) Mackinder, who was the first Reader in Geography at Oxford, used to say that geography was not so much a subject as a point of view. That is an excellent interpretation, for it means that the geographer looks at knowledge from a different standpoint from, let us say, that of the mathematician or the philosopher. He puts Place as his background instead of Number or Abstract Concepts. Yet it was not unnatural for opponents to ask how one was to teach a point of view.

Lesser men than Mackinder were apt to claim a narrower purpose for university geography, asserting that it was a natural expansion of the school geography of that day, as though a more profound knowledge of capes and bays, rivers and towns and products, could be an end in itself. There was, indeed, some danger that university geography would aim primarily at producing teachers for school geography.

To those who, with better knowledge of education, put forward the sounder issue that geography set out to interpret all the other sciences, both natural and social, there was a ready answer from the obstructors. How, they would say, could an interpretation of all scientific knowledge be taught to young people? Surely that would more properly be a subject for post-graduate study? Interpretation, too, must involve judgment and •experience, the privileges of maturity, even if the

requisite wide field of knowledge could be assumed as possible. How could one devise a schedule for the teaching of university geography that would not be open to the criticism that it was indefinite and woolly, a thing of shreds and patches, a study without firm foundation or a definite aim?

A further weakness in the case for geography was that it appeared to have no well-defined technique. The chemist had his test-tubes, the biologist his museum, the historian his documents, the classic his codices; but what tools would the geographer want, what method would he follow other than the unacademic one of travel?

So there was trouble. Teachers of established subjects objected to this new *omnium gatherum* of a study, which threatened to invade their boundaries; the universities found it awkward to fit it to their traditional division of learning into Arts and Sciences; and, worse still, the geographers themselves were far from unanimous in their choice of a niche in the academic structure.

It says a great deal for the university authorities of that day—and indeed for the subject itself—that these difficulties and hindrances were surmounted. The schools founded then at the two older universities have since been followed by all the others, and geography is now fully established as an honours subject.

CHAPTER III

GEOGRAPHY FROM THE ARM-CHAIR

WHENEVER two or more intelligent people are discussing affairs, whether at home, in the office, or in the bar at the "local," an argument about Place is almost certain to arise.

The main source of geographical facts is an atlas of maps, the most condensed form of encyclopaedia we know. It is probably no exaggeration to say that there is an atlas of sorts in every home and office, and I venture to assert that there should be one in every bar. If some enterprising publisher would bring out an atlas, specially designed for the purpose and printed on paper resistant to beer stains, it would most certainly be used and would equally certainly give rise to as many arguments as it settled. The hint to publicans is not an idle one, nor should it be without interest to a wise Ministry of Education anxious to increase the facilities for adult instruction.

Of atlases there is no end. They are of all sizes and all styles, and to every degree of detail. But in this chapter we are concerned with something in the middle range, not[^]so vast as to have to be used on a table, nor so small that it can be carried in the

pocket and become dog-eared *in* a few weeks. It will probably be called "Senior" or "Advanced," and, if it has a good, stout cover, as it certainly should, its cost will not be much under ten shillings. Beware of the "Commercial" atlas and incline rather to "Physical," for the latter has more promise for the casual reader. The physical features of a region are the broad basis on which the commercial or economic development must rest. If the horse is to draw the cart, it is as well to have it in front.

USE OF THE ATLAS

To most people, an atlas is little more than a kind of dictionary, with two sets of names in it, one set in alphabetical order in the index, and the other set on the maps. We look up the queried name in the index, find the place on the map, then shut the atlas, satisfied that we now know all we need. But an atlas is not a dictionary, but an encyclopaedia, and it ought to tell us more than that. It is, however, a graphic encyclopaedia, not a written one, and we must understand its shorthand if we are to read it with full profit.

Quite the best way to treat an atlas is to consider it as the detective considers the room where the murder took place, full of information if one but seeks for it hard enough—and knows the tricks. Fortunately the tricks are easy to learn.

Most atlases begin with a series

forbidding in appearance. Were I a publisher, I would put these at the end as an appendix to the maps, which they really are. Yet they have their uses, even in the bar at the "local."

For instance, someone reads out of the evening paper that there is a dim comet to be seen by those with sharp eyes, and it is near the star Aldeharan. Thereupon, those present all want to look for the -comet, but where are they to look? Will the .atlas help? They turn to the page of astronomical charts and are confronted by a confusing network of circles and radii. Most of them give sighs of disgust, but one of their number perseveres and finds Aldeharan. As he reads out that it is near a circle labelled 20^0 and a radius labelled 70^0 , interest Cends to dwindle to vanishing-point, but when he adds that it is near the Milky Way and on a line between Orion's Belt, which everyone knows, and the Pleiades, which everyone thinks he knows, the party troop out to find the comet in the sky.

Whether they find it or not, they are bound to Spend an astronomical evening, for on the next page of the atlas there are diagrams, one showing paths of comets, another showing the seasons, another showing the phases of the moon, another showing the "apparent path of the sun"—all provocative, if not very illuminating. The party may unanimously decide that ,the atlas is like the professor of fiction, learned but unintelligible, and pass a tacit resolution that .something ought

to be done about improving the astronomical pages.

On another evening the chief item of interest in the paper may be the progress of Mr. X on his round-the-world flight. He has reached Singapore and now, *en route* for San Francisco, has left on his next hop—to the Aleutian Islands, of all places. Why on earth does he go away up into the Arctic when the Mercator map of the world shows a direct route via Hawaii?

One of the party murmurs that there is something funny about a Mercator projection. He looks in the atlas for a hemisphere map, which says that Mr. X is right—that his shortest route is indeed via the Aleutians. The result is general puzzlement, which is not much clarified by the two pages of text at the beginning of the atlas on the subject of map projections. Mention of equidistant and equal area, true direction and loxodromes, orthographic, stereographic, homalographic and other graphics—all this simply stuns both the reader and his listeners, or stirs them to pass yet another resolution, begging for a more intelligible treatment of projections.

It is with relief, then, that they welcome the next evening's news item. One of them mentions that he has had a letter from a friend who is concerning himself with ground-nuts at a place called Kongwa in Africa. At last they can skip those awkward first pages of the atlas and look up an honest-to-goodness map that everyone considers he can

understand. They find that Kongwa is about a hundred miles inland, some thirty miles from a railway and over three thousand feet above sea-level. This, however, does not satisfy the recipient of the letter, and, by looking at other maps of Africa, he is able to announce further facts : that the yearly temperature varies only from 60 ° to 70° F.; that the rainfall is heavy in January and non-existent in July ; that Kongwa is in dry steppe country, but near woodland, and that it is not far from the tribal districts called Ugogo, Usagara and Masai.

After this orgy of information, they begin to think they know something about the circumstances in which the distant friend lives, and to consider that the atlas has helped to earn Its cost.

USE OF THE GLOBE

For the home geographer, as distinct from a member of the floating population of the tavern, there are two more things besides an atlas on which money is well spent.

The first is Whitaker's Almanack. Compact, succinct, yet comprehensive, it answers more current geographical questions than any book of its size that I know. Moreover, it is cheap, even the Complete Edition of eleven hundred pages being only twelve shillings and sixpence.

The second is a globe. It is liable to be expensive

and takes up a lot of room, so would seem to be superfluous when a whole atlas is available, but it will answer certain questions of geographical interest in a way that nothing else can. Even a small one will serve, if properly mounted, or we can fashion one out of a child's large india-rubber ball and a basin.

To test our equipment, we may now imagine a family circle: Mr and Mrs. Jones and their two children, Peter and Molly. Mr. Jones is sitting by the fire—for it is the 10th November—with the newspaper; the children are at the table, Molly with Whitaker's Almanack, Peter with atlas and globe; and Mrs. Jones shares the fireside with her husband, while she mends socks and puts in suggestions of an intuitional kind every now and then.

The first item of news to challenge these home geographers is a mention in the newspaper of the republic of Andorra. This is plain fact-finding of a straightforward kind. Peter soon locates it as a small area perched high in the Pyrenees, and Molly discovers from Whitaker that it has a population of 5,500 living on 175 square miles under the joint protection of France and Spain, and that its capital, of the same name, has 700 inhabitants. Mr. Jones now remembers that there is another tiny republic in Europa and a short hunt in atlas and Whitaker soon unearths San Marino, smaller in size than Andorra, if greater in population, yet large enough to conclude treaties with Italy and Great Britain.

The next place calling for attention is Guatemala, where, according to the newspaper, there is trouble—in fact, several kinds of trouble: an earthquake, volcanic eruptions, general political unrest, and a tendency to blame the British for everything. The geographical and political facts are soon found and are interesting enough, though perhaps a little barren and static; but Peter, by looking up the volcano-earthquake map in his atlas, finds scope for all sorts of deductions and debate. Guatemala has a whole string of volcanoes—active, recent, and extinct—and also lies in a region noted for its frequent earthquakes. The awkwardness of picturing these volcanic belts on a flat map, and the puzzling nature of the curves showing the rates at which earthquake waves spread out from their origin, drive the Jones family from the atlas to the globe, and they begin to appreciate its value. Earthquake zones, traced roughly on the globe, show themselves to be in two incomplete rings, one round the Pacific, the other round Africa. This gives rise to discussion in our family group, as does the possibility of a connection between volcanoes and earthquakes.

The last item of news is the round-the-world flight that caught the attention of the party in the bar at the "local." The paper refers to Mr. X's route via the Aleutian island of Attu and gives the distance in nautical miles between Attu and Tokyo, where the flier had landed on his way from Singa-

pore. It also mentions the time in which the journey was accomplished, the date and hour when Mr. X left Tokyo, and the date and hour when he arrived at Attu, having crossed the International Date Line *en route*.

By referring to Whitaker, Mr. Jones and the children find that a nautical mile is a useful unit for all global measurements, being one sixtieth of a degree, measured along any meridian. They therefore stretch a strip of paper along a meridian and mark it in degrees. Then they apply it to the globe between Tokyo and Attu, checking the distance,, and observing at the same time that it is pretty well the shortest route from Japan to San Francisco.

The Date Line is not so easy, but, with the help of Whitaker, the globe for the earth, and an electric lamp for the sun, they wrestle out some understanding of it. Whitaker gives the line where the change of date occurs as 180° from Greenwich,, with certain local modifications. They see that along the meridian that faces the light (under the sun) it must be local noon or midday. Therefore along the meridian on the opposite side of the globe, 180° away, it must be local midnight, changing from one day to the next.

This is plain enough when one is considering people who stay in their home town, but what if they are not stationary, but moving east or west? It occurs to the Joneses to put a miniature aeroplane on the globe on the parallel of 60° North

latitude, and to assume that it can travel at the rate of 15° of longitude an hour, which is quite possible up near the Arctic Circle. This means that it travels at the same rate as the sun does.

They entrust the piloting of their tiny aircraft to a certain Mr. Y, whose presence will help to clarify this perplexing matter of the Date Line, and decide that he shall first go westwards round the earth, starting at noon. Treating the globe as a model, which is what it is, they turn it from west to east at the rate of 15° a second. This is the same direction as that in which the earth goes, but, by turning the globe 15° a second, they have compressed Mr. Y's day from 24 hours into 24 seconds.

Simultaneously with the turning of the globe, they move the aeroplane 15° to the westward every second, thereby making the circuit of the globe. But as the globe is revolving in the opposite direction, the aeroplane remains under the sun—or electric lamp—all the way round. As far as Mr. Y is concerned, it has been noon ever since he began his trip, which we will say was on Tuesday; there has been no midnight and therefore no change of date: but by the time he reaches his starting-point again, it will be noon on Wednesday for those who stayed at home. Mr. Y has lost a day and must add one on, or, alternatively, he should have called it Wednesday at some stage in his journey.

The Joneses now send him in the opposite direction. Starting at noon, under the sun, they

move the aeroplane 15° a second as before, but now eastward. In six seconds it has gone 90° eastward, while the sun, with the turning of the globe, will now be over a meridian 90° to the west of the starting-point. Aeroplane and sun are now on opposite sides of the globe, so for Mr. Y it will be midnight and he must call it Wednesday. In another six seconds, he is under the sun again and it is noon on Wednesday. At the eighteenth second after starting, there is another midnight and he passes into Thursday. At the twenty-fourth second, he gets back to his starting-point, which has had only one midnight and where, therefore, it is still Wednesday. So Mr. Y has gained a day and must take one off, unless he has dropped one out of his calendar somewhere on the way round.

This point where he should have added or dropped a day, according to the direction in which he was travelling, is known as the Date Line. Fixed by international convention in 1883, it is, as I have already mentioned, roughly the 180th meridian from Greenwich.

For the purpose of explanation, we have used an aeroplane, which is fast-moving, but speed does not really enter into it. Travelling eastward at any speed one likes, one is "meeting" the sun, and each period of daylight is a little shorter than if one stayed still; travelling westward, each period of daylight is a little longer. Whatever period of

time the circuit takes, the loss or gain will add up to a whole day.

We can reduce the matter to a formula by saying :

" If you are going eastward, repeat the date in mid-Pacific; if you are going westward, omit a date."

The International Date Line is, of course, of particular interest to those few people who live on islands close to it, whence arises the tale of the missionary and the dipsomaniac. The missionary lived on an island five miles westward of the Date Line, and the dipsomaniac on another island five miles eastward of it, where there was no Sunday opening of the bars. After preaching on Sunday on his island, the missionary would get into his motor-boat and cross the Date Line to the other island, where it was still Saturday. On the following day he would preach again and, thus travelling each week-end, he contrived to have one hundred and four Sundays in the year. The dipsomaniac also had a motor-boat. After his Saturday night orgy, he would cross to the other island, where it was Monday and the bars all open. There were no Sundays at all in his year.

The globe does not really come into prominence as an aid to arm-chair geography until someone produces one of those conundrums that demand a knowledge of both geography and astronomy. For example, in the family circle that we are imagining, Mr. Jones incautiously states that the sun always rises at east Peter pounces on this as wrong

according to observation, and is required by his father to produce proof. He asks Molly to look in her Whitaker and ascertain the declination of the sun for that day, the 10th November. She finds that it is exactly 17° South. Peter then sets his globe to their latitude—London, 51° North—by tilting it until the north polar axis is 51° above the horizon circle. Molly having told him that the sun on that day is vertically over 17° South latitude, *ht* notes where that parallel cuts his horizon circle—which, of course, is the imitation sunrise—and reports that it is 116° from the north—that's to say, 26° south of due east. The same setting shows that the sun will rise exactly on the east only when its declination is 0° , on the Equator, which Molly informs him, after further reference to Whitaker, will be on the 21st March and the 23rd September.

At this stage in the evening, Mrs. Jones looks up from her darning to the clock on the mantelpiece, which says it is half-past nine, and remarks that the globe would be of more practical use if it would tell her what her sister in Melbourne, Australia, is doing at this moment. On his mettle, Peter reads off the longitude of Melbourne, 145° East, and, dividing by fifteen, informs his mother that it is nine hours and twenty minutes later in Melbourne and therefore Auntie is probably having her breakfast.

Another conundrum is posed by Mr. Jones, who puts it into the mouths of Tweedledum and Tweedledee.

" I'll go steadily south-west," says Tweedledum, " while you go steadily north-east, and when we meet we'll have a batde."

" Very well," replies Tweedledee. " It suits me, because I haven't got my armour to-day."

Clearly he does not expect to have a fight. The globe will help Peter and Molly—and every other home geographer—to decide whether the dauntless warrior was right or wrong.

For our grandfathers, " The Use of the Globes " was a regular subject in the curriculum, possibly disliked by the pupils, but certainly putting them ahead of the youth of to-day in that particular branch of knowledge.

The globe they used was mounted in such a way that it could be rotated on its axis, and the axis itself could be set at any angle to the horizontal circle by turning the circle, known as the meridian circle, that runs from pole to pole. The meridian circle was numbered in degrees from the Equator to Pole, 0° to 90° . The horizon circle was usually numbered from 0° at one end to 180° —both ways—at the other. The globe itself had the meridians and parallels marked, together with the seas, continents and a moderate number of names.

The easiest way to understand what is to follow is to consider the globe for what it is, a model of the earth, but with a horizon plane not tangent to the surface, but passing through the centre of the earth. This is the only unreal point about the

model, but as far as the sun and stars are concerned, it makes no difference, since the radius of the earth, 4,000 miles, is such a tiny distance compared with our distance from the heavenly bodies.

To set the globe for the latitude of a place, say London, we turn its axis until the northern pole is $51\frac{1}{2}^{\circ}$ above the horizon, because the latitude can be described as *either* the angular height of the pole from the horizon *or* the angular distance between the Equator and the zenithal point (immediately overhead) of the given place.

There is one other artificiality—perhaps it should be called a trick—in using the globe, and that is the idea of a "sun mark" or "star mark." Navigators call these the sub-solar or sub-stellar spots, by which they simply mean the place on the earth where the sun or the chosen star is overhead at any given instant.

For us, the sun's path for the day is of more interest than its place at any moment of the day, and we can get it very easily from Whitaker's Almanack. In the monthly tables we can find the declination of the sun for every day in the year, and that is the same thing as the latitude of that day's path of the sun mark or sub-solar spot. For to-day, for instance, the 30th August, 1948, its declination is $+9^{\circ}07'$ at noon, having moved from $+9^{\circ}29'$ at noon yesterday, and it will be $+8^{\circ}46'$ at noon to-morrow, by Greenwich Mean Time. Neglecting minutes, this signifies that the

overhead path of the sun for to-day is along the parallel of latitude of 9° north of the Equator. Consequently anything we want to know about the doings of the sun to-day at any place in the world can be got from that parallel.

For example, how much daylight will they have at Oslo to-day? It is in latitude 60° North and longitude 10° East approximately. We set the globe so that the North Pole is 60° above the horizon circle, and Oslo itself under the meridian circle. We then notice that the sun's path, 9° North, disappears below the horizon at 114° East—that is, 104° east of Oslo. Allowing 15° per hour, we estimate that this is about 7 hours before noon, or 5 a.m. by Oslo time. The day is therefore 14 hours long, if we mean by that the length of time the sun is above the horizon. If we extend the day to include twilight and dusk—that is to say, until the sun has sunk more than 12° below the horizon—we shall find, by the same kind of measurement, that the period was 18 hours, even at the end of August.

But we are going too fast and too far with our globe—and maybe the Joneses are, too. In any case, Mrs. Jones will have said long since that a globe in the sitting-room is hard to keep dusted and awkward to move about. She asks why these clever geographers cannot invent a flat globe for their studies, one that can be put away and kept clean, and will occupy no great space.

The answer is that a very clever geographer did that very thing over 2,000 years ago. His name was Hipparchus and in 150 B.C. he devised the stereographic projection. The medievals turned it into an instrument for doing sums—indeed, one of them called it "the Mathematicall Jewell" and claimed for it, in the style of his time, that it "performeth with wonderfull dexteritie, whatever is to be done either by Quadrant, Ship, Circle, Cylinder, Ring, Dyall; Horoscope, Astrolabe, Sphere, Globe, or any suchlike heretofore devised; yea or by most Tables commonly extant . . . with great and incredible speede, plainnesse, facilitie and pleasure."

