

**ENVIRONMENT
AND RACE**

BOOKS BY GRIFFITH TAYLOR

A. GEOGRAPHY.

- Australia, Physiographic and Economic.* Oxford, 1911.
A Geography of Australasia. Oxford, 1914.
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B. METEOROLOGY, &c.

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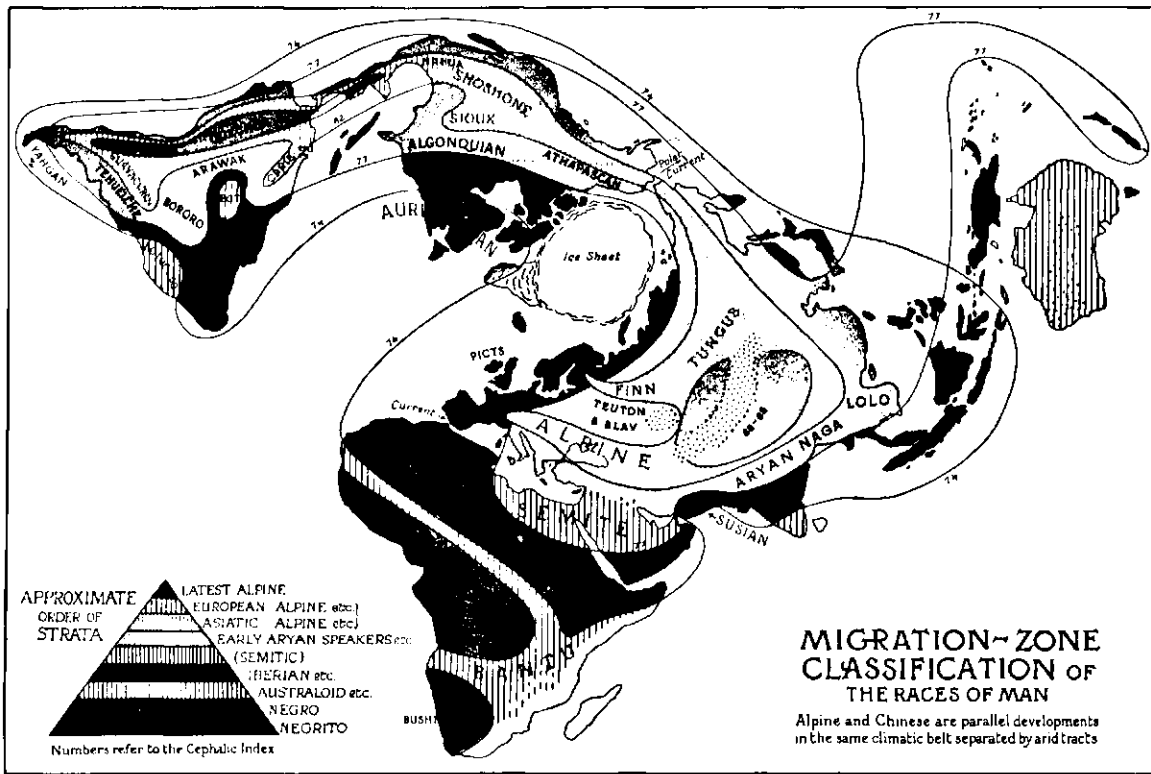
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- The Archeocyathinae (Cambrian Corals).* Adelaide, 1910.

E. ETHNOLOGY.

- Environment and Race.* Oxford, 1926.

* Joint Author.



The Zones are generalized, and based on the primitive races in the regions

'Semitic' is a later variety of the Iberian zone

(The map is slightly modified from that given in the author's paper in the American 'Geographical Review' of 1919)

ENVIRONMENT AND RACE

A Study of the
Evolution, Migration, Settlement
and Status of the Races
of Man

By

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PREFACE

THE past half-century has been marked by the conclusive establishment of the theory of organic evolution. Hence Biology is now largely experimental, and in this science the *method* of the evolutionary processes is being investigated. There is little doubt that evolution in great part resulted from a *varying environment*, and I believe that research from this latter point of view will bulk more and more largely in the near future. For this reason, in Part I of the present book I have dwelt rather fully on the changing environment in Quaternary time, even where at present its effect on racial evolution is not yet more than indicated.

The other three sections of this study of Environment and Race are largely based upon three papers which have already been published. Since, however, the views herein elaborated will be novel to many students, I may be allowed to point out that the explanation of the evolution and migration of the races of man in Part II was first given in the *American Geographical Review* in 1919 and 1921. It has been adopted by Ellesworth Huntington in his recent book, *Character of Races*, for the following reasons. He states :

‘ Taylor for the first time advances a broad anthropological hypothesis which is in harmony with the facts of modern geography, and also with the facts

proved by geology as to the evolution of the great families of mammals. I am surprised at the way in which Taylor's conclusions accord in the main with those to which we have been led in previous chapters on the basis of paleontology, ecology, and geology. Another reason for believing that Taylor's main thesis is correct is that Willis in his remarkable study of *Age and Area* has demonstrated with mathematical precision that, other things being equal, the oldest families and genera of plants are also the most widely distributed. . . . Another important confirmation of Taylor's hypothesis is that Dixon [in 1923] has independently come to the same generalization, although his methods and temperament are absolutely different from those of Taylor, and many of his facts are drawn from different sources.'

As regards the section dealing with the Australian Environment (Part III) it is an amplification of the presidential address given to the Geography Section of the Australasian Association for the Advancement of Science in Wellington, N.Z., in 1923. The conclusions are less roseate than those held by most of our politicians and publicists, but they are accepted by almost all scientific Australians. They have developed as the result of sixteen years' research in problems which are much more susceptible of proof than is the domain of comparative ethnology; for they are founded on the readily ascertained facts of rainfall, temperature, and growth of settlement.

The last part is concerned with Future White Settlement. This is obviously somewhat speculative, but is adapted from my paper in the *American*

Geographical Review of 1922. It has been extensively discussed and the conclusions generally accepted and used in later publications by Dr. Isaiah Bowman, Raymond Pearl, and others.

I have to acknowledge my thanks to those responsible for permission to adapt the three papers specified, and especially to Dr. Isaiah Bowman for his encouragement and help in my research during the last six years.

I am greatly indebted to Sir Arthur Keith for his assistance in seeing the book through the press, a matter of great difficulty to a writer living in the antipodes. To Sir Harry Johnston I owe a number of valuable photographs of ethnological types which he very kindly lent to me for publication. The Trustees of the British Museum have also been very kind in this direction. Finally, my demonstrator, Miss D. R. Taylor, in addition to reading proofs, has helped me very materially in a secretarial capacity.

I fear that some of my diagrams have little artistic merit—but I believe that many readers will excuse this defect since it enables them to make use of the author's actual sketches.

Tokyo, 1926.

G. T.

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GUIDE TO RACIAL PHOTOGRAPHS ON PLATES II TO VI

Zone.	Africa.	Australasia.	Asia.	America.
ALPINE	—	Tonga III	Tatar VI Javanese III	Salish III
INTERMEDIATE	—	Gilbert Is. VI Tikopia III Maori III	Japanese VI Malay (a) III Malay (b) III	Fuegian VI
AUSTRALOID	—	Australian (a) III Australian (b) VI	Pariyan (of Mysore) IV Veddah VI Sakai III	—
NEGROID	Uganda IV Gold Coast IV Berg Damara IV Hottentot IV Hottentot VI	Buka IV (N. Solomons) New Ireland IV Fijian III Tasmanian III	Semang III	—
NEGRITO	Bushman (a) IV Bushman (b) IV Pygmy (a) VI Pygmy (b) II	—	—	—

N.B.—The above are arranged approximately in order of evolution (i. e. earliest stratum below).

I

INTRODUCTION

I

THE SCOPE OF THE BOOK

THE world problem of to-day is the adjustment of the nations to the crowding which for the first time in history is affecting the whole earth. While every branch of research is necessary to assist us in a satisfactory solution of this great problem, the conditions are so different from any which have obtained before that we must be cautious of following too blindly the methods which have more or less satisfactorily carried us through crises in the past. For, in addition to a remarkable restriction in the resources of the world, we have an equally remarkable increase in the aspirations of various backward races. These races have hitherto been too ignorant of other peoples and other countries to realize their own potentialities. To quote concrete examples, we have on the one hand the United States strictly limiting the influx of all immigrants, whether cultured or otherwise; on the other hand we have millions of Indians and millions of Chinese realizing that their standard of living is immeasurably below that of peoples with less valuable natural resources and a much lower average of human industry. In the present stage of human evolution we find that national power depends more and more on these two material factors, resources and industry. In the long run an infinite capacity for taking pains will determine the status of the nation as surely as it determines that of the individual.

In the past it has been usual to explain national progress largely in terms of military power, religious beliefs, and sagacious rulers, as witness almost any history written in the nineteenth century. It would be foolish to deny the great influence of these factors, but there is a growing school of thinkers who believe that the environment is at least of equal importance, although the study of this factor has been neglected in the past. This neglect is a natural one, since it is only within the last half-century that the environments of the

various peoples have been understood at all adequately. Further than this, many scientists are coming to the conclusion that it is the *variation in the environment* which is the most potent factor of all in influencing human evolution, whether biological or social. An adequate discussion of this concept is so recent that the number of important English text-books on the subject may almost be counted on the fingers of one hand, but two of the most valuable may be mentioned even at this early stage. They are Ellsworth Huntington's *The Climatic Factor*¹ and C. E. P. Brooks's *Evolution of Climate*.²

We shall not progress far unless we recognize that in essence primitive man and, to a great extent, civilized man are controlled by exactly the same fundamental factors as are the other members of the animal kingdom. In the mass they are conservative and prefer the known to the unknown. The main objective of man is to procure sufficient food and shelter to ensure the survival of the race. Only when conditions become uncomfortable owing to overcrowding or to a change for the worse in the environment does the tribe or emigrant leave the familiar homelands. A vast amount of evidence has accumulated of late showing that during the time of man on the earth it is this last neglected factor (the changing environment) which has led to many, perhaps most, of the migrations, aggressions, and wars which constitute so much of the history of man both in the earlier and later stages of his evolution.

As we shall see in later chapters, it is the climatic change which has affected man most directly in the past. It is much the same to-day. Famines due to drought are more disastrous to man than wars, which, however, are often indirectly based on the same phenomenon. One school of biologists following W. M. Matthew³ refers the whole course of mammalian evolution to those climatic changes which have occurred most markedly in the largest land-mass, the continent of Asia. As a result of these changes in the environment the various orders of animals have been thrust out from Asia in great waves or migrations. If this is true for the Carnivores and Ungulates,

¹ *The Climatic Factor, as illustrated in Arid America*, Washington, 1914.

² *Evolution of Climate*, London, 1922.

³ *Climate and Evolution*.

it must be true for the Primates, including that section which comprises the Races of Man.

One of the main objects of this book is to demonstrate that primitive man, being subject to the same laws as other animals, has evolved and migrated in response to similar stimuli. He has been affected throughout in the same fashion, so that we find a distribution of the ethnic types which indicates a racial history almost precisely the opposite to that which was taught during the nineteenth century. We were led to believe from the older text-books that the centres of human evolution were those places where the most primitive races are found to-day. Thus Central Africa and Australia were favourite 'cradles of the human race'. The new ethnology teaches that the most primitive races are to be found *farthest away* from the centre of evolution of the human races. Throughout the ages the fundamental law of the survival of the fittest has obtained, but it may be expressed more exactly as regards man by the phrase 'the weakest goes to the wall'. The fittest tribes evolve and survive in the most stimulating regions; i. e. where living is not so hard as to stunt mental development, and not so easy as to encourage sloth and loss of initiative. The least fit are ultimately crowded out into the deserts, the tropical jungles, or the rugged mountains.

Since, however, this 'crowding-out' is still occurring, we should expect to find (and *do* find) that there are a few primitive peoples still living in attractive lands, provided they be so far *distant* from the cradle-lands or centres of evolution that the fitter races have hardly reached them. These primitive people are doomed to extinction, however, as we have seen in the case of the Tasmanians, the last of whom died in 1876. To quote another example, the aborigines in Victoria and New South Wales are reduced to 120 and 1,200 respectively; and a chart of their death-rate shows that these tribes are unlikely to last fifty years.

I have now indicated some of the problems which I propose to discuss in the following chapters. Since the distribution of man depends so largely on the environment, it seems logical to commence by a brief survey of the world, which will draw

attention to the very definite 'plan' which underlies the arrangement, structure, and surface features of the continental masses. We shall see that Asia may be looked upon as the central land from which extend three great 'peninsulas'. These are the Eur-African peninsula, the Australasian peninsula, and the American peninsula.

From the ethnological point of view it is sufficient to study only the salient geographic features, such as the distribution of mountains, forests, deserts, and grass-lands. These are arranged in a fairly symmetrical fashion in zones around the North Pole. This zonal arrangement has a great bearing on the distribution of man, which indeed is in no small degree directly consequent upon it.

As to the controls which dominate the distribution of man, they have obviously changed to some degree in modern times. The mingling of races is taking place so rapidly to-day that we are apt to feel it is impossible to disentangle the strands which are forming the web of civilization. But modern civilization may be conceived as starting with the sixteenth century. From the point of view of the student of world settlement this was an epoch ranking with that which marked the change from paleolithic to neolithic times.

In Pre-Columbian times the races were compelled to migrate slowly. The greatest speed was that of the nomad, and he was obviously blocked not only by the seas, but to a large extent by the deserts, mountains, and dense forests. But the discoverers of the vast empty areas of America, Siberia, and South Africa, and later of southern Australia, 'turned the flanks' of all these obstructions. Their voyages led to the establishment of distant nuclei of white settlement which soon disturbed that relatively simple arrangement of the peoples of the world which had obtained before the sixteenth century.

It will therefore be found very helpful in our study if we consider the distribution of man during two periods of history. First of all the Pre-Columbian Period (Part II herewith), and secondly the Period of Modern Migrations (Parts III and IV). This division is the more useful in that it should help to free our minds from that natural but erroneous national prejudice

which makes most of us imagine that *our own race* is necessarily the highest in mental, moral, and physical status.

It cannot be too greatly stressed that the feeling of superiority which dominates the so-called 'white' races is a growth of the last few centuries. It was certainly not warranted in Pre-Columbian times, and was not entertained by the humble Europeans who first came in contact with the Indian and Chinese empires (see Fig. 53). Whatever determined the ethnological status of the various races, it was certainly not the industrial revolution of the last hundred years, which is the chief reason for the material superiority of the white races to-day. We know that the races were differentiated before the dawn of civilization. Indeed one result of the study of the distribution of man is to lead the writer to the belief that the so-called 'yellow' or Mongolian type of man is a later product of human evolution than many western members of the so-called 'white' or European type. In other words, the Eastern Asiatic is farther from the primitive anthropoid stock, while the negroid and West-European peoples are earlier, lower offshoots from the line of human evolution.

It is obvious that if we are to understand the migrations of primitive man, which led to the Pre-Columbian distribution of races, some knowledge of the criteria upon which ethnology is based is necessary. There is, unfortunately, no unanimity as to the classification of the major races. In the present work skull measurements and hair texture are considered of basic importance and in association with the environmental factors (such as climate and topography and their changes) furnish the best evidence of racial affinities. It is believed that much new light is thrown on a vexed question by this association of criteria; which indeed has been used with great success by Ripley in his study¹ of one relatively small region of the world.

When the general world-environment and the ethnological criteria have been discussed, the study of the distribution of primitive man in Australasia is entered upon. First of all a more particular account is given of the remarkable changes in the environment off the south-east corner of the Asiatic

¹ *The Races of Europe.*

cradle-land. It is shown that great areas in the East Indies have been submerged since man lived in these regions. Even more important are the changes in climate and vegetation of which the evidence in Australia is no less striking than in better-known regions of the world. Much of the confusion as to the ethnology in the Melanesian islands would seem to be due to the attempt to group all the inhabitants of the islands together. In point of fact these islanders include races perhaps as little allied as are Bushmen and Swiss Alpines. A series of zones is shown to exist in the East Indies and in Australasia, which is so arranged that the most primitive are found farthest from Asia, and the most advanced nearest to Asia. This distribution about Asia is shown to be true in the other 'peninsulas', and is of fundamental importance in discussing the evolution and ethnological status of the peoples concerned.

The Eur-African peninsula is now considered. Here the racial types have been fairly well investigated. We know that the term 'European' has no value as an ethnological distinction. Thus the Savoyard of Eastern France is akin to the wild tribes of the Pamirs, but not to the primitive peoples of the Dordogne only two hundred miles to the west. The Corsican is much more nearly allied to the Cornishman than to the Italian peoples of the adjacent Alps. In Wales, we are told, there are small groups still essentially allied to Neandertal man.

The races of Europe can be 'zoned', and the three major races are distributed around Asia in the same fashion as we have shown that the peoples of the East Indies and Melanesia are arranged.

In Africa we are dealing with the most numerous examples of primitive peoples. To borrow a term from the spectrum of physical science, here the colour-bands are broadest and it is easiest to trace their relations *inter se* and to the adjacent higher races. The inhospitable environment of the most primitive peoples is markedly exhibited. Indeed in the inaccessible negrillos of the Congo forests we almost certainly find the most primitive type of man extant.

The peoples of the Asiatic 'Centre of Development' are considered next. This is the land of greatest extremes of climate

and topography. We have good reason to believe that it also exhibited the greatest changes in environment in the past. Whichever region we consider, Africa, Europe, Australia, or America, we find that the major migrations have always been from Asia. The dominant feature of its ethnology is the solid mass of broad-skulled peoples in Central and East Asia. A great wedge of these folk projects into Europe and constitutes the European *Alpine* peoples. A somewhat similar wedge of peoples projects down the 'corridor' of migration along the western side of the Americas. A third wedge reaches south from China into the East Indies. All round the margins of these broad-heads we find a 'shatter-belt' of long-head peoples. Thus on the south it extends from the Alps through the Caucasus and Himalayas to the Indonesian Islands and Melanesia.

The next chapters deal with the American 'peninsula'. The novel conclusion (which was first published in 1919¹) is arrived at that the aborigines are for the most part more closely allied to the West Europeans than to the typical 'Mongolians' of Asia. In fact they represent the relics of a zone of peoples who once occupied the eastern coastlands of Eur-Asia just as their congeners still occupy the western coastlands of the same land mass.

