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E. G. R. TAYLOR.

GEOGRAPHY OF AN AIR AGE
"Looking Forward" Pamphlets, No. 4

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GEOGRAPHY
OF AN
AIR AGE

by
E. G. R. TAYLOR



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CONTENTS

I. INTRODUCTION	7
GENESIS OF THE WORLD MAP	8
Ancient Maps	8
Mercator's Map	10
The Globe	14
II. GEOGRAPHY AND AVIATION	19
GENERAL CONSIDERATIONS	19
THE WEATHER	22
WORLD AIRWAYS	24
III. GEOGRAPHICAL RELATIONSHIPS	36
GEOGRAPHY IN GERMANY	36
GEOPOLITICS AND PSEUDO-DARWINISM	37
THE PACIFIC OCEAN	41
THE INDIAN AND SOUTHERN OCEANS	45
THE ATLANTIC AND ARCTIC OCEANS	47
IV. CONCLUSION	51
MAPS	
Fig. 1. Great Circle Routes from New York	14
Fig. 2. Great Circle Routes from Cairo	15
Fig. 3. The Principal Hemisphere	26
Fig. 4. Strip Map: Washington to Singapore	28-29
Fig. 5. Oblique Mercator Strip Map	28-29
Fig. 6. Pacific Margins (<i>diagram</i>)	40
Fig. 7. The Three Oceans.	48

EDITORIAL NOTE

Under the general title of "Looking Forward" the Royal Institute of International Affairs is publishing a series of pamphlets on the international aspects of reconstruction. The pamphlets are concerned with basic issues and are intended to stimulate thought and discussion. Their object, therefore, is to present problems rather than to solve them, though writers will be free to express their own opinions on the subjects they discuss. While no attempt has been made to impose uniformity of treatment on contributors to the series, they have been advised to aim at clearness of presentation, to avoid technicalities as far as possible, and to explain those which they feel compelled to use. It is hoped that by the assembly of the facts, often complex, and by their arrangement in reasonable perspective, readers will be provided with the material for sound judgement.

HAROLD STANNARD,
General Editor.

Britain and the World by H. A. Wyndham, *International Law* by Norman Bentwich and *What is a Nation?* by Harold Stannard were the first three pamphlets in this series. *Freedom from Want* by E. C. R. Kahn is in the press.

I. INTRODUCTION

Now that we have entered an air age, the obvious fact that airways need not and will not follow the accustomed seaways has struck the popular imagination. Where will they go? Who is best situated to command the air? Will such "key" points as Gibraltar and Singapore be by-passed? Maps and globes have suddenly become news, and in the United States journalists and geographers have seized the opportunity to produce a spate of novel and often very illuminating maps and models which have convinced people there and in Great Britain of the need to look at the world with fresh eyes and a keener sense of geography. Like ourselves, the generality of Americans have hitherto been satisfied to hang up in their schoolrooms, offices and business premises a map of the world on Mercator's projection. On both sides of the Atlantic the particular world view which this map presents has become part of the current climate of thought, governing our habitual and unconscious reactions to world relations and world affairs. The public now learns, with some dismay, that Mercator's world map distorts the truth here, completely hides it there, and is quite incapable of indicating the new and vital relationships brought into being by flight, not to mention the new dangers arising from the latest methods of warfare. This is the more disturbing in that to the majority of people a "map is a map": that is to say it is assumed to be a simple objective presentation of facts such as cannot mislead the user. This however is not the case. Every map, every globe even, has certain subjective elements and employs certain conventions which must be understood and allowed for if we are not to draw false conclusions. The first chapter of this pamphlet is therefore devoted to the examination of the map as such, and this can best be made by reviewing briefly its origins and development.

Ancient Maps

The making of maps and plans goes back to remote antiquity, the oldest surviving examples coming from ancient Egypt and Babylonia. Among them two types at least can be distinguished, those that are largely schematic, designed to illustrate concepts, and those that are representational, designed for some practical purpose. In Greece the cartographical art first took shape in Ionia, and (if Herodotus is to be believed on this point) a map engraved upon bronze, and representing in recognizable fashion the then known world, was carried by Aristagoras of Miletus when he visited the King of Sparta to enlist his help against the Persians. As he traced with his finger the Royal Road to Susa the visitor made an invasion of Asia appear easy and profitable enough, but after three days' reflection King Cleomenes asked what was the distance to the Persian capital, and on being told that it was three months' march, bade the Milesian stranger leave Sparta at once.

Five centuries later the Greeks were making maps and globes in several styles, and the "grid" or reference system of latitude and longitude had been established as we have it to-day.¹ Strabo, who wrote at the very beginning of the Christian era, makes quite clear the distinction to be preserved between the more mathematical and formal representations of the earth suitable for philosophical studies and the sort of map that should be used by statesmen and men of affairs. The latter were not concerned with the sphere as a whole, but only with that part of it, believed to be a great island, which comprised the known habitable world. While it was agreed there were

¹The Greeks, by measuring an arc of the meridian, had arrived at an approximately correct value for the circumference of the earth. Eratosthenes (fl. 230 B.C.) obtained a result usually interpreted as 70 miles to the degree, while Ptolemy (fl. A.D. 150) accepted and made widely known the figure of 62½ miles (500 stades). The correct figure is 69.41 statute miles.

most probably comparable habitable regions in other quarters of the globe, and while there were known to be uninhabitable regions, all of these as being beyond reach had no practical importance and could be left to the speculations of the philosophers. Since the known habitable world, or *œcumene*, was small in relation to the entire globe, it could be represented on a flat map on which the convergence of the meridians and the curvature of the circles of latitude could be ignored without serious error. The lines of reference could therefore conveniently be shown as a rectangular grid.

Nevertheless, it was important, Strabo insisted, that users of the plane map should be aware of the shape and size of the globe, and of the simplifications that were being employed. It is to neglect of this proviso that faulty deductions from the map have mainly been due from that day to this.

The Mediaeval Christian map was a further simplification of the classical map of the *œcumene*. The Christian man had no need to look beyond the world island in which alone the sons of Adam, heirs to salvation, could be found. If as a result ignorant people pictured the world as a flat disc, it was none the less true that all scholarly churchmen were aware of the correct shape of the globe and its approximate size. By the thirteenth century this knowledge was common to a quite unlettered group of men, the sailors. The use of compass and cross-staff in seafaring was accompanied by the appearance of accurately drawn representational charts of the seas of commerce, and every master-mariner had to learn "the doctrine of the sphere." What troubled Columbus's crew was not fear of encountering the edge of a flat earth, but rather the idea of visiting its underside. For (in common with many people at this very day) they believed the sphere to have a top and a bottom.

The restoration of Greek learning, followed by the Great Discoveries, meant that the diagrammatic mediaeval world map

was superseded by maps and globes once more drawn or modelled on a mathematical basis. The network of latitude and longitude reappeared, and mathematicians vied with one another in devising projections that would best present the greatly enlarged known world upon a flat map. Yet seamen's charts were still drawn in the old style with a reference grid based on the sixteen rhumb lines or compass directions. These had answered well enough for the small range of latitude over which ships had sailed down to the fifteenth century. But as a basis for charting the world they introduced gross errors, as the convergence of the meridians was ignored. It was as a new seaman's map which preserved compass directions correctly while at the same time it allowed the fixing of position by latitude and longitude, that, in 1569, Gerard Kremer (who latinized his name to Mercator) devised his famous projection, now such a source of misapprehension.

Mercator's Map

On Mercator's world map the lines of longitude (or meridians), which on the globe converge upon the poles, are shown as parallel straight lines, so that distances from west to east are increasingly exaggerated as we go from equator to pole. If, however, distances from south to north are exaggerated in exactly the same proportion there is no distortion of direction, and no distortion of the shapes of small areas. For example, at latitude 60° , the meridians on the map are twice as far apart as on the globe; consequently south to north distances here must also be doubled, and the result is that areas are four times their correct size. At latitude 70° the meridians become more than $2\frac{1}{2}$ times their true distance apart, and south to north distances are stretched proportionally. Areas are exaggerated more than six-fold, and it is this rapidly increasing exaggeration polewards that is one of the great defects of the map. The poles themselves on such a map lie where parallel

straight lines meet, namely at infinity, and hence a second defect is that the Polar Regions cannot be shown at all. This was of no consequence in a seaman's map, since navigation was not possible in the neighbourhood of the poles, but it matters very much in a flying era, for air-routes may pass across very high latitudes or even across the poles themselves. A third notable defect is that, since the scale alters continuously from equator to pole, it is impossible to lay a ruler or place a pair of dividers across Mercator's map and measure off a distance. It is impossible, therefore, to discover from such a map whether, for example, Moscow is nearer to Vancouver than to Cape Town: inspection of the map would lead to the wrong answer. Nor is it possible to trace across it the direct route from, say, Moscow to Vancouver, or to ascertain what places would be passed on the way. The straight line drawn from one city to the other would be a rhumb line or compass course, but such a course is longer, often very considerably so, than the direct (or great circle) route as measured on the globe.

It might well be asked why, if it has so many defects, Mercator's map is still made and sold at all? The answer is that its property of being "compass-true" is of inestimable value to navigators, and that for a sea-people like ourselves it served very well in the days when sea routes were of first importance, besides flattering our pride by the way that it displayed the Empire. Since, however, we unconsciously judged the scale by reference to our own islands which are in fairly high latitudes, we greatly underestimated the size of tropical countries, such as India and Brazil, by comparison with Europe.

Because it is compass-true, Mercator's world map is one (and indeed almost the only one) on which the four edges of the map actually correspond to the four cardinal points, north, south, east and west. It therefore supports our slovenly use of the words top and bottom, up and down, as the equivalents of north and south. We heard of fighting in progress "in the top

corner of Alsace," of a front line which was "stable up at the top but more fluid down at the bottom," of Germans trapped in the "bottom of a pocket" which was "at the bottom of the Cherbourg peninsula." Such language can only obscure our grasp of space relations, and is an irresistible reminder of a certain conversation at cross-purposes which took place when (according to a mathematical cautionary story of the eighteenthies) the Sphere paid his inexplicable visit to Flatland.¹

Mercator's map shares with all the other projections that depict the globe within a rectangle the disadvantage of suggesting that east and west are widely separated—that they are, in fact, "the opposite ends of the earth." Even although a few moments reflection may remind us that the right- and left-hand edges of the map represent an identical line upon the globe, the unconscious impression of their separateness which the map leaves is extremely difficult to dispel. Even harder to combat is the notion that there is "nothing beyond" the northern (or equally the southern) edge of the map. It requires a real effort to grasp that the coasts of Siberia and Canada, which appear to lie far apart along one and the same straight line, actually face each other across a relatively narrow Polar sea in just such a way as Italy faces Libya across the Mediterranean.