The curious thing is that, within limits, he was justified in his grandiloquent claims. In a modified form, I tried it out on classes of young navigators in the recent war. It achieved some success until the advent of radar enabled the hard-pressed air-navigators to pass their headaches on to an instrument, and to put away some of their tables and graphic plottings. Doubtless it will be tried again in an even more modern form, not so much to please Mrs. Jones, perhaps, as to persuade the ordinary intelligent man that there is no great difficulty in finding an approximate answer to all the problems that arise from our inhabiting a spinning sphere, which is subject to the rule of a life-giving sun that dictates our daily routine.

GEOGRAPHICAL PASTIMES

We will now put away our globe and return to our atlas, the most handy aid to the arm-chair geographer.

The most intent and absorbed student of the family atlas is usually the child of from eight to ten years, when the world is still very new and wonderful. Maps are pointers to dreams of travel; they open a magic casement that even all the dull demands of an examination system cannot quite close. It is for parents and teachers to keep it open as long as possible, for the small boy, tracing with grubby fingers where he will go in his dream ship, grows into the youth making plans for a career that may take him out in the world, and the adult totting up his savings to see how far he can go *in* Europe during his holidays. If funds or restrictions on travel prevent a visit overseas, then the man must imitate the boy and go back to the Atlas of Romance.

And why should there not be an Atlas of Romance? The modern publisher has no time or money to spare for drawing galleons scattered over the oceans; he uses the space for bathymetric data: and where dragons and potentates might have delighted the eye, there are contours and graphs of economic products. Yet it is not a lost art, as the late Macdonald Gill has shown, and the way is open for the artist-geographer to produce an atlas in which verity and imagination achieve a degree of harmony that will delight the child and not offend his father.

Again, we might have a Scribbling Atlas, for children of all ages up to sixty at least. It would be mainly of blank maps on paper of texture ripe for pencil-work, and over it the owner should have full licence to scribble where he wanted and what he wanted, from kudos to diamonds, from "Here be bears" to "There be rhubarb," or, in his later years, his routes of travel or those of his friends. One pauses to wonder what the scribbling atlas of Mr. Churchill—or of Hitler—would have contained, had they been available in those days.

We cannot direct and discipline romance, for each casement is private, so we can but instance a few of the games that children have applied to atlases.

There was once the satisfying and pharisaical amusement of finding out where the British Empire was. A game rather outmoded now, or at least modified, it then consisted of taking the Mercator map of the world, with its flattering exaggeration of Canada, and picking out the Empire, right down to the last least island underlined in red, or with (Br.) alongside it. It mattered not how small their actual size or population—indeed, the more isolated they were the better, since they gained in importance thereby. Consequendy, Pitcairn and Tristan da Cunha and St. Helena had an undue amount of attention, especially as they had a tang of piracy, duress or adventure.

Such search soon developed into the Empire hopping game, wherein, if one dared to scribble,

routes across the oceans were traced so as to visit every spot of red. With the progress of air travel, this would now be a set of straight lines, and the game may well be common.

Distances and directions were later subjects of geographical recreation, but they were apt to be unpopular, because the different maps gave different answers, and the bugbear of projections smelt of class-work. More acceptable were memory contests : capitals of countries, the longest list of places beginning with a certain letter (X and Z being out of bounds), the highest mountain, the deepest sea, the longest river—and so on. There was even an obscure form of treasure-hunt, the clue being in words suitably camouflaged, and the key being a tiny dot alongside the proper answer in the atlas. This was more of a teen-age game and led to a more elaborate one, which has been known to amuse and confound professors in the subject. One was presented with a most extraordinary-looking continent, the coasts of which were compounded of tracings of coasts from maps to every scale and all possible orientations. One was asked to name the country for each section of the coast, and it at least brought home the fact that our habit of always having the north to the top of the map has unduly influenced our memory of outlines.

Another game, quite instructive and to be recommended to those owning an atlas containing examples of projections, is to choose a reasonable

projection, say the globular or stereographic, of a hemisphere. On this one can draw the most handsome face in profile that one's art can achieve. Then the face is transferred, as though it were a continent, to the other projections, the latitude and longitude of nose, ear, etc., being faithfully followed. The result soon shows that one should choose the silhouette of an enemy, rather than one's best friend, for the exercise.

Such a game should, logically, lead on to the more abstruse and fascinating one of devising new projections, or—which sounds more attainable—new ways of taking a section of an india-rubber ball and flattening it out on a plane surface. It is a game usually left to the mathematicians, who delight in adding even more useless projections to the present formidable array, but one needs no mathematics to take a globe and elect that each area covering, say, ten degrees of latitude and longitude shall be copied on to flat paper as a square, a rectangle, a trapezoid or even a curvilinear shape.

Whether one stops at the ten-year-old stage or progresses to the grown-up kind of geographical game, it is a painless introduction to what one might call the grammar of geography : where places are and what they are like.

One need not be very old to appreciate the fascination of place-names, the music of the maps. Indeed, it was one of the earliest games, to find the longest and most euphonious name or, by contrast,
o*

the shortest or most unpronounceable. Who can resist the beauty of Assiniboia or Woolloomooloo or Nimitabel? Who can fail to try his tongue on Przemysl or Ixtacihuatl? Who would not love to visit Lehututu and Molepolole, even though they be mainly mud huts, or Verkhoyansk and Kangerlugsuak, frozen though they be for most of the year? There are also a legion of oddities: Mbo and Mvumvumu, Bongongolong and Wagga Wagga, Illilouette and Muskogee.

There are mysteries here—and mysteries, too, even in the study of familiar place-names of our own country, so that there is growing up a whole library on the subject. For the interested there are, in the names of capes and bays of the world, whole chapters of the history of exploration. They are challenging names, some of them: Massacre Bay, Young Nick's Head, Cape Turnagain, Thank God Harbour—all simply asking for the stories concerned in their naming. With these to choose from, we can ignore, even while we deplore, the Smithfields, the Jonestowns and the Brownvilles that mar the map.

The misinterpreted names alone would fill a chapter. Cape Race of Newfoundland, so familiar in transatlantic flights, is merely the Cap Raz—or Flat Cape—of the Basque fishermen. Delagoa Bay was the refuge sought by the Portuguese when returning *from* Goa with their spices, while Algoa Bay (Cape of Good Hope) was so called because it was on the way *to* Goa.

THE COLOURING OF MAPS

We have seen that the first function of an atlas is to show where other people live. In addition to this, however, it attempts to show the conditions under which they live—the factors, especially the physical factors, that control their mode of life, their work and their comfort.

Perhaps the most fundamental of these "controls," as geographers often call them, is the relief of the country, both the altitude above sea-level and the hilliness. Over half of the world's population lives within five hundred feet of sea-level and, of the remainder, the majority live on relatively flat land, the inland plains and valleys. Man is not wont to live on steep hillsides.

Modern atlases have, therefore, a large proportion of maps with some device to show relief, usually called physical maps. It has to be a device—almost an illusion—because the map itself has only two dimensions, length and breadth; height is a third dimension and cannot be shown as such.

After many experiments, the map publishers have now almost universally adopted the method of layer-colouring, and this is moderately effective. Its weakness—a serious one—is that it makes the country look as though it consists of a series of shelves, with sudden jumps of level along the changes of colour. Custom enables us to ignore this stepped effect, but it is there, and only interpretation, which may become subconscious in time,

gives us a true picture of the relief. Ready interpretation is much hindered by the fact that, in maps of different scales, the selected layer-colours are liable to have different meanings. In a map of all Africa, the lowest tint (green) may be from sea-level to six hundred feet; in a map of Egypt alone, the publisher is tempted to keep the green tint for only the first hundred feet above sea-level.

Quite apart from this change of value for a tint from one map to another, the value of the different tints changes as the higher altitudes are reached. The upper colours often have a range of several thousand feet, partly because there are not enough colours to go round, partly because, in really high, steep country, the changes of colour are very close together, and it would be impossible to print them with the same value as the colours of the lowlands.

The layer-coloured relief map is therefore somewhat artificial and to interpret it fully needs care and practice. Improvements in methods of showing relief are on the way, particularly what one may call the shadow-relief map. This can be made by constructing a low-relief model of the country and photographing it in a low, oblique lighting, usually from the north-west. The process has two drawbacks : first, that the models are expensive to make, and second, that the delicate shading, so effective in the photograph, tends to be smothered when names, roads, etc., are printed over it. There are indications, however, that these difficulties will be overcome,

and that the atlas of the future will have a more realistic illusion of relief than the atlas of to-day. It is likely, too, that actual three-dimensional models in low relief will in time become available, though they could not be bound up in an atlas as we know it.

Though the relief of a country is a fundamental control, there are others almost as important, and the best atlases will attempt to show them. Perhaps the most vital is climate, and here again the map-designers have had a major task. There is such a variety of data—temperature, pressure, winds, rainfall, humidity, etc., and each of them is so variable. For these and other reasons, the climatic maps have to be entirely separate from the ordinary ones and only a few of the details can be accommodated on any one map.

The result is that the average man finds climatic maps difficult to interpret, if not actually dull and uninteresting. He has no real wish to wrestle with strange things like isotherms, isobars, isopleths—lines wandering over the blank outlines of the maps, with somewhat indirect meanings that have to be deeply pondered over. No wonder he generally contents himself with a glance at the simple and more generalized maps in which averages of temperature appear as different shades of red, rainfall as shades of blue, and so on. Though so important, climate maps are difficult. It is a pity it should be so, but it is not quite inevitable. There will come im-

provements. Already some atlases print graphs of climatic data for individual places and areas, as well as maps with iso-lines of one kind or another. These, it is to be hoped, will become more common, but in a rather different form, and since this form can be practised by anyone who has access to the data, as many readers have, we may expand the theme.

GRAPHIC DEVICES

The pioneer in this field of climatic graphs is Professor T. G. Taylor of Toronto. He has produced many types of graph, most of which have so far appeared only in his own books, but are likely to receive increasing attention.

Taylor calls one of these a climograph. To construct a climograph for our own home town, we take a piece of squared paper and mark off the left-hand side for temperature from about 35 °F. to about 80°F. The lower edge we mark off in inches for rainfall, from 0 to, say, 6. The ranges will depend on the kind of climate our town enjoys. We now supply ourselves with details of the monthly averages of temperature and rainfall, and plot them on the graph. If, for instance, the average temperature for January is 40°F. and the rainfall two inches, we put a small dot on the point where the 40⁰ horizontal line crosses the two-inch vertical line. We follow this with all the other months, labelling each dot, if so desired, with the initial letter of the

month, and then join the dots with straight lines.

We now have a queer, twelve-sided figure, the shape of which tells us something about the climate of our town. By itself this climograph is not of much value, but for comparative purposes it is most illuminating. We can make climographs for other places : the rival town, the nearest big city, a town on the same latitude in another country, the nicest town we know—or the nastiest, for that matter. We can plot them on the same sheet as the first, but it is preferable to lay tracing-paper over it. When a few climographs have been done, comparison of the different shapes of closed figures will tell us a good deal.

The climograph is the easiest, but not the best, of Taylor's graphic devices. There are many others, of which his habitability diagram—he calls it an econograph—is particularly interesting. For each locality, he constructs a four-sided figure. From a point, he draws a vertical line upwards, representing mean annual temperature, a line to the right, representing available supply of coal, a vertical line downwards, representing height above sea-level, and a line to the left, representing rainfall. He then joins the ends of his four lines, and the resulting shape is, as one would expect, fairly symmetrical for the more favoured places, and lop-sided or extreme for the less favoured.

If the reader is in doubt as to the efficacy of such a diagram, let him try his hand at an analogous one,

with the same general, but strictly private, purpose in view. His four axes may be labelled Features, Figure, Wealth and Charm—or other qualities to choice. With some friend or acquaintance in mind, a percentage is allotted for each characteristic, and a dot put on the relative axis. When the figure is completed by joining the dots, the draughtsman will be surprised by the difference in the shapes between, say, his favourite aunt and the wealthy curmudgeon over the road. The ideal sweetheart will come out, no doubt, as a perfect square ; the actual one—heiresses being at a premium in these days—a right-angled triangle.

This excursion into the art of graphs, both grave and gay, will not have been wasted if the reader realizes, as does the learned professor, that comparisons, especially as to climate, are one of the major activities of geographers, and that there are other ways of making them than by means of maps. It will also point the moral, which is the background of this book, that geography is a practical subject.

DISTRIBUTION MAPS

There are other types of data, other controls, that a good atlas endeavours to represent in a cartographic way, each with an appeal to the users according to their inclinations and interests. For the most part, they are called distribution maps, plotting in some way, by colour or shading, different kinds of

facts. Soil maps are rather hard to understand; vegetation maps not so hard. Geological maps, unless very generalized, are not for every reader, but everyone can appreciate a density-of-population map, or one showing distribution of products or crops. The habitats of various races or tribes are always interesting, and so are the maps that represent volumes of traffic using trade routes.

It is a case of each to his fancy, yet the geographer who is teaching himself will be advised to pay some attention to other people's fancies as well as his own. He may vastly prefer the vegetation map to the climatic ones, but he must understand that they are interdependent, and a little study of climatology will make him more interested than ever in his vegetation groups.

SOURCES OF INFORMATION

The atlas is an absolute mine of information, though it takes some patient digging to get *it* out, but it is not the only source. Whitaker's Almanack, as we have seen, is one; the daily newspaper is another. Magazine articles of a geographical nature are now common, but probably the most useful are those that set out to be purely geographical and, as a rule, provide a map and copious illustrations. Some editors allow their sense of the spectacular undue sway, but our own " Geographical Magazine " rarely so offends ; its pages are thoroughly inform-

ative as well as interesting. It has already passed the test of the dentist's waiting-room and is usually to be found there with "Punch" and those other stalwarts that have the reputation of soothing pain or distracting the mind from the anticipation of it.

For more professional articles, there are the journals of the geographical societies, and since the geographer gains much by association with other geographers, I will conclude this chapter with some reference to them.

The Geographical Association was founded some fifty years ago, primarily as an association of teachers of the subject, but anyone can join at the cost of a small subscription. Most large towns have a branch of the Association. These hold their own meetings and excursions, but there are annual meetings of the whole body, when papers are read, social gatherings arranged, and exhibitions organized. Its journal, "Geography," is published quarterly, the cost being included in the annual subscription. Anyone teaching himself geography, and wishing to find pleasant companionship at the same time, can obtain details from the headquarters of the Association, which are housed in the Municipal High School of Commerce, Princess Street, Manchester.

Mention has already been made in these pages of the Royal Geographical Society. In its headquarters at Kensington Gore, S.W.7, there are collections of maps, portraits and old instruments

that are a source of inspiration and interest. Its monthly magazine, "The Geographical Journal," is probably the most authoritative of all geographical publications, and the standing of the Society is recognized all over the world.

There seems to be an impression that membership of the Royal Geographical Society is limited and is also subject to rigorous examination or test. This is not so. As is stated in the preamble to its constitution :

"The object of the Society being the promotion and diffusion of geographical knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support. . . ."

I myself have received so much inspiration from being a Fellow of the Society that I have no hesitation in recommending those of my readers who are possessed of the necessary guineas to waste no time in seeking membership. This applies especially to those who are resident in London and could attend the weekly meetings. If they can teach themselves geography by reading books, they will progress much further by going to listen to eminent geographers speaking on their specialisms at the Society.

A free pamphlet describing the history, work and publications of the Society will be sent on application.

CHAPTER IV

GEOGRAPHY IN THE FIELD

IF there is pleasure in discovering the facts of geography from an arm-chair, how much more is there in discovering them in the field by direct observation and deduction. To visit places in imagination provides but a dim reflection of the joy of seeing them in reality. Yet travel, in the true sense, is no more than a relative term, and discovery is subjective in that a walk down a strange street in our own town is, to ourselves, discovery. A trip to the seaside, a railway journey, a bicycle ride, a walk in a new direction—all are, to some extent, travel, and all can include discovery and awaken interest in the new and the unexpected.

What distinguishes the geographer from the ordinary man on such expeditions is that he observes more closely, and uses a map or plan. There are those who say:

" There is your hill—the real hill. Why bother about its representation on a piece of paper? "

It is my task in this chapter to show such people that they are missing most of the pleasure by ignoring the message of the map. For a map, like an atlas, is an encyclopaedia with a wealth of in-

formation. But it must be extracted ; it cannot be read off directly or without some skill.

There is the story of a young man who once approached the great zoologist, Louis Agassiz, and asked to be taught zoology. Accordingly, he was put in a room with a piece of paper and a dead fish on a plate, and locked in for the whole day. When visited at the end of the day, he was a little peevish and wanted to know when the instruction was to begin.

" There is your instruction," said Agassiz, pointing to the fish.

The same procedure was followed next day, and from sheer boredom, the young man began to look at the fish, to note how its scales were arranged, to examine its gills and the curious line dividing its upper and lower halves. After a number of days alone with the fish, that young man had really found out a good deal and was launched, we hope, as a promising student of zoology.

We hardly dare suggest a similar practice with regard to geography, but certainly if a man were left alone with nothing but a map to occupy his mind, he would discover much that the ordinary person never suspects. We may append to the story of Agassiz, which sounds as though it has been embroidered, the true tale of a man—a geographer—who was blizzard-bound for some days in a tent in the Antarctic, with little more to entertain him than a map of China from a child's atlas. It showed only a few

towns, the rivers and some mountain ranges, but by the end of the blizzard, the geographer—an eminent professor of his subject in Canada—had deduced the whole structure of the country and, in a broad sense, knew China better than did the Chinese themselves.

Perhaps it is hardly the best way to study a country, but the true moral of the story is that the more you look at a map, the more you find *it* has to tell. The trouble is that most people will not look long enough at their maps and regard them more as a means of finding the way than as a mine of information.

THE MOTORIST'S MAP

In this country we are favoured beyond most nations in possessing maps to suit every possible purpose. They have been made by the Ordnance Survey over the period of a century and a half, and have only one fault: that they are, and must be, always slightly out-of-date.

Let us look at this valuable series and pick out the maps that will best fill our varying needs.

For the worst, if most favoured, way of seeing the country—that is, by motor-car—the most suitable map is that with a scale of $\frac{1}{4}$ -inch to the mile. If most of England is to be traversed, some dozen maps will be called for, but what else are car-pockets for?

It is the curse of the motor-car that, however in-

telligent and normal the driver may be, he is apt to be subject to an urge to arrive. All he asks of his passenger with a map is to put him on a good main road and tell him which way to go when it forks, and perhaps to warn him of railway-crossings. Nothing upsets him so much as to be asked to drive along side roads, unless it is to be halted suddenly in a narrow village street for the purpose of looking at an old mill, or to be pulled up short on a winding hill in order to admire the view behind. It is indeed very difficult for a car-driver to be a geographer.

Notwithstanding this, let us imagine a driver and passenger who are determined to enjoy the country itself and not merely the sensation of passing quickly through it. What will they do with their $\frac{1}{4}$ -inch map? To begin with, they will study it before they start; they will plan their route with a view to keeping off main roads as much as possible, without increasing the distance unnecessarily, each diversion having some object derived from information on the map, whether it be a large wood promising shady vistas, or a hill with a chance of a wide view, or even nothing better than the quaint name of a village or cross-roads. Who can resist Nether Wallop or Caxton Gibbet?

It is true that the $\frac{1}{4}$ -inch map does not enable the map-reading passenger to give his companion a great deal of information about the features passed, yet he can at least forewarn himself of a church or a ruined abbey, so that they can see in good, time

whether it is worth a stop. With a little practice, the map-reader can keep up a running fire of comment on what they pass, provided the driver goes at a leisurely pace. As map-readers, boys of twelve will give much better guidance than grown-ups, who always want to join in the conversation and fail to notice key-points. They are also much quicker at learning to read the map upside down, as they have to do when the route is southward.