The last ethnological chapter attempts to weld all these results. It shows that it is not enough to link the northern folk of India with the European peoples. We must prolong this zone to include not only many of the peoples of Burmah, South China, and Indonesia, but also the peoples of many of the Melanesian isles. Furthermore, the Polynesian peoples are akin to the Alpines of Europe, and are to be allied with most of the Amerinds on the American continent. In other words, the peoples and environments of each continent must be treated as those of Europe have been treated, and we find that exactly comparable zones occur in them also. It has even been suggested that there are traces in America of aborigines akin to the Melanesians and so ultimately to that great group of humanity to which the negroes belong.

¹ 'Climatic Cycles and Evolution', by Griffith Taylor. *American Geographical Review*, Dec. 1919, New York, pp. 289-328 (14 figs.).

The unprejudiced reader will feel, I believe, after a consideration of Part II, that a strong case has been made out for the superiority of the broad-headed peoples living now or lately in the central areas of Asia, the cradle-land of the peoples of the world. The great migrations have been thrust out of Asia in four great waves during the million years of Post-Pliocene time. An attempt is made to correlate these thrusts with the four advances of the Great Ice Sheet from the Pole, which occurred within the same period. The explanation is admittedly far from complete, but the writer knows of no other theory which supplies so adequate a 'mechanism' to account for the migrations.

Having discussed the migrations of the peoples in Pre-Columbian days in Part II, in Part III we consider the effect of the environment upon man in modern times.

Probably Australia offers a region where the problems of human settlement are less hard to solve than in any other new area of equal size. Here the poor resources of the arid interior and of most of the tropical coasts are the chief difficulties preventing white settlement. The aboriginal population is negligible in this connexion, but the economic pressure of the millions of Asiatics to the north is a factor always in the minds of Australian statesmen. Yet the problem of adequate occupation is important, for there are only about 9,000 settlers in one and one-quarter million square miles in the centre and north, practically one-half of the area of the Commonwealth.

In Part IV the deductions made in earlier chapters are carried to a logical if somewhat speculative conclusion. An attempt is made to forecast the distribution of man a century or two hence. The writer indeed hopes that this section may be found to be a useful scientific contribution to world politics.

It is assumed that Europe with its 400 millions is now fairly saturated with white peoples. The distribution of peoples in Europe is based on physical controls such as temperature, rainfall, coal, location, &c., which can be approximately evaluated. In this discussion the world is divided into 76 'natural regions' and their environments are classified in terms of the principal physical controls. By a graphical method *lines of*

equal habitability are then drawn on the map of the world. In Europe these are equated with the present *lines of equal population*. In this fashion it is possible to estimate how many white people can settle in South Africa, Australia, and America before it is saturated to the extent that Europe is to-day.

The status of a nation depends essentially on the natural resources and on the numbers of her people. Thus this last section gives us at least an approximation to the status of each of the regions of the world.¹

It would seem to be clear that the centre of the white races must move to the lands discovered since Pre-Columbian days. Thus the North American region will lead, followed by Europe, South America, South Africa, and Australia. The most significant conclusion is in accord with the deductions of Pearl, Knibbs, East, and others, and indicates that all the useful lands of the world will be fully saturated within two or three hundred years.

¹ Asia is excluded because the standard of living of Chinese, Indians, &c., is so different from that in Europe, and their rates of increase are not at all well known.

II

THE GENERAL WORLD-PLAN

THE student who wishes to obtain a knowledge of the various environments of man is likely at first to be bewildered by their apparently infinite variety. I find it useful in my lectures to assure my students that when the principles determining the environments in one continent are mastered, those of the other four or five will be found to be much the same. We may compare the great land areas to the four suits in a pack of cards, the arrangement in one suit is repeated in the others. In effect, there is a general world-plan.

(a) *Topographic Plan.*

From the point of view of the distribution of man it is probable that the customary choice of world-maps in which the Atlantic Ocean is in the centre and the Pacific Ocean at the margins has distinctly hindered the progress of ethnological research. For the Atlantic has been a barrier between the New and Old Worlds throughout the ages until the time of Columbus, if we except the abortive voyages of Leif the Norwegian in A. D. 1000. On the other hand it is generally believed that the Behring region has been a great corridor of entry from Asia into America right through late Tertiary times; and indeed, as I have suggested in the Introduction, America is to be looked upon as an eastern peninsula of the Old World.

However, a form of *Polar* projection (as used by Matthew) is undoubtedly best for our preliminary study of the world-plan. Such a map is given in Fig. 1. It shows very clearly the central Asiatic land-mass with the three great continental 'peninsulas', America to the north-east, Eur-Africa to the south-west, and Australasia to the south-east.

The map shows that the dominant highlands run from Central Asia westward towards Cape Town in the African 'peninsula'. The highlands next in importance constitute the Rockies and Andes of the American 'peninsula'. Finally the region of the East Indies and Australasia is a *drowned* series

of highlands, large areas of which tower 18,000 ft. above the flat floors of the Indian and Pacific Oceans (see Fig. 14).

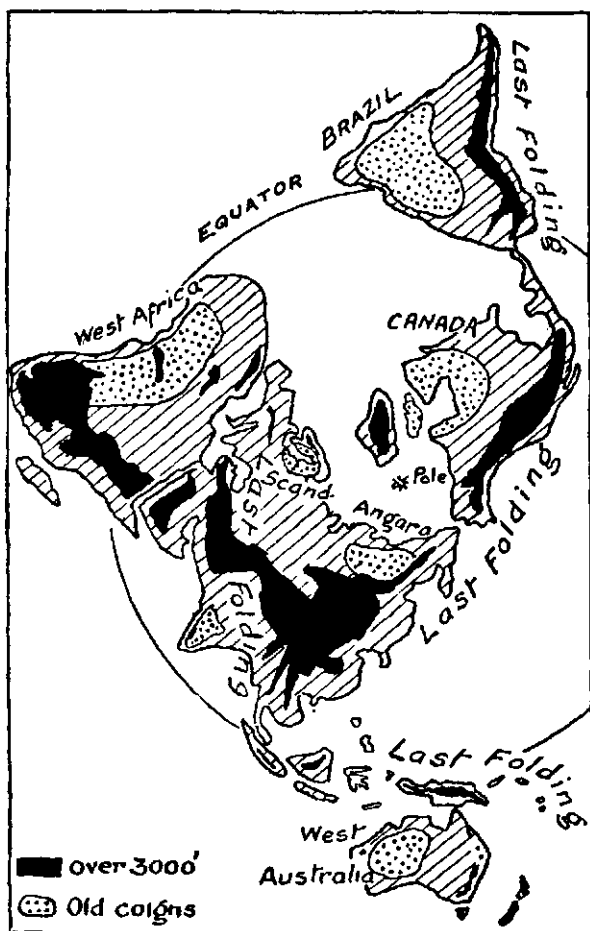


FIG. 1. The Old World and its three peninsulas.
(The North Pole is in the centre of the map.)

It is still generally believed by the layman that the high mountains are the most permanent features of the earth's surface. Literature is full of references to the 'old, unchanging hills'. In point of fact erosion is so much more rapid on the exposed surfaces of mountains and plateaux, with their swift

rivers and streams eating into the steep slopes, that it is not till such land-forms are worn down to their roots to form peneplains that they attain a stable position.

The most permanent portions of the earth's crust are the very ancient land-surfaces which are called 'coigns', or more graphically 'shields'. (These are dotted in the diagram, Fig. 1.) These shields flank the Atlantic and Arctic Oceans, while the greatest *elevations* of to-day, as we have seen, flank the Pacific and Indian Oceans. The most important 'shields' are found in Brazil, East Canada (Laurentian), East Siberia (Angara), Scandinavia, and Western Africa. There are two near the Indian Ocean, of which the less important constitutes the Deccan (South India) and the other West Australia.

Many geologists believe that this arrangement of the earth plan is a relic from the original cooling of the molten earth. Hobbs¹ points out that a hollow sphere made of thin metal which contracts when gradually exhausted of air tends to assume a tetrahedral (or pyramidal) form, which has four faces, four corners, and six edges. Without going too deeply into this 'tetrahedral' theory, we can see that it gives us some explanation for the world-plan. Let us suppose the tetrahedral earth stands on one corner. The waters of the tetrahedral earth would collect in those portions nearest the centre of the earth, i. e. on the four flat faces. Hence perhaps we may explain the Arctic Ocean on the (upper) horizontal face, and the Pacific, Atlantic, and Indian Oceans on the three other faces.

The four corners of the tetrahedron are explained as the coigns found in Antarctica, in East Canada, Scandinavia, and Siberia. The three (sloping) edges of our tetrahedron are the three 'peninsulas' of America, Africa, and Australasia, to which I have already referred.

No fact in geological history is so interesting as that we live in an epoch of great earth-movement. Probably in only three other times in the record (i. e. in Permian, Devonian, and early Cambrian times) were there such crumplings of the

¹ Vide *Earth-Evolution*, 1921. It is the *symmetry* of the world-plan which is concerned in man's distribution. Whether the Tetrahedral or Continental Drift theory explains the origin of the world-plan best is not material at this juncture. (See note at end of chapter.)

crust, such high mountains, such great variations in climate and consequently in environment. Thus late Tertiary times have been of tremendous importance in the evolution of life. It is in all probability due to these intensely stimulating conditions that the highest type of animal life evolved, and so the origin of man is a necessary corollary of the invigorating environment of Tertiary times. (See Table on p. 342.)

I reproduce in Fig. 3 a diagram¹ which correlates the periods of great environmental change with the periods of great biological change. The first of such periods is the dawn of the Cambrian, possibly 450 million

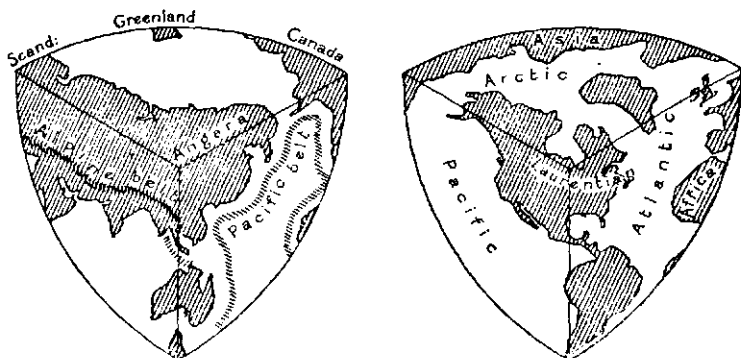


FIG. 2. The Tetrahedral World showing Oceans opposite Lands.

years ago, which for long years was accepted as containing the oldest record of fossil life. We now know of many fossils in somewhat older rocks, but there is no doubt that some enormous change in environment affected life at that time. At the close of the Silurian we have another critical stage, when the 'Caledonian' period of mountain-building occurred. There were feeble precursors of the vertebrates before the Devonian, but the vast array of sharks and true vertebrate fishes commenced in the Devonian (some 300 million years ago). At the close of the Carboniferous, about 150 million years later, the land floras and faunas changed remarkably. This was the great Hercynian or Appalachian period of mountain-building. Now the first reptiles crawled on the land, and we may with certainty follow Matthew and place the birth of the mammals in the Permian; indeed the most primitive mammal, the platypus, still maintains his amphibian method of life.

The close of the Tertiary is marked by another period of mountain-

¹ See 'Climatic Cycles and Evolution', by Griffith Taylor, *American Geographical Review*, Dec. 1919 (pp. 316 et seq.). (See Appendix A.)

building associated (as in the Cambrian, Devonian, and Permian times) with a series of great Ice Ages. It marks the culminating point in life, the dawn of the human age. No doubt the monkeys flourished in late Tertiary times together with that even more *plastic* type of mammal, our pithecoïd ancestor. But it was the strenuous times of the Pleistocene, commencing about one million years ago, which picked out the dominant type and gave to man the prominent position which he occupies.

Let us now return to the distribution of the mountain-masses of to-day. They are found to be puckered up against the resistant coigns or shields formed of the primitive crust. Modern theories assume a sagging of the crust in certain regions, especially in the great oceanic deeps,¹ which had led to folding of the weak continental *margins* against the solid coigns. This has happened throughout the ages, so that we find the early mountain chains (e. g. the Caledonian series) rising *near* the shield, while the later Permian folds are a little farther off, and the latest Tertiary folds (e. g. Swiss Alps) still farther off. A similar series of foldings occur between the Tongan Deep (off New Zealand) and the West Australian shield.

These 'new' mountains have only recently developed. Indeed they are probably still growing, as has been demonstrated in the Himalayas and the Andes. Almost each year geologists tend to place the dawn of the human period farther back in geological time, while they bring later and later the phenomena of mountain-building and other earth movements. Thus the student who wishes to understand the changing environment which has determined the evolution and the distribution of man must realize that many regions of the earth may have actually changed not only in climate but in elevation and topography within the human epoch. If we include in this epoch the Pliocene as well as Pleistocene and recent times, this may well comprise a period of some four million years.

It is a natural consequence of the fact that the great white civilizations have grown up on the relatively stable coasts of the Atlantic Ocean that the early geologists were inclined to believe in the permanence of continental morphology. In these

¹ See note at end of chapter on Earth-History.

regions near the North Sea and near the Alleghanias, though slight changes in the continental shelf have occurred in late geological times, there are no such stupendous bucklings as characterize the coasts of the Pacific or as took place in that 'Alpine Storm' which folded the lands from Mont Blanc via the Himalayas to Java.

The most mobile regions of the crust, those which have suffered the greatest movement in a vertical direction, are

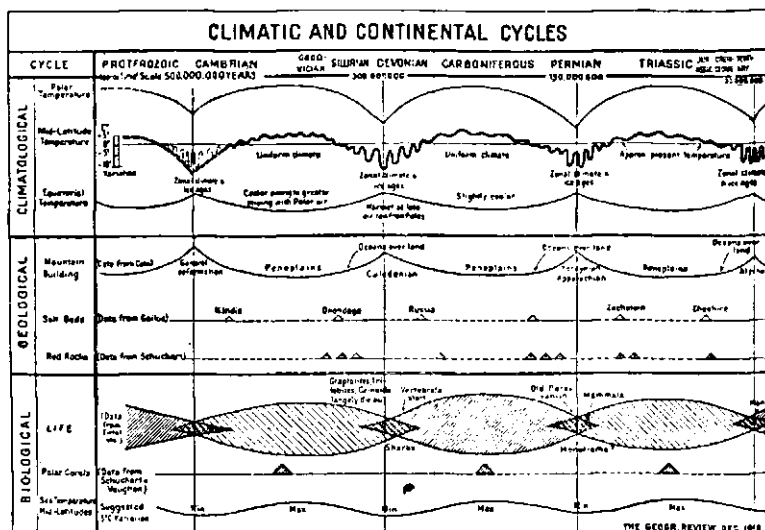


FIG. 3. Diagram showing the three major cycles in the climatological, geological, and biological records. (From *Geographical Review*, 1919.)

within the well-known earthquake belt. Pirson and Schuchert definitely assign the volcanic outflows of the Pacific, which resulted from these movements, to the Pleistocene. Hence we may deduce that these movements, or their effects, were factors in determining the migrations of man. Especially in connexion with the old land bridges and 'corridors' connecting the large land masses is this concept of recent marginal change of paramount importance.

Let us for a moment glance at the regions where slight differences in elevation would have the most effect in blocking the migration of animals. In America there is the Panama

region and the Behring region. Nearer the central Asiatic lands we find in the south the East Indies, which have been termed the 'Stepping Stones' to Australia. In the west are the Red Sea and the Straits of Gibraltar, and in the north-west we may add the North Sea.

If we refer to Figs. 1 and 4 we find that all these regions are in

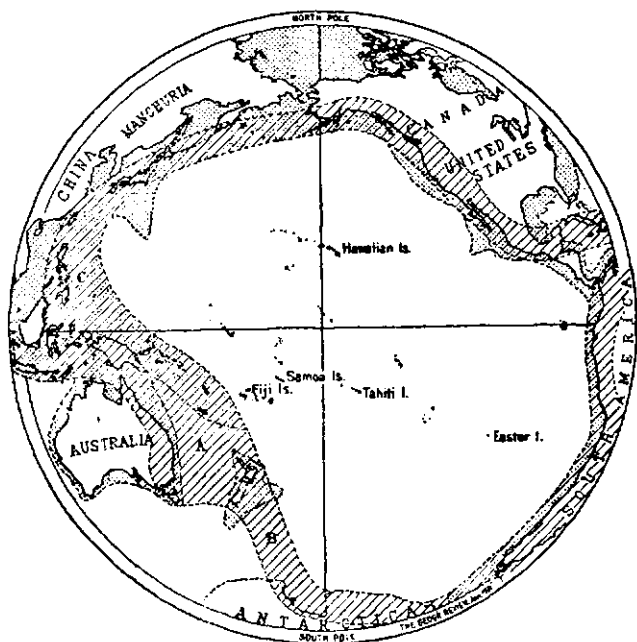


FIG. 4. The most mobile region of the earth's crust. The chief fault and earthquake belt (mainly after Hobbs) is indicated by ruling; the areas covered by terrigenous deposits (after Murray) by stippling. Much of the region indicated, except about the areas marked A, B, and C, was probably dry land in early Pleistocene time. (From *Geographical Review*, 1921.)

the belts which are labelled as subject to the 'Last Folding'. We know that *uplifts* of the order 10,000 ft. have occurred fairly lately in this belt. We may be certain that downward buckles of the same order have occurred, though the inflow of the sea has destroyed most of the evidence. In later chapters I shall give more fully the reasons for accepting the adjoining sketch-map as a picture of late Tertiary geography. Hence we see that the world-plan of a million or two million years ago

could be described even more closely than now as an Asiatic centre with three projections, which constitute the other continents (see Fig. 1.)