Such distortions, which are inevitable if we try to show the earth's surface within a single boundary line, whether a rectangle or an ellipse, are considerably lessened if we map the two faces of the globe separately, i.e. draw the World in Hemispheres. This map is found on the first page of most atlases. Scale, area and shape are well preserved, although compass direction is lost. But the fact that the New World and the Old World are shown each neatly enclosed in its own circular frame, and surrounded by the sea, gives a false suggestion of the separateness of the western and eastern hemispheres which strongly reinforces the view that the affairs and events of the

¹ A. Square, *Flatland*, 1884.

one are no concern of the other. It is the Isolationist's map. Few people remember that the two boundary circles, which on the map touch only at a single point, are an identical great circle of the globe bisecting the equator at points 180° apart, and so made up of two meridians. Fewer still reflect that the choice of this bounding circle is quite arbitrary, the terms east and west being purely relative. Many countries do not reckon longitude from the meridian of Greenwich, a fact that sometimes escapes boundary makers in defining territorial limits. It would be just as correct to transpose the two parts of the map, when our own hemisphere would become the western, the Americas the eastern half of the globe, relative, say, to the meridian of the Fiji Islands. (Compare also fig. 3, p. 26.)

It must be emphasized that it is impossible to devise a single-sheet world map free from grave defects. But why is it only now, it may again be asked, that the defects of maps and the wrong ideas we get from them are being pointed out? The answer, once more, is quite simple. What has been said above applies particularly to maps of the whole world. In maps of single countries, even in maps of the smaller continents, errors and defects are slight enough to be negligible. So long as we on this side of the Atlantic were chiefly concerned with European affairs and the Americans with American affairs, the fallacies of the map were of little moment. To-day, however, even before trans-Atlantic and trans-Pacific flying knit the globe into one, continental relations have been superseded by world relations, whether in terms of politics, culture or commerce. It is the "one world" with its unbroken surface and its continuous atmospheric envelope, which it is so difficult to hold truly before the mind's eye. Yet what has lately been termed, rather awkwardly, "global thinking"—the just appraisal of new geographical values—is as essential to the general public as to the politician. A well-balanced world is a condition of stable peace. The most obvious and sensible suggestion is that we should acquire this new skill of geographical

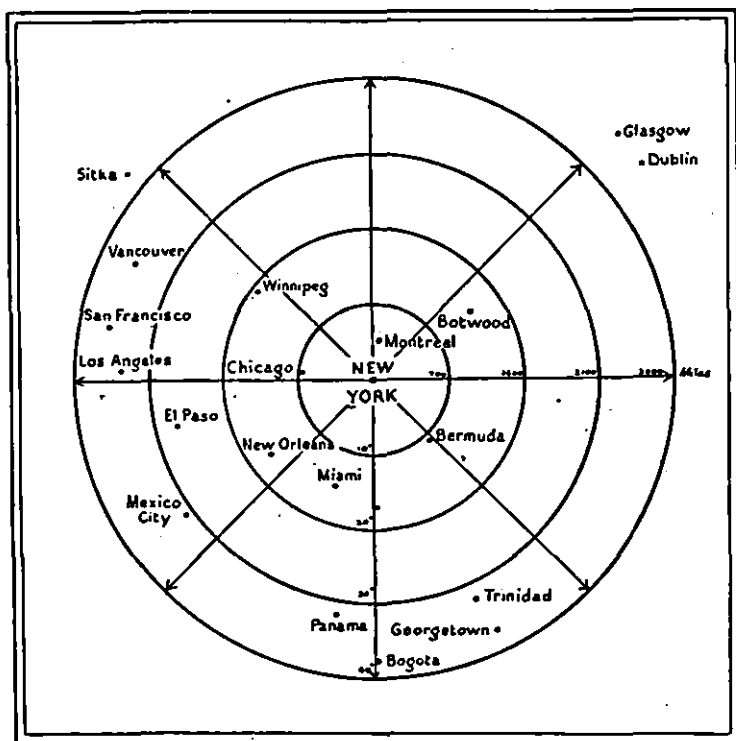


Fig. 1. Great Circle routes (radial lines) and equal flying times (circles) from New York.

judgement by returning to a general use of the globe, long laid aside on the schoolroom shelf or consigned to the second-hand dealer. Nevertheless the globe, too, has its limitations in use, and its misleading conventions, upon which brief comment will now be made.

The Globe

A well-made globe provides, of course, a true representation of the earth's surface without distortion of size, shape, distance or direction. Measurements upon it can be made at once,

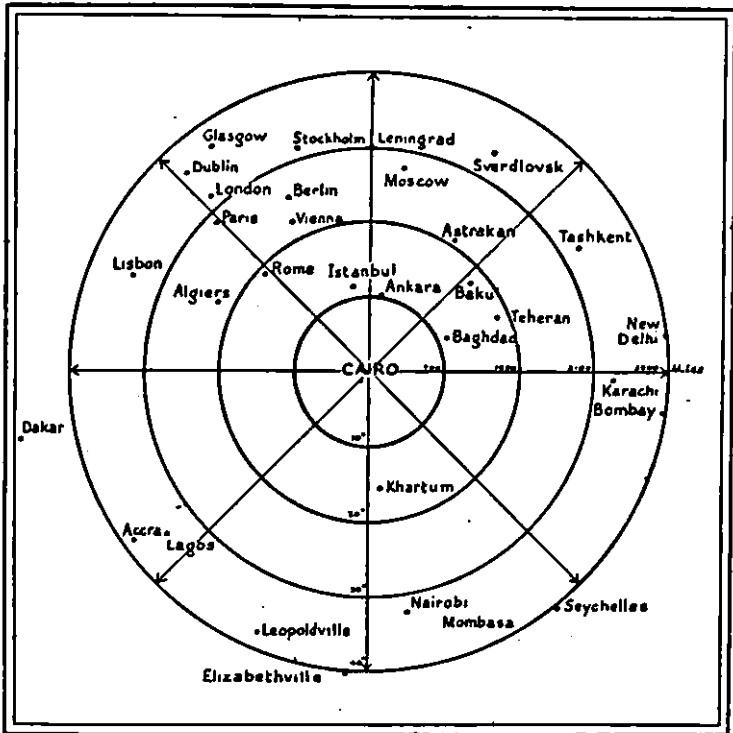


Fig. 2. Great Circle routes (radial lines) and equal flying times (circles) from Cairo.

either with a correctly curved scale, or with a flexible one which shapes itself to the surface curvature—even, indeed, with a piece of string! Such scales will at the same time mark out, where they touch the globe, the line of the great circle (i.e. the shortest) distance between the measured points. The ordinary globe as sold to-day is, however, a nuisance to use because it is mounted to show such astronomical matters as day and night, the seasons and the zones. These are schoolroom matters of no immediate concern for our particular purpose,

and this style of mounting makes the globe much too clumsy and cumbersome to be handled with patience. Moreover, not only does it obscure the polar regions, which have become of such particular interest, it gives rise to the fallacious belief that the earth is actually fixed or poised in that fashion upon some ghostly horizontal plane, with the northern hemisphere at the "top," the southern hemisphere at the bottom, or "down-under." Actually, of course, the term horizontal has no meaning apart from the earth's centre of gravity, and if we must mount our globes it would be equally correct (although less convenient) to reverse the hemispheres. Following Aristotle, who considered the southern hemisphere the nobler, writers of some mediaeval text-books did actually show the world thus in reverse.

There is little doubt that for ready perception of world relationships, some form of rolling globe is the best, the earth being represented by a simple unmounted ball with a cup-like rest from which it can be lifted and turned at will. Such a globe, having no visible axis, does not give the false impression that the poles (apart from their relation to the earth's spin) are in some mysterious way different from other spots on the earth's surface, and in particular that they are "natural centres." The latter notion has, of course, been fostered by the fact that, for excellent reasons, the network, grid or graticule which is applied to the globe for convenience of fixing position has the two poles for its primary points of reference. All the meridians of longitude pass through the poles, and the circles of latitude are drawn at equal angular intervals from the poles. The former, which are all "great circles" of the sphere, are divided into degrees measuring approximately 70 miles. The latter (save for the equator, which is a great circle) are "small circles" of the sphere, divided into degrees the length of which is a mathematical function of latitude. Unlike the great circles they do not show the shortest routes from point to point, although they appear to do so on many kinds of maps.

What is important to realize in connection with flying is that any point whatsoever on the globe in conjunction with its antipodes can be treated as the poles of an axis, and the two made to serve as points of reference for a similar network of great and small circles. The great circles are direct flying routes from the selected centre, while the small circles show equal flying times from the centre. Such a network, whether marked directly upon the globe, or, as can easily be done, drawn out on the map, provides an airways map, although not (paradoxically enough) one that would prove very useful to a navigator-pilot. The two examples shown in figs. 1 and 2 (pp. 14 and 15), are centred on New York and Cairo respectively. The great circles (corresponding to lines of longitude on the ordinary network) appear as radiating straight lines, along which the scale is everywhere 70 miles to a degree. The concentric circles mark off equal distances and flying times. They can be spaced at three, five, ten, or any other convenient interval in degrees. Taking a cruising speed of 210 miles an hour, every three degree interval along a great circle represents an hour's flight. On the two diagrams the outermost circle is approximately 2,800 miles from the centre, and therefore represents very nearly the limit of a practicable single "hop." Coastlines have been omitted (although they could easily be drawn) from these two "maps," in order to emphasize the fact that up in the air they are non-existent. Comment on the relationships between various towns which the figures show will be made in the next chapter. Here it is merely ways of representing globe relations that are in question.