But jay-driving in narrow lanes is on a par with jay-walking in city streets, so let us turn to a better way,

THE CYCLIST'S MAP

Thanks to good roads and bicycle-manufacturers, we are a nation of cyclists, and no one can really pretend, even if he does live in a city, that he cannot afford the open road and the wide skies.

The cyclist is concerned with more detail than is the car-driver—bridle-roads and hills, for instance—yet he cannot carry a whole set of maps. Consequently, the scale of $\frac{1}{2}$ -inch to a mile suits him well. Unless the machine is a tandem, he cannot consult the map's fine detail while actually riding, but if he is wise, he will consult it at every stop, interpreting from it the features he will encounter during the next few miles. Cyclists suffer, though in a less degree than motorists, from the passion for covering distances, and the best time to combat this is when the

ride is being planned. If they want to enjoy the country, they should calculate the time required for the round trip and then multiply it by two—or even three—and stick to their schedule firmly. To those who are bored by long, straight stretches of road and are not satisfied with the pastime of constantly comparing their speedometers with their watches, I offer the following advice:

Use your ½-inch map as a chronicle of your rides. Mark it in pencil, either with numbers, with a column of remarks on the edge of the sheet, or with initials—" P " for puncture, " V " for view, " L " for lunch, etc. This alone becomes a pleasant record and aid to memory, but it is only a beginning. The cyclist should now ask himself:

" Which features particularly interest me as I ride along ? "

It may be the names of pubs, or the types of churches, or the kinds of birds, flowers or crops, or the number of rabbits or tramps observed, or ploughs, tractors, haystacks or quarries passed. The list is endless, but no matter how trivial the thing may be, it becomes, strangely enough, more important when recorded by the cyclist on his map in whichever way seems to him best. What began as a rather forced interest grows into a fascinating pursuit, especially if a number of cyclists are concerned in it, when there can be an element of competition in spotting specimens of the class of thing chosen for the day. Whether anything of value can be deduced

from the frequency of " William the Fourth " inns, or the proportion of horse-ploughs to tractor-ploughs, is not the point. By plotting his observations on a map, the cyclist is truly teaching himself geography *in the field*. He is beginning on the sequence that is characteristic of geography : observation, distribution, deduction. By noting the incidence of inns and ploughs, he is interesting himself in distribution, which is indeed the essence of the study of Place.

THE WALKER'S MAPS

Now we come to the slowest and most satisfying way of travelling with a map : walking. Here the Ordnance Survey really comes into its own, with its excellent I-inch to the mile map. The two larger scales, the 6-inch and the 2 5-inch, are not for everyone, since they are expensive and cover but small areas. On the other hand, for frequent strolls in the home neighbourhood, and particularly if one wishes to add one's own pet detail to the map, they are invaluable. If the detail is to be very abundant—for instance, individual trees—then the 2 5-inch will be required, though it contains little more than the 6-inch, beyond the registered numbers and acreages of fields. When a 25-inch map is not available, it is easy enough to enlarge a part of a 6-inch map if more space is needed. This can be done either by hand or by photography, as is explained later in this chapter.

One of the great merits of the large-scale maps is that they contain many more figures concerning height above sea-level. These data are presented in two ways: either as dots on a road with the height in feet (known as "spot-heights") or as broad arrows pointing on the map to such things as gate-posts. Each arrow has a height in feet and tenths printed alongside it, together with the letters "B.M.," which stand for "bench-mark." If still extant, the bench-mark—a broad arrow with a horizontal line over it—will be found cut deeply into the relative gate-post, wall or house-corner. The horizontal line is the actual bench-mark, or a levelled point, and it is to be found only on the 6-inch and larger scale maps.

These bench-marks are of great assistance if we are concerned, in any way, with the slope of the ground, or are attempting to insert contour lines of our own between the printed ones. We must remember, however, when trying to be precise in our measurements, that the height in feet refers to the mark itself and not to the ground below it. The mark is not often more than three feet above the ground, but in flat country this small error, if made, may make a good deal of difference to the run of the contour.

ORIENTATION AND IDENTIFICATION

Let us imagine ourselves on the top of a hill with a view. We have supplied ourselves with a 1-inch

map and we follow out the map-reader's ritual.

The first thing to do is to set the map correctly; to place it in its proper orientation. This can be done roughly almost by instinct, but if an accurate setting is required, there is a better way. Some distant feature—a wood, a church or a road-junction—is picked out and the mark found on the map. Next a pencil, or a straight stem of grass, is placed on the map so that one end is on our hilltop and the other end on the distant mark. The map can now be orientated by turning it until the pencil or grass-stem is pointing directly at the chosen feature.

Our next step is to identify the objects in which we are interested. It is always rather fun, for instance, to see how many churches or farmhouses we can pick out. Doubts about any particular object can be settled by further recourse to our improvised pointer. Another help is a sense of distance, which can be quickly cultivated.

If, after our survey, we mark our position with a little cross and write alongside it "7C 15F," it does no harm to the map and serves to remind us afterwards that from this hilltop we saw and identified seven churches and fifteen farmhouses.

IMPROVING THE CONTOURS

On our hilltop we may next turn our attention to the relief of the surrounding country. We estimate our own height above sea-level by means of the

marked contour nearest on the map to our position, and we note which hills in view are higher or lower. It will be odd if, in so doing, we do not begin to see the hills forming some sort of pattern, of the kind mentioned in the next chapter.

Then we may begin the grand game of improving the map, for it will not have escaped our notice that a 50-foot interval between contours misses out a lot of minor ups and downs in the landscape. We must first identify the printed contours on the map with the relative section of actual countryside, and then draw in by eye where we imagine the intermediate contour would be. Only a little can be done from one spot, but if we make it a regular practice, we shall soon find that the contours we have added to our map make the relief stand out much more strongly, especially in flattish country, and that the map really is improved. The pencilled contours can be inked in afterwards in red.

A little more drawing of a simple kind will enable us to find the profile of the ground along a certain line. A piece of squared paper is laid along the line of section, and a mark made on the paper wherever its edge crosses a contour, beginning with the lowest contour crossed. When these marks have been joined, we have a profile, and a little smoothing of the corners makes it a fair representation of the section across country. We cannot call it more than fair, because it is exaggerated in some degree, depending on the size of the squares on the graph-

paper. We have stumbled on the fact that—in normal country, at all events—the hills we complain of while cycling are really very small humps in relation to the ground we cover when crossing them. We have to use overdrawing in order to appreciate them at all as hills. It is, indeed, very easy to jump to false conclusions from such profiles, and misconception can only be avoided by occasionally sketching one, without exaggeration, under the one already pencilled in.

The physical geographer sometimes needs to find the gradient of a river. This requires a little more ingenuity than the ordinary profile, because a river does not follow a straight line across the map.

The best use of profiles for the geographer is for purposes of comparison, or, more strictly speaking, of correlation of things that seem to have dependence on slopes and heights. In fact, this dependence is often only to be discerned when such a profile is drawn. We shall examine this matter further in the next chapter.

Map contours vary enormously in accuracy, depending upon the time and skill expended on them by the men who made the original surveys. Our own Ordnance Survey maps are of a very high standard in this respect, the survey having taken scores of years to make and been subject to continual checking. Nowhere else in the world, except over small areas, are map contours so accurate, or the work so faithfully carried out. Nevertheless, even the Ord-

nance Survey contours are not entirely faultless. Some have been surveyed in great detail with level and chain, but others—the intermediate ones—have been drawn in by eye. Broadly speaking, it may be taken that contours are most accurate near towns and in coal-bearing areas, while they are least accurate in sparse country and uplands.

It is quite unfair to sow the seeds of distrust in contours without being a little more specific. We may say, therefore, that for most of England the best-surveyed contours are 50 feet, 100 feet and then by hundreds to 1,000 feet. The less reliable contours are the intermediate ones, and these are generally found only on the I-inch maps.

ENLARGING AND ADDING TO THE MAP

For the beginner at maps, there is a good deal of interpreting to be done. He must understand the meanings of the different signs and symbols, every one of which portrays a fact. His I-inch map, however, has room only for a fraction of the detail, and he may also wish to make other recordings of his own: crops seen, types of woods, hedgerow flowers, rocks, soils—almost anything, whether natural or man-made, that is a part of Place. The real student of Place, whether a geographer or a natural scientist, will never rest till he has a map large enough to enter all his discoveries on, relating their position by eye to the detail already on the map.

The 6-inch Ordnance Survey maps are printed in quarter sheets representing three miles length by two miles breadth, and they are cheap as maps go, although one often finds that the area in which one is interested is so situated that four sheets have to be purchased in order to get the full picture. Even this large scale is sometimes too cramped to add many extra names and particulars; and, as an alternative to spending extra money on the 2 5-inch series, we should consider the possibility of making our own enlargements. This is the more necessary since the maps are apt to get badly out of date where houses are concerned—and such detail is the first thing we usually want to put in.

Let us suppose that it is our purpose to enlarge a 6-inch map to twice that scale—12 inches to the mile. On the original we draw in pencil a grid of $\frac{1}{2}$ -inch-sided squares; and on a blank sheet of paper we draw a similar grid, but with 1-inch-sided squares. Then, square by square, we draw the detail from a $\frac{1}{2}$ -inch square on to the appropriate 1-inch square, relating by eye the field boundaries, roads, etc., to the sides of the square. If we do not trust our judgment over a $\frac{1}{2}$ -inch square, we should use $\frac{1}{4}$ -inch squares, drawing on to $\frac{1}{2}$ -inch squares. For a particularly difficult square, it is as well to draw the two diagonals on both map and paper, and use them as additional guide lines. When all the detail has been inked in, the pencilled lines can be rubbed out.

By this simple method, it is possible to enlarge to

any scale. The amateur photographer will, of course, go to work in a quicker and more accurate way by making a negative of the original and enlarging it; or, if bromide paper is in short supply, projecting it on to a drawing-board and tracing it in.

The urge to make maps, to plot on paper something that does not appear even on the 25-inch, is growing. If a boy has access to large-scale maps, he soon wants to bring them up to date and add detail of his own, especially if he has some outdoor hobby such as collecting birds'-eggs or butterflies or wild flowers. With a large-scale map, he can mark down every nest he finds, or watch a pair of garden robins and gradually sketch in their "territory."

It is an easy matter to add details to existing maps without such expensive instruments as a surveying compass. This can be done in various ways, but I will quote but one of them, linking it with the boy who is interested in birds'-eggs.

We will take it that he wishes to put on his map the location in a large field of the trees that have nests *in* them. He provides himself with a flat board, a pencil and a thin, straight lath about two feet long. Having pinned his map to the board, he takes his gear to a point already marked on the map—say a corner of the field, which we will call "A"—and begins operations by setting the map in the correct position on the ground. This he does by laying the lath so that the edge passes through "A" and "B," the second being a point that is visible

from " A " and also identifiable on the map—for example, the opposite corner of the field. He then swivels the board round on the ground until the lath is pointing towards " B. " The map is now set and the board must not be moved or jolted in any way.

The boy next directs the lath towards one of his selected trees by pivoting it on " A " and glancing along the edge of it. When the line of sight is " on, " he presses the lath down and pencils a line along it. This " ray " will pass through the point where the tree is to be on the map. Before he leaves that position (or " station "), he draws similar rays, labelling them if necessary, to any other nest-bearing trees that he can see. He then takes his gear to another station that is recognizable on the map, where he goes through the same procedure. The intersection of each ray with its companion ray from the first station is then the position of that tree.

With a little care, this method ensures greater accuracy than could be obtained with the help of a good compass. It is a simplified form of what surveyors call the plane-table method of mapping detail.

MEASUREMENT OF DISTANCE

In the 6-inch map, the roads and houses are drawn true to scale and not to conventional size, as in the 1-inch and smaller scales. Every scale has its limita-

tions as to what can be truly drawn. Rivers are an interesting example. At their estuaries, where they are wide, one can measure the width even on a $\frac{1}{4}$ -inch map, but at some stage up the river, the draughtsman has had to draw it a conventional width. Above that point, which is not indicated on the map, no measurement can be made.

The most frequent measurement required from these small-scale maps is the distance along roads from one place to another. It is almost our first demand on a map, yet it is not at all easy to do it if the road winds. A makeshift method is to lay a piece of limp thread or string along the route, following the curves, and then to stretch it over the scale; but this is more difficult than it sounds.

For those who are more than casual users of maps, the expense of a map-measurer is justified. In its best form, this consists of a small wheel mounted on a tiny horizontal screw at the end of a sort of penholder. When the wheel is revolved, it travels along the screw until it is brought to a stop at the end. To use the instrument, the wheel is set at the beginning of its run, then pushed across the map along the route that it is desired to measure. When the wheel will no longer turn, it is transferred to the scale at the bottom of the map, placed on the zero **and** turned in the reverse direction till it comes back to the beginning of its run, when the distance is read off the scale.

It is possible, but far from simple, to use a shilling

in a somewhat similar fashion, holding it between finger and thumb and rolling it along the route. The turns are counted and the coin is then rolled along the scale for the same number of turns.

In practice one does not need any great accuracy in such measurement, but if, for any reason, a distance has been exactly calculated on the map, and the road is afterwards traversed in a car or on a bicycle fitted with a speedometer, a curious discrepancy will appear: the distance recorded by the wheels will always be greater than that reckoned from the map. This is especially so in hilly country.

The reason for this is that all distances measured up slopes are "reduced to the horizontal" by the surveyors when they plot them on the map. For example, for a gradient of i in 10 , a distance of 100 yards along the slope will be reduced to $99\frac{1}{2}$ yards and plotted as such on the map. For a gradient of I in 7 , the discrepancy is I per cent. The difference is rarely noticeable, but this convention as to distance has a curious consequence in that if a man buys a plot of land on a slope, he receives slightly more surface of ground than is stated in the deed. Assuming a square plot with sides 100 feet and, a slope of I in 7 , he would get about $10,100$ square feet of surface instead of $10,000$. The extra 100 square feet would not help him much if he were going to build a house, for the floor has to be *level*, but if he were going to grow strawberries, he would be able to get in a few extra plants.

FINDING THE AREA

These niceties as to distance and area hardly concern us unless we are dealing with very hilly country, but we do occasionally want to find the area of a field or a farm as outlined on a 6-inch map.

To do this, we take a piece of paper transparent enough to see the boundary-lines through it when it is laid on the map. On this sheet we rule a series of parallel straight lines two chains apart, taking that unit from the scale at the bottom of the map. The ruled paper is then laid over the field on the map, twisted about until both the upper and lower points of the field are touching one of the parallel lines, and fixed there with weights.

The field is thus split up into a number of strips with irregular ends, and these we proceed to turn into rectangles by drawing vertical straight lines, known as "give-and-take" lines. These are drawn by eye and, with narrow strips, are very easy to estimate. By this little operation, the field is split into a number of rectangles, each two chains wide. If we add their lengths together, we have the equivalent of a long rectangle of the same area as the field. We multiply the total length of the rectangle by two, thus turning it into square chains, and, 10 square chains being 1 acre, we insert the decimal point and have our answer in acres.

It goes almost without saying that if we are likely to need such areas often, it is worth drawing the parallel lines in ink on tracing-cloth, so that it can

be used over and over again, the give-and-take lines being done in pencil and rubbed out afterwards,

LEVELLING THE GROUND

The most tedious and difficult part of mapping is finding the difference of level of the ground surface, but even this is not beyond the reach of one who really perseveres.

For the purpose of illustration, we will assume that it is proposed to lay out a tennis-court on slightly sloping ground. In practice this means driving in a number of pegs so that their tops are at the same level, thereby showing the diggers where to "cut" and where to "fill." A post about five feet high is driven into the ground in the middle of the site, and a flat board about two feet long fastened to the top by one nail, so that the board can be swivelled round. The ends of the board have short uprights about four inches long nailed to them, and to each of these a length of glass tube is attached vertically with string or elastic bands. The upper ends of the tubes protrude above the supports, and their lower ends are connected by a length of rubber tubing. Water is poured in until it reaches almost to the tops of the glass uprights. The two surfaces of water, known as the meniscus surfaces, will always give a level line, in whatever direction the board is pointed.

The operator turns his water-level towards the

highest part of the ground, where his helper has driven in a stout peg flush with the surface. On this a pole about six feet long is held upright by the helper, while the leveller glances through his tubes, getting the level line of sight from the meniscus surfaces. Where that line of sight meets the pole, the helper draws a pencil line distinctly enough to be seen clearly by the leveller.

The rest of the operation follows simply enough. Wherever a peg seems desirable, the helper drives one in, not too deeply to begin with, and holds his pole on it. Taking his instructions from the leveller, he drives in the peg bit by bit until the sight line meets the pencil line on the pole. The final result of the work is a number of pegs in the ground, with their tops at the same level.

If the water-level is fastened to a camera tripod instead of a fixed post, and if the pole is graduated in feet and tenths, the operator has the apparatus with which he can find the profile of a hill-slope, or show the farmer where he should run his drains. He will have to observe certain precautions that cannot be specified here, but enough has been said to show that simple levelling can be done without fancy instruments.

THE PERSONALITY OF PLACE

Every geographer in **the** field appreciates **that** the things he sees do not explain themselves fully, and

that his map adds something that is not in the scene itself: the names of some of these things.

Names bring the human element into a scene and increase its interest enormously. How fascinating it is, for instance, to select a farm, learn all the names that belong to it, enter them on a large-scale plan, and construct some partial story of the past. A chat with the ploughman will supply the name of every field on that farm, some of them obscure maybe, but all rational at the time they were given, whether descriptive or historical.

Such research work will soon show that Place is not just so much hill and dale. It includes the people who live there now and those who lived there before, away and away back to primitive man, each doing something to make Place what it is to-day. Place, therefore, makes one think of people, and from that it is an obvious step to include the work they do and have done from time immemorial.

The landscape, then, gains a new meaning. It is alive. Its present is just a picture made up of its past and leading on to its future. It has character—almost a personality. The hills remain, it is true, while people live and die amongst them, their work, for the most part, not enduring ; but they all belong to the scene. Nature has linked the permanent with the temporary, the land with things that live on the land and then disappear.

Clearly, therefore, the geographer cannot be content with the mere physical features of a landscape.

He seeks the character of that landscape, and if he is pagan enough, he may even endow it with some dim kind of personality and picture some tutelary deity or guardian spirit. There is nothing strange in this to the geographer—or, indeed, to any student of man—for he is familiar with it from his knowledge of history or anthropology.

All men catch, if but faintly, something of the spirit of Place, even though that spirit is largely subjective, due to the moment or the mood of the beholder. It may be smiling or grim. Perhaps that is most vividly evident of the gaunt parts of the world. The traveller in Arabia loves his stark deserts, the harsh contrasts of heat and cold ; while Scott wrote from his inmost heart at the South Pole:

" Great God ! this is an awful place. . . ."

Scenery is what you make of it. It is not just earth and rock and trees. If it has not a guardian spirit, it has a meaning and a character.