(b) *Climatic Plan.*

We may now turn to the climatic arrangements of the world-plan. These are determined primarily by latitude and

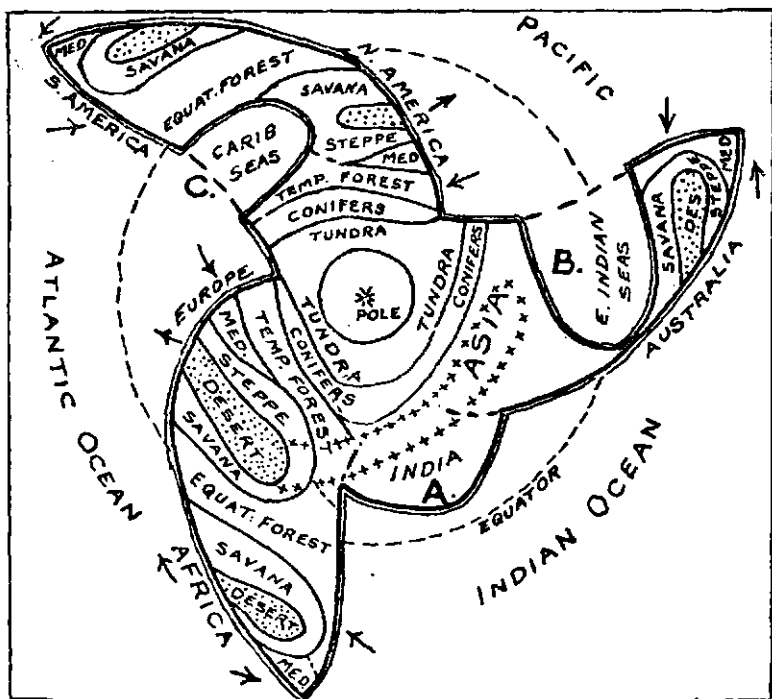


FIG. 5. Scheme illustrating the simplified 'Tri-Peninsular' World.

secondly by aspect. Man has until quite lately in his history been engaged either in hunting, in agricultural or pastoral pursuits. These depend entirely upon the mantle of vegetation which covers the earth's surface. We cannot do better than consider how the varying types of vegetation depend on the controls mentioned above.

Let us consider the vegetation between the North Pole and South Africa. The most striking feature is the parallel arrange-

ment on each side of the Equator. Especially is this seen on the Atlantic coast. Thus the central belt is the West African and Congo tropical forest. On each side of this is a savana belt, the Sudan to the north, the Angola region to the south. Then come the Sahara desert on the north and the Kalahari desert to the south, each flanked on the polar side by a belt of scrub-land and grass-land which may be termed steppe. Passing farther from the Equator we reach the typical Mediterranean vegetation (*Med.* in Fig. 5) with its cork-oaks, olives, and vines. This is duplicated in the south by the similar belt near Cape Town. To the north we pass through broad-leaf temperate forests (oak, elm, &c.), then through coniferous forests, and so reach the lichen-covered tundras of the polar circle. These last three zones are not present in South Africa, for its latitude only extends to 34° south.

If now we turn to the arrangement of the vegetation in the American 'peninsula' we see that it is exactly the same, save that the Gulf of Mexico and Caribbean Sea have taken a great bite out of America on the Tropic of Cancer. Turning to the remaining 'peninsula', that of Asia-Australasia, we find the same belts to north and south, but the submergence of the East Indian areas (to which reference has already been made) has modified the zoning very materially in equatorial regions.

The most striking interference with the simple plan indicated in Fig. 5 is, however, not due to the presence of a large sea within the 'peninsula', but results from the fact that the Indian Ocean is so much smaller than the Atlantic or Pacific. Hence the eastern side of the Eur-African land-mass does not quite follow the world-plan in northern temperate latitudes. Partly as a consequence of this great spread of land from west to east (and the east is the windward side in these latitudes), the desert of Sahara extends more or less continuously across to China. This is indicated by the area enclosed in crosses in Fig. 5. There is, as always, a belt of warm temperate forest and savana about 500 miles wide on the eastern (windward) side of the desert belt.

It is unnecessary to dwell on the reasons for these belts.

They depend essentially on the rainfall and dominant winds (see arrows in Fig. 5). The trade winds (from the east) give rains and forests on the eastern sides of the peninsulas in latitude 23° , but are drying, offshore winds on the leeward (western sides). Nearer the poles the wet, westerly winds accompanying the temperate cyclones give rainfall and a luxuriant vegetation to the western coasts between latitudes 40° and 50° . Further details will be described in later chapters.

As regards latitude, therefore, we may generalize somewhat and arrange the vegetation zones as follows :

TABLE I

Latitude. North or South.	VEGETATION ZONES.		
	West aspect.	Centre.	East aspect.
70°	Tundra	Tundra	Tundra
$60^\circ-50^\circ$	Coniferous forest		
48°	Deciduous forest	Steppe	Deciduous forest
40°	Mediterranean	"	"
30°	Steppe	"	Warm temperate forest
23°	Desert	Desert	"
15°	Savana	Savana	"
Equator	Tropical forest	Tropical forest	Savana

Thus there are only nine types of vegetation, and these are merely repeated in the various ' peninsulas ', so that to use the playing-card analogy we are concerned with three ' suits ' each containing nine similar cards.

How do these vegetation belts most immediately affect man ? In the early days of his history he was quite unable to cope with the dense forests, whether temperate or tropical. He had no greater love for the desert or tundra than the average man of to-day. Hence his chief abiding places would be found in the belt between the desert and the forests. The park-land type of country, just on the drier edge of the forests, would seem to be best suited to early man. Probably the primitive negroid peoples would prefer the warmer savana woods, while the higher races would expand on the edge of the temperate forests.

These belts would also be the great *corridors* of migration until man tamed cattle and horses, when the drier steppes

would be equally available. With the use of bronze and iron tools some progress would be made in cutting down the deciduous forests of the temperate zone, but as regards the tropical forests, man has not even yet made much impression on them. Dr. Bowman, in his masterly study of the Peruvian Andes, writes as follows of the Amazonian forests :¹

'The tropics must be won by the strong hands of the lowlier classes who are ignorant or careless of hygiene, and not by the khaki-clad, robust young men like those who work at Panama. . . . It is pleasant to think that the tropical forest may be conquered. It is nonsense to say that we are now conquering it in any comprehensive way.'

It is of greater significance in the present study to realize that these belts of vegetation have varied in position during the life of man on the earth. Every one knows of the swing from tropic to tropic of the sun during each half-year. The effect of this swing is first felt as a change of temperature, and this brings about a similar seasonal swing in the wind belts and also in the rain belts. There is thus a direct connexion between the change in a temperature belt and the change in a rainfall belt.

In the four Great Ice Ages of the Pleistocene we have the clearest evidence of remarkable changes in the temperature belts of temperate and frigid latitudes, and to a less degree of tropical latitudes. Much attention has been given to the temperature changes, and but little till lately to the changes in the rainfall belts. But it is the latter which chiefly determine the position of the deserts, steppes, and parklands ; and therefore we feel sure that the environment best suited to man swung north and south with the fluctuations in the temperature during the Pleistocene. The same phenomena have occurred to a less extent since the last Ice Age, and it is this changing environment which has very largely led to man's evolution and to the differentiation into the various races with which we are familiar to-day. Further, we have in these climatic changes the most logical explanation of the migrations which characterized the early history of mankind.

¹ *The Andes of Southern Peru*, by Isaiah Bowman, 1916, New York (p. 34).

We may briefly refer to the thesis of Part II at this juncture. In the Ice Ages the expanding ice-fields of northern Eurasia drove away the forest belts towards the equator and also the animals, including earliest or negroid man, who dwelt therein (Fig. 69). Some tribes remained isolated or lost in the equatorial regions and did not evolve, for there was no stimulus there then any more than there is now. Those tribes who returned with the stimulating environment to the central Asiatic region continued to be subjected to climatic stimulus of a pronounced type and gradually evolved into peoples akin to the Hamitic folk. The onset of the next Ice Age led to their dispersion, but those who returned to or still remained in Central Asia were developed into Iberian and Semitic peoples in the next long interglacial. So also arose the Alpine races, including many of our progenitors. These races were dispersed in irregular zones all around Asia. Science already recognizes the Caucasian affinities of the Polynesian, but I would claim even closer affinities for some of the Melanesians of the Solomon Islands and adjacent regions. I also believe that the Amerinds should be zoned in the same fashion, so that the Arawak and Carib peoples and many of the Plains Indians of North America belong essentially to the same zone as ourselves.

'SURFACE-HISTORY OF THE EARTH.'

This illuminating book by Joly (Oxford, 1925) should be read by all interested in the causes of the earth-plan. He concludes that there are four major catastrophic ages at equal periods. Using the 'uranium time-scale' these occur at intervals of 150 million years. (These deductions agree with those shown in Fig. 3.) On another time-scale (based on thorium-lead) the periods are shorter. (In the present writer's opinion the *Laramide* (Eocene) 'catastrophic' period merely ushers in the last phase of unrest.)

Joly believes that the continents represent a 'scum' of lighter refractory granite, &c., floating on a heavier layer of basalt some 70 miles thick. The latter is heated to melting-point at the end of every cycle by accumulated heat due to the decay of radio-active minerals.

Thereupon the tidal drag (due to the moon) acting on the continents can hold back the thinner *lowlands* of the crust, while the deep and high continental masses are less retarded, and are moved slowly to the east by the fluid magma. (Similarly the huge icebergs move north from Antarctica quicker than the thinner pack-ice.) Joly suggests that South America may have moved east of North America because of the higher and deeper Andes. So also New Zealand has outstripped Australia. The tidal drag to the west helps to explain why the crust often cracks in north-south rifts at the margins of the great oceans, and why the mountain-building generally takes place here also. (See also Appendix A, p. 342.)

III

ETHNOLOGICAL PRINCIPLES, NATIONALITY AND LANGUAGE

(a) *Ethnological Principles.*

THE science of ethnology is so largely a product of Western European peoples that it is natural for all classifications of the races of man to accept as a fundamental principle that this group is the highest type in human evolution. In this study we are concerned with ethnical not ethical status, with material rather than with mental status. Indeed our problem is mainly biological at first and concerns physical rather than cultural anthropology. Later on we shall dwell on the economic status of peoples at some length.

A well-known method of exhibiting racial relationships is by means of an 'ethnological tree'. Here it is assumed that there are certain root-stocks from which arise various later ethnological branches and twigs. Thus from a root-stock or main stem of ape-like creatures, we find a low abortive branch given off which represents *Pithecanthropus*, the ape-man of Java. A little higher is a branch representing *Eoanthropus*, the primitive man of Piltdown. Modern types are foreshadowed by *Homo Rhodesiensis* (from Broken Hill, Rhodesia) or *Homo Neandertalensis* from the Neander valley near Düsseldorf. It is believed by many ethnologists that the negro races descended from types not unlike those just specified, so that the large group of negro peoples would be represented as branching off hereabouts. Then later we should find branches labelled Mongolian and Caucasian, with all the hundreds of yellow and white races of to-day indicated by twigs on these branches.

I do not propose in this study to deal in any detail with current theories as to the relative status of such extremely primitive types as those preserved at Piltdown, Broken Hill, or Trinil (in Java). There are no living species akin to these animals, and our brief study is necessarily confined to the peoples of to-day. But since the 'ethnological tree' is still

used, it seems well to point out that it does not illustrate at all closely the phenomena which characterize racial differentiation and dispersion. For instance, Wells, in the adjoining figure,¹ has to merge very distant branches to form the Japanese and Irish respectively. I venture to suggest that ethnologists would have done better to borrow from the geologist rather than from the botanist for an analogy to the ethnological processes. For we are here dealing not only with horizontal distribution

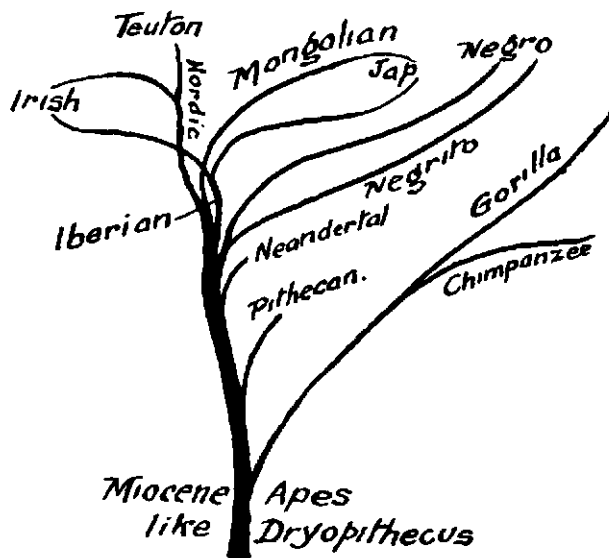


FIG. 6. The conventional Ethnological Tree.

but also with *vertical* distribution. The ethnologist of to-day learns as much from 'fossil' evidence of earlier inhabitants as from the characteristics of the races who still occupy the region under investigation.

These features can both be combined in what is really a development of the 'block diagram' of the geographer and geologist. In Fig. 7 this arrangement of *Zones and Strata* is shown in a very generalized form. We are supposed to be looking to the west over Europe and Africa. The distribution of the races is shown, with the most primitive zone (Bush-

¹ The early chapters of the *Outline of History* with their admirable illustrations furnish an excellent summary of the history of primitive man.

men, &c., No. 1) to the south (left) and the latest arrivals (Slav-Alpine group, No. 8) in the north (right). Each zone may be conceived as pushing the preceding away from Asia, as indeed can be shown to be the case. The mixing of races which inevitably takes place where one zone comes in contact with another is much more logically deduced from this type of diagram than from the 'tree'. This block diagram also shows clearly that the retreating races leave relics of their sojourn in the shape of buried data. These may consist of actual graves, artefacts, hut-sites, &c. ; or of place-names and

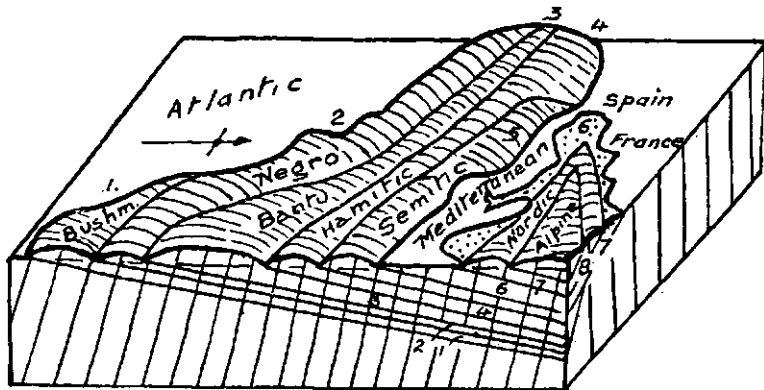


FIG. 7. A much generalized block diagram of Eur-Africa, illustrating the Migration Zones from Cape Town to Russia, and showing the order of 'strata' submerged by later migrations.

folk-lore ; or of some traces in the form of hybrids ; or even of small groups of refugees still living isolated in rugged mountains. This may be called the evidence from stratification, and this concept of zones and strata will frequently be appealed to in the text.

Evidence is indeed accumulating that the Paleolithic folk of Europe were much more closely akin to races now living on the periphery of the Eur-African region than was formerly admitted. Sollas advanced this thesis in a general way in his stimulating book, *Ancient Hunters* ; but it seems to me that the principle can be applied in every part of the world.

We can gain a still more valuable picture of race dispersal if we consider an analogy which comes within the experience

of every one. We may call it the *Analogy of the Evolution of Transport*. In the vicinity of any large city, such as Sydney, where these words are being written, as we move farther from the centre of industry we find more and more primitive methods of transport (see Fig. 8). Thus in some of the rough forest country about 100 miles away settlers still depend on the primitive ox-wain with its team of oxen. A little nearer we find a zone where the four-wheeled wagonette is the chief conveyance. Nearer again we find the old yellow omnibus which

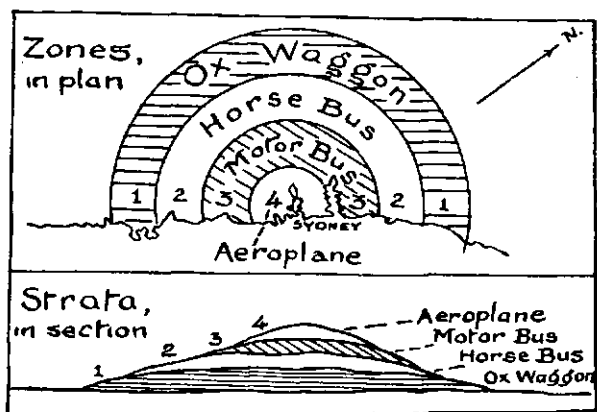


FIG. 8. The Evolution of Transport, used as an analogy for the Evolution of Races. The centre of stimulus (Sydney) is surrounded (*in plan*) by zones of evolution. *In section* (in an engineer's dump heap) the same order of strata is present.

once carried the traffic of the city. On the margins of the city the motor-buses have displaced these more primitive vehicles. Finally, over the city we find aeroplanes frequently hovering and exemplifying the latest development of transport.¹

So much for the *Zones*. Now let us visit a large engineering repair shop in the city and inspect its heap of scrap-iron and waste material. We shall perhaps find a broken air-propeller on the top of the heap. Beneath will be countless relics of motor-buses, covering old carriage-springs and fragments of horse-drawn vehicles. Finally at the bottom of the heap we may find an old ox-yoke or similar evidence that some hundred

¹ Vide 'Migration Zones', *Proceedings of the Pan-Pacific Congress*, 1923, p. 253.

years ago the ox-wagon was a common sight in the streets of Sydney. So much for the *strata*.

Here, then, we have a close parallel with the *zones and strata* which are indicated for the peoples of Europe and Africa. But the most valuable concept is yet to be elucidated. It gives us a key to the evolution and status of the various races involved. In the case of the vehicles we saw that each member of this series of types first developed *in the same centre*, where the stimulus was greatest, and was driven out as the better types were evolved. Here, no doubt, commercial competition was the chief factor. Moreover, the most primitive type is naturally now found farthest from this centre of maximum stimulus. Lastly, the agreement between the series of the zones and the strata shows us the *order of evolution*, and in a sense the relative status of the objects in question.

This, then, is the chief contribution which the geographer can bring to ethnology. It is indeed an amplification of this which forms the text of the first portion of this book. It seems clear to me that we have an exactly parallel case to our transport evidence in our Racial evidence. We can show the same series of zones about a common centre in Asia. We can show that the climatic stimulus was greatest in Central Asia. We can show that the most primitive races are farthest from this centre, and that a similar series of zones is preserved in somewhat the same order if we dig down through the Recent and Pleistocene strata in Europe and North Africa.