One of the drawbacks of the globe, namely that only one half of it can be seen at a time, and even so with the marginal areas much foreshortened, provides the chief argument for continuing to prefer the flat map. Others, equally obvious, are the impossibility of slipping a globe into the pocket or transferring it to the pages of a book. If, however, we are prepared to handle

our rolling globe familiarly, rid ourselves of false notions about there being a "right way up" for maps, and leave mathematical rigour (as Strabo did) to the philosophers of the day, it is easy to prepare useful transcripts from its surface. With the help of a strip of paper laid along some selected great circle, we can make a sketch-map which brings out spatial relationships completely concealed by more conventionally drawn maps. An example of such a "strip-map" is given in fig. 4 (pp. 28 and 29) and this too will be discussed later. Supposing, however, a greater measure of accuracy is really necessary, a professional cartographer can supply us with a suitable network. The selected great circle can be treated as the equator of a set of great and small circles drawn (or calculated) with the twin poles of that equator as points of reference. This network is then projected on the Mercator principle and an outline, or if required a more detailed map, is exactly drawn in relation to it. Since within a moderate range of latitude from its equator the distortions of a Mercator map are slight enough to be immaterial, useful strip-maps can be prepared on this principle (termed the oblique Mercator), an example of which is given in fig. 5 (pp. 28 and 29). It has always to be borne in mind that the cardinal points, north, south, east and west, are defined on the ordinary map or globe by the lines of longitude (north-south) and the lines of latitude (east-west). The two strip maps therefore do not show compass direction, although the airman who followed the "equator" of such a map would be flying "straight ahead" and would eventually arrive back exactly at his starting point.

Another very useful way of getting new and more dynamic views of the three dimensional globe from a flat map is to project the sphere from its centre on to a circumscribed solid plane figure. If we imagine a transparent globe in black and white with an illuminated point at its centre and surrounded by a paper cube, we can see that a shadow map would be cast on each face of the cube which could be transferred to the paper. A

map of the world on six squares would be the result, and the cube could be opened out and its faces arranged in any pattern we please. Supposing the cube to have been symmetrically arranged in respect of the globe, the faces which touched the poles would show maps of the polar regions and the other four the parts of the world on either side of the equator. But the cube can equally well be fitted obliquely so that the outlines projected on to its faces bring out some novel world view. Australia, for example, might be made to fall centrally on one face, or Japan. In the example given in fig. 7 (p. 48), the object was to give a comparative view of the three great oceans.

II. GEOGRAPHY AND AVIATION

GENERAL CONSIDERATIONS

The foregoing necessarily rather tedious description of maps and globes amounts in sum to this. The conventions and methods in use for formal geographical studies can often with advantage be laid aside, while we must also get rid of certain fallacious impressions which we have derived from them if we wish to understand the new and coming world relationships. Our planet is merely a ball which in terms of human movement has now become quite small. At a cruising speed of 250 miles an hour the antipodes of any place whatsoever are no more than fifty flying hours away, or just over two days actually in the air. Were relays of planes and pilots waiting, a girdle might be put about the earth, if not perhaps in forty minutes, yet in one hundred hours, rather more than four days. Every great circle or circumference of the globe measures 25,000 miles.

Once a plane is actually in the air it is immaterial whether the flight is over land or sea, mountains or plains: nor do deserts, jungles and swamps present any obstacles to travel, though there

are atmospheric phenomena associated with topographical features, e.g. local instability, which affect flying. But to land for refuelling or refitting in such localities is likely to be impossible, while to make a forced landing might be disastrous. Topographical features that are obstacles to free movement on the ground have still, therefore, to be reckoned with when movement is by air, for the power of the plane employed and the weight of fuel carried must be such as to ensure that the obstacle will certainly be cleared. Except on very large aircraft a hop of 3,000 miles means such a weight of fuel that passengers and freight must be reduced to a load hardly paying for carriage, and a distance of no more than 1,700 miles between airports has been suggested as one most suitable for long distance flying for machines as at present designed, although half or one quarter this distance is quite usual on secondary and local routes. Within small countries like our own, which is a mere six hundred miles from end to end, flying makes its greatest appeal when it saves a tedious journey by combined rail and boat, to Ireland for instance, or in so far as it allows quick access from the provinces to some major airport where continental or trans-oceanic routes can be picked up.¹

It might appear at first sight as if only the great centres of population would be of first importance to commercial aviation, because of the mails, freight and traffic offered. Such centres, however, already have first-class systems of rapid communication by road and rail which compete with the airways, especially as regards passengers, and it is perhaps in more isolated or less developed areas that the greatest readiness of the average man to use the new means of transport will continue to be shown, although this will not, of course, produce the greatest total of fliers. While, indeed, weight of numbers

¹The helicopter will change the situation. Wise planning should allow for office buildings in the immediate vicinity of major air ports, e.g. Heath Row, to accommodate businesses with large overseas interests.

must tell, the combined factors of remoteness, vast distances, an extraordinary variety of natural obstacles, and poorly developed or poorly integrated rail and road nets (as for example in the southern continents) can be combated most successfully by flight. It is in such areas that civil aviation may be expected to transform, probably very rapidly, existing social, cultural and economic conditions. In the out-of-the-way parts of Canada and Asiatic Russia, too, the story is the same. There are primitive Arctic peoples in both continents who have encountered mechanical transport for the first time in the shape of the aeroplane, which has preceded even the wheeled cart in their experience.

While the greatest triumph of aviation in recent years has been the establishment of regular trans-oceanic routes, it still remains true that, to raise the payload, the open ocean hops should be as short as is feasible. The geographical consequence of this principle is that shore lines running in particular directions, peninsulas and continental islands which prolong the shores seawards, as well as oceanic islands affording way-stations on long hops, are topographical features that have suddenly assumed an importance quite unrelated to their size, population and resources. The political affiliations of such key places are being closely scanned, and the United States is already entering into a series of agreements with foreign countries which will secure convenient landing facilities along proposed long distance airways. That Greenland is under the Crown of Denmark, for example, carries a new significance nowadays, as does the fact that Iceland is an independent State, and that part of the western fringe of the Sahara is an appanage of Spain, but hitherto one so little regarded that it is barely ten years since it appeared worth while to Spain actually to raise her flag there. To-day, the most westerly protrusion of Africa has become a vital link on the route between Europe and South America, while the globe (but not Mercator's map) will show

that the most direct flight from New York to Moscow is broken up into comfortable hops at Goose Bay (Labrador), Cape Farewell (Greenland), Reykjavik (Iceland) and Trondjhem (Norway), from which point it leads on through Leningrad to Moscow. No doubt it might well be profitable to leave the great circle immediately upon reaching Europe, and make the round of the North Baltic capitals, Oslo, Stockholm, Helsinki, before proceeding to Russia. Tracing the great circle gives general guidance as to the direction to be followed, especially on sections where no local traffic is to be picked up, but obviously there comes a point when the route will turn aside to follow the traffic, or rather to seek it out where it is still only potential. While, however, the provision of touching-down points is important, the hazards, delays and expenses incident on landing must be balanced against increased payload.

THE WEATHER

Another factor which may take an air route well out of the direct course is the weather. While it is often said that modern aircraft are independent of the weather, this is only true within limits. Their speed is drastically cut down by head winds since (unlike ships) they are flying wholly within the medium, the air, whose motion constitutes the wind. In taking off and landing, too, weather conditions may be of crucial importance, and the enormous area occupied by a first-class airport depends upon the fact that runways must not only be very long for heavy aircraft but must be multiplied so as to be available corresponding to winds in different quarters. Stratosphere flying, at altitudes of six or seven miles, is a costly business, for it demands special types of plane and equipment, including a pressure cabin. Commercial planes, it is stated, will be able to fly at about 20,000 feet, but this is not necessarily "above the weather," and the climb up and down has to be considered. Fog, low cloud, violent adverse winds and blizzards, some at one time of the year

and some at another, are unfortunately characteristic of parts at least of the New York to Moscow route that has been outlined. Indeed, they are probably characteristic of all oceans and ocean margins in high latitudes, while between latitudes 45° and 60° , whether in the northern or southern hemisphere, there are likely to be following winds on the eastward journey, headwinds on the return.

Meteorological observations over most parts of the world, especially over the oceans, are too sparse to make possible any exact assessment of the most probable weather, and an air-route requires, in addition to airports and landing fields, the support of a network of meteorological observing stations. This gives further importance to remote islands and uninhabited shores. It has recently been revealed that a weather station on Tristan da Cunha provided invaluable information on the Cape route. The tiny island of Jan Mayen, for example, situated mid-way between Narvik and Greenland, and formerly frequented by whalers, was for long abandoned to the sea-birds after the decay of the fishery. But in 1929 Norway claimed possession of it and established a meteorological station there which has since proved of inestimable value for shipping as well as for aircraft using the northern routes. The explanation is that European weather moves forward from the west, and much dirty weather originates owing to atmospheric conditions of which the onset can be observed or predicted from Jan Mayen or Greenland.¹

High latitudes have no monopoly of bad weather, but they enjoy the special privilege of long or even continuous daylight in summer which is a valuable asset when flying. The Horse Latitudes or trade wind belt, in which the Azores and Bermuda lie, provide the world's principal fine weather zone, with

¹The special thermal and humidity conditions in an air mass which promote a cumulative deposit of ice ("icing") on aircraft are still incompletely understood and remain hazardous.

skies normally serene and cloudless, a zone repeated in the same latitudes in the Pacific, as well as in the southern oceans. Between the northern and southern exemplars of these fine weather belts lie the narrow doldrums, where the constant recurrence of heavy clouds and thunderstorm rains is likely to mean bumpy flying. Moreover at the western extremities of the fine weather regions, where they approach the continents, there occur at certain seasons of the year those violent tropical storms which, although fundamentally alike, go under various names in different parts of the world—the hurricanes of the West Indies, the typhoons of the South China Seas and the cyclones of Indian waters. Fortunately the habits and lines of travel of storms of this type have already been well studied in the interests of shipping, and they can usually be avoided, although at the cost of delay. The South Atlantic alone is free of them, and they need not therefore be feared on the air-route between Europe and Brazil. American planes, on the other hand, when flying to Brazil, must cross the hurricane belt of the Caribbean Sea.

Whether they are driven off their course by bad weather, or whether they are flying blind through cloud or fog, aircraft can be directed by radio signals and guided to their objective along a wireless beam. The beam follows a great circle, and therefore brings the airman home by the shortest way: maps that show great circles by straight lines (rather alarmingly called gnomonic), and Mercator maps which show compass directions as straight lines, are the twin bases of all scientific navigation.