There are many who, having observed and recorded, will be satisfied to leave it at that. They have seen *what* is there and have taken pleasure in noting it down. The really inquiring mind, however—the mind of the geographer—, will ask *why* it is there, and so will embark on the endless, thrilling career of a detective, not of crime, but of evolution, or devolution, of Nature and of Man, which is the invariable characteristic of Time and Place.

Why is that field ploughed up and down the hill

instead of along the slope ? Why are there many rabbits in this field and few in that ? We may take the natural course and ask the ploughman or game-keeper to answer these questions, yet we will also begin to think for ourselves; to relate facts with each other in our attempt to view the matter as a whole ; to look beyond the furrows and burrows, and see meaning in the landscape in front of us.

Once we begin to look for explanations, we are in a fair way of becoming geographers. We see that there is some relation between the rabbits and the furrows ; that the climate, the farmer and his fore-runners, the county and the country—even the history of the world—all fit together in some mutual way. This does not mean that they fit together neatly; but there is interdependence as to both Place and Time. To explain one thing is to explain all.

When asked to explain what we see and thence seek understanding of the whole world, we may be aghast. We may prefer to lead a practical life, broad-based on comprehensible things like walks, maps, and buttered scones for tea. But unless we stay on our hilltop or farm for a few more musings, we shall never become geographers ; we shall remain merely collectors of 'half-considered facts, which will rattle in our minds like so many pebbles in a tin.

CHAPTER V

THE PHYSICAL BACKGROUND

PROBABLY every reader will have an idea as to what physical geography is. He may have a pronounced opinion about it, either favourable or unfavourable. Thus he may recall with distaste lessons at school concerning puzzling things such as tides, monsoons and cycles of erosion; or he may associate it with more interesting and practical things such as measuring rainfall, finding the time by the sun, and making Plasticine models of canyons. He may know it better under the name of Physiography or Applied Geography, but, whatever the tide, it is clearly enough the study of the physical environment of Man.

But what an omnibus subject, surely almost the whole content of Natural Science! The earlier books on it, of which the most fascinating was H. R. Mill's *Realm of Nature*, were wont to begin with the universe and end with molecules, and they had a grand way of dividing the "realm" into "Atmosphere," "Lithosphere" and "Hydrosphere," and going into detailed descriptions of all three. Although it says much for the quality of their authors that these books were very readable and popular in their day,

and although they have had successors equally interesting on that same spacious theme, cannot we set reasonable boundaries to the subject, or are we to assume that no one can be a physical geographer unless he has first become a climatologist, a geologist and an oceanographer ?

The heading of this chapter is a reminder of one very obvious limitation. Since physical geography is the background for the rest of geography, which is to study the activities of Man with regard to Place, we need to understand only so much of physical science as effects Place in relation to Man. It may be considered that, while this does circumscribe our field of study, it defines it very dimly, yet by a clearer definition we might erect artificial barriers, putting knowledge back into the compartments that have so cramped it in the past. We will, therefore, keep our aim in steady view and take leave to step across any boundary to any science, if there is material on the other side that w[^] neeH for the understanding of Place.

SOIL EROSION

There is no better example than soil erosion of the interaction between Man and Place, and therefore it is a very proper subject of study for the geographer. It is usually brought into action by man's misuse of land and is even now threatening the food-production of the world.

Soil erosion is, in itself, an entirely, physical process in which the wind or water—or both—remove the top soil of an area and render it barren and useless to man. It must be tackled if man is to survive.

To do so with prospect of success requires the efforts of all manner of scientists, from the geologist and biologist, who can report on the physical changes taking place, to the social anthropologist and the economist, who can advise on methods of dealing with the population in the affected area. For many years all these have been at work on their sections of the problem and, as a result, we now know, *in general terms*, how to combat soil erosion.

Now think of the administrative authority, or executive officer, who is to direct the soil-conservation campaign, and of the geographer who is to sum up the problem. Either of them—and there is much to be said for it being one and the same man—must understand just enough of the science involved to enable him to carry out his duty, without being a specialist in any one branch. On the purely physical side of the process of erosion, he must use his physical geography to assess how much contour trenching or vegetation cover or seasonal fallow will balance the tendency for the soil to move. You may say that it boils down to common-sense with a tinge of science, and you would be fairly right.

THE AMATEUR DETECTIVE

That, indeed, is the keynote of this chapter, which, it is hoped, will show that anyone can be a physical geographer in some degree. It is a field study, a practical subject, a bundle of problems to be approached in somewhat the same way as the C.I.D. tackles a crime ; but instead of murder or the theft of jewels, the physical geographer investigates a curiously shaped hill, or a queer bend in the course of a river, or an invasion by sand dunes.

The general procedure is much the same and begins with a visit to the scene and the observation of all the facts in the case. The next step is to collect the evidence of bystanders, which, for the geographer, means consulting books or interviewing the oldest inhabitant. Often enough it will prove to be a problem solved long ago by others, but its elucidation is still interesting. Other dodges of the detective may come into the inquiry : experimenting with the objects concerned, reconstruction of the situation, the search for analogies in another place or time. The procedure differs from the investigation of a crime in that there is no exciting arrest at the end of it. The witnesses, too, are mostly inanimate and therefore inarticulate, yet in consequence there is likely to be less false swearing and suborning of evidence.

The suggestion that it should be a practical study leads to a corollary that it is simpler to begin with the examination of the processes we can observe in action and go on later to the results they have pro-

duced in the past. Everyone knows that the familiar landscapes in which we live have been shaped in some way by processes that are still going on before our eyes. Every little feature, including that hill up which we pant on our way to the office, is due to some combination of such processes, in which water may have taken a major role, but in which ice, wind and other agents doubtless played their parts.

The volume by Mr. Peel in this series gives a resume of how these features are formed, and some of the fascinating theories that have been elaborated to explain the more puzzling cases, but we ought not to be satisfied with merely reading about them. Let us go and look at them ourselves, build our own theories, test those of others, and make our own little experiments.

THE PROBLEM OF THE WAVES

Since it is more interesting to study action, we turn to those agents that are ceaselessly at work: eroding or depositing, building up or breaking down, hindering or benefiting man. In a brief chapter, I cannot do more than suggest a few examples of such agents ; to hint at the problems they give rise to in our minds ; and possibly to prompt a way of approaching them*

The most convincing of all these agents is the sea. When we are holiday-making, we relax and try to forget the dullness of the daily routine, yet, even

while basking in the sun or splashing in the water or building castles in the sand, we still wonder, perhaps sub-consciously, why that last wave came up farther than the others, why there are patches of unpleasant shingle in places, why a great ugly groyne has been built out into the sea, and why there are such quantities of sand.

For most of us, these speculations will be momentary and idle ; for the rest of us, the work of the waves is important and we seek enlightenment. We watch the next wave as it surges in. We see it disturb the sand into a cloud of particles, of which the smallest remain suspended longest in the water and are removed farthest from their starting-point as the wave recedes.

" Of course," we say, " that is why there is all this sand, so uniform and clear of mud. It has resisted the longshore currents and stayed, while the tiny particles have been taken out to sea."

That was an easy question, but what about that extra large wave that caused us to move our deck-chair hurriedly, murmuring cliches about seventh waves ? That is more awkward to explain. We begin to count these outsize waves and find that there is a rough cycle, though not often in groups of seven or any other constant number. This gives us cause to suspect that there must be different kinds of waves—plain waves, wavelets, ripples, billows and surges—all coming in at the same time, and all with varying heights and periods and origins.

We cannot get much farther than that, any more than can scientists with recording instruments, but it is at least amusing to speculate whether that last wave came from a storm in mid-ocean, or was an accidental union of two different series overtaking one another, or was merely the wash of the last passing steamer in the offing.

Or those groynes? Obviously they were put there to prevent the beach from being removed by the sea, for the sand or shingle is always higher on one side of them than the other.

"Is the sand being shifted," we ask ourselves, "by a current or by some trick of the waves?"

We watch carefully what happens to the sand as each wave lifts it for a moment and then allows it to settle again.

"Yes," we decide, "there can be no doubt of it; the grains do come down in a slightly different place each time, either because of the general slow, long-shore drift, or because of the direction of the wave itself."

Surely this is a clear case for experiment: to get some sand of contrasting colour, to put it in the strand-line at a marked point, and to trace its movement over a dozen waves. That would perhaps explain the origin of those long spits of sand and shingle that stick out from promontories and put bars across the mouths of rivers.

The direction of the waves is a puzzle in itself. Out at sea they behave logically and run at right

angles to the wind, but inshore they curve round, which must be something to do with the bottom friction in the shallowing water. On some days the sand is uniformly sloping; on others there are curious half-moon cusps convex to the sea. Could that be due to the change in the wind and the formation of crossed waves, so that in places the wave shoots farther up the beach and, on its backward rush, takes sand with it and forms a low valley ?

If we get as far as that in our wonderings, it will be odd if it is not the beginning of a whole set of queries, some to be tackled by thought, others by means of books and conversation. Why are some parts of the beach easier to walk on than others, some parts quickly dried, others remaining soggy ? Why is it that, when we step on surface-wet sand, our weight makes a drier patch instead of a wetter one ? and why is the patch flooded immediately our weight is removed ?

I will answer that last poser here, because it is so puzzling that for a long time it defeated even the scientists.

When, as the tide goes out, each rounded grain of sand settles, it fits neatly in with its neighbours, leaving a minimum of space for air and water. But when a heavy thing such as a foot presses on the sand-grains from above, they slide against each other and become less closely packed. This increases the available pore-space, which the water runs in to fill, thereby draining the surface. When the weight of

the foot is removed, each sand-grain tends to settle back into its former snug position, and the water is squeezed up to the surface again.

This property of dilatancy, as it is now called, possessed by conglomerations of loose, smooth particles, has been used since classical times, without being understood, in the selling of corn by volume. Merchants must have observed that, by shaking the measure as it was filled, they could get more corn into it, which was the last thing they wanted to do. Alternatively, by slow filling—and better still by pressure on the sides of the bag—the corn could be made to "dilate" and occupy more room. In consequence, the measure was filled gently—and with a stick in it, known as the strike. When the corn overflowed, the strike was very carefully removed, without any shaking, and passed across the top of the measure to remove the apparent surplus.

The same property can be discovered by sitting down on an apparent soft bag of corn. When weight is put on it, the softness is replaced by an uncomfortable hardness, the grains having shifted to distend the bag to a curious solidity.

THE WORK OF THE STREAMS

With these few instances of what is going on year in and year out on all seaside beaches, we have barely opened the book of shore problems, but we must leave the pages unturned while we consider another

holiday scene, its land-forms and erosion processes.

In the hills, whether of gentle relief as in southern England, or bolder as in the Yorkshire fells and the crags of the few mountainous areas, we are surrounded by the work of streams. There being no active volcanoes or any significant disturbances from heated magmas below, all our hills are residual—that is to say, they are what is left after the streams have been at work on them for millions of years, broken only by a few periods when ice-sheets took over the task. The ice, too, has left its mark very clearly, and has half hidden the topographic character of the pre-glacial landscape, a palimpsest effect asking for deciphering.

As one hikes or bikes through the West Riding of Yorkshire, one is aware of the picturesque grey rocks that cap the hills with abrupt cliffs; below them coarse screes, and above them flat plateaux most curiously seamed with cracks. This rock is called either carboniferous limestone or Great Scar limestone. One name tells its age, the other its character; for the beginner, the latter is more useful. But the denominative word is "limestone," for that defines a rock that is hard, yet slowly soluble by running water—attributes that cause it to be seamed by cracks, potholes and caves; to have no surface water, but to be undermined by springs at its junction with softer rocks below. These springs erode the soft rocks, undercutting the harder limestone, which occasionally falls, leaving vertical cliffs

—or " scars "—with their bold scree below them.

In *Teach Yourself Physical Geography* there are to be found simple tables by which the commoner rocks can be recognized and classified by colour, relative weight, etc. A more important attribute is their relative softness, but that unfortunately cannot be included in the table, because it varies in the same rock ; there are hard sandstones and soft sandstones, firm granites and rotten granites, very soluble limestones and almost insoluble limestones.

This makes it rather difficult, since it is the erodibility of the surface rocks that largely determines the land-forms in an area. So much is this so that one is tempted to suggest that the important aspect of every river valley is not so much the height of the encompassing hills or the shape of the valley bottom, as the profile of its slopes—its cross-section, in fact, which reflects very faithfully the character of the rocks out of which it has been carved.

Broadly speaking, the real problems for the physical geographer in the hills and mountains relate mainly to the land-forms he is walking over, the processes that have produced them, and the relative resistance of the rock formations to the ceaseless action of eroding agents.

THE FASCINATION OF ROCKS

To **the** physical geographer, the nature of a rock **is usually more important than its name or its**

mineral constituents. There is, of course, a certain satisfaction in calling a thing by the name the scientists use, but that is less important than knowing its physical character. The long names given to rocks, or the processes at work, are the last things to be worried about; they are necessary for organized knowledge and for scientific debate, but the amateur can make a good sound beginning without them.

The true geologist will no doubt look upon all rocks with an equal eye, favouring none and ignoring none, just as the zoologist must be ready to study worms with the same fervour as he applies to the graceful birds or to the noble stag. We amateur geographers, however, may be allowed to put a little sentiment into our science and have favourites among the rocks: those coarse-grained igneous rocks, with character and personality in every mineral; that pleasant, clean granite of Aberdeen, with its clear-cut feldspars and glassy quartz; the dark, enchanting gabbros of Skye or Cornwall, gloomy enough high up in the Cuillins, perhaps, but showing almost gem-like lustre *in* their olivines when polished.

Even in decomposition as serpentine, gabbro remains attractive and keeps here and there a bronzed olivine crystal to show its origin. The whole range of porphyries, which are igneous rocks with certain of their minerals of extra large size, have character and demeanour and are worthy of a place in our homely collection. If we come across a pegmatite,

a local variation in which not one but all the minerals are large, we go into raptures and take back with us far more than our mantelpiece will conveniently hold.

The finer-grained volcanics, black basalts and green dolerites, white rhyolites and tinkling phonolites, are less striking members of the igneous family and are collected less for their intrinsic value than for their souvenir interest, reminders of a climb or a sea-shore ramble. They all have a disappointing habit of not looking so attractive at home as they did in the field, though they brighten when wetted. The enthusiast who finds that his friends do not appreciate his licking each specimen when exhibiting it will have to buy a little emery powder of various grades and polish his pet pieces on an iron plate, finishing on glass with rouge. Then he can descant on their beauty without giving offence.

Igneous rocks are all too rare in our country. Even in the mountainous parts we have to make do with their cousins—degenerate cousins—the metamorphics, which were once true igneous or true sedimentary rocks, but have been so altered by the ravages of time, heat and pressure that they have lost their old characters—and have found new ones. Quartzites are somewhat dull and featureless and very stubborn, *yet* the many-coloured slates and the mica-glistening schists make amends. The knobbly, white-eyed gneisses may even rival their parent granites for character and solidity. The shales, of

course, are disappointing; slimy when wet, fissile and false for the climber; altogether a plebeian rock.

The sedimentaries also have their disillusionments. Who would collect clays, for example ? But amongst the limestones we find many colours and textures, while the sandstones and grits have personality of their own, a little dimmed, perhaps, by their fineness of grain.

The Londoner may complain that, except on rare holidays in the north and west, he cannot share in these collectings, surrounded only by London clay and Bagshot sands, with chalk his nearest real rock. Yet he has only to climb about the debris near St. Paul's, where he will find the best specimens of all the most striking rocks of Great Britain : granites and gabbros, marbles and porphyries, sandstones and flagstones and whinstones, many of them ready faced and polished. Secondhand collections of that kind cannot have either the charm or the memories of collections from the original outcrops, but for choice and typical specimens they will be almost up to museum standard.

A TYPICAL VALLEY

To assist us in our study of physical geography, we will take a typical valley and see what can be done towards explaining its form and features.

We will select a valley in the north midlands, be-

cause it is accessible to many, being near the centre of maximum population of Great Britain. Southern England has valleys just as charming, but they are of gentler mould and have sleepier streams ; and also they do not have characters due to the Pleistocene Ice Age, that grand event that gave the finishing touches to Great Britain, just before, and including, primitive man's occupation of our country. We must disappoint the Scots too, that nation of physical geographers, because their mountains are too remote, their rocks rather too old and hard, and their streams too violent, for easy study.

Our choice is the lovely vale of Edale in the Peak District. It is only fifteen miles from Sheffield and twenty from Manchester, yet in its land-form features it is typical of most of northern England. A walk of ten minutes from the road leading from Castleton to Chapel-en-le-Frith brings us to the ancient encampment on the top of Mam Tor, whence we can see the whole of the short valley at a glance.

Looking across it to the most un-peak-like plateau of the Peak itself, our first impression of the valley is its U-shaped formation, the smooth slopes on each side flattening gradually to the stream at the bottom, as do most of the valleys in the Yorkshire moors. This shape at once awakens memories of school lessons concerning the work of glaciers. If this is a glacier-formed valley, there should be moraines and shoulders (alps) and other textbook features somewhere. Just below us to the west,

there is a shoulder of sorts and, better still, curious humps roughly in line, all in textbook style ; so we go down with the intention of making acquaintance with a high-level lateral moraine on a glacial bench or terrace.

The result is sheer dismay, and the textbook is looked upon with scorn. These are not moraines at all, but local landslips that have come from Rushup Edge just above us. The ridge, in fact, is not formed of the hard limestone we walked over from the Castleton side, but of soft shales sloping towards the valley. Hence the landslides.

Amongst the hummocks are tiny peaty tarns and a general sogginess of ground and tussockiness of grass. As climbers know well enough, on most mountains it is a case of " the higher the wetter." Thanks to coarse, matted grass and the peat underneath, more water is held up on the steeper slopes than on the gentler cultivated area below. We must be grateful that this is so, not only in the vale of Edale, but also elsewhere, since the slow drainage during the summer keeps our lowland springs and streams running when all else is dry.

Our conjectural moraines having vanished into thin air, the mystery of the smooth U-shape deepens. We realize, too, that because the valley slopes are of soft shale, we need waste no time looking for the glaciated pavements and striated boulders of the textbook. Nor would an " erratic " * be recognizable as

* A stray mass foreign to the surrounding strata.

such in country surrounded by the ubiquitous coal strata.

From just below the landslides, the smoothness of the valley slopes is more impressive than ever, and they are interrupted by nothing more than a series of parallel gullies, draining the upper slopes, which are not so much side valleys as gashes. When we follow one down, it soon develops into a miniature gorge, still in the soft Edale shales, and it has such an abrupt edge, cut into the otherwise smooth profile of the valley side, that the germ of an idea comes to us.

If the shape of the main valley was due to a glacier—a theory that we cling to in spite of finding no moraines—then these sharp gullies represent the erosion since the ice disappeared. Our hopes rise considerably when, nearly at the bottom of the valley, we come upon a small dam, which is almost full of mud and silt brought down by the gully. If, we suggest to ourselves, we could find the amount of silt in the dam and divide it by the number of years the dam has been there, we should know the annual erosion in that gully. Further, if we could find the volume of material that has disappeared as a result of the erosion that made the gully, and then divide it by the annual erosion aforesaid, we should have some idea of the lapse of time since the glacier vanished. This is beyond the time and means of such casual visitors as ourselves, but it would not be a long job with a few surveying instruments. It was,

in fact, done some years back by a party of University students, who arrived at the conclusion that the gullies began their careers 12,000 years ago. The oldest local inhabitant still tells with glee how he completely upset their original calculations of 22,000 years by remarking :

"Along in Mr. Brown's time they properly cleaned out that there dam, they did."