Thus two novel conclusions are foreshadowed. First, that Europe was settled in somewhat the same order as that of the zones in Africa; and secondly, that the West European peoples (British, North French, North Germans, Spanish, &c.) are probably an earlier development of man than those living in the centre of dispersal, i. e. the Alpine-Mongolian group of peoples.

Let us now consider some of the features of a race-migration. They have been somewhat the same throughout the ages, and a modern 'migration', such as that of a city crowd to a football match, presents some useful analogies. First come the lowest classes and pariahs, who wander freely over the ground long before the general public arrives. They have arrived there by

the usual roads and tracks, but ultimately are found perched in tree-tops and in the least attractive positions of the ground. Then the proletariat advances along the same roads and corridors. They are driven out of the best seats, which are reserved for the last comers.

In the past history of man he has advanced from Asia along the same corridors, which were determined by the topography and vegetation, as we saw earlier. Thus Europe during the early ages was invaded chiefly by way of the south-east. Australia has always been entered by the East Indian corridor, and America by the Behring corridor. The latter case is the most instructive, for we shall see that the last-comers still hold the corridor and have not yet had time to drive the earlier peoples away from the best regions. Yet these more powerful later tribes have disrupted their predecessors and driven great numbers into the rugged hills or distant forests on both sides of the line of migration. So also on a smaller scale the primitive short dark folk of Britain were driven west into Cornwall and east into the Cambridgeshire fens by invaders from the Continent. Further disruptions of the same nature occurred when Africa was reached from Asia, and so the Abyssinian highlands are full of the early-comers, i. e. the pariahs driven there by peoples advancing across regions near the Red Sea.

In geological language, when two large areas of rock are displaced, a 'shatter-belt' develops at the plane of contact. So also in ethnology such a shatter-belt occurs along the edge of the main corridor and is especially illustrated by the tribes of California and by those on the western edge of the Brazilian tropical forests.

Two other concepts of considerable value in connexion with this method of treating the distribution of man should be mentioned here. In geology, if a new formation is built up around a mass of *older* rock, the latter is called an *Inlier*. Such structures are very common in ethnology. The Basque inlier is classic. So also we have a small Neandertal inlier near Plinlimmon in Wales, according to the researches of Fleure.

No less common is the opposite structure, the *Outlier*. This name is given to an outlying hill of *newer* rock which has been

severed by erosion from the parent mass. Such outliers in ethnology will readily spring to mind. Noteworthy examples in Europe are the Bretons in Brittany, the Lapps in Norway, the Magyars of Hungary, and the Wends of Central Germany.

In some instances we seem to see an example of 'transgression', wherein the usual sequence is to some extent hidden. This is worthy of note because some of the broad-heads of Europe (Ladins, Lithuanians, &c.) certainly preceded some long-heads, who are almost invariable members of earlier zones

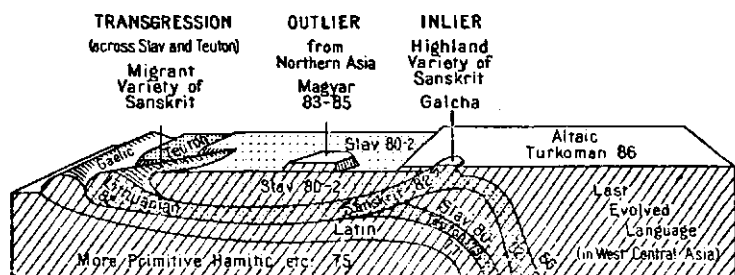


FIG. 9. Block diagram (Scotland to Turkestan) illustrating an analogy of geological structure applied to the migration of language. The order of evolution is that of the cephalic indices (75-86); but the migrations have been somewhat irregular, especially the Sanskrit Alpines (Lithuanians, &c.). Later the Slav tribes dominated the Sanskrit Alpines and were in turn overrun by the Altaic Magyars. (From *Geographical Review*, 1921.)

elsewhere. The illustration herewith (Fig. 9) shows that the broad-head tribes akin to the Galchas of the Pamirs migrated to Europe before many of the Slavs and constitute the Lithuanians. This race forms a 'transgression' (across the Slav zone) and seems to have moved out of order. The same race remains near the centre of dispersal, as shown by the inlier of Galchas, while the records in the Sanskrit language elsewhere seem to show that these peoples once had a much greater range than at present.

(b) Language and Nationality.

The chief popular criteria of race differences are skin-colour, language, and nationality. None of these is at all satisfactory; in fact language and nationality have nothing to do with ethnical characters in the strict sense. We can best illustrate

the difference between popular and scientific classification by a reference to some of the European peoples. Which are the purest races in the sense of biological (or physical) anthropology? Probably the Swiss and Czech. Yet the former speak four languages in different parts of their small country, three of which are characteristic of very different peoples. From the other point of view the strains composing French and Italian nations are extraordinarily mingled. In both countries in the west are short, dark long-heads (Mediterraneans); next to them are tall, fair broad-heads (Cevenole and Ladin groups) (see Fig. 42). Much the same four zones occur in Greece. Nationality is usually the result of a more or less harmonious common occupation of a well-defined natural region. Given time and goodwill, the most diverse races will amalgamate, as the whole history of man demonstrates.

Language is therefore only of secondary value as a criterion. There is much danger in laying too much stress upon it, for it has often been the first characteristic of a group of people which has been scientifically studied. Long before accurate measurements and colour data regarding the Europeans had been obtained, it was realized that there was a close affinity between almost all the languages of Europe. They spoke Aryan languages. Later it was found that these languages extended through Persia into Northern and Central India.

It was natural for this similarity of language to sway the ethnologist, especially as it agreed to some extent with similarity in skin-colour. Looking farther afield we find the Polynesian peoples, who are generally allowed to be allied to the European peoples, yet their languages belong to quite a different group. In the same ethnic family are many American Indians ('Amerinds') with a type of language differing from almost all those in Europe (except Basque and Abkasian), in that they are polysynthetic. In these languages the expression of a simple sentence takes the form of a single word of unwieldy length.

In the adjoining figure I attempt to show what has perhaps happened to the languages of these migrating 'Zones'. On the left is shown a series of peoples spreading out from the centre of evolution in Asia but still in fairly continuous contact.

The physical characteristics (which determine race) only alter very slowly, so that we can still trace the common origin of the A group of tribes even when they have penetrated far into the three new regions (see right-hand figure). But in those peoples entering America a tendency to polysynthesis perhaps characterized the dominant races at that period and in the course of ages spread generally through the continent. So also in Europe the higher peoples spoke synthetic languages, ranging from Erse (B_1) up to Albanian (C_1), and these obliterated all

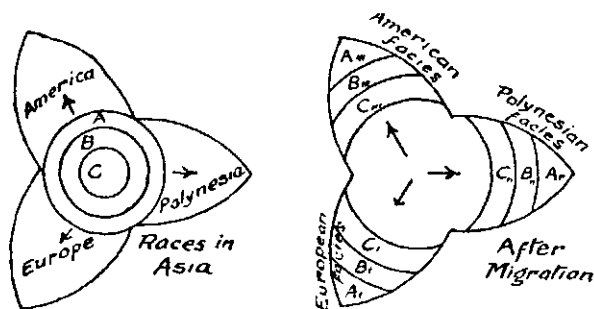


FIG. 10. Diagram illustrating the differentiation of racial characteristics with increasing isolation.

the languages of the earlier peoples except in the Pyrenees (A_1) and the Caucasus. In Polynesia very little is known of the affinities of the language save that it is akin to the Malay and Melanesian languages, and by analogy one would expect that the two latter are the groups indicated by A_2 and B_2 , while Polynesian (and allied Indonesian speech) is represented by C_2 .

Though language is so variable a character, yet it gives us many clues to racial evolution. Indeed it is possible to show that the same kind of evolution of language is present in each world-peninsula. Thus Erse (spoken farthest from Asia) is probably the most primitive Aryan speech, and Sanskrit was first spoken at a much later date. So also the American Indians of the Western regions (on the corridor of entry) speak languages of a more advanced type than did the first-comers, such as the Iroquois or Eskimo, who lived farthest from Asia. These aspects of the problem will be more fully considered in the sequel.

IV

ETHNOLOGICAL CRITERIA

WE have seen that nationality and language, although they appeal forcibly to the layman, have very little bearing on the problem of physical classification, which is the final court of appeal. The most obvious of these physical criteria is the *colour of the skin*, and for scientific purposes this should be judged on the inside of the upper arm and not from the face. A pale skin such as that characteristic of northern Europeans is due to a lack of pigment in the lower layers of the skin, while a rosy colour, on the face, is due to the blood showing through the uncoloured skin. Tanning or freckling is due to the formation of pigment in pale skins by the action of the sun. All skin pigment appears to be of the same type; pigment granules are, however, more abundant in the skin of the dark than in the skin of the fair races.

Anthropologists are not certain as to the colour of primitive man. Since many dark races are lighter at birth, and lighter on unexposed portions of the body, it is possible that early man was a dark brown or red-brown colour. He was in all probability almost covered with hair, as are one or two of the primitive negrito tribes found in Central Africa.

The logical explanation of dark skin-colour seems to be that it is the result of exposure to the sun's heat. It has often been pointed out, however, that there are dark peoples (such as Eskimo and Tasmanian tribes) in cool countries and light-coloured tribes in hot countries like North India and Western Brazil. To my mind the difficulty largely vanishes if we take into account the *time-factor*. There is no doubt that a change in the skin coloration would only be made permanent by a very long sojourn in the suitable habitat. We know so little of the past history of many peoples that we cannot say if they have occupied their present territory for five thousand or fifty thousand years. If we assume that the dark Tasmanians had only comparatively recently been 'pushed' into temperate regions after spending most of their life history in hot Australia; and that the dark-brown Eskimo (originally nearer black?) had

only relatively recently occupied the Frigid Zone after a long sojourn in temperate America; then the difficulty of explaining

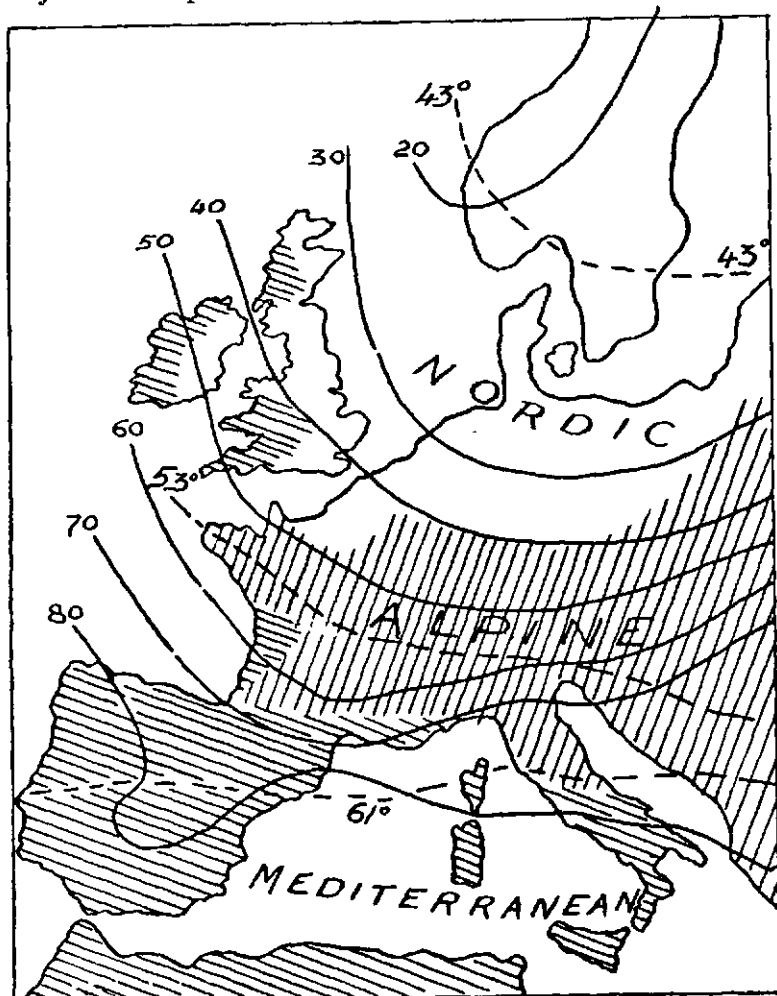


FIG. 11. The distribution indicates that there is a direct relation of climate to pigmentation.¹ Figures on full lines give percentages of brunet individuals. (Partly from Ripley.)

their 'disharmonic' colour is much lessened. These, however, are suggestions merely, and cannot be said to be proved.

¹ Note that Nordic and Mediterranean races have developed from almost the same stock. (See Fig. 40 A.)

With a few notable exceptions we find that there is a fairly close relation between skin-colour and more important criteria like skull-proportions. But we must first clearly realize that really *white* races are numerically unimportant, and so are the really *black* races.

TABLE II

Colour, Head-form, and Temperature.

Average regional temperatures are given in degrees Fahrenheit.

	<i>Colour.</i>	<i>Dolichocephalic.</i>	<i>Mesaticephalic.</i> ¹	<i>Brachycephalic.</i>
I	Coal black	Guinea Blacks (78°)	Bishari (80°)	
	Sooty black	Papuan (80°) Solomon Islanders (80°)	Dravidians (78°) Melanesians (80°)	
	Chocolate brown	Australians (75°)	Some Hindus (78°)	
II	Copper red	Niam-Niam (78°)	Algonquian (60°) Maropa (Bolivia) (60°)	
	Yellow brown	Eskimo (20°)	Guarani (75°) Samoyede (20°) Malay (80°) Japanese (50°) Plateau Indians U.S.A. (50°) Tehuelche (50°)	
III	Olive yellow		Polynesian (70°) (in part)	
	Olive white		Italian and Levant (60°) Semites (70°)	
	Pale		Western European (50°)	Alpine (50°)
	Florid		Scandinavian (40°)	Finn (40°)
IV	Clear yellow		Hottentot (60°)	Northern Chinese (50°)
			Brazilian Indians ? (75°)	N.W. Amerind (40°)

N.B.—The colour data are chiefly from Paul Topinard, *Anthropology*, London, 1890, p. 344; and from W. L. H. Duckworth, *Morphology and Anthropology*, London, 1904, p. 353.

¹ Head index about 78.

The South Europeans are certainly not white, nor are most of the negroes black; we may add that none of the Red Indians are red and the Australian Black-fellow is chocolate. The logical order in the series of colours would seem to be: dark chocolate (occasionally reaching black), red-brown, brown, olive (bleaching to white), and yellow.

The intensely dark people are all dwellers in hot countries and are all very dolichocephalic or long-headed. In almost every case these dark tribes have lived for untold ages in hot climates and have perhaps hardly varied their climatic environment since their original development somewhere in or near the tropics of the old world.

In addition to skin-colour, eye-colour and hair-colour are to be observed. The great majority of peoples have dark-brown eyes due to pigment scattered through the iris. If there is little pigment the natural blue-grey of the background of the iris dominates. Mixtures of these colours give greenish eyes. The colour of the hair is also dark for most races in the world. It varies through black, dark brown, reddish brown, light brown, blond, golden, and red (light, brick, or auburn). Here again, as in eye-colour, the chief variations from the normal dark colour are found in Europe and adjacent regions. Hence these features do not assist us much in determining the major classifications of mankind.

A much more important criterion is found in the texture of the hair. Indeed, some ethnologists have based their classification on this feature. We find a wide range of textures with the negrito at one end and the so-called 'Mongolian' at the other. L. R. Sullivan¹ uses the following types. Spiral tufts (pepper-corn), woolly, frizzy ($\frac{1}{2}$ cm. wide, $\frac{1}{2}$ cm. deep), curly, deep-wave ($2\frac{1}{2} \times 1$ cm.), medium wave ($4 \times \frac{1}{2}$), low wave ($5 \times \frac{1}{2}$), and straight. The figures refer to the *width* between adjacent waves, and *depth* of each wave.

In ethnology we are dealing with 'specimens' of very different sizes and ages. Hence it is usual to record measurements by proportions as well as by actual measurements.

¹ *Essentials of Anthropometry*, American Museum of Natural History, New York, 1923.

These proportions are termed *Indices*. They are used for the skull, hair, eye, nose, and other less important criteria.

If we examine the cross-section of the hair of various races, we find that it varies from a flattened oval in negroes to a circular section for Mongolians. To obtain the Hair Index

		Negrito	Sudan Negro	Iberian	Nordic	Alpine-Mongol
HAIR	Hair Section	40	50	60	70	80
	Color	Black	Black	Black	Brown to Black	Brown to Black
	Wave					
Skull						
Jaw						
Eye						
Nose						
Height		Akka 1400 m.m.	Wolof 1725	Corisican 1630	English 1700	Kirg 1640 Kirg 1612
Skin Color		Usually Black	Black to Chocolate	Dark brown to Olive	Light brown to white	Light brown White + yellow

FIG. 12. Scheme illustrating variation in Ethnological Criteria.

we assume that the longer diameter is 100 units and then find the shorter diameter, using the same unit. Thus the index runs from 40 (negrito) to 80 (Mongol). In other words, it represents the *breadth expressed as a percentage of the length*. This is true of the other indices mentioned. In the eye we obtain the *Orbital Index* by making the greater length (across the bony orbit) equal 100 and finding the percentage of the

height of the orbit. Here again we find a regular series from negritoes (80) up to Alpine folk (about 92). For the nose we measure the length from the nasion (upper end or root of the nose) to the lower edge of the nasal septum. This is called 100, and the extreme width of the fleshy wings (alae) of the nose is expressed as a percentage. The negro folk have very broad noses (platyrrhine)¹ with a nasal index of 100. South Europeans and Iberians often have an index about 80 (mesorrhine); other Europeans have thin noses (leptorrhine) with an index about 66. The Alpine Mongolian folk are very variable, from 66 (Galchas of the Pamirs) up to 90 (many Polynesians), but the nasal index varies very considerably even in the same group and among allied peoples.