WORLD AIRWAYS

It has already been suggested that as the "air-mindedness" of the civil population is likely to be a function of remoteness or inaccessibility, the network of airways, actual and potential, is no mere reflection of the population density. The term re-

moteness, however, raises the query, remoteness from what? And the answer is, from those great metropolitan cities which, as the most forceful and colourful centres of modern life, are continually growing by accretion from the countryside. When they cease to exercise this centripetal or indrawing force, they are doomed (or so say the geopoliticians), like other unnourished organisms, to suffer decay and ultimately death: a theory that will be tested by the proposed forcible stop upon the growth of London. Such cities, in addition to their functions as administrative and cultural centres, are normally points of concentration for a very high proportion of the commercial activities of their country or region, industry taking only a secondary place. This special character ensures their importance in respect of the origination of mails, and of the particular classes of passengers whom experience shows to be most likely to travel by air.

It becomes relevant, then, to look at the pattern of world population, and particularly the distribution over the globe of monster cities. Considering first the western world of Europe and the two Americas, we find there a total population of about 800 millions, with their "centre of gravity" a little to the southwest of Cape Clear in Ireland, and in latitude 50° W. To this point the nearest great city is London. If as a rough definition of a city of metropolitan type we take a population of over a million, then there are forty-four such conurbations,¹ thirty in the Western World. Associated with the west by political ties, as well as by geographical propinquity, are the 150 million people of Africa, with whom may conveniently be grouped the 50 millions of the Middle East. These 200 million non-Europeans add only one "million city" to the total, namely Cairo. Altogether it may be reckoned that nearly half the world popula-

¹The term *conurbation* covers a multiple city (e.g. Manchester-Salford) and a city with its suburbs (e.g. Greater London), denoting the population group apart from particular administrative boundaries.

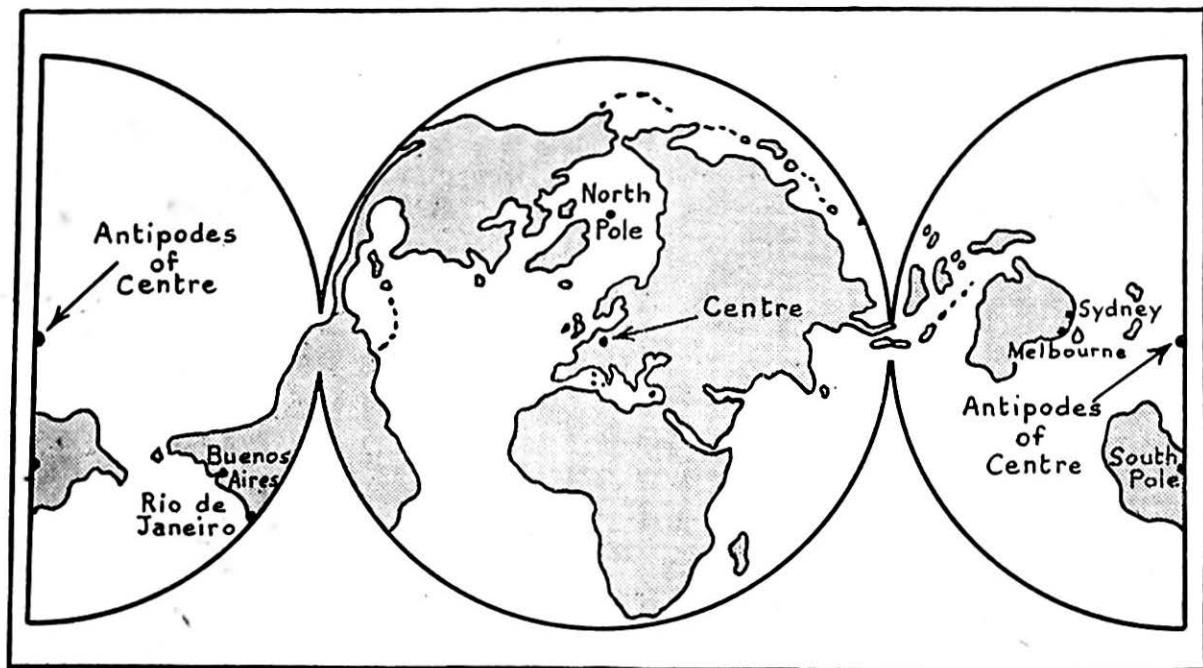


Fig. 3. The principal Hemisphere centres on Western Europe, and contains all but four of the world's Metropolitan cities.

tion, a thousand million people, live to the west of the Pamirs and Hindu Kush Mountains. On the far side of the Roof of the World, and extending in a huge arc through that part of Asia yearly drenched by the monsoon rains, are the lands of the second, and slightly larger half of humanity, the Far Eastern peoples. Their "centre of gravity" lies in South China, in the mountains of Yunnan, and they contribute twelve more to the world total of great conurbations, of which no fewer than six (according to the latest figures published) are ranged along the southern margin of the mainland of Japan. Finally, remote from their fellow Britons, and indeed at their Antipodes, are the eight million or so Australians and New Zealanders who, in spite of an economy based on "great spaces" producing crops and stock, are as highly urbanized as ourselves. Greater Sydney and Greater Melbourne contain half the population of the Australian continent.

The strip map, fig. 5, on pp. 28 and 29 drawn on an oblique Mercator projection,¹ includes the sites of all the world's giant cities save one, the relatively isolated Los Angeles. This map may therefore be taken to represent the zone within which there will be the greatest development of flight. Here it may, however, be remarked that, although it is possible to weigh the two halves of mankind, western and eastern, one against the other, and discover a world "centre of gravity" somewhere within the sparsely peopled Kirghiz Steppe, yet as potential travellers by air and originators of airmail, the oriental peoples must be heavily overbalanced, on account of their low standard of living and comparative illiteracy. Quite apart, too, from such considerations, the sense of urgency, of feeling that no time must be lost, which is one of the intangibles determining readiness to fly, is absent among eastern races.

Returning therefore to the distribution of cities, we can project the world on to a map (fig. 3, p. 26) which will show its

¹An extract from a map prepared by the late Mr A. R. Hinks, F.R.S.



Fig. 4. (Left) Strip Map showing the direct way from Washington to Singapore.

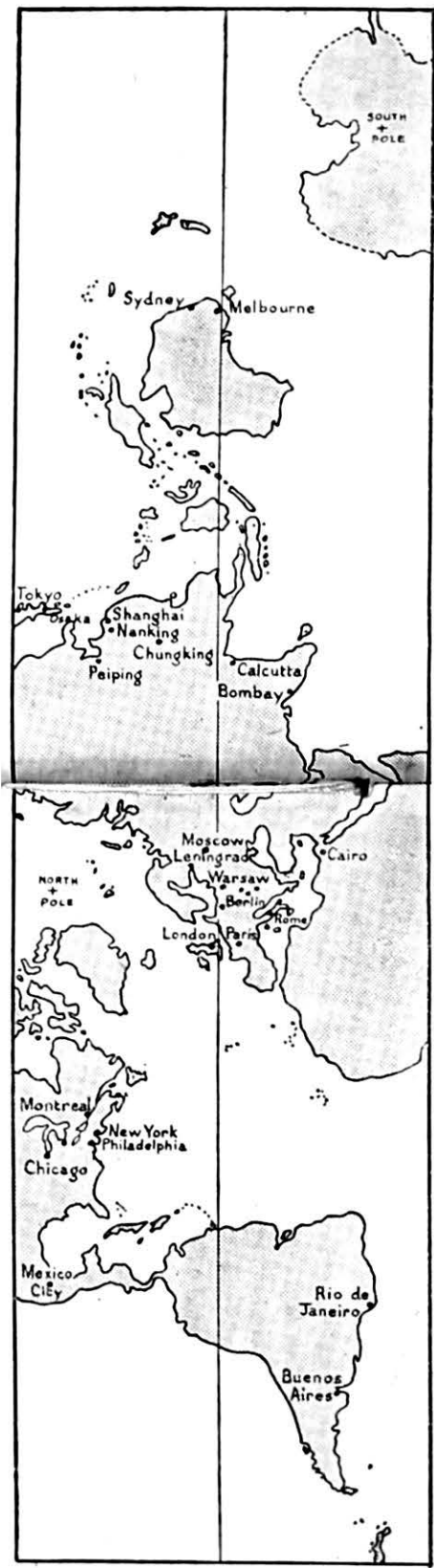


Fig. 5. (Right) Oblique Mercator Strip Map, with in which lie all but one (Los Angeles) of the Conurbations with over a million inhabitants.



most central point in relation to them. Such a point may be termed the "centre of position." It is not far from Berlin, for as the map shows, taking the hemisphere of which Berlin is the centre, we find that the greater part of the land surface falls within it. The radius of the circle containing this hemisphere is one quarter the circumference of the globe, roughly 6,250 miles. All but four of the world's great cities as they have here been defined are situated within that radius of Central Europe. Those at a greater distance are São Paulo (Brazil) and Buenos Aires in South America, and Sydney and Melbourne in Australia. Rio de Janeiro is just on the edge of the circle. In point of fact, however, London might equally well claim to be situated in the "centre of position," for while Berlin has a slight advantage as regards mean distance from all the other large cities, no more than three, Buenos Aires, Sydney and Melbourne, are individually more than 6,250 miles, or say 25 flying hours, from the English capital. On the other hand, all the great cities of Asia lie outside the hemisphere of which New York is the centre. On balance, therefore, although both Berlin and New York can claim a greater nodality than London as regards secondary feeder routes, the world position of London, in the direct path of the full flow of traffic from the Americas to Europe and beyond both by land and sea, remains unique. Yet, since a couple of hundred miles or so may be of little moment in flying, Paris might well challenge a supine London for supremacy.

Whatever pattern of airways the future may reveal in detail, the linking together of London, New York, San Francisco and thence the Pacific in the one direction, of London, Central Europe, Cairo and thence the Middle and Far East in the other direction, must provide the main elements in the encirclement of the globe. South America sends strong feeders to the United States airways by way of the Caribbean Sea, but the routes following the margins of Brazil and West Africa to west-

ern Europe are very direct and may eventually prove the more frequented. In so far as long-term capital investments are any index to mutual business interests and contacts, the position in 1939 (according to League of Nations figures) was that the United Kingdom still had a slight lead over the United States in respect of South America in spite of the great increase in capital exports from the latter country after the last war. The present financial position is, of course, obscure, but Brazil (to take but one example) has been reorganizing her economy on a wider basis so as to increase the output of products in which Great Britain is interested.