At the bottom of the valley, we reach the little river Noe. It is clearly doing in miniature all that we have read of larger rivers : showing meanders and terraces, flowing deeply under 30-foot bluffs, with shallow water on the concave sides of the bends. Violent enough at times to move sizable boulders, yet easily crossed, it looks a perfect paradise for the student of river action ; full of small problems for the amateur.

Why, for instance, do the side gullies end at the river in little falls ? Could the gullies be more recent than the Noe itself, or is it that with its greater volume it cuts down its bed faster than do the small tributaries ? Why does it divide here into two parts round an island ? And why does it there take a plunge of several feet ? Obviously such accidents of profile and course must have something to do with the local rock it meets at those places.

Climbing up the other side towards the Peak, we notice that the slope is rather steeper, the valley being slightly out of symmetry in relation to its visitor. We wonder whether this is due to a dif-

ference in the dip of the strata on the two valley-sides, or whether we may attribute it to our supposed glacier, saying it was due to its sweep round from the upper part of the vale.

Having come so far, we must persevere to the top; to the Kinderscout, famed for its stories of people being lost, and even dying of exposure, within a few miles of large cities. The last few hundred feet up the " clough " is steep and arouses our mountaineering instincts, but these sink to a low ebb when we reach a flat and rather monotonous plateau, inhabited by grouse and their keepers, scattered with shooting-butts, and intersected by the most extraordinary natural ditches, so deeply carved in the peat that they are difficult to cross at any speed. These have their problems for us, too. The chief impression we get is that vegetation is clearly an agent in physical geography ; a protecting one, for the most part, and capable of massive deposits, even on the tops of hills, where one would least expect them.

We glance back down the Edale valley and decide that our glacier was probably once there, but that it never got a fair chance to leave the appropriate evidence, because it was a local glacier and had little or no connection with the vast ice-sheets which, as the textbook tells us, came to just the other side of the Pennines and not beyond.

At this point, we must leave the subject of river and ice erosion forms. The same kind of puzzles as

we have encountered in Edale can be found in every other valley, and musing on them can be a pleasant occupation, especially when there is a companion to join in the arguments that arise.

THE WEATHER

There is one aspect of our physical background that is so ubiquitous that we are inclined to forget its importance—climate. We in England have become so accustomed to the fickleness of our weather that we allow it to sway our activities as little as possible. It has done much, we are told, to toughen us and even to teach us patience; it has made us observant and given us a "weather eye." The next step to observation is inquiry as to cause.

Climate is a rather specialized branch of physical geography and has a jargon of its own that is, at first, a little daunting. On the other hand, it is one for which we have the data easily accessible. The weather is not only just outside the window; its immediate past and its forecast future are told us on the radio and in the daily paper. We cannot get away from it, and fortunately some of us do not want to. Weather lore is useful, especially if we are farming.

It is not difficult to pick up enough of the meteorological language to understand the daily weather-map and to grasp what is meant by "developing ridges of high pressure" or "fronts," warm and cold. We soon see how the forecaster uses his map

full of recent data as a guide to what is about to happen. There are several cheap books on the subject and, if the will to learn is there, a modicum of meteorology is easy enough to come by.

The man with the tidy mind will go farther than that. He will record the date—and the temperature—when the bluebells are out in the woods ; he will notice which winds have immediately preceded the first call of the cuckoo in the spring ; he will make some sort of correlation between the weather and anything that interests him, from the invasion of his greens by the Cabbage White butterfly to the onset of those rheumatic twinges in the autumn ; he will compare the behaviour of his old gardener—or the nearest pigs—with what follows in the way of rain or wind. It is, to some extent, an interest peculiar to the old or middle-aged ; the settled man with an allotment to look after and a holiday to be arranged to coincide with good weather.

Dare I go so far as to liken the weather-game to those other spheres of forecasting, horse-racing and football pools ? There are certainly points of resemblance in the methods of prediction, for the followers of each must consult a considerable mass of data. Where the weather fan is balancing recent temperatures and pressures, the racing fan is pondering over the probable effect on his favourite of the weight allotted, the state of the going and the choice of jockey. For both there will be gaps in the data and the uncertainty of some last-moment minor

circumstance completely altering the position : the horse being jostled at the starting-tape, or the depression going to the north side of Ireland instead of to the south.

It is better not to pursue the comparison too far, for the rewards of success are so different and there is no clear-cut result in the weather. Besides, one must consider the feelings of the learned Fellows of the Royal Meteorological Society at the bare mention of an analogy between themselves and the punters. Yet there is some purpose in the comparison if it persuades a reader or two that to produce a reasonable proportion of correct weather forecasts demands less poring over newspapers and less anxious assessment of recent results than to pick the winner of the 3.30 with any certainty.

It requires no great concentration and practically no mathematics to equip oneself with some ability at meteorology. As to interest, it can become quite an absorbing pastime ; to watch for that first high cirrus cloud, wait for the lower stratus to follow in a few hours, and then calculate how far off the warm front must be. There is the added satisfaction of being able to consult the morning's weather-map, either to check one's forecast or to indulge in a guileless form of cheating. It should be made clear, however, that day-to-day meteorology is less the business of the geographer than is statistical climatology. This too, in spite of its awesome title, has a charm for the amateur, and should appeal especially to

those amazing people who revel in railway timetables, or who remember the cards they held in the second game of the last rubber a fortnight earlier.

THE GARDENER AS PHYSICAL GEOGRAPHER

In a country like England, with its fairly equable climate and its mainly industrial population, we are inclined to take the rainfall for granted—and many of the other gifts of nature as well: reasonable fertility, absence of soil erosion, the presence of natural forests, and usually an adequate supply of underground water.

Farmers, however, have a clear idea of our dependence on the facts of physical geography. Few of them have time to read books about it, but nearly all use a sort of common sense that seems to come naturally to sons of the soil. Usually the farmer is satisfied with noting that one field has better soil than another; that one field needs artificial drainage and another does not; that some of the land is heavy and some of it is light. The more progressive farmer, on the other hand, seeks an explanation of these facts, since the remedy for which he searches is often tied up with the cause. Such a man is a natural physical geographer, making up by experience and shrewd wisdom for any lack of book knowledge. Whether he knows it or not, he is a scientist in the rough, and almost daily he uses that sequence of observation leading to hypothesis and hypothesis to

experiment, which is the foundation of natural philosophy.

On a smaller scale than the professional farmer, the amateur gardener is also a scientist in the rough. His laboratory is his garden and there he follows out the sequence as best he can. It is to physical geography rather than to biology that he applies a large proportion of his orderly common sense, because he is choosing or shaping the physical conditions of aspect, soil drainage, humidity, etc., arguing that these will be most conducive to beauty in roses, abundance in apples, or monstrous girth in marrows. He is persuading the three elements of soil, sunshine and water to combine favourably for his plants.

If he regards his work as the practical study of the processes of biology and physical geography, he will be a more interested gardener. For instance, on taking over a garden or allotment, he will dig one or more trial pits to see what sort of soil he has inherited. He may even make a sample test for lime in *it*, but his main concern will be water, which is even more necessary than lime and other soil salts. If he is wiser than his fellows, he will drive an inspection-pipe to see just how the level of the water in the ground rises and falls with the rainfall, the texture of the soil and the slopes. To do this, he will take a length of iron piping, drill some small holes near one end of it and close up the end. He will then drive the pipe down as far as he can in his deepest trial pit, add a section to it to continue it to the

surface, and fit a small screw-cap on the top. It is now a sort of well point and he can at any time find how deep down is the free water by putting in a dipping-rod. The free water rises *in* his miniature well after rain and sinks in the dry weather. The fluctuations of the "water table," as it is called, are a better guide as to the available water in the soil than is the state of the surface soil.

In the same way, he will experiment to find the warmer spots in his garden for the earlies, the loose-textured parts for his parsnips and other deep rooters, the finer-textured for his roses. If he insists on out-doing nature by growing mammoth marrows, then he has to provide artificial conditions: planting them on a mound so as to secure free drainage, feeding them with more fertilizer than the soil contains, securing sun for the leaves and shade for the fruit, making a support for its bulk to protect it from damp and keep its bloom, and even inserting a thread of cotton wick in its stem to provide extra water by a shorter route than the hard-pressed roots are using.

Whatever he does, he is observing and experimenting with natural processes all the time, and to that extent he is a physical geographer.

THE ART OF THE SUNDIAL

We turn to yet another application of the physical conditions under which we live. Most of us are

content to let the sun and moon pass daily over our heads, secure in the knowledge that their passing is regular and ordered. Others will want to know why and when and how these heavenly movements go on, if only to be able to understand the apparent mysteries of the time of sunset, altitude, latitude and all the other things a geographer should know.

This is not, I would insist, amateur astronomy, which calls for telescopes and logarithms and nightly vigils ; it is merely an interest in the effects of our living on a world spinning in space and revolving round a parent body, the sun—effects that order our lives so inexorably that we take them for granted, or regard as too mathematical or mysterious to be approached by the ordinary person. To such I would say that the mathematics required are just sums, and the mystery is largely created by professional folk, who are apt to look upon their knowledge as a cult not to be too readily shared.

An example of this application of physical conditions is the sundial, that favoured and decorative instrument that all the best people in the 18th century had in their gardens. Even then sundials were not nearly so useful as clocks for telling the time, and nowadays they are of still less account; yet if a man is of a whimsical turn of mind, he may take to "dialling." It requires a certain ingenuity of thought and an imagination that can see things in three dimensions.

If the reader is of such a cast and would like a

sundial in his garden, which we will assume is in London, all he has to do is place a rod or straight-edge on a horizontal surface, inclining the rod (called the gnomon) so that it is parallel with the axis of the earth. London is in latitude $51\frac{1}{2}^{\circ}\text{N.}$, so the gnomon is set at an angle of $51\frac{1}{2}^{\circ}$ from the horizontal.

The sundial now has to be fixed so that the gnomon is pointing north and south, and this is best done at the same time as the hour-lines are marked out on the face of the dial. To do this, it is necessary to wait for the week of which the middle date is either the 15 th April, the 12th June, the 2nd September or the 25 th December. At noon by the clock on one of those days (or the few days immediately before or after it) the sundial is set in such a way that the shadow of the gnomon on the plate is in line with the gnomon itself, and fastened down to whatever base is being used. If it is June, which is the month to be preferred to the other three, the constructor will get an easy chair and a book and sit by the dial for the whole day. At every hour by his watch, he will note where the shadow is, make a mark and rule a line radiating from the root of the gnomon, which will be the hour-line for that hour. And that is all; the sundial is finished and set.

Many will consider that marking out the dial by means of clock-time savours of cheating and will want to do it from first principles. Other enthusiasts will wish to put the dial on the wall of a house,

or use some design more attractive than the plain gnomon on a flat plate. There is no space here to go into these matters, and as for all the questions that arise, I must content myself with answering but one : Why this finicky choice of date ?

This mainly depends on the fact that, though the earth rotates on its axis at a uniform rate, it revolves round the sun at a variable rate, so that clock-time coincides exactly with sun-time only on or about the four dates mentioned.

For the person who likes graphic solutions to mathematical problems, there are very simple ways of marking out any sundial of any shape or aspect. These are given at length in the treatises that poured out from dialling enthusiasts in the 17th and 18th centuries, though most of them merely gave the rules without the reasons, and called *it*, magniloquently, " The Whole Art of Dialling."

THE SHORTEST DAY

We must take leave of this aspect of physical geography by mentioning one other problem that often causes concern, even consternation, amongst those who use an almanac.

Everyone knows that the shortest day in the year is the 21st (or 22nd) December, and would naturally expect that, from that date, the sun would rise a little earlier each day. But the almanac tells us that it goes on rising later until about Christmas Day and

does not rise earlier till nearly a fortnight later. We may consider that we are being cheated of daylight, until we look at the time of sunset, which does begin to lengthen out the evenings from the shortest day. Nevertheless, this unreasonable lack of symmetry of morning and afternoon may continue to puzzle the amateur geographer. Yet it is all very simple, especially if he has made that sundial.

Noon by the sun coincides with noon by the clock only four times a year, one of them being about Christmas Day. From that date sun-noon—that is, the middle of the sun-day—is later than clock-noon : three minutes later on New Year's Day and fourteen minutes later on the 1st February. Consequently our forenoons are shorter than our afternoons, as far as the sun is concerned. In the meantime, the total length of day is increasing as the sun rises higher in the sky each day (rate of decrease of southerly declination to the navigator) and by about the 7th January this increase overtakes the lateness of the sun-noon, and the sunrise is earlier by the clock each day, even though we still have unequal mornings and afternoons.

THE SUMMING UP

Our physical environment is largely but not wholly beyond our control, influencing our lives to a greater or lesser extent according to **the** nature of our work. We are not compelled to ponder its

mysteries; we have a perfect right to say that we prefer to enjoy the beauties of nature without inquiring into their origin. Many of us like to live in both camps, if indeed they are really separate ones ; we wish to appreciate and, at the same time, to understand.

This chapter and, in much greater detail, the volume on physical geography, sets out to show that it is quite possible to teach oneself enough of these matters to do both. The sorriest sight is that of a man who, for lack of spur or imagination or even of confidence, finds nothing of interest in his surroundings. Perhaps this chapter may persuade him to try to explain to himself what he sees, in attempting which he should pay heed to the sage counsel of Lewis Carroll's Dodo :

" * Why/ said the Dodo, * the best way to explain it is to do it. ' "

CHAPTER VI

HUMAN GEOGRAPHY

SO far in this book we have been dealing with the techniques and background of geography. Now we come to the heart of the matter. Place without Man in it lacks interest for most of us, which is what the British soldier meant when he described the high veldt of South Africa as " miles and miles of damn-all."

The heading for this chapter is poor, yet it is so much used that it now has a meaning. It has outgrown the stage when the smart could remark that, by inference, the physical side of geography must be a most inhuman study. Geographers themselves are dissatisfied with it and are constantly inventing new adjectives to specify some particular branch of the subject as applied rather to Man than to Matter. For a while, the awkward " Anthro-Geography " had a vogue, intended to cover the aspect of geography that deals with anthropology. Just now " Social Geography " is enjoying prominence, emphasizing the importance of communities in any study of Man and Place.

It is curious that almost every branch of knowledge spends a lot of time defining itself and in-

roduces not a little acrimony into the debate. You have only to get a few geographers together, and one provocative sentence will set them off arguing about the boundaries of the subject or, worse still, the relative importance of different aspects of the subject. As often as anyone says a thing is one and indivisible, someone else rises to prove that it is not only multi-partite, but must also be divided and dissected and have the dross thrown out. It would, perhaps, be a dull world without these precisionists, but it might be a more peaceful one. One wonders whether there will ever come a time when Trade Union principles invade the world of knowledge, and an anthropologist is forbidden to quote history, or a physicist is shooed away from Zoology. If that day ever dawns, it will mean the end of the geographer, for he invades all the sciences and half the humanities, and is not in the least ashamed of it, for it is his business to do so. There is no such thing as trespass in the search for knowledge.

There is no quarrel, therefore, between the physical and human sides of geography. Not only is the first the foundation of the second ; its scope is determined also by the needs of the second. That does not prevent anyone from feeling more at home with one side than with the other. After all, one may be a zoologist and yet dislike worms, or a helminthologist who has never heard of a kudu or an oryx.

Three of the five books in this series **are** concerned with the human side of the subject, **but** it

will be found that each author is careful to state the dependence of his branch on the physical background. I believe that the best way to explain the unity of the subject, and the essential part each branch has to play, is to take a very small geographical unit and show how it cannot be understood unless each section of geography has its say.

STUDY OF AN ISLAND

This unit is a small community of one hundred people or so on an oceanic island, cut off from the rest of the world by nearly 2,000 miles of ocean, receiving only rare and brief visits from passing ships. It is outside the tropics, where proverbially, but not quite accurately, one has only to lie under the trees to have food dropping into one's mouth. To make it still more interesting, there is mixed blood in the community ; some European, some African, and a touch of Asiatic. They belong to no country, they are nobody's responsibility, and they have to invent their own jurisdiction and their own industries, and devise a mode of life that will at least ensure survival.

The name of this tiny microcosm is Tristan da Cunha. If you were going from Buenos Aires to Capetown, a passage only a few ships ever make, and if, over 2,000 miles from your starting-point and almost as far from Capetown, you dipped a little south of your compass route, you would " raise " a

volcanic mountain, nearly 7,000 feet high and usually half hidden by cloud. Its sides have the regulation steep slopes, but for the last 2,000 feet are, for the most part, sheer cliffs down to the sea, making the almost circular island extremely difficult of access.

As you steam closer to the island, you see on the north-west side one shoulder that is lower than the rest, and one tiny bay with a steep beach. In that stormy ocean of the Roaring Forties, this beach would be practically impossible for a boat-landing, were it not for the masses of giant seaweed that grow off the beach, their long tough stems and leaves damping the swell to reasonable proportions. This kelp, then, is our first introduction to Tristan da Cunha—or any other sub-Antarctic island—and is curiously enough a natural resource. Washed ashore after storms, it makes a dense sea-wrack that is good manure and, in parenthesis, produces an all-per-vading and most reminiscent smell.

The islanders are there to advise you which roller to use for the wild sweep into the beach, and to catch the boat, hold it against the backwash and haul it up before the next wave comes. They are oddly but neatly dressed, with white woollen stockings and hide moccasins, Caps rather than hats, and the women's wimples made of handkerchiefs, hint at another characteristic of all oceanic islands in those latitudes : constant gales of wind.

You climb up a steep path to the settlement of

some twenty houses on the steep shoulder, which is only half a mile broad, and note among the islanders a friendliness and a shyness that will both endure, however long you stay. Their first questions may well be, as they were on one occasion :

" How's the King and Queen ? Was they crowned ? "

" What wars is on ? "

They acknowledge a leading man without any voting or formality, and the succession is of interest. The first of these was William Glass, a Scottish artilleryman, who reigned for thirty-six years. He was followed by Pieter Groen, a Dutch sailor wrecked in 1835, who became Peter Green and led for forty-nine years. The present headman, now formally appointed as magistrate, is William Repetto. His father was an Italian sailor who was wrecked on the island in 1890.

The physical geography of the island is obviously the first branch calling for investigation, since it is so directly the background of the life there. The eternal wind, which prevents any but stunted trees from growing ; the deep gorges radiating from the peak, which make a tour round the island almost impossible; the absence of any large area of flat land; the abundant rain and frequent mists : all these determine the crops and stock that can be grown.

Even more decisive controls have been plants and animals, and we have to turn to what we may call

bio-geography. The trees and tussocky grass will not grow above an altitude of about 2,000 feet, beyond which there is nothing but dense tree-ferns, leaving no room for pasture. Even so, in the first years of their occupation, the islanders managed to grow a certain amount of corn. To-day there is no grain produced in the island, for in 1877 a rat-ridden schooner was wrecked there and entirely altered its economy. The rats ate the small birds and their young, they gnawed and burrowed into the tussock grass, reducing its value to cattle, and they put a complete stop to the growing of corn. Indeed, they rule the island.

Other biological changes, due mosdy to man, have also affected the food supply. No longer are there fur seals and sea elephants ; they were all destroyed by visiting hunters. No longer is there abundance of albatross and other sea birds nesting on the island to provide an alternative source of food. Potatoes are the only main crop, and the islanders dare not import new varieties, for fear of disease coming with them, as has happened once or twice in the past.