Stature is rather a variable criterion and differs greatly among closely related people. Probably 99 per cent. of the world-peoples range from 5 ft. 1 in. to 5 ft. 10 in. But there are some interesting extremes. The Akka negrillos of Central Africa are 137.8 cm. high (4 ft. 6 in.), while the Galloway Scotch are 179.2 cm. (5 ft. 11 in.). Almost equally tall are many of the negroes of Sudan (174 cm.) and Indians of Central U.S.A. (174 cm.), while the Onas of Patagonia are said to be 183 cm. high, but this is probably an excessive estimate. No scheme can bring these diverse tall peoples into the same groups, for every one of the main divisions (except the negrito) is here represented. Stature is probably a feature which reacts very rapidly to changing environment. Indeed, colonial people with their more healthy life almost at once produce taller children than do their kin in the old countries.

The short-statured folk, however, are arranged in an interesting fashion all round the periphery of the world-masses. Thus they dwell on the shores of the Arctic Ocean. They fringe the south-east of Asia and inhabit the East Indian Archipelago and Melanesia. They have been driven into the Indian Deccan and the jungles and Kalahari desert of Africa. In Europe we find them in Corsica and the extreme south-west. In South America they occur in the Brazilian jungles and in the extreme south in Tierra del Fuego (Yahgan). In part this is certainly

¹ Note.—Platyrrhine is spelled as in Deniker, 1900.

due to a widespread primitive stock, which has become merged in the present inhabitants.

The most satisfactory criterion in ethnology in the writer's opinion is based on the *skull-measurement*. The most detailed and valuable study of a complex group of peoples is that by W. Z. Ripley, entitled *The Races of Europe*. Ripley states that 'the shape of the human head is one of the best available tests of race known (but) its value is imperfectly appreciated'. He

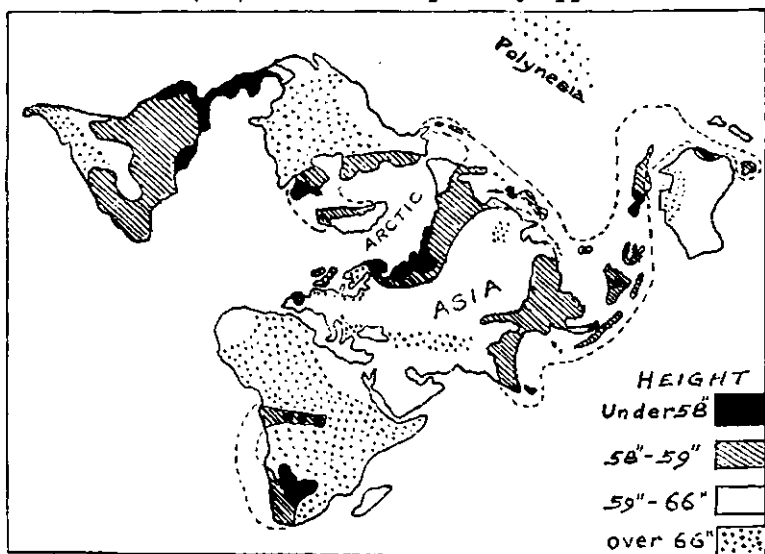


FIG. 13. Variation in height, based chiefly on Biasutti.

adds further that head-form is not very apparent to the layman (or laywoman), and so this criterion does not fall a prey to *artificial selection*. We know that skin-colour, eye-colour, and facial features have altered somewhat among various peoples in the past, according to the change in fashions. For instance, slight figures are more popular among English folk, while plump figures are appreciated among the Southern Europeans (*vide* Klaatsch), and very fat women are attractive to most negroes. Blondes and brunets vary in favour. Bearded or smooth skins are popular or unpopular in different parts of the world. If mating is at all generally influenced by some such fashion as this, the unpopular type tends to die out. The head index

(cephalic index) as usually measured is not open to these objections, for it depends on that aspect of the skull which is normally only seen by the aviator!

The cephalic index is the breadth of the skull expressed as a percentage of the length. The chief point of measurement is the *glabella* or centre of the brow (between the eyebrows). The skull-length is measured with callipers between the glabella and the extreme back of the skull, where the point which gives the maximum length is chosen. This length varies from 150 to 210 (or more) mm. The head *breadth* is the maximum width in a transverse direction wherever it occurs. It is usually slightly above and behind the tips of the ears. The width ranges from 125 to 175 mm.

$$\text{Cephalic index} = \frac{\text{maximum breadth}}{\text{maximum length}} \times 100$$

It is necessary to be familiar with the two chief terms in anthropometry. These refer to the cephalic index. If the breadth is less than 80 per cent. of the length, the head is dolichocephalic; if it is over 80 per cent. of the length, the head is brachycephalic. Notice that high figures in this index (80-97) mean *broad* heads, while low figures (65-80) mean *narrow or long* heads. It is a measure of BREADTH in reality, but heads which differ very considerably in their absolute length may have the same *relative* breadth.¹

The chief difference between man and the lower animals is in the development of the reasoning faculties. This is correlated with a growth of the brain, which takes place chiefly at the sides and top of the organ. Thus as the reasoning powers become of greater value (as man evolves), and the power of the jaw of less importance,² we can see that the sides of the skull would tend to bulge out and the front of the skull tend to become less prominent. At any rate, with the exception of the very small and aberrant group of negritos, we can show

¹ These are such ponderous terms, and occur so frequently, that I have ventured to use the contractions 'dokeph' for narrow heads and 'brakeph' for broad heads.

² W. D. Wallis points out that man's upright position leads to a decrease in the occipital muscles, and so to a broadening of the skull. *American Naturalist*, 1925, p. 68.

a continuous series of measurements leading from the primitive negro (69) up through the Iberian (75) group (the Mediterranean, &c.), and West Europeans to the Alpine (85) and the 'Mongolian' peoples (who have much in common). The various diagrams in Fig. 12 show that this order in these races is true of hair-section, hair-colour, hair-texture, orbital index, nasal index, jaw-shape (prognathism), and cephalic index. Skin-colour is fairly in accord, and indeed stature is the sole criterion which does not agree at all. As we shall see, this seriation from negro to Alpine is in accord with the zones of distribution, and is supported by a host of culture-facts and customs which have been spread abroad (in unison with the migration zones) from the original centre of dispersion.

The development of every individual recalls to a certain extent the evolution of the race. In the earliest embryo stage he shows traces of his fish-like ancestor (i. e. in the gill-slits). The 'lanugo' or woolly covering of the foetus indicates a stage when his ancestor was furred like the monkey. The new-born babe resembles somewhat the pithecoïd ancestor from which both apes and man descended. Then as he grows older there is a tendency to change from the primitive type of skull to the later type. Thus Professor A. Macalister (1897)¹ states that 'the infantile and primitive skull is relatively long, and there is a gradual change, phylogenetic (i. e. racial) as well as ontogenetic (individual), towards brachycephaly'. (This statement has, however, met with some opposition.)

It supports the view that the broad skull is a later development than the long skull. The primitive skulls from Java, Rhodesia, Piltdown, &c., are all long-heads; moreover, they have a small *brain capacity*. Here again there is a general progression in living races from the low brain capacity of the negro through the medium brain-contents of Mediterranean skulls to the largest capacity shown by the Europeans and Chinese; indeed Clapham declares that the Chinese brain is larger than that of the European.² The cranial capacity of

¹ Quoted in A. H. Keane, *Man, Past and Present*, Cambridge, 1920, p. 511.

² C. Clapham, 'Brainweight of Chinese', *Journal of the Anthropological Institute*, 1878, p. 89.

GENERALIZED TABLE SHOWING VARIOUS ETHNOLOGICAL CLASSIFICATIONS

(Partly based on Deniker, *Races of Man*, Chapter VII.)

<i>Date.</i>	<i>Author and basis.</i>	<i>A. Largely so-called 'yellow'.</i>	<i>B. Largely 'white' or 'brown'.</i>	<i>C. Largely 'black'.</i>	<i>D. Other groups.</i>
1860	Saint Hilaire (skin colour)	Mongolian, including Eskimo Australian	Caucasian, including tribes of Alleghanies	Ethiopian	Hottentot
1870	Huxley (colour)	Mongoloid, including Polynesian Amerind Eskimo Malay	A. Xanthochroid (Nordic) B. Melanochroid (Iberian)	Negroid	Australoid, including Dravidian Ethiopian
1878	Topinard (hair)	<i>Straight-haired :</i> Mongols Eskimo Amerinds	<i>Wavy or frizzy :</i> Europeans Semites Australians Turaniens	<i>Woolly-haired :</i> Negroes Negritoes	
1885	Topinard. (nose)	<i>Yellow and Mesorhine :</i> Eskimo Mongols S. Amerind (some)	<i>White and Leptorhine :</i> Europeans Semites	<i>Black and Platyrrhine :</i> Negroes Australians Negritoes	

1900 <i>circa</i>	Deniker (hair, &c.)	<p><i>Straight hair :</i> Mongol Eskimo Amerind</p>	<p><i>Wavy hair :</i> Blond. N. Europe</p>	<p>Brunet. Iberian Polynesian Paleo- Amerind</p>	<p><i>Woolly and Platyrrhine :</i> Negro Negrito Melanesian</p>	<p><i>Curly or wavy :</i> Ethiopian Australian Dravidian Assyrioid</p>
1919	<i>Migration-Zones and Strata Classification</i> (Griffith Taylor)	<p>Brachycephalic, Central Zone (Latest)</p> <p>West. Centre. East. Alpine | Chinese Many Polynesians, and 'Corridor' Amerinds</p>	<p>Moderately phalic, Zones</p> <p>West. East. W. Europe Malay Iberian N. Melanesian Semitic Ainu Hindu Many Amerinds</p>	<p>Dolichocephalic Intermediate</p>	<p>Very Dolichocephalic, Peripheral Zone (Earliest)</p> <p>West. South. East. Negro | Eskimo Some Paleo-Amerinds Papuan Australian Lower Melanesian</p>	<p>Brachycephalic Dwarfs</p> <p>West. East. Negrito S. E. Asia Central Africa</p>
1923	Cranial breadth and height (Dixon)	<p><i>Alpine</i> (high) <i>Ural</i> (low) Central Europe, Central and E. Asia, West of America, Polynesia, &c.</p>	<p><i>Caspian</i> (high) <i>Mediterranean</i> (low) N. and S. Europe, Arabia, Japan, N. Africa, Brazil, &c.</p>	<p><i>Proto-Negroid, Proto-Australoid</i> West Europe, Africa, Australia, S. India, New England (U.S.), Brazil, &c.</p>	<p><i>Palae-Alpine. Mongolian</i> (Largely dwarf stocks)</p>	

the Eskimo seems to be the largest recorded, but some of the estimates for Neandertal man are also very large.

Before closing this section dealing with criteria it is important that students should understand the great importance of a scientific nomenclature. Unfortunately we cannot say that ethnology possesses this yet. For instance, little progress was made in the ethnology of Europe as long as the term 'European' was used as an ethnological division. There are now recognized at least three very different types in Europe—the Mediterranean (Iberian), Nordic, and Alpine. Almost every other region of equal area has as diverse a series of peoples. The name *Chinese* will have to be dropped as a race-name since it includes the numberless races of South China¹ as well as the more homogeneous North Chinese.

The American Indians belong to many categories, whether we use colour, language, or skull measurement as criteria. Even the hair, though usually straight, is found to be wavy and even frizzy in certain parts of the continent. The Polynesian and Melanesian peoples are equally heterogeneous. It is perfectly absurd to link the primitive peoples of New Caledonia with the highly advanced Massim of the Solomon Islands. Naturally no progress is made in classifications as long as these principles are not fully understood.

We may profitably consider the various classifications which have been suggested in the past. The basis of the early-classifications was skin-colour. Then the value of the hair was appreciated (see Huxley and Topinard). The nasal index was the basis of Topinard's second classification. Deniker combined colour and nasal index. Of recent years skull characters are becoming of more importance. I have mentioned that Ripley used them combined with the facts of distribution and environment. This is the plan which appeals to the writer, and is the basis of the scheme published in 1919. It may be named the 'Migration-zone' scheme of classification, and is correlated with the order of Evolution. In 1922 Dixon, in *The*

¹ The name which appears in some modern text-books is *Pareocean*, which Haddon has adopted (*Races of Man*, p. 153) as an alternative name to the term 'Southern Mongols' or 'Indo-Chinese'.

Racial History of Man, has used skull measurements and has produced a classification very like my own. He stresses the height of the skull somewhat, but does not use the geographical distribution as a factor in his classification. Haddon in 1924, in his *Races of Man*, has made hair the chief basis of classification, and has combined this with skin-colour, stature, and head-form.

A reference to the preceding table will show that there are certain fairly harmonious combinations which to a certain extent justify the old classification by colour. These are :

- I. Very long-headed folk, broad-nosed, nearly all have dark skins, very frizzy hair, and live in the tropics.
- II. Broad-headed folk nearly all have white to yellow skins, wavy or straight hair, and live in temperate lands.
- III. Most moderately dolichocephalic folk have brown to white skins, thin noses, and wavy hair. They have no very definite climatic environment, but range throughout the tropical and temperate regions. It is this great range of migration which has prevented their common origin and real physical similarity from being recognized. On the other hand they invariably occupy a somewhat peripheral position outside group II and within group I.

The classification which I propose incorporates certain suggestions which have been put forward before. We see that St. Hilaire grouped some of the Amerinds with European folk, while Deniker linked Paleo-Amerinds (i. e. the first migrants into America) with the Iberians.

Dixon (1922) has followed my classes (of 1919) in grouping Eskimo with the negroid races, and Alpines with the Mongols and Corridor Amerinds.

The greatest difficulty is to place the negritoës. I think the evidence indicates an entirely separate stock for the brachycephalic negritoës (Aeta, Mincopi, &c.). There seems to me no good reason why there should not have been two pithecoïd stocks in Asia in Pliocene times which gave rise to permanent races.

Most zoologists believe that there were a number of primitive 'ape-men' like *Eoanthropus* and *Pithecanthropus*, although these perished without having any modern representatives. This variety would seem to me to be an argument in favour of polygenesis. I venture to suggest therefore that the living races are descended from two stocks which are equally impor-

tant in this connexion. These are: A. The forerunner of the brachycephalic negrito (Aetas, &c.); and B. The forerunner of the negro, &c. From this forerunner all modern races are derived, except A.

I hope that the following pages will show that my classification is based on the order of Evolution.

The Ethnograph.

In a number of other branches of geographical research, such as climatology and economics, I have found it very helpful to

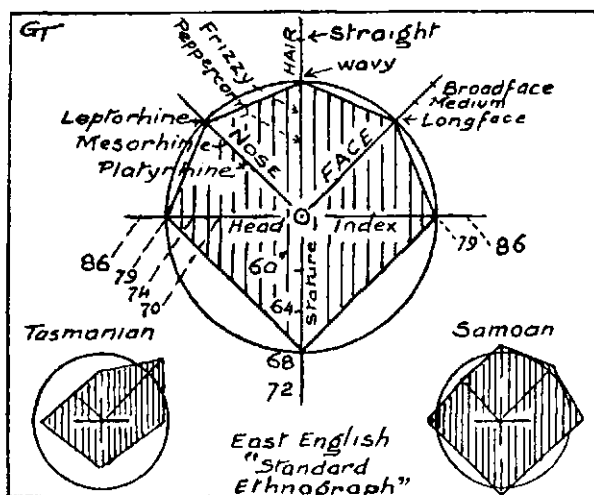


FIG. 14. Criteria used in drawing the 'Ethnograph'. 'East English' is taken as the standard type, and fills the circle. The Tasmanian has a lower head index, frizzy hair, and a short stature, but has a broader face and flatter nose. The Samoan has a slightly broader head and flatter nose. (Data from Biasutti's maps.)

use graphic methods for comparing numerous types. Such graphs tend to diminish the personal equation, and they enable conclusions to be drawn much more readily than do tables of figures. I have therefore devised an 'Ethnograph' in which the six chief criteria of race are graphically represented. Since, in my opinion, cephalic index is the best single test of race, I have used this as the chief measurement in my graph. Furthermore, in order to make every race readily comparable

with the type best known to my readers, I have so arranged matters that the unit of each criterion is that which is present in the typical Anglo-Saxon (Nordic ?) of East England.

The ethnograph is a six-sided figure, where the east-west axis corresponds to the value of the *cephalic index* (e. g. 79 for the East Anglian). From centre to top is the measure of *hair type*. From centre to bottom is the measure of *stature*. From centre to north-west is the measure of the *nasal index*. From centre to north-east indicates the *face-breadth*.

Drawing a circle, as illustrated, I consider that the hexagon which fits within the circle represents the East English race. Races with broader heads or straighter hair or broader faces or greater stature have correspondingly greater axes, as is the case with the Samoan. Races with narrower heads, frizzy hair, platyrhine noses, and shorter stature have correspondingly shorter axes, as is the case with the Tasmanian. In later illustrations, ethnographs for Europe, Asia, Africa, and America will be found.

II

THE PAST

THE CHANGING ENVIRONMENT AND
RACIAL DISTRIBUTION

V

THE CHANGING ENVIRONMENT IN THE AUSTRALASIAN 'PENINSULA'

(a) *Topography.*

WE have seen that the dominant features in the structure of this portion of the world are the *ancient shield* of Western Australia, and the highly mobile belt flanking it to the east running from Malaya through the East Indies and Melanesia to New Zealand. Research in this great region is naturally not so detailed as in the European or American areas, but enough evidence has accumulated to show that changes in the topography have here affected man's environment perhaps to a larger extent than elsewhere. Nowhere else do we see such enormous submerged lands as in the Sunda and Sahul regions. Nowhere else are recently elevated shore-lines better exhibited than in these coral-girdled islands (such as Kambing) which I have seen to the north and north-east of Australia. Nowhere else has isolation affected a people for so long a period as in Australia and Tasmania. In this region, moreover, are many of the most interesting primitive peoples as well as human relics such as the Trinil and Talgai skulls; here also is the habitat of the oranges and gibbons.