African airways, both on account of geography and of the Colonial and Dominion status of most African peoples, naturally run north to Europe. Cairo, where three continents meet, is likely to remain an important centre. The pair of maps on pp. 28 and 29 showing circles of equidistance from Cairo and New York, illustrate the great nodality of the Egyptian capital, as well as certain disadvantages inherent in an ocean marginal situation, such as that of the American city, especially as regards pick-up traffic. Save for Montreal, only 350 miles away, quite half the circuit of 11-13 flying hours' distance from New York has no traffic to offer, for Botwood and Bermuda are merely halts on the routes to and from Europe. Round Cairo, on the other hand, land stretches for many flying hours in almost all directions, and although there is much desert, the desert itself stimulates traffic because of its barrier character and the absence of alternative means of transport. The sea is, of course, a barrier, but many people will continue to prefer a sea voyage with its variety of pleasures, to one by air. Cairo stands, too, on the threshold of the East. The group of Middle Eastern countries, including Turkey, Iran and Arabia, ranged in a semi-circle about Egypt are all areas of actual or potential development, with mineral and especially mineral oil resources of very considerable importance. Further east still, India, to which

Great Britain is now a heavy debtor, is in a position to put forward a very big programme of industrial expansion, which will call for British capital goods. Air traffic along the routes beyond Cairo is therefore likely to increase in volume.

The position of Cairo in relation to the airways of southern Asia is matched by that of Moscow in relation to the vast and still comparatively little developed interior of the continent. The commercial and cultural links between the Soviets and Iran, Afghanistan, Sinkiang and Mongolia are being steadily strengthened, and Russian airways reach the borders of all these States, and in one or two cases already cross them. The shortest way from Europe to the Far East lies through the Soviet Republics: for example, the points Berlin-Leningrad-Tokyo and the points London-Moscow-Shanghai lie on great circles which swing towards the Arctic. But great circle routes embracing a quarter of the globe, as these do, are of theoretical interest only. The developed airways of Russia are well to the south, following the tapering population belt which crosses Asia from the Urals to the Pacific, that is to say the belt of old colonial settlement which picked out all the best lands. From this main west to east trunk line (which, like the trans-Siberian railroad, has international importance), branch airways run northwards to the newly exploited mining districts within and beyond the *taiga*—the immense northern forest—as well as southward to the new industrial, mining and farming areas of Kazakhstan, and into Mongolia. The Central Asian Soviet Republics are directly linked to Moscow through Kuibyshev, the focus of their airways being Tashkent, the largest city in Soviet Asia. A second west to east flying route follows the Arctic shore parallel to the Northern Sea Route, which it serves to reinforce. It is worth notice that the most northerly group of Russian islands, situated beyond Cape Chelyuskin, is little more than a thousand miles from Canadian territory, while a flight of

well under 3,000 miles across the Polar regions would link up existing Russian and Canadian airways.

The main stimulus to the development of civil aviation in Russia has been the lack of transport facilities, often even of roads, over a large proportion of the eight million square miles under the Soviet flag. The passengers carried are chiefly officials, scientists, engineers and other key personnel, and their total number, about a quarter of a million in a year, is of the same order as that recently recorded for Canada, a country comparable in respect of terrain, but less than half the size, and having not one-tenth the population, of the Soviet Republics.

Returning to a consideration of the southern routes from Cairo, it is worth note that a great circle drawn from that city to Singapore passes through the British Bahrein Islands in the Persian Gulf (rich in oil and pearls), and the city of Bombay. Owing to the pull of north India, however, the air-route enters it at Karachi, and goes thence to Delhi. From Delhi the distance to Sydney is about 6,500 miles, and the direct route runs through Malaya and the East Indies, so that with quite inconsiderable deviations from the great circle alignment, a chain of the principal cities, Rangoon, Bangkok, Singapore, Batavia and Port Darwin can be reached in succession. Their colonial status, as well as their geographical configuration—an archipelago of twenty large and thousands of small islands—marked the Dutch East Indies out for a vigorous development of aviation, assisted by the fact that they are rich in oil. Representing as they do the emerged portion of a huge mountain range rising from the sea floor, the Sunda Islands group are strung out into a line which provides an ideal pathway to Australia. It leads precisely to Darwin, from which the chief interior routes of Australia diverge.

The margins of the Pacific Ocean, representing the terminal points of flight from the west, are also the objectives—at least as far as their fringing groups, Japan, the Philippines, New

Zealand—of flying routes from the United States. The direct way from Washington to Tokyo, as the strip map (pp. 28 and 29) shows, is through Alaska, and the distance is over 7,000 miles. From the strategic standpoint (as the Americans discovered) the most direct approaches are of the greatest importance, but as regards civil aviation, the trans-Pacific flying routes are largely determined by the key position of the Hawaiian Islands. Situated about 2,400 miles from the United States coast this island group serves as an admirable, even (as will presently be shown) an essential, pier-head thrust forward into the ocean. Its position is analagous (given the difference of scale) to that of the Azores in the Atlantic Ocean. Since San Francisco happens to lie just mid-way along the direct line from New York to Honolulu, and since it is also the leading port and business centre of the Pacific coast, it has naturally become the starting-point for Pacific airways.

Honolulu does not, however, lie on the direct route between San Francisco and Tokyo, for the great circle joining these cities curves northward to within 300 miles of the Aleutian Islands. A very slight detour would allow its division into two convenient sections of about 2,700 miles each, the planes touching down at one of the new Aleutian airfields. This, however, is a decidedly bad weather route, particularly in winter, like its counterpart in the North Atlantic. Should a commercial route to Tokyo be established, it could more conveniently branch off from the mail route between Honolulu and Manila, the greater distance to be covered being offset by the better weather. By a happy geographical, or to be more exact, geological accident, the Hawaiian Group is extended by a long chain of islets of volcanic origin which (issuing from a fissure on the ocean floor) follow a great circle for 1,400 miles in the exact direction of Tokyo. Near the end of this chain is the American naval and air base of Midway Island, from which the hop to Japan is only about 2,700 miles. Should a way station be desirable, it is to be

found in Marcus Island, at present a possession of Japan, and 1,300 miles from their capital city. The airway from Honolulu to Manila goes by easy stages through Midway, Wake Island and Guam, the two latter early lost to the Japanese (but now recovered and certain to be retained), for the enemy had all the advantages of position. Yet, as recently as February 1939, the American Congress rejected a proposal to fortify Guam on the grounds that this "tiny island" had nothing to do with Manila, still less with the security of the United States.

Speaking generally, the great circle from Honolulu through Midway to Tokyo may be said to bound and define that part of the Pacific Ocean, the south-west, which is studded with countless islands. Because of these islands, air-routes might theoretically be established in any desired direction, meeting no obstacle unless it were a political or military embargo. Very different is the case in the eastern and north-eastern Pacific, the part which borders the Americas. Here there is a belt of ocean over 3,000 miles wide and extending for a matter of 7,000 miles from the Aleutians in the north to Easter Island in the south, in which there is not a single island. Only at one place does this empty stretch of water narrow down to a breadth affording a comfortable stage for commercial aircraft, and that is between San Francisco and Honolulu. It is this ineluctable fact, coupled with their possession of the Alaskan land bridge into Eastern Asia, that gives the Americans pride and power of place in Pacific aviation.

Starting from Honolulu, the Pan-American Airways route to the Southern Pacific heads direct for the Fiji Islands. A convenient half-way stage was found in Canton, an island in the British Phoenix Group. The United States Government laid claim to this island and its neighbour Enderby in 1938, and a few months later it was announced that the two countries, Britain and America, had agreed upon equal facilities in the islands for both parties in the field of international aviation and

communications, the question of sovereignty being left in abeyance for an indefinite period. From Fiji the American air-route goes to Noumea in New Caledonia, a French colony with specially valuable mineral resources in which America is interested, and thence on to Auckland, New Zealand. Auckland is linked to Sydney: the circuit of the world is thus complete.

III. GEOGRAPHICAL RELATIONSHIPS

GEOGRAPHY IN GERMANY

In the years immediately preceding the first world war, the Swedish scholar Rudolf Kjellén attempted a reply to the question: What constitutes a Great Power? Under the title of *Die Grossmächte der Gegenwart (The Great Powers of To-day)* his book on the subject went into no less than nineteen editions in Germany between 1914 and 1919. The last few issues must have been read with very painful interest, for of the eight States which Kjellén had initially classed as "great," the war had destroyed three and further exalted five. To fit the new situation the author rewrote his work as *Die Grossmächte und die Weltkrise (The Great Powers and the World Crisis)*. It had gone into a second German edition before he died in 1922. Six years later, when two of the broken Powers were showing new signs of life, General Professor Haushofer undertook to edit Kjellén's work afresh, not only as a tribute to the spirit of the dead Master, but to demonstrate the correctness of his prognoses. To this, the twenty-second German edition, he gave the title *Die Grossmächte vor und nach dem Weltkriege (The Great Powers before and after the World War)*.

Had a book of such a title originally been written in English, its author would certainly have been a historian or a student of politics, and the text would have contained but a glancing reference to geography. But to Kjellén and his disciples,

geography lay at the very root of the matter, and it is therefore not surprising that Haushofer called in as his collaborators in the necessary revision a number of distinguished academic geographers including Professors Obst and Maull, the former one of the founders (in 1924) of the *Zeitschrift für Geopolitik* (*Journal of Geopolitics*). Meanwhile, Richard Hennig, another well-known geographer, had published his general treatise *Geopolitik* (*Geopolitics*), of which a second enlarged edition appeared in 1931. So great was the interest now aroused in the subject that the author was begged on all sides, especially by educationalists, to produce a cheap, simplified and popular version, suitable as a text-book for the upper forms of schools, as well as for the general public. It is this little book, *Einführung in die Geopolitik* (*Introduction to Geopolitics*), necessarily more dogmatic in tone than its larger prototype, that perhaps should receive the greater attention of the two, on account of the part which it was intended to play in the education of German youth.