Even in the short 140-year period of occupation, the geography has altered, so that part of the study involves the geography of the past—historical geography—to be got mainly from such written records as exist and from the older inhabitants. This links closely with such little political geography as can be said to apply ; small enough, but vital to die settlers,

who were liable to be claimed by Britain when use could be made of the island, and disowned by her when the cost seemed too great. The internal organization also comes in; the curious way in which a headman is tacitly acknowledged

There would seem at first to be small scope for economic geography in a place where there is no money, no regular trading, and but little surplus of goods of any kind. There is personal property, however—cattle and potato patches—and a rough accountancy of them. In the past, there have been attempts at organizing industry. In the time of the wise "Governor" Glass, the islanders actually owned a schooner to further trade in seal-skins and oil, but the venture was sabotaged by visiting sealers, who killed off the seals they could not take away themselves. That was early in 1823. Later attempts to establish a fishing industry failed because of the damp atmosphere, which prevented drying the catch, stormy weather, which limited the fishing days, and, most of all, the lack of a harbour or any shelter for a ship.

Economic geography does not depend only on trade, and there are elements in the study of the island community that have a very direct economic bearing on its existence. The scale may be small by world standards, but it is large enough to affect the comfort and stability of the settlement. For instance, there **are** two natural resources that in course of time may be harnessed to provide comfort, if not in-

dustry. These are the high winds and the abundance of high-level water coming off the mountain.

Some day one of the steep gorges will have a small reservoir built on it, leading the water down a few hundred feet to provide electric power and, the greatest need of the islanders, light. At present they have to kill penguins to obtain a meagre supply of oil for lamps, and everyone goes to bed early to save light. There is the tale of a dance in the " parish hall," given in honour of a Norwegian expedition, during which " the room was so dark that the men usually took the nearest girl rather than betray any partiality by too prolonged a search."

To-day the chief value of the island is that it lies on the weather side of South Africa, albeit 1,900 miles away, and as a meteorological station it is bound to find a new lease of life in so far as communications are concerned. Unfortunately, anything with value of that kind is liable also to have strategic value, and the island may yet come into the international situation, as it did when Napoleon was a prisoner on St. Helena.

I have used Tristan da Cunha as but an example to illustrate the complexity of geography as a subject, and the prime importance of human geography as its goal. For those who wish to know more of the strange, lonely island and its 190 inhabitants, several books are available. The most readable and up-to-date is *I went to Tristan* by Allan B. Crawford (Hodder and Stoughton, 1941).

THE STUDY OF CITIES

It may be objected that we have gone to the extreme for our illustration; that at Tristan we have geography in the raw, so to speak, and physical circumstances have an overwhelming importance. We will glance, then, at the other extreme—geography in the tame and sophisticated—by considering a district in the East End of London.

We note at once that, in contrast to Tristan, physical geography is all but submerged, built over and controlled, so that the inhabitants can feel almost independent of it. They would be very sorry for the Tristanites, but the Tristanites would be equally sorry for them. To each the life of the other would be the very antithesis of rest and comfort, which is yet another proof that, of all the animals, man is the most adaptable.

In this East End district, the map is still important—that is to say, the distribution of things that affect the people, their dwellings, their open spaces, their places of work, where their supplies come in, and where their products go out. It is, for the geographer, an infinitely more difficult and complex study than an island. Since there is no fixed boundary to the area, it is *in* contact with a host of other areas; there is even a shifting population that is different by day and night. Instead of clear-cut results, one is forced to adopt approximations, and the figures themselves are hard to come by. For instance, density of population is a factor much

quoted in sociological reports, but what does it mean exactly? In a large factory, the density for some eight hours a day may be at the rate of more than a million per square mile. When the workers come out at the end of the day to occupy the streets and the playing areas, the density may drop to a few thousand per square mile. Then, at night, they seek the areas of their homes, many of them tenements one over the other, and the density goes up to a hundred thousand or so per square mile. What shall we take to be the density of the working population?

Distributional studies, where hygiene, occupation, leisure and other such human factors come in, are often lumped under the term Social Geography, indicating that sociology, the study of the community as such, has rather more to contribute than geography, the study of Place. A district in a large city is, in fact, more dependent on the inhabitants themselves than on physical environment, which has been created—or at least modified—largely to serve man's needs instead of determining them. It is artificial in that sense, but very real in every other sense; it is an intensive aggregation of man busily doing things that affect the world, and consequently it is far more important to the world than is a lonely oceanic island.

Students of cities are liable to become sociologists rather than geographers; not that it matters, if that be their choice. There is now a large literature concerning the study of cities, and very interesting

it can be in skilful hands, besides being of fundamental importance to planning authorities. It is an intensely human study, requiring an unusual technique compounded of a variety of disciplines besides geography, including engineering, architecture, economics and even mass psychology.

One can say that, while a city originates in a natural place, where the right geographical factors exist, it may in course of time expand, in spite of geography, artificially and unnaturally. One has only to think of the situation of many large standing camps established in the recent war, to realise that man can, if he wills it, build a city almost anywhere. In such cases it is due less to geography than to military necessity or politics or local economic advantage.

Not a few of the vanished cities of the past were of this character, one of the strangest being a city for half the year and more or less deserted for the other half. This was Smeerenburg, on the west coast of Spitsbergen in the eighteenth century; a centre for the whaling industry of the Arctic summer, when over 15,000 people gathered for the harvest of whalebone and blubber. With the frankness of the pioneer, they named the centre of their industry "City of Grease," which no doubt it was.

UNNATURAL BOUNDARIES

It is common exercise in senior school geography to give the class of students an Ordnance Survey

map and require them to deduce just why a village is where it is. From the teaching point of view, this can be very instructive and good practice, but the answer may often be wrong, for there is no factor, except possibly water supply, that absolutely controls the site for a village. In the newer countries, we find that a township may be established for a variety of different reasons, some of them almost whimsical. Many a town in the western parts of the United States grew up round the first saloon bar or the first general store.

Human geography, therefore, must take account of man's frailties, as well as his common sense, in controlling the distribution of his chosen centres. Indeed, it often seems that man has violated geographical factors rather than been governed by them. This is most marked in the case of boundaries to property. Even on the parish scale, a boundary rarely goes where common sense and geography would suggest. Much more vital and effective reasons have long since changed the original lay-out of our forefathers. Legacies, disputes—even plain grab—have, as a matter of history, altered property boundaries : a farm may be in two or more places; a road may go over a hill instead of round it; access or rights of way take a most roundabout route.

The causes of the curiosities of distribution and lay-out are often quite obscure, reflecting the whims or injustices of strong personalities long since for-

gotten, and they have become the object of study by antiquarians. On a larger, national scale, there is not so much uncertainty, since wars and treaties are usually well documented, although even international boundaries are subject to the same kinds of personal factors as those of property. This study comes under the heading of political geography, a branch of our subject not easy to define in detail and, indeed, best left undefined. An unkind person once said that political geography is the geography that politicians should know and don't.

There can be no doubt that diplomacy and international politics have played a large part in the apportionment of Place to People, and will continue to do so. One has only to look at a political map of the world to realize how very few international boundaries are natural, so preordained by nature and geography that even politicians have admitted the fact and left them alone. Whole treatises have been written about international boundaries—describing them, classifying them, even justifying them—yet they remain a sad spectacle for the student of human nature.

For our purpose, we may classify them briefly into four groups. There is the rare group of Natural Boundaries, like the Pyrenees. There is the group that we may call the Curiously Constant, like that between Canada and the United States; curious because *it* is quite unnatural, being mainly a parallel of latitude, and constant because there is common

sense on both sides. In unhappy contrast, there is the Curiously Inconstant, like many in Europe, which have swayed to and fro throughout history. Lastly, there is the group that can only be called the Plain Ridiculous, boundaries that offend almost every criterion one can possibly put forward as a basis for partition.

One is well-nigh forced to conclude that, since natural boundaries are so rare, the best ones are those established by a victor who has chosen a line he can defend when the fortune of war changes. The only corollary to that is the very cogent one in favour of a boundary, such as that between Canada and the United States, that is quite impossible to defend.

The last people to trust in drawing boundaries seem to be the diplomats, for they care little for geographical reasoning and a great deal for power politics. Hence some of the Plain Ridiculous boundaries established in the partition of Africa. The argument is not finished when the contracting parties have signed the paper agreement defining where the boundary line shall run ; there is still the demarcation on the ground to be done, and impressive boundary pillars to be erected.

One or two instances will show how easy it is for the treaty itself to be dodged in minor ways, or even be self-contradictory.

A boundary commission headed by an English military geographer once had to demarcate a

boundary between two South American republics. The line was defined as the divide between two watersheds, and the commission was accompanied by small parties of "observers" from the contracting states.

Climbers will know that an actual divide is often somewhat flat and boggy ground, and that a swamp of more or less stagnant water can easily be induced to flow one side or other of the range by a little intelligent work with a shovel.

The head of the commission noticed that the observers from one state were much more energetic than those from the other, getting up long before anyone else in the camp, and going off along the general route for the day well in front of the main body. He became suspicious and ultimately found that these men were gaining many square miles for their country by a short spell of spade-work each morning.

Only a few extra thousands of acres of rather useless tussock grass were gained thereby, but sometimes the value is on a different scale altogether. Suppose that the boundary line is defined as the deepest part of a large river, in which, at one point, there is an island. Careful sounding will establish on which side of the island the deeper water runs, and ownership of it is thence confirmed. But what is to be done if the river subsequently elects to erode the shallower channel until it becomes the deeper? Shall a new boundary commission decide a change

of ownership ? or shall the parties sign a new treaty confirming the first demarcation and deeming that, for the purposes of the boundary, the shallower branch shall be taken as the deeper ? Both of these alternatives have been adopted in the past.

Where the country concerned is still little known and poorly mapped, there is a disposition to specify lines of latitude and longitude as the boundaries. One would imagine that, however unnatural such a paper allotment might be in terms of physical features, it would at least simplify demarcation. Far from *it*, for so keen is the sense of ownership, so unprincipled the determination to grab the last inch of territory, that major disputes have arisen, and weighty boundary commissions have solemnly adjudicated on situations worthy of a Gilbert and Sullivan opera.

Some of these situations have been due to bad wording. What, for instance, is meant by "the middle of a wide channel" ? what is "the north-west point" of a lake that has a dozen inlets towards that quarter ? who is to decide which is the source of a river that has several tributaries at its head ? what is *to* be done when, through lack of accuracy in old maps, a treaty lays down a boundary as such and such a parallel till it crosses a river, which, in fact, it never reaches ?

Is it any wonder that some boundaries are still in process of demarcation a century or two after the treaties defining them were made, or that the cost of

such demarcation is, in the aggregate, greater than the value of the land being acquired or yielded by the parties concerned? There are not a few instances of appellants hanging on to the nominal ownership of land when it is patently a disadvantage to both sides that the boundary runs as it does.

The classic case of such a cutting off of noses to spite faces is *in* Africa. At one of the partition discussions in 1884, it was insisted by Count Caprivi, the German representative, that German South-West Africa must have access to the Zambesi for purposes of navigation to the east coast: this in spite of the Victoria Falls and a few other complete obstacles to navigation. It was agreed that Germany should have a strip, some three hundred miles long and from twenty to sixty miles wide, extending from German South-West Africa to a point on the Zambesi, crossing two major rivers and two very arid belts of country. As a result, access to their Caprivi Strip, as it came to be called, was so difficult for the Germans that it had to be via South Africa and Bechuanaland and Rhodesia, a distance from Windhoek, the capital, of some two thousand miles, instead of the direct route of about five hundred.

Yet such is the sanctity of treaties once signed, however idiotic and out-of-date, that that boundary still holds, a nuisance to everyone, including the country that administers it;

POLITICAL SCIENCE

The study of political boundaries involves a good deal of history, and attracts historians and political scientists, but it is a very small section in that rather indefinite field known as Political Geography, the content of which, in a broad sense, is the mutual relations between man's behaviour and Place. We cannot fully correlate one with the other, since there are a host of contributory factors, but we can say that the student of world politics must be constantly aware of geography, just as he must be aware of world economics, racial characteristics, religion, and so forth.

Political geography is, therefore, perhaps the most preponderantly human part of human geography and could quite easily find a place in other disciplines ; it has a strong overlap with political science and history and economics. Perhaps the best way of describing it is that the geographer is only one of the contributors in a discussion on politics and the behaviour of nations. To illustrate that statement, one has only to think of that constantly recurring question : What is a nation? Is it a natural grouping of men, due to circumstances of Place, the land it occupies ? Certainly not; if it were, the British Isles or the Iberian peninsula would each be one nation instead of two or more. Is it, then, racial—a natural community of common origin? Again certainly not; if it were, the United States would be a dozen nations instead of

one. Is it due to history, the gradual settling down of juxtaposed peoples into a sort of harmony? There certainly are instances of such a fusion, the British nation itself being one. If so, how far was it due to comparative isolation, a geographical fact, and how far due to common interests, common resources, threats from other nations, or even a sort of common national character that slowly evolved?

There is no end to the theories one may put forward, but they are all partial, and those based on geography are but contributory, often enough rather remotely so. At the same time, the geographical facts—distribution in space, if you like—are the inevitable background to the study of human nature as shown by nationhood, just as gravity is the background to all physical phenomena. So there is such a thing as political geography, and very absorbing it can become. It is seething with problems.

Why, for instance, is there a strong element of racial jealousy in South Africa and hardly any in the United States? or, for that matter, why is Europe so quarrelsome while the United States, originating from Europe, has lived in reasonable harmony for the last ninety years? Why does Latin America incline to sudden changes of power by revolution?

These are all vital matters in various degrees, because they contribute to the unrest of the world as a whole, but the answers to them are never conclusive—indeed, they seem to grow more difficult with the

advance of civilization. It is therefore a most composite subject, political geography, and rather a depressing one; in modern times it is almost synonymous with the study of unrest, each world war sowing the seeds for the next, each routed ideology being replaced by another.

THE FRUITS OF THE EARTH

Let us turn, therefore, to another branch of geography—a branch concerned with what should be a unifying influence, namely trade and industry. It is an attractive thought that, if nations were so interdependent that they could not afford to differ, we should have no wars. Unhappily, the recent trend has been the other way and nations have striven to make themselves entirely self-sufficient. Nevertheless economic geography has a more hopeful message than political geography, for human needs have a common factor, whereas command, power, dominion are exclusive and threatening.

Manifestly the two studies are closely related and share a good deal of ground. Economics has the reputation of being rather a melancholy, morbid science, perhaps because it deals so much with the alleged root of all evil. But, as with every other branch of knowledge, all depends on the handling of it. In Mr. Thatcher's volume in this series, economic geography is shown to be a lively and interesting as well as a vital branch of our subject.

In this chapter there is space only to refer to one or two of the broader aspects of what is essentially the relation between Work and Place, with People as the agents.

The Press is increasingly occupied with references to a major threat to civilization : the rapid increase of world population and the lag of world production of food. The word " global " is constantly used to impress the fact that it is a world shortage, but it is a little misleading in that there are parts where there is plenty for all, and parts where there has been scarcity for centuries. We continue to hope that civilization is progressing towards a balanced economy, so that want in one area will be rapidly relieved by surplus from another, yet there is at present a whole series of obstacles to such an economy. Of these, exchange, incentive for production, and standards of life are only a few.

World conferences on the shortage of foods are admirable for ascertaining and publicising the facts, but they are a little apt to ignore the sheer economic actualities of the situation, A country cannot, even if it wished, produce food at a loss, except for a brief emergency, and the economic geographer must convince the philanthropist that he must plan according to the structure of trade, and not in spite of it. More generally, one might say that a country can only eat what it earns in the long run, and further, that if it insists on preferring guns to butter, it must tighten its belt and not complain. The trouble is that if

that preference becomes a threat, then other countries have to follow suit and the whole mad whirligig starts once more.

Who is to advise on how to break such vicious circles ? Certainly the economic geographer must be one of the council, for he deals both with geographical facts and with man's handling of them; with the products of the earth and with their distribution. He must be ruthless in his honesty ; he must tell the truth even if it offends ; he must face the facts.

One such fact is that an ideal world of no wars, of no plagues and pestilence and of no infant mortality would not last fifty years before there was barely standing room for the population. The ghost of Malthus, laid for a century, is now with us again and must be hearkened to. There is a struggle for existence, a survival of the fittest, even for the highest of living creatures, and it is useless for us to close our eyes to it.

WORLD FOOD PRODUCTION

For world production of food, the problem is somewhat less complicated, as is always so when one is dealing with the soil rather than with human frailty. There are still large areas of potential production in the world, and we must apply our experience to them, with agriculturalists to guard us against wasting the soil, economists to warn us that

their laws cannot be disregarded, sociologists to see that human welfare is part of the development, and engineers to provide communications and to see that water is not allowed to run to waste. We must hope that the diplomat and the idealist will not interfere too much, though one needs them in the offing.

In Africa and South America there exist the basic necessities for food production : water, fertility and suitable climate. It is true that many difficulties are presented and that new methods of production will probably be required. At all events, we cannot say yet that we have tried very hard to use these large areas, though we are making a beginning in Africa.

Not the least part of the problem in these two continents—which, in their tropical regions, have so far been subsistence areas and not surplus-production areas—will be to find a formula, or a persuasion, for the inhabitants to be world citizens, to emerge from their isolationism and make a contribution to the world economy. They are comparatively contented as they are and it will take all the arts of the sociologist to convince them that they should, indeed that they must, join in the general struggle for existence ; that they are part of a world economy and must participate or go under.

The economist must be listened to by the sociologist, for again there must be criteria for incentive, profit and standard of living. There is, indeed, always a danger of people working within their own

compartment, which is just what the economic geographer is there to avoid. For instance, a welfare officer, partly by reason of his title, is very prone to consider his whole duty to be the welfare of his own particular group, even at the expense of other groups, or in defiance of economic verities.

There is a good instance of that partial view in our own administration of African Crown Colonies, admirable as it has been for the most part. Broadly speaking, our policy has been to prevent the African from interference or invasion from outside; to let him rule himself and to choose his own development in his own time. We are coming to see now that a world threatened with under-nourishment cannot wait for some of the more fortunate, and more backward, peoples to make up their minds as to whether they will share in the world exchange market.

These two instances of the larger problems, on a global scale, must suffice to show the part that the economic geographer may take *in* world affairs, though normally he works on a much smaller scale, finding any one country quite enough to keep him fully occupied.

FLORA AND FAUNA

Another aspect of human geography—an aspect with which Mrs. Anderson deals more fully in her volume in this series—is the relation of man to the

plant and animal life that is part of his environment. Bio-geography is not merely the distribution of plants and animals, which is properly the business of the biologist, but the effect of that distribution on Place and Man.

Whether we like it or not, we are only a higher animal, and we must apply some of our zoological techniques to ourselves, even confessing that we belong to the predatory class of animals rather than the ruminatory. We prey not only upon lesser animals, but on ourselves as well, with tanks and atom bombs instead of with tooth and claw.

We have not the time to spare to become zoologists and botanists, but we must learn to understand their language and use their summaries and deductions. As usual in geography, it is the "place where" that is of prime importance, as well as the characteristics of the form of life concerned. But distribution alone does not take us far. It is merely a fact. We must know in addition why that form of life lives there, and what special adaptations it has found necessary in order to survive.