Let us glance at the wonderful series of earth-folds which characterizes so much of this region. They commence at the south-east corner of the Tibetan Plateau. Here are six parallel ranges separated by deep river valleys within a distance of four hundred miles. These valleys are unique in that each is occupied by a river which maintains its course to the sea without joining any of the others. Running from east to west these six head-waters are the Hoang-Ho, Yangtse, Mekong, Salwen, Irrawadi, and Brahmaputra. Such a drainage scheme dates back only to yesterday, yet it is the direct result of the mountain-folding which resulted when the Himalayas were

built up. Associated with this is the volcanic action off the mouth of the Irrawadi.

As a result of these comparatively recent bucklings we find a well-marked division separating the peoples to east and west of this line. Indeed the Indo-European peoples who speak Aryan tongues reach no farther east than the Brahmaputra.

Passing to the east these bucklings are continued in the elongate islands of the East Indies to New Guinea. We obtain a better picture of the topography if we consult a block diagram of the region, where the sea-bottom is shown as if the waters were drained away (see Fig. 15). The ridges constituting Sumatra, Java, &c., are seen to be perched on the edge of a huge drowned area, Sunda Land, which rivals the whole of India in extent. Much of the sea between Java and Borneo is less than 200 ft. deep. So shallow is it that the channels of buried rivers can be made out, which once drained Sunda Land to the north-west. The heads of these rivers are still preserved in West Borneo and Sumatra and contain the same kinds of freshwater fish, while the fish of *East Borneo* are quite different.¹

Sunda Land extends as far as Lombok and the Macassar Strait. Then comes the Banda Deep separating it from the ancient Sahul Land which once connected Australia to New Guinea. This also is drowned by about 200 ft. of water, so that an area of land of the size of New South Wales (or France together with Britain) has been lost here in recent geological time. All round the margin of the Banda Deep is a broad rim of land, submerged about 1,000 ft., on which are perched the islands of Bali, Timor, Ceram, Celebes, &c. It is generally held that these two large areas, Sunda Land and Sahul Land, were above sea-level during the last of the Ice Ages. The melting of the ice consequent on the change of climate has produced an enormous amount of water, which before was locked up on the lands. This influx of waters has led to that drowning of the coasts of the world which is so marked a feature in almost all areas where it has not been counterbalanced by recent uplift.

We thus see that during the Great Ice Ages an influx of primitive folk into Australia would have been much easier than

¹ *Vide* Molengraaf, *Geographical Journal*, 1921.

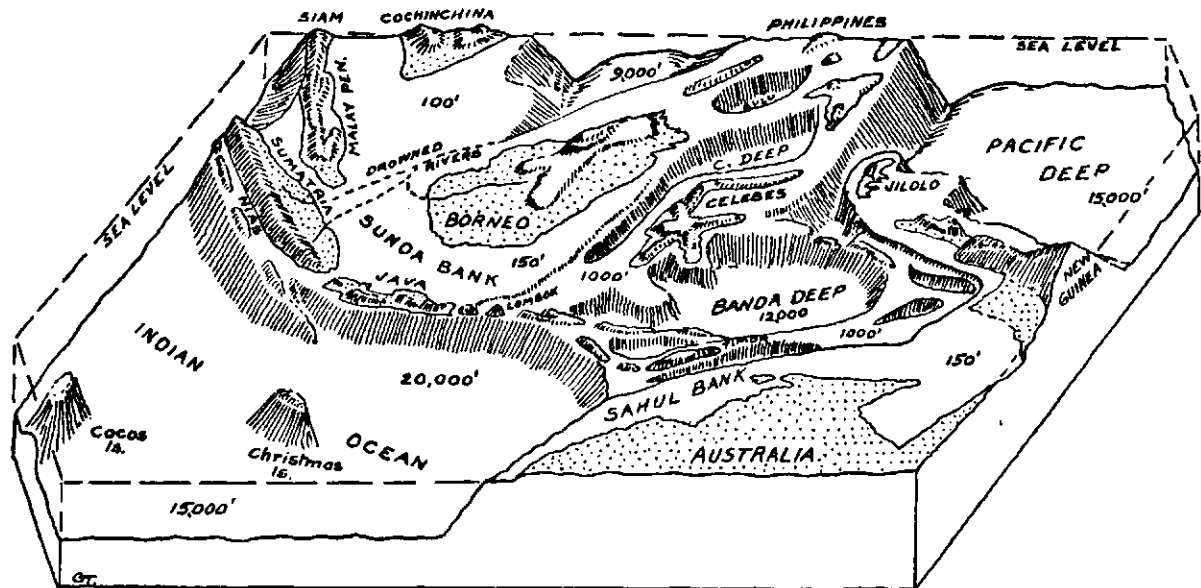


FIG. 15. Generalized block-diagram showing the 'Stepping-Stones' to Australia. The ocean is supposed to be absent. Notice the Sunda Bank and the Sahul Bank, each only 150 feet below sea-level. Between is the profound Banda Deep surrounded by the Celebes-Timor shelf 1,000 feet below the surface. Lowlands are dotted. (Depths from Dutch surveys.)

to-day. Between Timor and Australia is now about 850 miles, but from Timor to the ancient Sahul Land was only sixty miles. So also in those days there was no gap larger than sixty miles along the northern rim from Borneo via Celebes and the Moluccas to New Guinea and Australia. We know that there never was a *complete* land connexion, for none of the Asiatic mammals has reached Australia except the dingo and rat, which probably came with man.

It is important to note that the Tasmanian presumably crossed before the Australian, and he also must have had some sort of a raft for the same reasons. One can picture these primitive folk wandering from Asia into Sunda Land and then retreating slowly before the influx of more advanced tribes. Finally, when their hunting grounds are completely overrun, they despairingly put to sea in their rough rafts made of bark or bundles of rushes. Many are lost, but some few reach the islands to the east, whence they ultimately enter Australia.

Two factors preserved them when they reached the Australian continent. We may reasonably suppose that soon afterwards Sunda and Sahul Lands were drowned, thus greatly diminishing the risk of attack; and secondly the climatic conditions in the north of Australia certainly did not attract any peoples who were not driven there by dire necessity. We shall consider this aspect later.

The great folding forces swept round the eastern side of Australia, buckling up New Guinea to heights of 16,000 ft. (in the Dutch region). Many successive earthquakes may have accompanied this buckling, for Rawlings speaks of a fault-face 10,000 ft. high near Mt. Carstensz.¹ The flanks of the uplift are covered with active or recently active volcanoes and raised coral reefs are common features all along the coasts.

In the South-West Pacific there are four major buckles, which are indicated in the accompanying block diagram. On the east is the Tongan Deep, with a maximum depth of 5,155 fathoms (30,930 ft.), which extends more or less continuously from Samoa to Chatham Island, 2,400 miles to the south. Here is the 'engine' (according to Hobbs) which has caused the crustal

¹ David, 'Papua', *Federal Handbook*, British Association, 1914, p. 321.

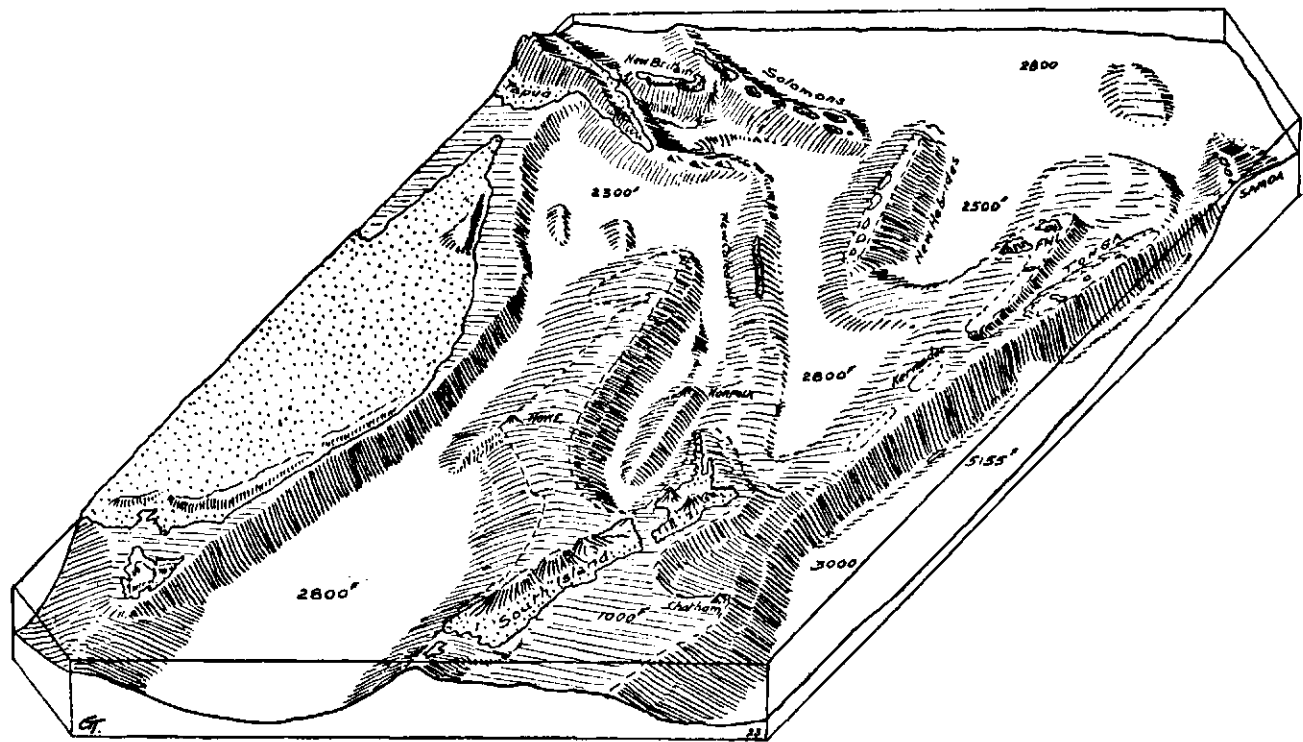


FIG. 16. The Warped Floor of the South-West Pacific. (Depths in fathoms.)

deformation. Thrusts to the west have caused an enormous ridge from 18,000 to 30,000 ft. high to develop, which reaches above the sea in the Samoa, Tonga, Kermadoc, and Chatham Isles. The next ridge rises about 8,000 ft. and carries the New Caledonia group. The next appears at the surface only in Lord Howe Island. These three unite to the south in a broad submarine plateau on which rises New Zealand to a height of 12,300 ft. above the sea. Then there is a fairly deep trough and the Australian cordillera flanks the continent, rising to 7,000 ft. above the sea.

We do not know much about the age of these uplifts, save that the whole region is still very active with many volcanoes, especially in the New Hebrides, Tonga, and New Zealand. Mawson¹ and others have shown that the western 'festoon islands' (New Hebrides, &c.) seem to have undergone continuous upheaval, for they are veneered with coral reefs of very recent growth. The Fiji region seems to have been elevated and then to have subsided many times in fairly recent geological time; while the islands farther to the east (e.g. Funafuti) are coral atolls which denote that subsidence dominates the movement.

Turning to the mainland the buckling is insignificant compared with that shown nearer the deeps. The 'wave-depth' changes from 30,000 ft. to 5,000 ft. (see Fig. 17). This certainly supports the theory that the folding pressure comes from the east rather than from the solid shield in the west.

The chief elevated region in Australia is confined to the east coast, where the earth-buckles connected with these waves moving from the Tongan Deep have raised a broad ridge about 100 miles wide and running approximately north and south. This elevated portion consists of a series of fault-blocks, of which the highest reaches 7,328 ft. at Kosciusko. Several other blocks attain 5,000 ft., such as New England, Bimberi, Mt. Bogong, &c. Relatively lower blocks have determined the course of the rivers, such as those flowing north or south in Victoria, and the Upper Murrumbidgee, Tumut, and Snowy rivers.

The drainage system is of recent origin; hardly a river on the eastern side of the Great Divide flows normally to the sea. Reversals, 'boat-hook bends' (in tributaries), alternating senile plains and juvenile gorges are characteristic of these eastern rivers. For instance, the Nepean river flows in meanders through a deeply alluviated plain for many miles. It then

¹ Mawson, 'New Hebrides', *Proc. Linnæan Soc. N.S.W.*, 1907.

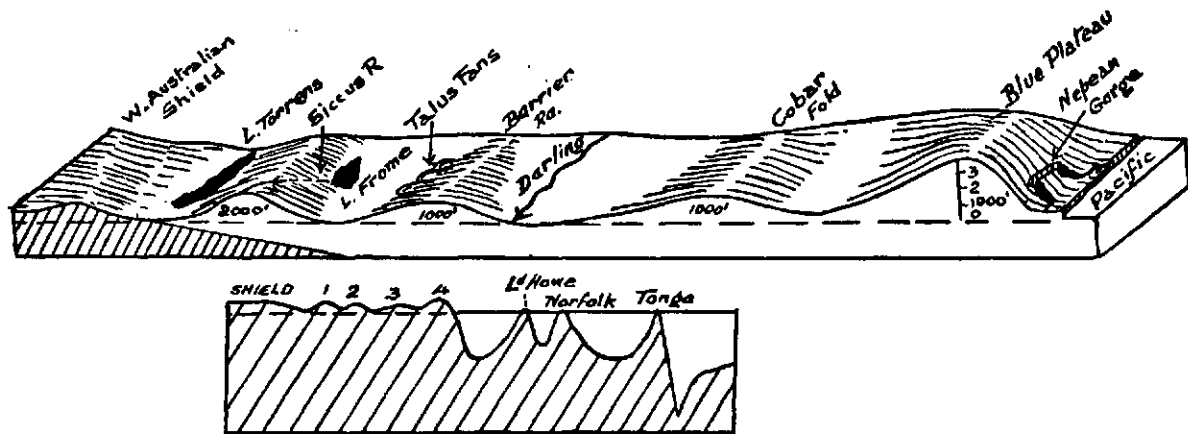


FIG. 17. The four late buckles in south-east Australia. Their relation to the Tonga Deep is shown in the lower figure. (Notice the ancient Siccus R. and the Nepean Gorge.)

enters the buckled region of the Blue Plateau Warp near Mulgoa and for 10 miles occupies a gorge up to 700 ft. deep. It leaves the warp near Penrith and enters another alluviated plain which was probably at one time a warp lake, 15 miles long.

Other late movements have cut off the head of Yass river, forming a fault-scarp 250 ft. high. At the foot of this scarp is Lake George, about 20 miles long and 6 miles wide. From the silts deposited in the lake it is possible to estimate in a vague fashion the age of the faulting. Possibly about 20,000 years ago is as near as we can get to the date (see *Proc. Linnæan Society N.S.W.*, 1907, p. 339).

The most striking example illustrating the recency of the warping is found in South Australia. Here is a fourth wave in the series between the Tasman Sea and the West Australian Shield. It constitutes the Flinders Range. Howchin¹ shows that originally the Siccus river flowed from Lake Frome to the gulfs at Wakefield. The warping dammed back Lake Frome and elevated the Siccus gravels to a height of nearly 2,000 ft. at Orroroo on the top of the uplift. Here these are found as a deposit 600 feet deep, indicating the recency of the warp.

The greater part of the mainland has not been below the sea in late geological time. The chief area won from the sea is at the mouth of the Murray, where a long tongue of late Tertiary formations speaks of an elevated gulf akin to those drowned to the west of Adelaide. But much land has been lost to Australia along the east and south coasts, as is shown among other evidence by the presence of river divides right on the coast (e. g. Cairns, Bulli, &c.). The evolution of Bass Strait is not clearly understood. There is no need to invoke dry land for the Tasmanians to reach their island, for they certainly had no bridge across the gap west of Papua. Further, the fauna seems to indicate complete separation from Australia since man appeared, or else we should expect the dingo to have crossed. However, the tiger and devil have only recently died out in Australia, though numerous in Tasmania. So that Tasmania was probably connected during most of Tertiary time.

Evidence of drowning to the extent of one or two hundred feet is universal, and may be logically set down to the melting of the Pleistocene ice-caps. The Bass Straits are crossed by

¹ Howchin, *Aus. Assoc. Advance. Sci.*, 1913, p. 169.

two ridges, still apparent in Flinders and King Islands. But the straits are much deeper than the Torres Straits. However, Hedley has shown that the eastern and western marine shells have not yet fully mingled by way of the straits, so that we are at a loss to fix the date as to when the island was last severed from Australia (see, however, chapter vi, *postea*).

Speaking generally, Australia is a low plateau about 1,000 ft. above sea-level. Only about 5 per cent. is above 2,000 ft. in elevation. Tasmania is a somewhat hilly state, since rather more than half exceeds 1,000 ft. This is due to its being merely an isolated portion of the Cordillera.

These Eastern Highlands are the chief economic regions in Australia.

The rest of the continent consists in part of the lowlands of the Murray Basin and the Lake Eyre Basins. These have experienced some subsidence and much filling by river alluvials in the last geological epoch. Lake Eyre is shallow, with its shore 39 ft. below sea-level. Its waters are unapproachable owing to the belt of mud surrounding it. The remainder of the continent is the 'West Australian Shield', almost all very arid country and covered largely with desert 'waste', dunes, laterite, &c. This is described in greater detail in Part III, chapters xxiv and xxv.

(b) *The Changing Climate.*

In the preceding section the changing topography has been discussed. We are unable to assert that man occupied Australasia during all these changes. But Dubois believes that men akin to the Australians lived in Java during the Pleistocene,¹ so that man may have witnessed much of the warping referred to previously. As regards the changes in climatic conditions we are on surer ground, and the evidence is much more abundant.

Australian climates depend essentially on the latitude. No other continent has so large a proportion of its area in the Trade Wind Belt, and consequently no other has relatively so much of its extent desert. From the point of view of changing climates, we are to picture Australia as crossed by a broad belt of arid climate which swings north and south with changing

¹ *Proceedings of the Royal Academy*, Amsterdam, 1921, 'Man of Wadjak.'

temperatures. Normally this swing of temperature results from the swing of the sun from tropic to tropic, about 3,200 miles. The rainfall belts swing in unison, but five weeks later. This is clearly shown in the 'Solar-Control Model' which I have published elsewhere.¹

Thus the centre of the Trade Wind desert also swings with the temperature, and it can be plotted month by month. This centre of aridity lies over Pine Creek (lat. 14°) in July and over Tarcoola (lat. 29° 30') in January. It therefore swings through 15½ degrees each six months. Putting this another way, we see that when Australia is hottest (January) the desert conditions reach to the south coast. When Australia is coldest, they reach practically to the north coast. Luckily the Tropical Rain Belt covers northern Australia in summer, while the Polar Rain Belt covers southern Australia in winter. Hence only the central portion suffers from desert conditions all the year round.