Neither Kjellén nor Hennig relied upon easily refuted assertions concerning master races, or blood and soil: their arguments and conclusions were based upon material and maps to be found in standard works of general and political geography. But there was a difference. Geopolitics may be defined as Political Geography charged with emotion, and thus containing implicitly or (as in the case of Haushofer) explicitly, a call to action. That is only to say that whereas in this country instruction in history and geography is given with complete detachment, lest writer or teacher be stigmatized as tendentious, in Germany life has been married to learning, and has produced an aggressive progeny.

GEPOLITICS AND PSEUDO-DARWINISM

The fundamental principle of Kjellén's geographical teaching was that a State is an organism, a form of life. The Great

Powers were the Aristocracy of States, and so the very highest form of life. States are therefore (in this view) subject like other living creatures to the Law of Life. They too must struggle for existence, and natural selection will decide the survival of the fittest. States, as Hennig pointed out, may be observed to arise, to grow, to produce progeny ("daughter States"), to reach a limit of growth, to languish, dwindle and die. But the truly great State, the Great Power, could escape death by refusal to accept any limit to its spatial growth: "Der Drang nach Raumerweiterung ist einer der elementarische, absolutesten Eigenschaften jedes lebenskräftigen Staates." (The urge to expand is one of the elementary, unailing characteristics of a virile State.) That the urge to expansion was the sign of greatness in a State was a doctrine learned and accepted not only by young Germany but by Japan and Italy besides. The Japanese are said to have been among the most eager of the disciples of Haushofer. If it were true that the Great State is a higher type of Being than man the individual, a Being that could only be nourished by an expanding Lebensraum, then war for space became the highest duty.

It is an unfortunate fact that, owing to the strongly humanistic bias of the education of the ruling classes in the western world, science is too often only introduced into affairs in some crude, distorted or out-of-date form. And very frequently the distortion lies in treating a figurative expression as a literal expression of fact. Much of the raw material of geopolitics derives from the great nineteenth-century German geographer Ratzel, whose emphasis on the "geography behind history" has laid him open to the charge of geographical determinism. Ratzel, it is true, pointed out that in many of their aspects States resembled organisms, but it was the geopoliticians who said that they actually were organisms and therefore subject to the laws of life as demonstrated by Darwin. Now for every thousand public (and private) men who excuse anti-social con-

duct by speaking (like Kjellén and Haushofer) of Nature's Law of the Struggle for Existence and the Survival of the Fittest, it is safe to say that hardly one has read the *Origin of Species*. Darwin was most careful to explain that he used these terms in a "large metaphorical sense" and added: "It is difficult to avoid personifying the word Nature; but I mean by Nature, only the aggregate action and product of many natural laws, and by laws the observed sequence of events as ascertained by us." The Germans are not alone in ascribing to the "observed sequence of events" (which fresh observations may at any time modify) the compelling force of laws conceived of in the moral and legal sense.

Here, however, it is only relevant to note that the supposed natural law of "Grow or Die" led those nations accepting it to a minute scrutiny of the globe in search of space. In particular, all those circumstances were examined which might be said to give to a nation the natural right to some particular territory. Such a right might be based upon colonization, upon ancient history, upon need, or even upon propinquity and physical configuration. A map of the Pacific Ocean published in Haushofer's edition of Kjellén (1929-30) shows the Japanese sphere as embracing both Hawaii and Singapore besides the Philippines and the Sea of Okhotsk. This was prior to the attack on Manchuria, and that it was no mere speculative illustration to an academic text-book is confirmed by the reported speech of a Japanese General in 1931: "With such wealth and resources (i.e. the Chinese conquests) at our disposal, we should then be in a position to drive away the United States to the east of Hawaii and Great Britain to the west of Singapore and to hold supreme power on the Pacific without any difficulty, while all the islands constituting the South Sea Archipelago now under Dutch rule, as well as the British Colonies of Australia, New Zealand etc., would be within easy grasp at our Imperial will." That is to say the Will to Great Spaces.

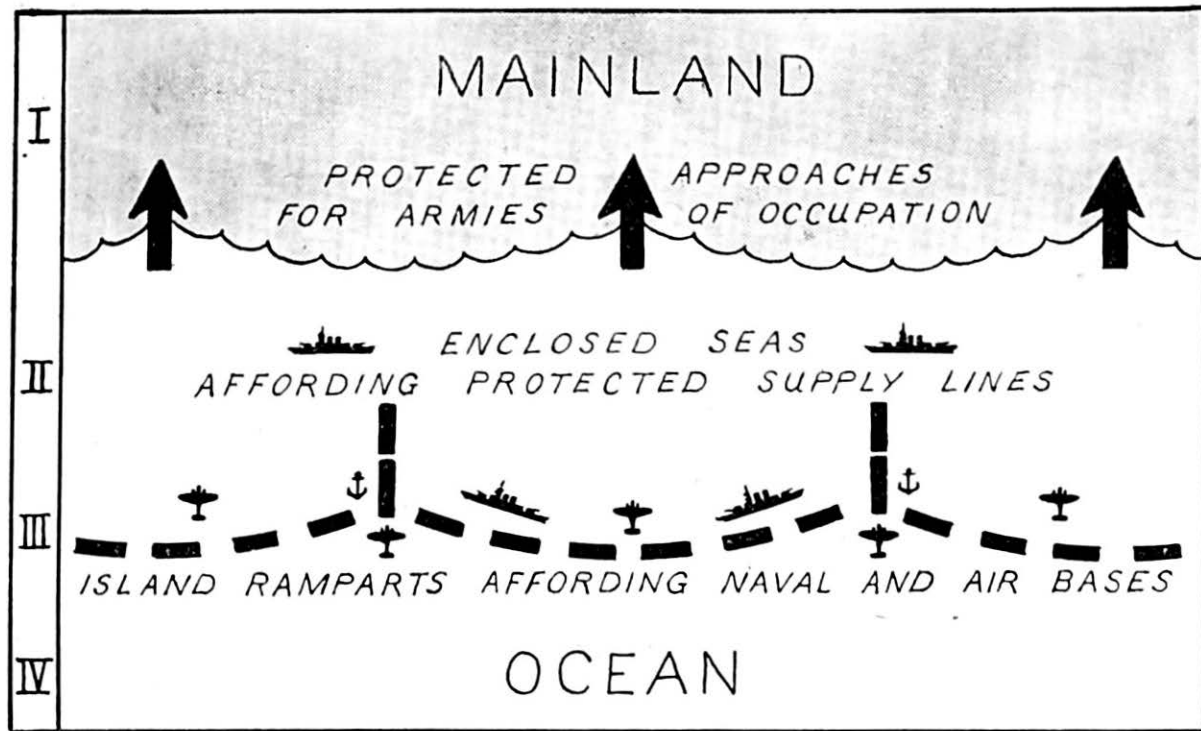


Fig. 6. From Alaska to Burma the Continental approaches are guarded by an outer peninsular and insular rampart enclosing a succession of Narrow Seas.

THE PACIFIC OCEAN

The idea that natural frontiers exist towards which a nation has a right to expand is not current among enemy powers alone. In the Pacific it might easily be argued that the natural frontier between America and Asia is that wide belt of empty ocean already described. Devoid of islands, it has served in actual fact as a zone of separation and of protection between American territory and the fighting front. In this view Hawaii would lie on the Japanese side of the frontier, forming part of the island world of Oceania. Certainly the Japanese are the largest single racial group in the islands, but they are for the most part immigrants since the date when the Hawaiian people themselves requested that their country be annexed to the United States. The concept of a natural frontier is closely linked, and indeed often confused, with that of a good strategic frontier, and by an obvious transition of ideas "natural" becomes identified with "rightful." The configuration of the western Pacific is certainly such as to suggest and stimulate, even help to implement, a plan for globe-wide conquest; for island follows island, and no natural barrier or boundary is to be seen.

This is specially true of the immediate continental margin, where from the Arctic Circle to the Equator, and beyond, there is a regular repetition of the same simple geographical pattern which as seen from Japan held immense strategic possibilities. Briefly (see fig. 4 and fig. 6) the continental mainland is everywhere separated from the open ocean by a succession of partly enclosed seas each protected and easily defended on the Pacific side by curving peninsular and island barriers. These loop-like barriers, swinging towards the mainland at either extremity, not only define and separate the marginal seas but lead to a sequence of straits and narrows that have great strategic significance. Moreover, since each unit is of moderate dimensions (of the order of 1,500 by 1,000 miles) the whole lay-out

lends itself to the technique of serial conquest, step by step, one at a time, which has proved so successful elsewhere.

Commencing in the Alaska Peninsula, and continuing through the Aleutians, the first arc ties in to the shore of Kamchatka, shutting in the Bering Sea and so covering the easy entries into the Yukon and Anadyr valleys. Near the Alaskan end the United States has a strong naval base at Dutch Harbour, while the corresponding Russian base is at Petropavlovsk, on Kamchatka, whence it is also possible to keep watch on the second island loop. The Japanese, after attacking Dutch Harbour, expected to move along the Aleutians step by step from the western extremity until they commanded the whole. Actually, however, they had delayed their enterprise too long. The Americans had awakened from the Mercator map view of the Aleutians to that shown on the strip map (pp. 28 and 29). In their turn proceeding step by step from the nearer end they had hastily created powerful air bases (supported by the Alaska Military Highway) in the islands hitherto completely unguarded. The Japanese got as far only as Kiska, from which, however, they were only dislodged after a year's interval, and at heavy cost.

The second unit in the repeated pattern commences in the Kamchatka Peninsula, and is continued without break by the Kurile Islands, which follow a running curve and then tie in closely to the north-eastern extremity of Hokkaido. From this large island the Japanese stepped northwards along the chain as early as 1875, and they now have a northern Gibraltar at Paramushiro, the last of the islands, in sight of Kamchatka. They look upon the Sea of Okhotsk, with its valuable fisheries, as home waters, but although they have gained from the Russians some concessions as regards fishing stations, the inner shores of the Sea on three sides north of parallel 50° N. are still under the Soviet flag. They give access to the great Lena and Amur basins.