Further, since we are viewing plants and animals from the selfish point of view of man's dependence on them, we must follow the biologists' skilful work on food-cycles, plant associations and indeed the whole balance of animal life in the world, even if our sole purpose is to tip that balance in man's favour. The old phrase, "Eat or be eaten," is only a crude way of summing up life as a whole, since the balance

itself depends upon it. It not only improves pastures to be eaten in moderation ; they may even disappear if they are not eaten.

Yet we must be cautious in attempting to make improvements in the natural equilibrium we find existing. The rabbits taken to Australia as pets to remind the early settlers of their homeland not only took charge of the continent, but are now almost unassailable, because they have become a vested interest. One section of the population make three million pounds a year out of the sale of their skins and pelts, and oppose the remedies of another section, who say that they do thirty million pounds worth of damage a year.

It is easy to start a devastating cycle of the type innocently described in the tale of the house that Jack built. To combat the rat invasion of Tristan, the inhabitants imported cats, which went wild and took to eating the birds. Then dogs were obtained to kill the cats—and so on. But the rats are still supreme.

Man has scored a few successes against pests by encouraging a pest enemy, the most dramatic being the introduction into Queensland of a small American insect, named *Cactoblastis*, to eat up an introduced American pest, the prickly pear. Both pear and insects increased their appetites in Queensland, but the insect is winning.

Food chains of all forms of life are important to man, who is learning slowly how to insert links, or

destroy them, so as to benefit himself and rob some animal or plant that is in competition with him. Animals, too, may acquire new tastes and break into the human food chain, as New Zealand farmers found when their mountain parrot, the kea, forsook seeds and insects for the kidneys of live sheep—even, it is alleged, growing a bird-of-prey beak to be more expert at the work. There is, I believe, some difference of opinion as to the truth of this matter; bird-lovers and climbers, who delight in the antics of this buffoon of his tribe, strongly deny the accusation. Changes of food do take place, however.

WAR AGAINST PESTS

The subject of disease among animals and plants is but another aspect of the same theme : an interference with the desired food supply of man, occasionally with the clothing supply. There are notorious diseases in this category—rust in wheat, Colorado beetle in potatoes, boll weevil in cotton, swollen shoot in cocoa trees—and we have a whole army of researchers at active war with them. The details of this research are not the business of the geographer, but the results are very much so; if successful, they may entirely alter the prospects for man and his distribution, even his use of land. Success in this research may be dramatic ; the work of one scientist, or a small team, may alter the value of half a continent.

The scientists quite naturally get very annoyed when the politicians go too fast and claim success for science before it has been assured. But we may be permitted to do a little hoping, based on the scientists' work against the tsetse fly of Africa, which is the cause of sleeping-sickness and what the scientists call trypanosomiasis, but what we more tongue-tied people call nagana, or cattle disease. *If*—and we must italicize the word—*if* antrycide, or any other drug, proves capable of giving absolute immunity to the disease, and if *D.D.T.*, or any other drug, proves fatal to every tsetse that touches it, then we can draw a picture of promise.

Somewhere in Africa, a herd of cattle is inoculated with one drug and coated with the other. It would be better still to catch some wild buffaloes and use them instead, but that would not be easy. The beasts go into the tsetse country and their moving forms attract the flies, which bite them and die. The beasts do not die ; they go on carrying death to the flies.

THE PRICE OF A COW

In our imagination, we now skip a number of minor difficulties and delays, and consider the fly exterminated in that area. The African at once takes to keeping cows, and the first benefit for him is the protein food that has been deficient in his diet hitherto, so he becomes stronger. The mixed farming that comes in provides manure for his crops, so that

he no longer has to practise shifting cultivation; burning trees to gain potash, but losing nitrates in the process. Moreover, the humus content of the soil increases and more water is held by it. He can then grow more beef and grain than he wants for himself, and trade some to a hungry world. He tackles new areas for a mixed agriculture ; swamps first, if he is wise, and then dryer parts, for it is easier to get rid of excess water than to convey it to arid areas. In our picture, then, he uses more land, increases his own population to cultivate it, and becomes a participant in the world production of food.

There is, alas ! no if without a but, and, in honesty, we must dim our highly coloured picture by mentioning some of the buts. One of them is that the African prefers live cows to dead ones. A live cow, even a scraggy one, can buy a bride, or more accurately, a third or fifth of a bride, depending on the bride-price ruling at the time. A bride is much more valuable than a cow, for she hoes and sows for her husband's food, she cooks and she breeds children, preferably daughters, since they are exchangeable for more cows, and so on. A wife, in fact, is the whole basis of the African's whole economy, and until she can be bought with money or grain or something other than the traditional cow, the African cattleman will not enter the beef trade of the world.

Again, the African at present is apt to favour a four-hour day, as far as work goes. If he has more

wives to do the work, more small sons to herd the cattle, more daughters with which to buy more beasts, is he not more likely to reduce his working hours to three than to increase them to five in order to help a hungry world ? Will he not rather imitate the Masai and do no work at all, hiring or bullying other tribes into such digging of wells and building construction as is required ?

These and a host of other hindrances warn us to postpone our millennium for Africa, and with it our dreams of teeming millions of cattle roaming over its plateaux, not to mention an increase in our own meat ration. Nevertheless, the general outline of the picture remains, granting that first proviso : success to the anti-trypanosomiasis investigators.

THE MORAL

The real moral of the story is that the geographer is very much concerned with developments in pest control and practical biology, for they may—and indeed will—change the face of the world very considerably, if but slowly. A secondary moral, perhaps, is that it would be advisable for politicians, who are the ultimate handlers and implementers of such scientific developments, to take a course in geography. It may prevent them from rushing in where even geographers would be wary of their tread.

The welfare of man as a whole therefore depends

largely on his battle with other forms of life, or on his skilful improvement of certain forms. The Australian sheep-breeder, for instance, increased the average weight of fleece from three to eight pounds in under a century.

A FACULTY OF HARMONY

Thus far we have not found much comfort in our conspectus of what is meant by human geography—in fact, it has rather emphasized the frustrations and difficulties that seem to be the heritage of man. One is almost inclined to suggest that what is wanted in the universities of the world is not so much Faculties of History, Geography and Economics as a Faculty of Harmony, wherein frail humans might learn the elements of goodwill and unselfishness.

Yet it is a grand world we live in, full of beauty, interest and pleasing prospects. Who would not be a geographer with this whole wide, vivid panorama as his field, places and peoples and occupations, and all the sights and sounds and smells that combine into an atmosphere peculiar to each part ?

Well may the physical geographer glory in his subject and in its comparative simplicity, but the human geographer has chosen the better course, for he takes as a challenge the vagaries of human conduct associated with the environment that is partly responsible for it, and he wrestles mightily to explain them and possibly to correct them. His aim is to see

clearly and see whole; to climb the peak for the whole view, not to dally in the pleasant valleys below.

Of all the many branches of the subject, human geography is indeed the ultimate goal.

CHAPTER VII

GEOGRAPHERS AT WORK

IN the earlier chapters, we have considered geography from the standpoint of one who is going to teach himself. The emphasis has been, I hope, on the fact that *it* is a practical subject and that, while it can be considered as a whole, there are some sections of it that are more fundamental than others, and cannot be left out. The inference to be drawn from the title of the series is that it *is* possible to teach oneself the subject, and this is true, in as much as geography, unlike professional subjects such as engineering or medicine, is a line of thought, a point of view. It is, therefore, possible to pursue that line of thought with the help of such guides as the books in this series should be.

For the most part, our readers will be drawn from that sound and solid core of the population that is intelligent enough to want to be aware of things, to take an interest in other places, to keep abreast of current affairs. In the main, they will be reading these books in the hope that they will get useful tips as to the further pursuit of what seems to them an attractive subject. They will be busy people, for whom geography can be only a side line, a recreation,

even a hobby. These books will not cause anyone, unless they are very young, to abandon a chosen career in order to do a university course in geography.

Notwithstanding this, I think I ought to include a page or two of description in answer to the commonest question addressed to me by intelligent people :

" What does a student do in the geography courses at the university ? "

A NEW SUBJECT

It was stated in my second chapter that geography as a university subject is a recent development. It is not much more than half a century old in England, which, in this respect, lagged behind the continent of Europe. We have, indeed, only just lost the very first formal head of the Geography School at Oxford, the late Sir Halford Mackinder. Moreover, one of the original pleaders for a university status in the subject is still alive. He is Dr. Hugh Robert Mill, who wrote the *Realm of Nature* already referred to in these pages, and who, with Mackinder, has been an inspiration to young geographers throughout his life.

Consequently, we might expect to find that geography has not yet settled comfortably into the academic groove; that it still has ragged fringes that do not seem to belong very clearly to one discipline rather than to another.

It can be taken that such evidences of youth and inexperience, though they do exist, are more apparent than real. The general direction of development has been the same in all universities, though there are distinct differences in the emphasis laid on certain aspects of the subject. This is not only natural, but also all to the good ; even a general subject may have its specialisms, and experts in those lines are necessary.

Yet, if it took very little time for the aim of geography to become uniform, it has not yet fitted uniformly into the university curriculum. This, of course, is of interest only to educationalists and university administrators, who are anxious to keep their pattern of subjects neat, and the steps to a university degree suitably graduated. "Geography is indeed an awkward subject to pigeon-hole—in fact, it defies pigeon-holes, and it is no good telling it to choose whether it calls itself a science or a humanity, for it is both.

So the course of study, the building and the activities that I am about to describe must be taken as a general picture, a mosaic of what is to be found at several universities, but not at any single one. Thus we must assume that the student is going to spend three years at geography and be given a degree in that subject, whereas in some universities it may be only a two-year course, in others four. In some, also, it may be a separate subject, while elsewhere it has to be taken in conjunction with other subjects.

We may consider for a moment the point of view of the head of a department of geography, and see what he would like to give his students, had he the resources and staff to carry out such a programme. He knows that his students will vary widely as to the amount of geography they have had, so his programme must cater equally for those who have practically none and for those who have got distinctions in a higher examination. Some may have specialized in science subjects, while others have favoured classics or history. He may well decide, therefore, that in broad terms the first year must be devoted to learning techniques and establishing a sure foundation in the fundamentals ; that the second year shall attempt to cover the whole field of geography ; and that in the third there shall be options for a certain amount of specialization.

Most schools of university geography follow such a plan in greater or lesser degree. It is in details that they differ, and the difference naturally depends on the resources available and the predilections of the head and his staff.

THE FIRST YEAR

We will suppose that our student is about to begin his three-year course, having surmounted the preliminary hurdles of passing certificate examinations, finding acceptance and accommodation in the university of his choice, and so on. We can assume that

he is going to read geography because he is attracted by it, and perhaps he has taken it to a high standard in his school. This is not always essential, but if he has done so and can flourish a distinction in front of his tutor or lecturer, he may—or may not—find that he can omit certain sections of his first year's schedule. If he is not allowed to do so, it may—repeat may—be because the lecturer considers that, however advanced the school standard may be, it cannot fit exactly into the university schedule, and no harm will be done by recapitulating some of what he has already learned.

More usually, he will not have specialized in his school; he may even have made geography his choice long after leaving it behind in his fourth-form work. If so, he is not at a serious disadvantage; he may even find it to be the contrary, if he has done classics or science to a higher standard. It could hardly be otherwise with a subject of so general a viewpoint as geography.

In general, the freshman will find that his first-year studies will include a high proportion of practical and cartographic work, much of it on a strictly physical basis. Not only will he learn to interpret maps, the most fundamental aptitude of all for a geographer; he will also find himself constructing them from other maps, from statistical data, or from nature itself. He will do exercises in projections—distasteful to the non-mathematical—, exercises in the use of globes, and exercises in the use of carto-

graphic instruments, pantographs, planimeters and other devices for plotting, measuring and copying maps.

On the physical side, the lectures will be associated with a large amount of practical work, so that the student learns his rocks from hand specimens, makes himself acquainted with meteorological instruments by taking a week's observations, interprets geological maps, weather-maps and hydrographic charts. In the field, he will be learning elementary surveying, including measurements of river discharge, and going on excursions to see the landforms of his district and, if necessary, measure them. The actual details of his physical work will vary widely, but the basic plan is that he shall learn to observe and handle the different elements in their physical environment.

The physical and cartographic side of the first year's work may take as much as half of the time, or it may take less. In any case, it will be accompanied by courses of lectures on other aspects, particularly human geography. These will tend to be introductory, preparing the way for more intensive work in the next year on economic and historical geography, on the geography of animate things, including the distribution of races, and on political geography. Some university schools introduce regional geography—the study of a particular region—in the first year, believing that the earlier the all-round view of Place is learnt the better. Other

schools leave regional study till later on, or subdue it considerably, holding that the student must have full command of his techniques, and a sound knowledge of the whole background, before he can profit by such synthetic treatment of a region.

This is a point on which there is a healthy and vigorous difference of opinion amongst geographers. We cannot join in the debate here, but we can point to two of the factors that contribute to the arguments. One is the waywardness of examining bodies, which will airily specify enormous regions for the school examinations—giving headings such as "General Geography of the World" and "Regional Geography of the British Empire"—leading, in school geography, to what one experienced professor has called "the breathless rush to cover the world." The other factor is the laudable, but not necessarily wise, intention that, from the very beginning, the geographer should learn to appreciate a region in all its aspects.

THE SECOND YEAR

If the first year can be called the preparatory and technical stage, then the second year is, or should be, geography in all its aspects. There is likely to be less practical work, but what there is will be more closely focused; it will be applied to the requirements of one or more of the aspects. For instance, the lecturer in historical geography may well set his

students to put the data of the Domesday Book in cartographic form; the economic geographer may require his class to construct graphs of statistical summaries; the physical geographer will almost certainly take parties into the field, to measure beach profiles or study the water table or dig holes for soil profiles.

Political geography, as such, is likely to make its first appearance in the curriculum, though it may take other tides, such as "The Geography of Current Affairs." Social geography may also appear as such, but this is not a very explanatory tide and it is, therefore, another subject for an argument amongst geographers, of which I shall mention only the extreme views.

On the one side, there are those who consider that social studies, especially in an urbanized country such as this, are so important that geography should lay more and more emphasis on man and less on his physical environment, which in cities is rarely an overruling control, as we have seen. On the other side, there are those who say that social geography is not geography at all, but sociology with a geographical tinge, and is therefore better left to the social scientist, who has, in the main, quite a different training and field of work.

I feel myself that there is no reason why a geographer should not gravitate to sociology if he wishes to, but I shudder to think of training him in that direction; of inserting in an already bursting

curriculum such extras as psychology, mass-observation, social anthropology and the like.

An important part of the second-year work, if it has not already begun in the first year, is the special and individual study of a region, or a topic chosen by the student himself and pursued in his own time and in his own way, under advice from his director of studies. This may take the form of an essay of but a few thousand words which is delivered up to the examiners at the end of the year, or it may extend over a longer period and assume the dimensions of a small monograph, according to the value set upon such work by the authorities.

There can be no doubt that it is desirable for each student at this, or a later, stage to learn how to find his material; how to combine consultation with observation; how to achieve a balanced judgment; and how to put it down in writing. The regional study can be abused, of course, and in either direction. One student will bury himself in it, produce a tome and thereby neglect his normal work. Another will make it a mere compilation, a sort of guide-book to his region, culled from any source he can command. Nevertheless, the regional essay, or its equivalent in individual work of some kind, is firmly established as a definite part of the training in most university schools of geography.

It is during the second year that the student will have discovered his real leanings, so that he rarely has much difficulty in choosing the direction of his

specialization in the final year. He will also have found his feet amongst his companions and have taken part, according to his inclinations, in the semi-official activities of the community, the meetings of the geographical club, the long-vacation projects, which may range from mere jaunts in new country to something approaching an expedition to comparatively inaccessible places.

THE THIRD YEAR

In his final year in almost any university, the student is allowed some degree of option as to special subjects, and he will be swayed mainly by his inclinations, but also by his choice of career. In general, his inclinations should be the safer guide.

The extent of his choice will usually depend on the size of the department concerned and on the facilities it can provide. The majority of students "opt" for specializing on the human aspect, as is natural in a subject that uses science more for its groundwork than for its final goal. In some departments, the student will be able to study one region so thoroughly that he becomes a minor authority on it. In other departments, he will merely delve more deeply into those branches of geography that please him—economic, historical, political, or even more closely defined aspects.

Should he choose the physical side, he will find himself increasingly in the field, or, if he is at a large

centre, alternately in the field, making measurements and observations, and in the lab., making experiments with his chosen process or material. There seems reason to believe that the innovation of an advanced laboratory for physical geographers, which has been introduced at one or two centres already, will spread gradually to others.

In such a lab., the student will learn to use working models of rivers and seashores, of sand dunes and soil erosion, of landslips and meanders, of single spits and deltas, even of glacial phenomena. Such practical work is, of course, supplementary to field observation and in no sense alternative to it, the general idea being that the models are under control and measurable, whereas a process in nature may be quite uncontrollable, and is certainly beyond experiment as far as varying the conditions is concerned. In so far as such work is on the border-line of research, the lecturers have to be careful that too much time is not devoted to it, for there is the final examination ahead and the student should be learning rather than researching, even if he is also learning how to conduct research in the future.

In one or two centres, there is another and rather adventitious choice for the senior student. This is advanced work in topographic and geodetic surveying. No one would pretend that this is a branch of geography; it is a vocational subject and has been admitted as an accessory more by accident than by design. It is, however, a very useful accessory,

particularly in the newer developments of aerial survey, and many students choose it as a matter of interest, without any idea of adopting surveying as a profession.

THE ADVANTAGES OF TRAVEL

There is one corollary to a three-year course in geography that must be mentioned. An almost inevitable result of such intensive study of Place is a great longing to travel and see places before settling down to a career. In consequence, a proportion of students find means of satisfying that desire in the year or so immediately following the degree, sometimes to the confusion of their parents, but rarely at their expense.

If a student is wise, he will, during his three-year course, seize on every opportunity to travel, and nowadays it is no longer difficult to find such opportunity. One or two universities have official exploration societies—not confined to geographers, of course—which carry out the difficult preliminaries of raising the funds, collecting the gear and choosing the personnel. Most universities and colleges look favourably on such vocational activities and, often unofficially, assist in overcoming the chief hindrance, the financial one. There are also travel societies that organize parties to special regions, and geographical societies with a modicum of funds for allocation to expeditions.

Viewed from the student angle, the financial obstructions to travel are not as mountainous as they would appear to the ordinary holiday traveller. Thus, if you want to go to the Faroes on £25 to study the mode of life there, you do not go to Denmark first and get a comfortable passage from there on a liner or an Iceland boat; instead you do a deal with a firm of fishing trawlers, and make up your mind to have a miserable journey. But you get there, and when you do, you rely on working or wheedling your passage from one island to another in fishing schooners, which provide another kind of adventure and thrilling misery at sea. However, you carry out your purpose: you make many friends amongst the lonely Faroese and you apply your academic training in the field at very small cost.

Lest readers should exclaim that it is well enough for tough young men seeking adventure, but not for normal people, I should add that this trip was done in 1948 by two women students on a grant of £50.