Let us now see the effect of changing the temperatures. If the land be subjected to cooler temperatures, this is equivalent to increasing the factors which bring the southern rain belt to Australia. We should expect a strengthening of this rain belt so that it became broader; in effect, the desert would retreat to the north. If the climate as a whole became hotter we should expect a movement south of the desert and a deterioration in the living conditions of southern Australia. We shall show that this deterioration has occurred in the latest geological epoch.

In the adjoining illustrations I attempt to show how the changes in temperature affect the rain belts, not only under present conditions, but also under conditions somewhat hotter (Pliocene) and colder (Pleistocene) than at present.²

The centre of aridity, under present conditions, agrees approximately with a temperature of 75° F. The Tropical Wet Belt reaches down to about isotherm 85° F., and the Polar Wet Belt reaches north to about isotherm 55° F. If now we postulate an epoch like the *Pleistocene*, when the snow-line moved down 2,000 ft. on Mt. Kosciusko, we may assume a temperature some 6° F. cooler. This 6° of vertical cooling is

¹ Frontispiece to *Australian Meteorology*, 1920, Oxford.

² See 'Climatic Cycles', *op. cit.*, p. 292.

equivalent to about 400 miles of *horizontal* movement; for we must move 70 miles (or one degree of latitude) to experience one degree diminution of temperature. Thus the Pleistocene winter should show moist conditions about 400 miles north of where they are to-day (Fig. 18 at c).

The evidence of wetter conditions in southern Australia in recent geological times is very strong. Thus we find botanical 'outliers' in moisture-loving plants far in the desert. *Flindersia* is allied to the tropical teaks, and several species occur in our coastal rain-forests. But one species—the 'Leopard Wood'—is found throughout the arid Darling

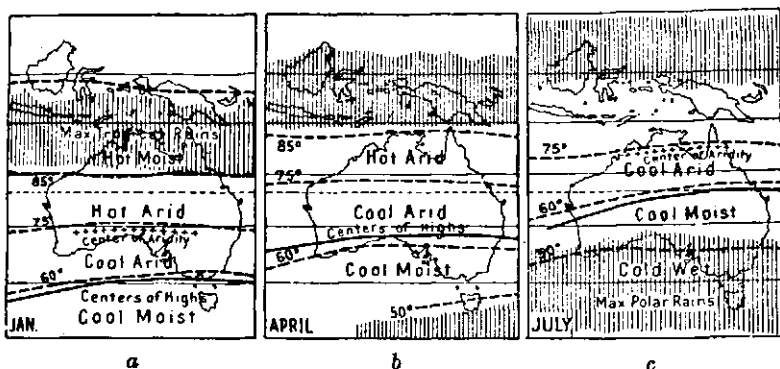


FIG. 18. Pleistocene Climates in Australia: a, Present Summer and like Pliocene Equinox; b, Present Equinox and like Pleistocene Summer; c, Present Winter and like Pleistocene Equinox. In the Pleistocene Winter the belts were probably still farther north.

Basin, where the rainfall is only 10 in. Like a number of acacias it changes its habit with age, as E. C. Andrews points out, for its trunk (which grows to a height of 20 ft.) is surrounded by a dense brambly growth when young, which it drops off as the tree reaches maturity. Thus an early *humid* habitat, followed by an *arid*, and then by a *less dry* environment, is indicated. Nearly all the inland acacias do not possess true leaves, but the flattened stalk (or phyllode) acts as the leaf. When a seedling, the acacia has ordinary bipinnate leaves, but gradually the leaves change to phyllodes. The intermediate leaves are very interesting, showing clearly the response of the plant to the change from a moist climate to an arid climate, where phyllodes conserve the plant's moisture better (see Fig. 19).

We may now turn to the physiographic evidence, which is equally clear. All through southern Australia are dwindling rivers losing their way in silts which not long ago formed no barrier to them. Every inland river now ceases to flow, not

even excepting the Murray, which has dried in its lower courses three times in the last century. The Darling is often dry for eighteen months at a time. The Lachlan and Murrumbidgee usually reach the Murray, but a dry spell stops their flow.

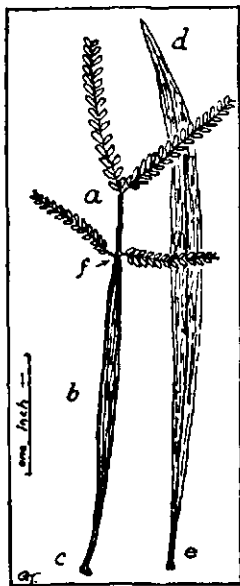


FIG. 19. The change in leaf-form in some Australian acacias illustrating past change of climate. The first leaves of the seedling are bipinnate like the portion *fa*. The second stage of leaf is like *ca*, then the stalk broadens and the final leaves are all phyllodes like *ed*.

The Victorian tributaries, such as the Wimmera, lose themselves in the mallee sand dunes which now extend for nearly 100 miles between the Wimmera and the Murray. Farther west in South Australia the river valleys have been dammed by dunes and silt so that meandering salt-lakes or playas are formed, as at Lake Labyrinth near Kingoonya. These salt-lakes are characteristic of southern West Australia, and hundreds of them occur in the gold-field region. Their growth is due to a peculiar form of arid erosion consequent on the desiccation of the continent to the south of the Trade Wind desert. Penck has described similar evidences of desiccation as universal in the other continents in the same latitudes, i.e. from 25° to 30° .

Even in those regions where the rainfall is still adequate, there seems little doubt that it was once much heavier. In fact there seems some evidence of several pluvial cycles. If we examine the caves at Jenolan, we find that they are cut in an almost vertical bed of limestone which runs across the Jenolan river valley. This deep juvenile valley was eroded in response to a rise of some 3,000 ft. when the Blue Plateau was formed, probably in early Pleistocene times. The homogeneous bar of limestone has been eroded into several large caves at each of three distinct levels. These levels are connected by narrow, more or less vertical channels. The simplest explanation is that the large caves were cut during the pluvial cycles, and

the narrow vertical channels during the drier cycles. [We cannot, of course, be sure that periods of *slower* uplift were not also factors in the differential erosion.]

The most striking evidence, however, is found in the records of the Pleistocene Ice Age, which are becoming more numerous as the highland areas in the south are carefully investigated. Throughout Tasmania the higher regions exhibit cirques, glacial lakes, erratics, and moraines which have been described by J. W. Gregory, N. Benson, A. S. Lewis, and others. At the Tasmanian National Park (Mt. Field) the writer has investigated the cirques, and there seems to be evidence of two cycles of ice erosion

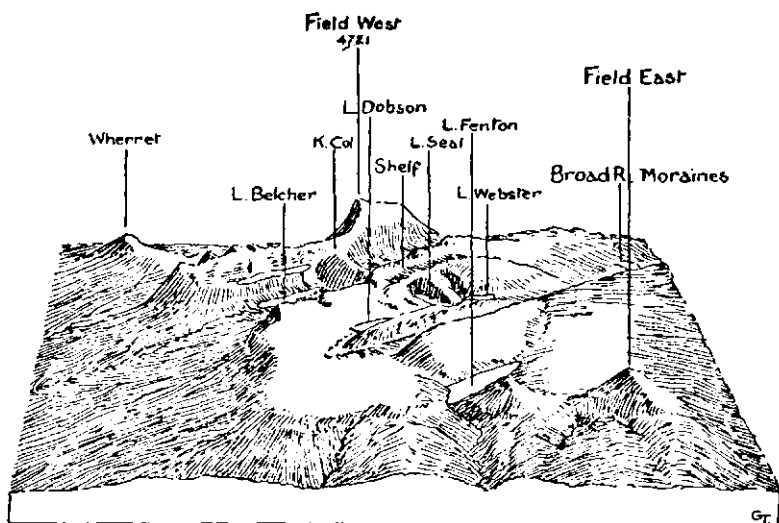


FIG. 20. Glacial features on Mt. Field Plateau, Tasmania. From Field West to Field East is seven miles.

at least. The plateau is at a level of 4,000 ft. and is drained by the Broad River. Three or four terminal moraines across this valley show resting stages of a glacier, which extended some 5 miles from the summit at its maximum. Possibly also in this cycle the large cirque occupied by Lake Seal was cut out to a depth of 1,000 ft., the floor being not much above the Broad Valley glacier. The other cycle is marked by a curious rock-shelf, about 400 yards wide, carrying seven tarns, which drain *along* the shelf, as well as over the edge and down to Lake Seal. This shelf is at 4,300 ft. level and was cut out, I imagine, during the last cycle, when the zone of maximum erosion (by sapping) occurred at this level. This zone (which is that marked by the strongest thaw-and-freeze action) necessarily

accompanies a temperature of about 32° F. It now lies about 1,500 ft. above the Mount Field Plateau.¹

The Kosciusko evidence is perhaps shown most clearly in a block diagram. This is based on a contour survey carried out in 1921 by Dr. W. Browne, Mr. Jardine, and the writer.² The summit reaches 7,328 ft. and is a small rounded dome about 900 ft. above the adjacent plateau. A good motor road takes one to the highest point on the continent, which fact itself shows how strikingly the topography of Australia differs from that of the other great land masses. Cirque erosion is not so striking as on Cradle Mountain or Mt. Field in Tasmania. In summer great snow-drifts, several hundred feet long and possibly 20 ft. thick, lie on the sheltered eastern flanks of the divide, about 6,800 ft. high. They usually melt in the autumn. In winter the snow-drifts are very thick over the plateau down to the 5,000 ft. level. A little sapping leading to miniature cirques still seems to be occurring in sheltered hollows. Professor Sir Edgeworth David has pointed out that the glacial evidence indicates at least two ice ages. The moraines near the summit are in many cases quite fresh in appearance (e. g. Jensen Moraine), and belong to the last ice advance. But at lower levels there are relics of much greater moraines (David Moraine) which go back to the earlier ice age. Cirques occur on a large scale near Blue Lake and Club Lake, and a group of small cirques constitutes a sort of karling on the flat range above Charlotte Pass.

At the maximum period an ice-cap covered most of the plateau above the 5,000 ft. level. Ice flowed to the east from the highest land across the Snowy gorge, over Guthrie Range, and so into the Crackenback gorge. Over-deepening in the Snowy river valley is not so marked as one would expect, nor are terminal moraines visible below 5,800 ft., but thick timber hides the portion below 5,000 ft. The most suggestive evidence at the 5,000 ft. level is the occurrence of rounded granite blocks ('buns') which cover the level swamps and would appear to have been ice-borne. The whole plateau, except near the summit, is built of almost uniform granite which makes it hard to detect erratics.

Finally the faunal evidence supports this change in climate. In the soft muds of the salt lakes the bones of the Diprotodon, a marsupial as large as a rhinoceros but akin to the wombat, have been found. These occur right across southern Australia, and Lake Callabonna (near Lake Frome) and Lake Darlot in West Australia are noteworthy localities. They lie in desert regions receiving only 7 in. of rain a year. It seems unlikely that when this huge herbivorous animal was alive the herbage was as scanty as it is to-day in these regions.

¹ See the writer's paper on Mt. Field in *Proc. Roy. Soc. Tas.*, 1921.

² *The Kosciusko Plateau*, Royal Society N.S.W., 1925.

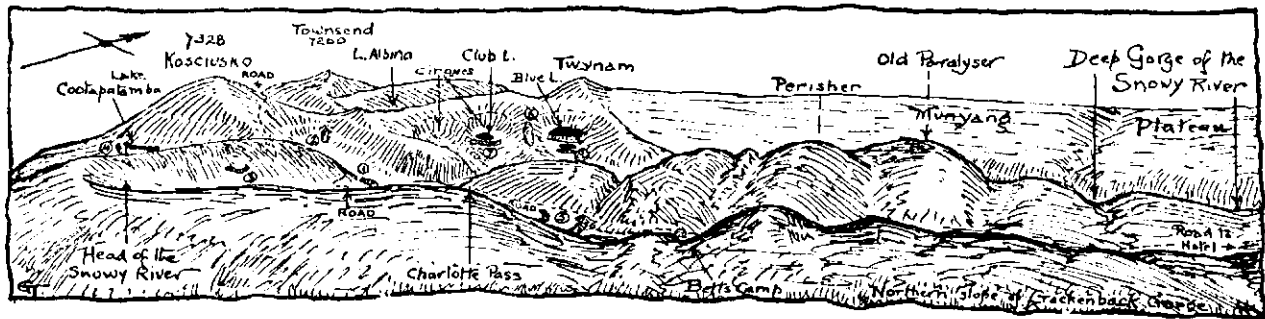


FIG. 21. Panorama sketch of the Glacial Features on the Kosciusko Plateau—looking N.W. across the shallow Road Valley and the deep Snowy River Valley to the Great Divide. The chief Moraines are numbered (1-8). The freshest are 3 (Jensen), 4, 7, and 8. The oldest appear to be 1 (Masson) and 5 (David). They all lie above 5,500 ft. The lakes are black. The region shown is 16 miles wide.

Turning now to the arid region immediately north of the desert-belt, and near latitude 20°, the evidence is less well known, but it seems to indicate that conditions are now wetter than formerly. Thus the small lakes in this belt are usually fresh or brackish, as, for example, Lake Woods and Lake De

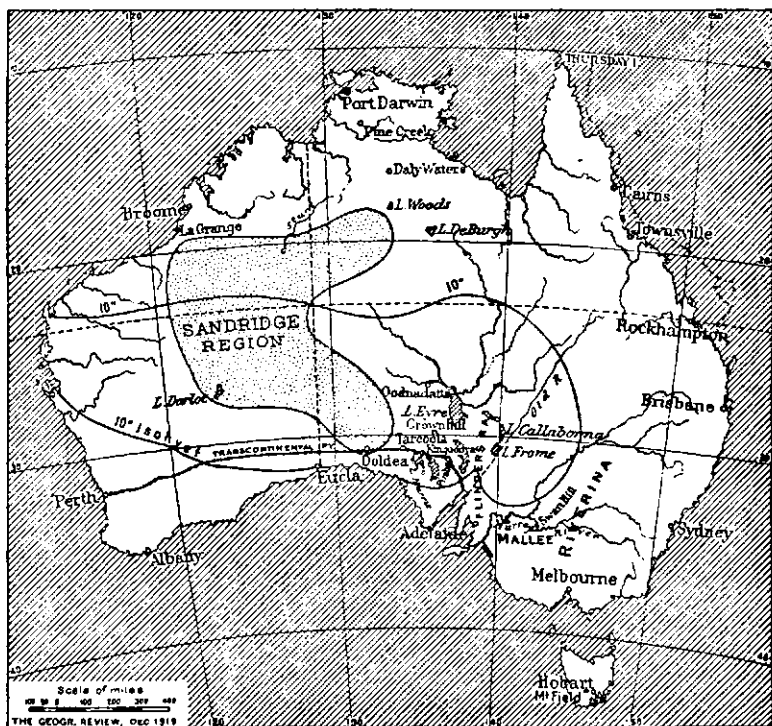


FIG. 22. Sketch map of Australia to illustrate Pleistocene conditions. The course of a pre-uplift (Old) river is indicated. (*Geographical Review*, 1919.)

Burgh in Northern Territory, and Gregory's Lake into which Sturt river flows in Kimberley, W.A. It seems possible that these inland *basins* are due to a cycle of arid erosion of which such hollows are characteristic. They have, however, become lakes through the wider range of the tropical rain-belt. With the warming which occurred after the Ice Age, we should expect the desert to be encroached upon, as has been explained

earlier. The surface deposits also support this view. Great sheets of laterite and travertine, which are now forming under the increasingly arid conditions in the south, are breaking down in the north owing to the wetter conditions of to-day. The country around Camooweal in north-west Queensland shows accordant evidence. Here luxuriant Mitchell grass covers a sheet of desert-waste which has apparently persisted from desert conditions, while the hills and plains, even in regions receiving 18 or 20 in. of rain, still show profiles recalling the 'inselberg' ridges and 'billiard-table' floors of arid erosion.

Thus there would appear to be quite clear proof that there have been marked climatic swings in Australia since man was in the vicinity. We may picture much more repellent conditions in the north during the Pleistocene Ice Ages than obtain to-day. These may well have prevented any higher race from following the Aborigines into Australia. On the other hand, the changes in the south may help to explain the curious distribution of the tribes, whereby a rather primitive group of matrilineal aborigines occupies most of New South Wales.

No doubt the 'corridors' of migration were very different in Pleistocene times. From the north the best line of entry may well have been down the great rivers of the interior, between the deserts of the north-west and the temperate jungles of central New South Wales. Nowadays the natural corridor would be along the western slopes of the cordillera, a route possibly 600 miles east of the old corridor.

VI

THE DISTRIBUTION OF THE RACES IN THE AUSTRALASIAN REGION

(a) *The Main Groups.*

THIS is probably the most complicated ethnological region in the world, since it has the most diversified environment and is quite near the centre of dispersion. Hence the later races have pressed out into the island areas, while the older races have been preserved in many isolated mountain areas clothed with tropical jungle. We shall do well to tabulate the major races with their ethnological characters. The races are given in the order of superposition, i. e. the early, primitive races below, and the younger, more advanced races above.

TABLE A

Generalized Scheme of Races in the Australasian Regions.

No.	Race.	Types.	C. index.	Hair.	Stature.	Skin.	Nose.	Culture.
6	Proto-Malay	Javanese	81+	Straight to wavy	in. 63	Brown	Meso-rhine	Metals, weaving, &c.
5	Later Polynesian	Samoan, Tahitian	79+	..	68	Light brown	..	—
4a	N. Melanesian	Micronesian Massim	77	Wavy	65	Dark brown to black	..	—
4	Mid-Melanesians	Igorots, N. Solomons	75	..	63	..	Platy-rhine	Neolithic, Megaliths, Couvade.
3	Australian	Arunta, Kamilaroi	73	.. ¹	65	Chocolate	..	Neolithic, primitive weaving. No metals or pots.
2a	S. Melanesian	New Caledonia	72	Frizzy	65	Dark brown	..	—
2	Papuan	W. Melanesia, W. Papua	71	..	65	..	..	—
1	Negrito	Acta, Tapro, Tasmanian	Variable	..	58	..	..	Very primitive Paleolithic.