The third unit commences in Sakhalin, which is separated by less than 20 miles from the continental coast and extends southward for over 700 miles to within sight of the north-western tip of the two-horned Hokkaido. From this point Japan itself forms the outer defensive (and offensive) arc, which at its south-western extremity approaches within sixty miles of the coast of Korea, the strip being further narrowed by an island at mid-distance. The southern half of Sakhalin was obtained by Japan after the Russo-Japanese war, while Korea was annexed in 1910 after a long period of virtual domination. In spite however of repeated threats and alarms the remaining 700 mile stretch of the shore of the Sea of Japan, including the valuable natural harbour and continental entry of Vladivostok, remains under Russian sovereignty.

The fourth geographical unit can be traced from the Korea Peninsula, through Kyushu (part of Japan proper) and the Ryukyu chain which ties in to the great island of Formosa, the enclosed East China Sea having a secondary inner basin—the Yellow Sea, and two innermost recesses, the Gulfs of Chihli and Liaotung, behind the Kwantung Peninsula. The Japanese moved along the Ryukyu chain in 1878, they took over Formosa from a helpless China in 1895, acquired the Kwantung Peninsula—at the inner gate—in 1905, and made Korea part of the Empire in 1910. Thus the whole outer arc, nearly 2,000 miles long, and facing in towards the entries to Manchuria, the North China Plain and the Yangtze Basin with the premier entrepôt of Shanghai, became Japanese. Expansion into this region so rich in all that Japan herself lacked, to Manchuria first, then Northern China, was the logical consequence. In the southern entry to the East China Sea the Pescadores narrowed the Formosa Strait and were fortified.

The fifth repetition of this almost monotonous geographical—and historical—pattern is drawn out upon a decidedly larger scale than its predecessors, and its exploitation was more dif-

ficult and consequently more recent. Commencing in Formosa, the outer protective barrier runs through the Batan Islands (part of the Philippines), Luzon, Mindoro, Palawan, Northern and Western Borneo, Billiton, Banka, and eastern Sumatra. The last-named swings in towards Malaya and so completes the enclosure of the South China Sea, and defines its southern entry through the Malacca Strait. Singapore, Bangkok, Hanoi, Hong Kong, lie within this barrier, which the Japanese made all haste to secure throughout its length after the attack on Pearl Harbour. After three years the Americans recovered Luzon, the key position in the arc, and then proceeded in turn to menace Formosa, to enter Palawan, to bomb and subsequently invade the Ryukyu chain, and to attack North Borneo at Tarakan and Labuan.

Unit six is even larger and less closely knit than unit five, but it appeared to lend itself to the same pattern of conquest. Here the continental shore enclosed and at one time threatened is that of Australia. The outer rampart, defining the Coral and Tasman Seas, is a double one. Commencing in the Bismarck Archipelago and New Guinea, it continues through the Solomon and Santa Cruz Islands, through the New Hebrides and New Caledonia, and then (across a gap of nearly a thousand miles) to Auckland Peninsula, New Zealand. With a strong base at Rabaul, the Japanese began to move along the chain, but the American landing on Guadalcanar put a term to this enterprise.

The seventh and last unit is in the Indian Ocean, and here the enemy met with better success, for the unit is relatively small. From the north-western tip of Sumatra, the Nicobar and Andaman Islands, prolonged by some inshore islets as far as Akyab, enclose the Andaman Sea and cover the sea entry into Burma by the Martaban Gulf and Rangoon. Normally a Dependency of India, the outer island arc was occupied by the Japanese when they over-ran Burma, now happily recovered.

THE INDIAN AND SOUTHERN OCEANS

The Japanese mastery, although only temporary, of an 8,000 mile long island chain, from Attu to Akyab, covering an almost equal length of protected supply lines by sea, and assisting spectacular continental conquests, is perhaps no less remarkable than the geographical feature itself. Neither phenomenon is a random one. The submerged mountain chains that form the borders of the marginal seas are related to stresses generated in the rigid Pacific floor by the literal physical shrinkage of the globe, while global conquests are related to the relative shrinkage brought about by flight. Beyond Akyab the Indian Ocean takes on its own individual form, and the massive tablelands of peninsular India, Africa and Western Australia would call for a new form of conquest, no doubt from a large-scale island base, a Ceylon or a Madagascar (fig. 7).

Considering this ocean as a unit, India itself is naturally the centre of interest and of most active traffic. Its industrialization, which should result in a rise in the standard of living and of purchasing power, will also be to the advantage of South Africa, Australia and such smaller communities as Mauritius, since their primary products are complementary to those of India. Colombo in Ceylon is the natural focus of routes from the south, which would there link up with Indian airways. From Durban the direct route is very conveniently broken into stages by the islands of Mauritius (having, like Natal, a large Indian community) and Diego Garcia in the (British) Chagos or Oil Islands Archipelago, a dependency of Mauritius. Coming from Perth, West Australia, the Cocos Islands, where there is a cable station, break the 3,500 mile journey to Colombo. This great trans-ocean flight can, however, be shortened by flying north along the West Australian coast to Port Hedland. This Port is also the natural starting point for an all-British route to East Africa, for there is a direct run through the Cocos Islands to Diego Garcia, and thence, using the Seychelle Islands as a half-

way halt, to Mombasa, where contact is made with the south-north route between South Africa and Cairo. The Seychelles, lying a thousand miles out from the African coast, might well play the part in the Indian Ocean that the Bermudas play in the Atlantic. They are within easy flying distance of Aden, Bombay, Mauritius, Tamatave (Madagascar) and Mombasa, and might be made attractive as a holiday centre.

Antarctic flying is probably much farther away in the future than Arctic flying, for enormous though the Antarctic Continent is, it is completely surrounded by an empty and very stormy ocean. Yet this ocean has proved a remarkable food base, being the major source of the world supply of whale oil from which edible fats are manufactured. Norway has played a principal part in developing this industry, although in the years preceding the war German and Japanese whalers made their appearance. Consequently Norway has been at pains to secure island and mainland bases, where radio stations can be maintained. Not without some demur on the part of the British Government (for one Captain Norris had raised the Union Jack there in 1825) the uninhabited Bouvet Island, lying far to the south of Tristan da Cunha was annexed in 1928. In 1929 "first possession" was taken of Peter I Island within the Antarctic Circle in the South Pacific. Ten years later Norway decided to imitate Australia and New Zealand by proclaiming sovereignty over a vast tract of the Southern Continent itself, a step that France too had taken a year previously. Partly because of easy definition on paper, partly because of a vague notion that a country has a "right" to extend its territory between its bounding meridians and the extremity of the earth's axis of rotation (the imaginary Pole), the territorial divisions of Antarctica consist of wedge-shaped regions all meeting at a point. Should any individual pitch his tent on the Ice Cap at the spot corresponding mathematically to the pole itself, he would be unavoidably resident simultaneously in Australian,

French, New Zealand, British Colonial and Norwegian territory, not to say American, if the United States annexes Marie Byrd Land. It is possible that in the distant future the South Pole may become a place of resort if only to watch the sun move horizontally round the sky; it is more probable, however, that with a growing appreciation of the importance of meteorology, and of the methods of long-range forecasting of the weather (and hence of the harvest) the first Antarctic settlements will be meteorological stations. In connection with the whale fisheries, too, much biological and oceanographical research has been carried out which demonstrates the richness of these waters in animal and vegetable plankton of high nutritive value. Leaving speculation aside, it is worth recalling that when island bases were selected in relation to sailing routes steamships were undreamt of, when they were selected as cable stations wireless telegraphy was undreamt of, and it would be dangerous to dogmatize about the uselessness of any part of the globe.

THE ATLANTIC AND ARCTIC OCEANS

The Atlantic Ocean, as the little map (fig. 7) clearly shows, is like a long S-shaped corridor, leading out of a small ante-room, the Arctic Sea—a sea rather than an ocean. It was claimed by the late Alfred Wegener that just as the examination of the two torn halves of a visiting card would lead to the certainty that they had formerly been united, so an examination of the two sides of the Atlantic Ocean made it clear that the Americas had parted from the Old World and swung slowly away to the west and north. Certainly the shoulder of Brazil would fit sufficiently well if drawn back into the Gulf of Guinea, and this jutting shoulder is of the highest importance in the geography and history of the Atlantic. The Portuguese mariners, taking a wide sweep to avoid head winds, discovered it accidentally on their way to the Cape, and the Pope's Line was

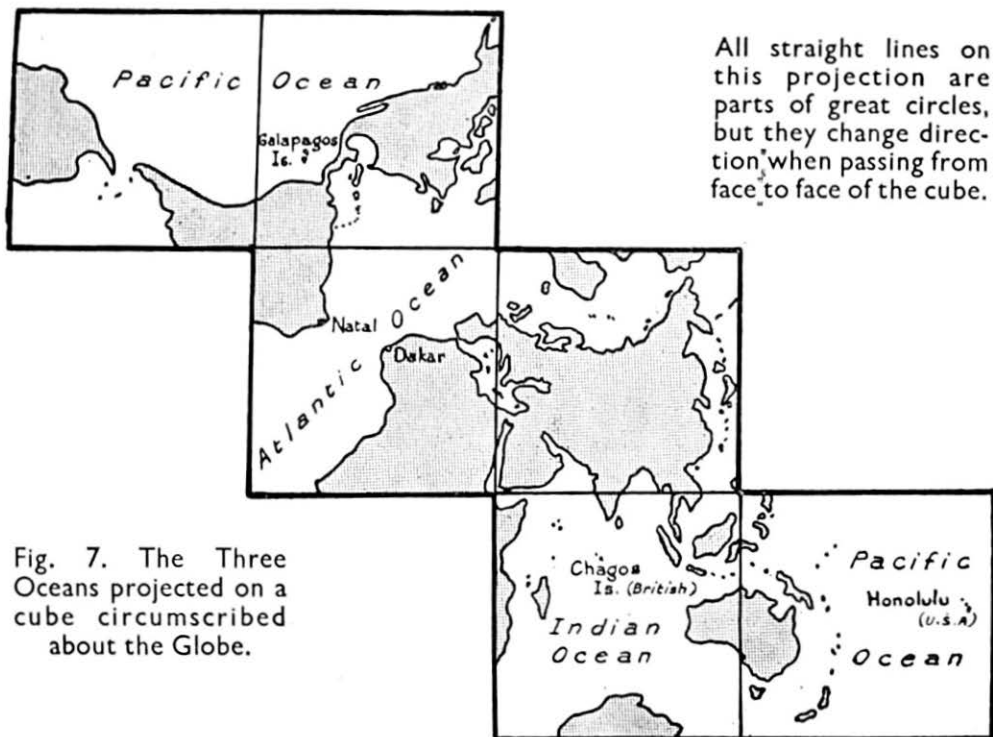


Fig. 7. The Three Oceans projected on a cube circumscribed about the Globe.