There was a case in the same year of a junior student of geography in a northern university, who was determined to begin his study of glaciology in north-east Greenland. He surmounted almost impossible hindrances in the way of cost of passages and equipment, and got there with three other students attached to a Danish expedition going that way.

After these two instances of cheap travel, one may well believe that biking or hiking round the acces-

sible parts of Europe can be done at a low cost if one but tries hard enough. If the will to travel is there in sufficient strength, the way will be found, and, with certain qualifications, the harder it is to achieve this holiday travel, the more valuable an experience it becomes.

One may go to too great an extreme, of course, as did a student of mine who shipped as cook's mate in a Canadian cattle-boat in order to see Canada, but spent most of his vacation producing, according to his own calculations, 42 miles of potato-peelings. He could have afforded a liner, but he deliberately chose the harder way. Whether as a result of that mode of travel or in spite of it, he is now a prominent banker and an authority on certain aspects of the lumber industry of eastern Canada.

I may also instance the case of another man who, after his three-year course, decided to work his way round the world, and had a most instructive and, by his own account, delightful two years of wandering. He was, we must premise, peculiarly gifted for such an Odyssey, in spite of having a most noticeable accent of the Oxford variety. He put in three months as a timekeeper to a gang of Irish road-menders. How he converted them to enduring his accent and accepting his views, he would not afterwards say, but when he moved on to another country, they presented him with a gold watch.

Or the girl who chose to go and live for the best part of a year as a Lapp, with a Lapp family well

within the Arctic Circle. If she keeps her promise to her professor and publishes it, we shall read how she managed to pursue her human geography while she lived on meat and milk and blood and shared in the whole reindeer economy of the clan. All that civilization knew of her doings was the report of a journalist on his way to Spitsbergen on a Norwegian collier. Passing an island with a Lapp colony on it, he scented "copy" and landed. While looking at the skin tents, he noticed that the skipper was talking to a group of Lapp women in their own picturesque costume. He was surprised to see that one of them was exceedingly good-looking, and then was quite confounded to overhear her say to the skipper:

"But I only came down from Newnham last year."

To such strange surroundings will the passion for geography take people after three years of its study, provided that they are unusual people. Unusual, but not abnormal, as the sequel shows. The lady in question is now gracing a research community, of which her husband is a member, quite close to the Equator, and we need not attach undue significance to the fact that it is within calling distance of the Masai tribe, who also live on blood and milk.

At a crowded meeting of the Royal Geographical Society at Queen's Hall in 1914, a paper was read by an author who referred to himself as "a recorder of experiences which are on the eve of being super-

seded." This was Rudyard Kipling on "Some Aspects of Travel," which he described as intimate and personal, even trivial and absurd, yet real.

It was really a brilliant exposition of the customs of travel—the sights, sounds and smells of travel—and, incidentally, some analysis of travellers he had met, not excluding the "disappointing" men who went about the world with their eyes shut; who, in the words of "Punch," were apt to say :

"Rome ? Rome ? Wasn't that the place where I bought those bad cigars ?"

In his inimitable way, Kipling fascinated his audience with phrases that recalled to them the material memories of their own travel and, in their train, the mental and emotional consequences. With a wizardry all his own, he penetrated the mental barriers of every one of his hearers and transported them to other scenes by phrases that recalled sights and sounds and, most especially, smells.

"The smell of burning fuel and the smell of melting grease" which "either singly or in combination, make the background and furnish the active poison of nearly all the smells that assault and perturb the mind of the wayfaring man returned to civilization.

He spoke of a "heart-searching little motif of five notes : horse; old saddlery; coffee; fried bacon; and tobacco," which can accompany man down the latitudes, "through the scent of sage-brush and sharp peppery euphorbias, down to the torrid goat-scented

south where fried beans, incense and the abominable brassy smell of pulque will pass him on to all the forlorn brood of mangrove foreshore and yellow fever stinks, until he leaves his horse on the beach, and the Tropics lift up his heart with the wholesome rasp of sunbaked coral and dried fish."

He has missed nothing, unless it be the acrid yet homely smell of the kelp that haunts every island in the stormy southern ocean.

"Forgive me, ladies and gendemen," he concluded that passage. "I will not go on with the catalogue, though I feel like the commercial traveller in the story, who said: 'If you don't care to look at my samples, d'you mind my having a look at 'em? It's so long since I've seen them'."

With his customary penetration, he went on to point out the risks and hazards of travel and the pains and penalties for failure.

"These things have never hindered men from leading or following. Even in these days a man has but to announce that he is going to gamble against death for a few months on totally inadequate cover, and thousands of hitherto honest Englishmen will fawn and intrigue and, if necessary, lie like anyone you choose to think of—in order to be allotted one life share in the venture."

Kipling ended his paper, which reads, by the way, as vividly as it sounded, with a summary of the fundamental desire in man to travel.

"The old mechanism **is** scrapped : the **moods** and
G*

emotions that went with it follow. There will arise—they are shaping themselves even now"—this was in February, 1914—" risks to be met as cruel as any that Hudson or Scott faced; dreams as world wide as Columbus or Cecil Rhodes dreamed, to be made good or to die for; and decisions to be taken as splendidly terrible as that which Drake clinched by Magellan, or Oates a little further south. There is no break in the line, no loads are missing; the men of the present have begun the discovery of the new world with the same devoutly careless passion as their predecessors completed the discovery of the old."

I have quoted thus copiously from a single paper read to the Society, because the words of Rudyard Kipling evoke, so much better than any I could suirimon, the inward spirit of geography, urging us to see, savour and smell what are to us the new and the strange places, and to do this through our own senses, not merely through the senses of others.

Much of the world we must visit by proxy, but can we not do our own little private exploring? Can we not find high adventure, if on a smaller scale, in our rambles round England? Is not travel what we make of it? Can we not share, on a peak in Cornwall, the wild surmise of Cortez and all his men on that peak in Darien?

If I am wrong, then is my whole philosophy of geography wrong also, because I believe that the foundation of interest is to go and see. Behind geo-

graphy is man's basic need to find out for himself; and whether he journeys to the next parish or to the South Pole, it is but a change of scale: one is a larger experience than the other, but they are of the same kind.

There is a corollary to vacational travel that is almost as important as the journey itself. The ordinary traveller finds his impressions getting confused and dim with the lapse of time. The wise student will write up his experiences, as something betwixt a narrative and a thesis, and either hand it to his supervisor for criticism or, better still, give it as a paper to his geographical club, where he will get free criticism in plenty. He must realize that it is part of his job to be able to " get his material across " to listeners or readers.

THE SOCIETIES

The student who has taken his degree and travelled as much as possible eventually ripens into the grown-up geographer, the established geographer—one cannot call him the professional geographer, since there is no such thing. What does he talk about, and what is his general approach to the learning he acquired during his training ?

One way to find out is to read an account of, or better still to attend, the annual meeting of the British Association for the Advancement of Science. It is, perhaps, not widely known that the British

Ass, as it is naturally called, welcomes visitors and local adherents, and is open to anyone for an almost nominal fee. It is a yearly assembly of all kinds of scientists to review their past year's work, to hear of fresh avenues of research and—most valuable of all, perhaps—to meet their opposite numbers from other centres.

The Association has now been established for 118 years, and for most of the time Section "E" (Geography) has been an active one amongst the dozen or so sections into which the whole field of science is divided for the purpose of the meeting. For the best part of a week, there is in every one of these sections a most embarrassing choice, of presidential addresses, individual papers, reports on developments, and excursions to local examples. Even if one sticks to one's favourite section, which is not at all obligatory, it is a busy week, but there are many lighter occasions, too, when the scientists prove that they are very human in their hours of leisure.

At Section "E" in particular, there will be a prominent geographer as president, often, but not invariably, a professor in the subject. There will also be many of the authors of recent books for geographers, a sprinkling of such specialists as explorers, together with surveyors, town and country planners and the rest; and the audiences will consist of approximately equal numbers of academic and amateur geographers.

Attendance at one of these meetings will do as much as this book—and more—in outlining the content and pleasure of geography to those who are not quite convinced about either. I commend the idea to any reader who would like not only to teach himself geography, but also to make the acquaintance of geographers.

The presidential lecture is usually a review of the past year's developments in the subject, but it has often been an authoritative description of its scope and meaning—its philosophy, in fact. The meeting is held in a different city each year, and one morning is commonly devoted to the geography of the local region—studies of one or all aspects. Discussions after each paper are the rule rather than the exception, and a spirited discussion very often illuminates a subject more clearly than the paper itself. Naturally the majority of papers are on the human aspect, but there are always a few on the physical side, and perhaps a technical paper or two on cartography and surveying, or map production. Exhibitions of geographical books, maps, instruments or aerial photographs are often run in connection with the meeting.

Much knowledge and a good deal of entertainment can be derived from joining the group for a holiday week in late August. No one need feel himself in any way an intruder. Particulars can be very easily obtained by writing to the secretary' at Burlington House, London, W. I.

I have been trying throughout this book to describe the standpoint of the geographer, which, let it be noted, can be adopted by anyone. We may see this standpoint even more clearly if we study the publications of the Royal Geographical Society, which is the official and permanent home of geography in this country. In its various Proceedings, Journals, Supplements and Special Publications, which stretch over more than a century and now constitute almost a library in themselves, we can not only trace the expansion of the subject, but can also get a clear idea of what geography is and how it sets about its study of Place and Man.

The journals give us vignettes of the sayings and doings of geographers over this period. The writers cover a wide field and, in the manner of geographers, gather in the more definite sciences for their contributions to the general study.

The most technical of the Society's publications is "Hints to Travellers," which is now a compendium in two volumes of all—or nearly all—that a traveller should know, covering every possible activity from fixing his position by astronomy to curing himself of fever. Its precursor was an interesting brochure, now eighty years old, called "The Art of Travel," but it was mainly concerned with the technique of camp life.

The Society has always been interested in geographical education. It publishes technical treatises, holds a special set of meetings for the more advanced

and less popular branches of geographical research, and devotes a considerable part of its staff-work to the co-ordination of geographical technicalities such as the spelling of names, methods of showing relief on maps, and styles of lettering.

It has close contact with several other associations concerned with special aspects of geography or of closely allied subjects. Of these I will mention but three : the Hakluyt Society, which for a century has looked after the publication of early manuscripts of travel; the young and vigorous Institute of British Geographers, largely composed of university teachers; and the Scott Polar Research Institute at Cambridge.

If we start with the earliest Proceedings of the Royal Geographical Society, we must expect to find discovery and exploration very much in the forefront. There was a great deal of unexplored territory to visit and communications were slow, so we can understand why most of the members of the Council were men of position and leisure, many of them belonging to the services and the diplomatic corps. The whole tempo of life was much less hurried than now, so that the occasional dinners of the Society were liable to occupy four hours, and the annual speech of the president might fill as many as fifty pages of the Proceedings.

In the rooms of the Society there have been dramatic scenes, usually connected with the great travellers who, in a special sense, were the emis-

saries of the Society in the field. The scene, for instance, on the 15th April, 1874, when a rough box lay on the table in the Council room, having been carried for a thousand miles on native shoulders all the way from Bangweulu Swamp to Zanzibar, the final service of four faithful followers to their beloved master, David Livingstone. When the box had been opened by three doctors, one of whom was his old comrade, Dr. John Kirk, the body was identified by the arm broken by a lion years before, and then enclosed in a formal coffin, which lay in state for two days in the Map Room.

Less tragic, but equally dramatic, must have been the Polar sensations of 1909-10, when, within a few days of each other, claims by Commander Peary and Dr. F. A. Cook to have reached the North Pole were cabled round the world. The Society declined to adjudicate on the rival claims, but the Council showed its opinion by awarding a special gold medal to Peary. This was presented on the 4th May, 1910, and it was a little unfortunate that, on receiving it from the president, Peary accidentally dropped it, an incident that the Cook partisans carefully noted.

Three years later, on the 10th February, 1913, there was a particularly moving incident at a Council meeting. I quote from a letter written to Mrs. Scott by Admiral Sir Lewis Beaumont:

" At 3 o'clock the Geographical Society's Council meeting began, and a few minutes later a telephone message came through from the Central News to say

that: Captain Scott and the Southern party had been lost on their way back from the Pole. The shock of this terrible announcement to us all sitting there together was very great."

As Dr. Mill says in his *Record of the Royal Geographical Society—1830-1930*:

"It is difficult for those of us in whose minds the horrors and heroisms of the Great War are set as a standard, to realise the shock and the response produced by the disaster to Scott's party. It moved the whole world with a poignant emotion."

The Society has been assailed at various times, even by its own Fellows, for unduly emphasizing travel and exploration, the descriptive rather than the constructive and the analytic; yet it has held on its way fairly serenely. Like the Mother of Parliaments, it has insisted that an Opposition has a status, on the same principle as cited by an American author who said that it was a good thing for a dog to have a reasonable number of fleas, for it kept him from forgetting that he was, after all, only a dog.

Whether this alleged bias was real or not, the supporters of exploration as a main subject for discussion and study are having to admit that, in the sense of new discoveries, it has almost reached its limit. They sigh for the great days of a hundred years ago, when every continent had blank spaces and men were ready to go and fill them; they grieve that there is now so little left to discover. Yet there is still much to be done. Wide areas of the

Sahara and the Amazon valley are barely known, mountains in New Guinea remain unnamed, and Everest has still to be climbed. Nor will man be content merely to fly over new land in the Polar Regions ; he must set his foot there as well. As for geography, there is little fear of its ever becoming a sedentary and purely academic subject. It will always be a field study and there will be volunteers to pursue it.

GEOGRAPHY AS A CAREER

I have mentioned the question most often put to me. If the speaker happens to be a parent, this is usually followed up by the second enquiry :

" What career, if any, does geography lead to ? "

In other words, what does a geographer do ? I have tried to describe what an academic geographer learns, and what a geographical society listens to, yet there must be still a little uncertainty as to what the label " geographer " really denotes. It is inadequate to describe him as one of those chaps who know about maps, and it is just as unsatisfactory to call him the philosopher of Place.

We can at least find out what becomes of the academic geographer, where his three years' study capped by a degree takes him, though there is reason to believe that the pattern of employment is changing. The figures I am about to quote are not quite up-to-date, but they will give an indication. They

relate to the students from one university during the period 1934-38.

Out of the 200 or so men graduates in geography of those vintages, 35% took teaching posts, 30% went into business, and 20% joined the services, including the civil service. The remaining 15% were untraced, or took work that could only be called miscellaneous. For women graduates from the same centre, there is a " census " extending over the twelve years up to 1944, which included the abnormal years of the war and would not be typical of the normal years that we are always hoping to reach. It concerns 155 women who had all taken a full three-year course. Education claimed 30%, the civil service took 9%, technical branches of the war services had 15%, and some 7% took to business, including social work in connection with industry. The remaining 40% married or were in miscellaneous categories.

In comparing these data with those from other centres, one has the impression that they are not very representative of academic geography as a whole, which at present seems to send at least 40% of its product to educational posts. Such a high proportion to one profession may be interpreted in various ways. It certainly is evidence of a shortage of geography teachers, and it may reflect a rapid increase in the demand for geography in the educational world. One might suggest that a wider market had not yet become aware of the value of the

geographer, particularly in business. More up-to-date figures will almost certainly point to such an expansion.

I believe that the world is rapidly discovering new uses for the geographer, some of which can be reviewed in the light of certain indications of a change. This change is partly due to the effect of the two world wars that have afflicted mankind since geography became a standard subject in higher education. There is nothing like a war for focussing the attention of the public on places, and it produces a flood of maps in the newspapers, as well as a cataract of articles by those who know the scenes of the fighting. Still more vivid becomes the sense of Place when, as in the last war, the radio gives frequent broadcasts of the actual fighting. It was not only the blitzkrieg that brought the war to our firesides.

OPENINGS FOR RECRUITS

Broadly speaking, business and industry want two kinds of recruits, the technical and the general. In the latter class, they look for men or women who are keen and well-informed, and who are likely to develop a sense of responsibility. These qualities are not, of course, a prerogative of geography students alone, but they must be there for a good degree in the subject. The real advantage to the business man would seem to be that the geographer

is dealing for a great part of his time with current affairs. He is up-to-date with his information and is accustomed to making correlations and deductions in world affairs and to detecting economic trends.

It remains to be seen whether business and industry will take that view, but there are already strong indications that they are becoming aware of the sort of training the academic geographer gets, and the way in which they can use it. To quote but one instance, there is a large trading firm that employs a geographer, a woman, to train its salesmen in where its goods come from and how they are made ; a key job and an exacting one.

If business is indeed becoming aware of the value of geography, it is likely that the civil service will be even more interested. To do it justice, it has for long recognized that, in those sections whose activities relate largely to Place, there is a need for a type of research officer who can handle distributions—a man who is not only adept at plotting and reading map data, but who can also find the reasons for a distribution and can make suggestions. Hitherto the civil service has either trained such men itself or done without them, but the recent war hurled a good number of geographers in among the permanent staff, and their value in this direction was discovered.

In a Ministry such as that of Town and Country Planning, there is naturally a very direct use for a geographical technique. A town-planner at present

is required to be a geographer, an architect, an engineer and a social scientist all in one. There have indeed been several such amazing people, but the Ministry seems to be recognizing that they are rare and that planners must fall into categories, of which the geographer will be one.

One might say more generally that geography, by reason of its wide scope, should produce what may be called the liaison officer for a good many branches of administration. This is a development that can be expected to take place in due course, especially in Colonial administration.

Administration, like education, has to be organized in departments, and there is a great danger of their endeavouring to be sufficient unto themselves, lacking or even avoiding touch with their fellow departments. This is particularly true of the more technical branches.

Take, for instance, the subject of soil erosion in a colony. At first sight this would seem to be the duty of the Department of Agriculture, which is quite prepared to carry out remedial measures, given the money and the authority. But it is not so simple as that. Should the measure include the impounding of flood water to prevent erosion, the medical authorities may raise the cry of malaria menace, indeed their department may ask for complete drainage, which might be fatal to fishery projects. Should there be ordinances proposed to compel the native population to do or not to do

certain things, the Native Welfare Department may have objections. The erosion remedies would almost certainly encroach on the Public Works Department, which wants to get on with its roads and bridges and does not really like sending its men and machines to do contour ridging. The Forestry Department is at once on its toes to see if it can get more forest reserves—and so on round the whole ring of departments.

It is the duty of the central administrative body or secretariat to see that there is co-ordination, and this calls for a man who is sufficiently familiar with the work of the technical branches to talk their language, and who will also look upon them as part of the whole machine with a single object. If the authorities appointed a liaison officer to deal with cases such as that just mentioned—and it is not an imaginary one—it is open to doubt whether they would call him the Geographical Officer, but that they would welcome such a key person, if available, is reasonably certain.

In the United States, where they are always ready to try out new ideas, the status of "geographer" is becoming recognized. The Secretary of State in Washington has a whole office full of geographers, of whom the majority have been trained at universities. Australia once had an official physiographer whose reports are quoted to this day. There are, of course, plenty of people in our own Ministries who are geographers in fact, whatever

ZOO THE USE OF GEOGRAPHY

their title and training, and it would be strange if it were not so, since we still have the most far-flung empire of all time.

It is hardly profitable to continue farther with the future possibilities of either the subject or its exponents, and the last thing we would wish to do is to claim more value for them than they deserve. We might sum up by saying that the geographer as such has yet to win his spurs in the general service of humanity, but that his boots are at least of the right shape to wear them.

THE END

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