All straight lines on this projection are parts of great circles, but they change direction when passing from face to face of the cube.

shifted so that it should be lawfully Portuguese and not Spanish. Nearness to West Africa meant that Brazil participated in the slave trade, so that there is a strong negro element in the population, but racial discrimination has never been practised, and there are considerable German, Italian and even oriental groups among the forty million Brazilians, a great people in the making. We in England owe a great physical debt to this shoulder of Brazil, for it diverts from the Southern Hemisphere the mighty stream of warm water that at long last reaches our shores as the Gulf Stream Drift. At the present day, however, its configuration is chiefly interesting in respect of airways, for the run of the Brazilian coast from the Tropic of Capricorn northwards is almost exactly picked up along a great circle by the run of the West African coast northwards from Dakar. The ocean crossing on this circle is well under two thousand miles, with good weather to be expected all the way, and it is decidedly the easiest Atlantic crossing. From Natal, the Brazilian terminus, one main route continues south-westwards to Rio de Janeiro and Buenos Aires, a second by Para and Georgetown to Trinidad, where it joins the American route from Miami which has followed the island chain of the West Indies. The distance from Natal to Trinidad is considerably over 2,000 miles, and from Trinidad a direct flight to New York by way of the Bermudas would be nearly 2,400 miles more. The great inward sweep of the Atlantic between the two Americas has, in fact, the effect of making the flying distance from Natal to London almost the same as from Natal to New York.

Between Trinidad and Florida the margin of the Atlantic takes on an aspect strongly reminiscent of the Pacific, a curving chain of islands covering an almost enclosed sea, the Caribbean, and controlling a very important entry. In this case, however, the entry is to another Ocean, by the Panama Canal. By leasing bases in some of the British islands, the United States was enabled to cast a protective semi-circle about this ab-

solutely vital point, the seizure or destruction of which would have necessitated the immense journey about Cape Horn for vessels and supplies destined for the Pacific theatre of war. Had the chief menace come from the Pacific side the position would have been very difficult. Here the only island group is the Galapagos, a thousand miles from the canal, where the United States has leased a base from Ecuador, the "owner" of the group.

Apart from the West Indies, the Atlantic is not very rich in oceanic islands, and consequently the importance of the few that exist is enhanced. The functions of Iceland and the Azores have already been touched upon. Madeira and the Canaries do not stand out very far from the African shore, but the outermost islands of the Cape Verde archipelago lie over 500 miles out to sea, supposing an alternative to the route across French territory were desired. From the Dakar region (both Great Britain and Portugal have colonies very near at hand) the direct route to Cape Town is over 4,000 miles, but the island of St Helena breaks it into two practicable sections. The saving of distance as compared to the present route through West and Central Africa is of the order of a thousand miles, but that of time would be more considerable. St Helena (like Ascension Island, which has played its part in war-time aviation) is one of those islands whose earlier function as a way-station for shipping has vanished, but no one has a clear picture as yet of how close-meshed the future network of airways will be, so that these lonely islands may continue to languish except where some special beauty or interest might make it worth while to develop them as tourist resorts, reached by air. Even in a flying age, Tristan da Cunha, for example, remains on the route to nowhere. Yet it is under 2,000 miles from Cape Town, and need no longer be left unvisited for years.

A globe view of the 2,000 mile long, 1,000 mile wide entry from the Atlantic Ocean proper into the Arctic Seas shows that

its trend is at first south-east north-west. On the right hand is the run of the wild broken coast of Britain from the Mountains of Mayo, past Cape Wrath to the tip of the Shetland Islands, taken up again by the Norwegian coast and skerry guard as far as Trondjhem Fiord. Exactly matching in trend and configuration (so that Wegener may be correct) is the Greenland Coast between Cape Farewell and Scoresby Sound. Neatly spaced across the thousand mile gap; between the Shetland Islands and the Greenland coast, the Faroes and Iceland have a strategic value that our seamen know at firsthand. Beyond Trondjhem and Scoresby the trend of the passage alters to more nearly northerly, and mid-way between its opposite walls lie Jan Mayen and Spitzbergen, the latter a further example of Norway's keen sailor eye. Not without sharp dispute was this No Man's Land finally yielded to Norwegian sovereignty in 1920, for it is a rich prize, with great seams of coal actually visible in the cliffs. Beyond it, in the same medial line, Fridtjof Nansen Land becomes a "possession" of the Soviets, following an announcement that they consider as Russian all lands "discovered or to be discovered" (as the Renaissance explorers used to phrase it) between their own shorelines northward to the mystic pole, where north suddenly becomes south without a turn of the head.

The passage-way just described is also a sea-way, by grace of the Gulf Stream Drift. But what goes in must also come out, and a great counter-stream of ice and ice-water moves towards the Atlantic, pressed against the coast of Greenland, Canada knows with what results!

IV. CONCLUSION

Reviewing all that has been said above it may be concluded that the most fundamental geographical factor in human deve-

lopment is accessibility, since without accessibility resources are valueless. The most important strategic factor is then seen as control of accessibility, while aviation presents itself as having revolutionized accessibility.

It is therefore interesting to find that the theme of the oldest work on Geopolitics in the English language was precisely this, the master card held by the nation that could control accessibility. In the days of Henry VI, when the *Libel of English Policy*¹ was written by a government official, the marts of Flanders and Brabant were the centre of world commerce, and access to them was by the English Channel. This access the English, who held both Calais and Dover, could forbid:

“We should them stop, and we should them destroy,
As prisoners we should bring them to annoy,
And so we should of our cruel enemies
Make our friends, for fear of marchandies,
If they were not suffered for to pass
Into Flanders . . .
The end of battle is peace, sickerly,
And power causeth peace finally.”

That history is determined by geography is a hypothesis not difficult to refute, but innumerable historical instances can be found where, as in the case of the rapid over-running of the Pacific by the Japanese, the geographical factor was one of cardinal importance. Professor George T. Renner, of Columbia University, goes so far as to say: “Many, if not most, of the issues and situations which cause war are geographical.” And he adds: “The use of political geography (i.e. Geopolitics) by the Axis Powers does not indicate that geography is bad, but it does show that the application of geographical thinking to politics and war is so useful that it made the otherwise hopeless schemes of Germany, Italy and Japan almost succeed. Mean-

¹Printed by Hakluyt in *The Principal Voyages of the English Nation*. London, 1598. Modern Edition, *Everyman's Library*, 1907.

while the democratic nations have been most ungeographical in their thinking . . . Possession of a working knowledge of political geography on the part of national leaders and diplomats is an absolute essential for maintaining international amity and profitable intercourse between nations." Which, *mutatis mutandis*, is precisely what the Greek writer, Strabo, said in introducing his geography text over nineteen centuries ago.

If the Allied Nations are resolved to undertake the re-education of Germany, they must at least equal their pupils in geographical learning. Richard Hennig taught no blind geographical determinism: "Das unberechenbarste Element selbst in den ganzen mathematischen Gleichungen der Geopolitik ist *der Mensch selbst*" (The most incalculable factor in the mathematical equations of Geopolitics is Man himself); and he goes on to point out how often "ein überragendes Genie in die Speichen griff und das Rad der Geschichte nach seinem Wunsch und Willen drehtel" (a surpassing genius grips the spokes and turns the wheel of history according to his own good pleasure). Hitler had not yet seized the helm and begun to make history when these words were written, but the way was being prepared for him, and in his concluding words Hennig bids his young readers lay aside all thoughts of Pan-Europa or universal brotherhood as Utopian dreams: "Gegenwärtig jedenfalls sehen wir, dass diejenigen Völker in der Welt am weitesten kommen, die am entschlossensten und lautesten den Staatsgedanken bejahen . . . *Diener des Staats* zu sein ist . . . das schönste Ehrenkleid für jeden Staatsbürger" (At any rate we see now that those peoples succeed best in the world who affirm most resolutely and clearly the purposes of the State . . . To be a servant of the State is the highest honour open to any citizen). It is not such a conception of duty to the State, but the geopolitical idea of the State itself that must be shown to be at fault. The doctrine of Haushofer that States are organisms which must engage in a life and death struggle for *Lebensraum*

cannot, nevertheless, be eradicated by merely denying that it is true, but rather by taking such action as will demonstrate that a world at peace is not necessarily, as it was between the two world-wars, a world of poverty, depression and unemployment. Only a widespread increase in production, consumption and trade can even begin to rid the world of want, and this involves stepping up the capacity to produce, both by means of more widespread industry and by the mechanization of agriculture. Yet a doctrine is widely held among the advanced industrial countries that while not a natural, it is yet an economic "law," that states should engage in a life and death struggle, not indeed for space, but for markets. Consequently they fear the industrialization of countries such as India, China and those parts of eastern and south-eastern Europe where perpetual poverty is the consequence of an economy too dependent upon peasant agriculture, and where "concealed unemployment" results from holdings too tiny to occupy the time of their owners, or to give them more than a starveling livelihood. Economists have demonstrated the falsity of this view, always provided that the old industrial countries keep themselves flexible and adaptable, ready to make the fullest use of what the young industrial countries lack—the widespread scientific and technical knowledge and skill among their peoples.

It is natural that the realization that the future depends upon the dovetailing of national economies into a world-economy should give rise to sensations of fear, and Sir Halford Mac-kinder has gone so far as to suggest that it is fear of the new concept of "one world" that has precipitated the present struggle.

"Is not the crisis of to-day, which penetrates into every human activity and almost every larger thought, essentially geographical in its origin? Mankind has suddenly become world-conscious and has taken fright. The nations have run to their homes and are barricading their doors. They have

realized that henceforth they must live in a closed system in which they can do nothing of which the repercussion does not come back upon them from the very antipodes. In an age that may become cruel, because imprisoned, their first impulse has been to make sure of their castles of refuge."

The revolution in accessibility can transform humanity into two thousand million enemies, or alternatively into two thousand million neighbours!