¹ In December 1924 the writer investigated the tribes of aborigines living on the edge of the West Australian desert (for 500 miles from Nullagine to Yalgoo), and found that the women and children are largely tawny-haired. (Vide *Herald*, Sydney, 27 March 1925.)



Java. 82



Tonga. 80



Salish (Br. Col.). 80



Tikopia. 70



Malay (Sumatra). 79 ?



Maori. 76



Malay (Sumatra). 75 ?



Australian. 73



Sakai (F.M.S.). 73



Tasmanian (negrito)



Semang negrito



Fiji negro. 69

III. MIGRATION ZONES BETWEEN ASIA AND TASMANIA

arranged approximately in order of evolution

(For explanation see List of Illustrations)

In the above generalized table I have made cephalic index the first criterion in establishing the ethnical types. It may be objected that such a classification splits up the Eastern Island peoples ('Polynesians'), such as Maoris and Samoans, into different classes, and allies the former with the Massim of Melanesia. This seems to me logical, for the term 'Polynesian' is based on habitat, language, and culture rather than on a physical basis. It would not be thought scientific to remove Booker Washington from the negro races because his culture and language are exactly those of the educated West European.

As regards some of the lower races the classification is not so difficult. The groups of negritos and Australians are distinctive, while the Papuan races have fairly definite characters. But the Melanesian peoples are especially hard to classify satisfactorily, as we shall see. Finally, the higher races on the frontiers of Asia are late comers into the Australasian region and can be correlated with certain Asiatic types with some certainty.

(b) *The Negrito Peoples.*

These are scattered through a belt of 'marginal' habitats from the Andaman Islands to Tasmania. With the exception of these two extreme regions, all their localities may be described as 'inliers'. In other words, they have almost been overwhelmed by succeeding 'strata', and are surrounded by the latter, who have driven them into forested highlands in every case. The Mincopi people of the Andamans and the Tasmanians, who are regarded by Haddon as 'a somewhat generalized variety of Negrito-Papuan stock', were preserved up to recent times by their isolation in islands about 200 miles from the mainland.

In Fig. 23 the main corridor, used probably by all the early peoples, is shown by the heavy black line. In Pleistocene time this traversed level plains for much of its course. Since then Sunda Land and Sahul Land in the north have vanished, while in central Australia the corridor has in all probability greatly deteriorated in attraction, as I have shown in a preceding chapter. The present habitat of the negritos is shown to lie off the corridor, in general far to the east in the high ranges

which once bordered the fairly continuous lands of the corridor. The broken line, including all the negritos of to-day, defines a narrow belt which must not be taken to represent the line of migration of the negritos. Each group of these branched off from much the same main corridor (as indicated by the short arrows). No doubt the Tasmanians separated from the

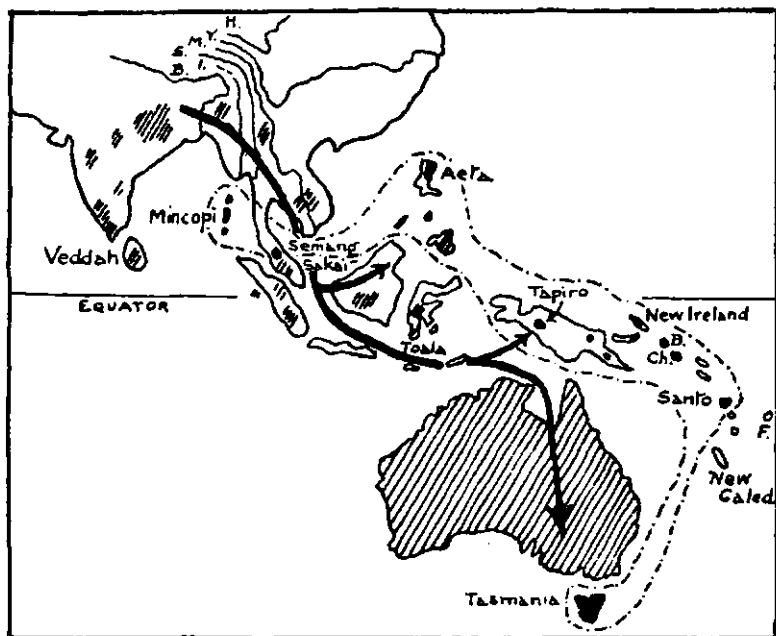


FIG. 23. The Negrito (black) and Australoid Zones (ruled) in the Australasian region. (Partly after Biasutti.¹) The main corridor leading to Australia is shown by the heavy black line. The Negrito localities are enclosed in a broken line. The six great parallel rivers of E. Tibet are indicated (see p. 51).

negritos now living in Melanesia (the region from New Ireland to New Caledonia), somewhere near the island of Timor or Celebes. So also the Aeta of the Philippines probably branched off from the main corridor near West Borneo.

(c) *The Tasmanians.*²

While it is probable that this people was not quite so primitive ethnically as the negrillos of Central Africa, yet the

¹ Biasutti, *Antropogeografia Generale*, 1912, Florence.

² See photograph on Plate III.

latter were in contact with much higher races, while the Tasmanians were completely isolated for centuries. The French explorer, Peron, about 1800, first described them, and his notes are some of the most valuable extant, for the British took little interest in them later on when Tasmania was first settled (1803). In stature they were from 5 ft. 2 in. to 5 ft. 5 in., but occasionally grew to 6 ft. In colour they were a dark brown, almost black. Their hair hung in corkscrew appendages about the men's faces, and there was much 'down' on the body. The hair grew low on the forehead and at the sides of the head on men and women.¹

The eyes were rather small, the mouth very wide, but the lips were less full than the negro's. The chin was small and retreating, and the face fairly prognathic. The nostrils were wide and full, and teeth large and powerful. The head index was variable but usually above 74, and a well-marked 'keel' characterized the top of the skull.

Every edible product of the region was eaten, from stranded whales to grubs and ants. Great shell middens still mark their resting places all round the coast. Various fungi, and the gums and pith of various trees, were eaten, together with kangaroos, wombats, and opossums. They made no pottery and so roughly roasted their food, if it were not devoured raw. Skins were used for rugs, for Tasmania has a climate like the South of England, and snowfalls are common in winter. Girdles, necklaces, and bracelets showed their love of ornament, while cicatrices and red ochre further added to their attractions. Singing and dancing filled much of their time.

Their technology was very primitive, for they had not begun to make polished stone weapons. Paleolithic axes and scrapers were the highest expressions of their art. A wooden spear, with a point merely hardened in the fire, was their chief weapon, though they made clubs (waddies) to kill birds. They seem to have built rough beehive huts at times, for such structures, large enough to hold thirty people, were seen on the west coast. But usually rough bark break-winds like the gunyahs of the Australian aboriginal served all their needs. Of special interest is the description which Peron gives of their rafts. They used three rolls of eucalyptus bark which were lashed side by side. The central roll was 14 ft. long and 3 ft. wide, and the lateral rolls were 12 ft. long and narrower. This raft was made more solid with reeds and would hold up to six men. Other observers saw a raft 6 ft. wide and 30 ft. long which would hold six people, and

¹ According to Dr. Hickson the hair at times was of a golden-brown colour (cf. p. 68).

this would float in rough water. For instance, it is recorded that they crossed three miles to the Maatsuykers Island on the stormy west coast. There seems to be no reason therefore why, when migrating, they should not have crossed the straits both in the East Indies and north of Tasmania in some such craft.

We have no knowledge of their numbers when the British settlers first arrived in 1803. According to Milligan, two thousand included them all. From Walker's¹ data the adjoining 'extinction curve' has been plotted. They were ruthlessly slaughtered in the early days, and only 111 were alive in 1834, and 44 in 1847. Drink and disease quickly killed these. In

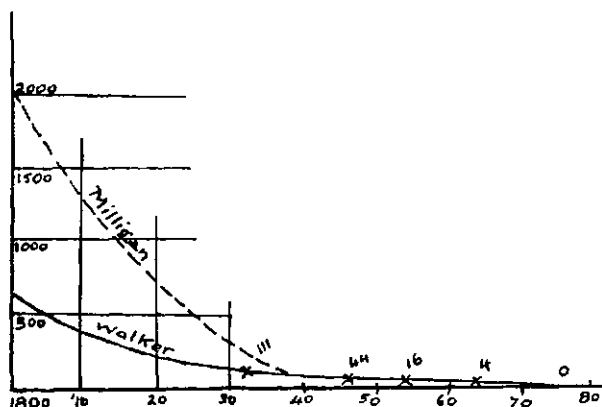


FIG. 24. Extinction curve of the Tasmanians.

1854 there were 16, and the last male, William Lanney, died of drink in 1865, leaving four women. The last Tasmanian woman, Truganini, died at about fifty years of age in 1876.

The attempt to conquer the Tasmanians in the famous 'Black Drive' of 1830 was a complete fiasco, for every native save one eluded the cordon! At present there are a number of half-castes and quarter-castes on Cape Barren Island in Bass Straits, and an aged quarter-caste niece of Truganini still lives on an aboriginal reserve near Moama on the Murray.

(d) *Melanesian and other Negritos.*

In Melanesia negritos of somewhat similar types occur in very small groups in the interiors of the largest islands. In

¹ *Aboriginals of Tasmania*, James Walker, Royal Soc. of Tasmania, 1898.

many cases the pure-bloods have become practically extinct, and the chief evidence of a former negrito settlement is the presence of tribes of smaller stature than usual, often with rather higher head indices than those of the surrounding tribes. Indeed, as the negritoes of this portion of the world become less pigmy-like so their head index decreases, as the following table shows.

Group.	Tribe.	Cephalic index.	Stature.	Hair.	Skin.
Asiatic Negrito	Aeta (Philippines)	79.6	ft. in. 4 9	Peppercorn	Chocolate
	Mincopi	82.1	4 11	"	Black
	Semang	78	5 0	"	Chocolate brown
	Tapiro	79.5	4 9	Frizzy	Yellow brown
Mixed types ?	Sakai	79	4 11	Wavy	Black
	Tasmanian	74-77	5 5	Frizzy	Dark brown
	Veddah	73-75	5 1	Wavy	Chocolate
(For comparison)	Australian	73	5 5	"	"

The most probable explanation is that we are dealing here with two original stocks best illustrated by the Australian and Aeta. The Tasmanian is probably a half-caste between the two. He has the stature of the Australian, the hair of the Aeta, and an intermediate cephalic index.

The *Tapiro* negritoes have been investigated by Wollaston.¹ They live just to the south-west of Mt. Carstensz in Dutch North Guinea at a height of over 7,000 ft.; they are active little fellows with big buttocks and big calves, thus being quite unlike the Papuans in the swampy coastlands below them. The nose is straight but very wide, the upper lip long and curiously convex. The hair short, woolly, and black, and the men have short, bushy black beards. Their weapons are bows and arrows, flint knives, and daggers made from cassowary bones. Instead of mere wind-breaks, their houses are built on piles and made out of lath and bark. They are therefore much ahead of the Tasmanians in culture.

(e) *The Australian Aboriginal.*²

Owing to its age-long isolation the continent of Australia has a remarkably uniform series of aboriginal tribes. All

¹ Wollaston, *Pygmies and Papuans*, London, 1912.

² See photograph on Plates III and VI.

authorities agree that they entered from the north and drove the Tasmanians before them. There is, however, considerable difference of opinion as to whether the Australians came into the continent in one great migration and thereafter differentiated into 'varieties', or whether their characteristics were determined before entering, so that they arrived in Australia with the attributes of several different migrations. We shall do well to consider their salient features before attempting to decide this problem.

Spencer¹ points out that there is a broad division into eastern tribes with female descent, and western, with male descent. Further, although there is an extraordinary homogeneity in their method of organization, yet there is a strong divergence in such matters as burial, weapons, &c. As in many primitive peoples, the individual is primarily a member of a special tribal-class, and only to a minor degree does he associate with his close blood relations. In other words, the idea of family relationship in higher races seems to have developed after the Australians left Asia.

The boundaries of the tribe were very definitely limited, and usually trespass gave rise to tribal warfare. But for certain special 'crops', such as the fruits of the *Araucaria* in Queensland or the bogong grubs near Kosciusko, these trespass laws were temporarily suspended.

Their food ranged through as extensive a programme as did the Tasmanians'. Kitchen middens from 20 to 50 ft. high are known near Port Phillip and Botany Bay, and smaller middens are common elsewhere. Yams and vine-roots were eaten. The sporocarps of Nardoo (*Marsilea*) were ground into paste on stone mills which are still very common along the Darling river. They are expert fishermen, and the stone weirs at Brewarrina (N.S.W.) were perhaps their most elaborate 'monument'. In these crescentic pools, built every year across the rapid Barwon river, Murray cod up to 120 pounds weight were secured. They also made large nets in which emus were caught.

Much of their time was spent in 'magic', which was essentially their religious life. The motive of most of the tribal laws and customs was probably to strengthen the power of the older men. Hence strict cere-

¹ Spencer, *Federal Handbook to British Association, Australia, 1914.*

monies accompanied the initiation of the younger men, while the women have a very low place in the aboriginal scheme. The following description is given by Howitt of an initiation ceremony for the tribes of the south-east quarter of New South Wales.

The head man sends a messenger to the other tribes who may be associated together for these ceremonies. He carries a 'churinga' or bull-roarer as a credential, and also various message-sticks. (The latter are strips of wood 8 in. long, with notches on the edges which serve to memorize dates and people. They are in effect a primitive form of writing.) The ground for the corroboree is now prepared and usually a more or less sacred site is used. A circular ridge about 50 yards in diameter is built up for the public ceremonies, while a smaller circle is made ready some 400 yards away in the bush. As the visitors arrive they dance and their leaders do 'magic'. The women are congregated around the larger circle, but turn their backs at the more important stages of the ceremonies.

The boys are painted and brought along by their sponsors, who are usually brothers of the potential wives. These men teach the boys the laws and legends, and give them their adult badges. Finally, in the smaller enclosure, to the sound of the bull-roarers, which are swung with a whirring sound, a tooth is knocked out with a mallet, and the boy becomes a man. This ceremony marks the time when he leaves his mother, and throughout is accompanied by much buffoonery and gesture.¹

The Australians are much higher than the Tasmanians in their technology. They make beautiful flaked spear-heads and knives, and many of the stone axes are as finely polished as those of the neolithic age in Europe. Spears and clubs are their chief weapons, and great differences occur in the varieties of wooden shields. In Victoria the latter consists merely of a bar of wood, only 2 inches wide, while in North Queensland huge elaborately painted shields are customary. The boomerang and womerah (spear-thrower) are characteristic weapons, but both are used among primitive folk of the same status nearer Asia. The womerah is not found in the south-east of the continent (i. e. where descent largely passes through the mother).

A number of investigators draw attention to the fact that there is a gradual evolution in culture from south to north. Assuming that the Australians arrived in one uniform migration, it is difficult to see why these culture-zones should be arranged in this fashion. Thus we find that the southern

¹ For the sociology and anthropometry of the hybrids between Kamilaroi and White see paper by Taylor and Jardine, Royal Society of N.S. Wales, 1924.

tribes have either no boats or use only pieces of bark bent into rough canoes. Those on the west coast (near North-West Cape) build rafts. Then in the zone nearer Asia, both on the east and west coasts, we find tribes who sew the bark to make a more elaborate canoe. Finally, on the north coast we find wooden canoes, and in North Queensland outrigger canoes.

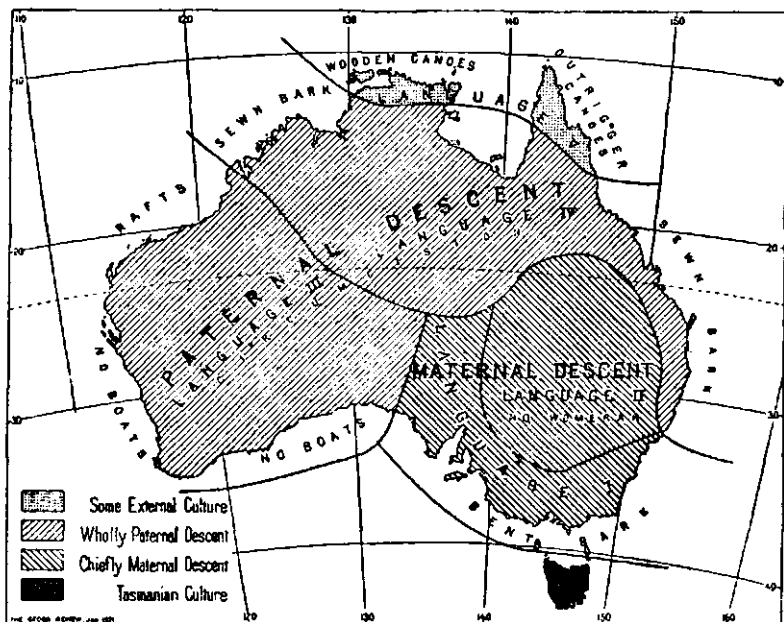


FIG. 25. The chief culture zones in Australia. Social grouping (descent), language, navigation, &c., are the bases of classification. (After Sollas, Curr, and Graebner.)

As mentioned previously, the south-eastern tribes mostly count descent through the mother. The children may look to the mother's brother for paternal care, and the true father is often of much less importance to them. This stage usually implies a more primitive development than descent through the father, which obtains among the remaining tribes in the centre, north, and west. The latter tribes also practise circumcision.

Schmidt,¹ who has studied the structure of the various languages, is satisfied that there is a gradual evolution, in general from south to north. Thus the south-east languages

¹ Schmidt, *Anthropos*, 1912.

have a post-posed genitive as in the Tasmanian languages. These were spoken by the first migrants. The next migration used a pre-posed genitive. The last did not use initial R or L.

Kroeber¹ has recently discussed the affinities of the various Australian dialects. He corroborates Schmidt in most particulars. Thus there seems to be a division between the northern (vertical ruling) and the southern languages, as indicated by the heavy boundary in the adjoining figure (Fig. 26). But Kroeber believes that some languages stand relatively

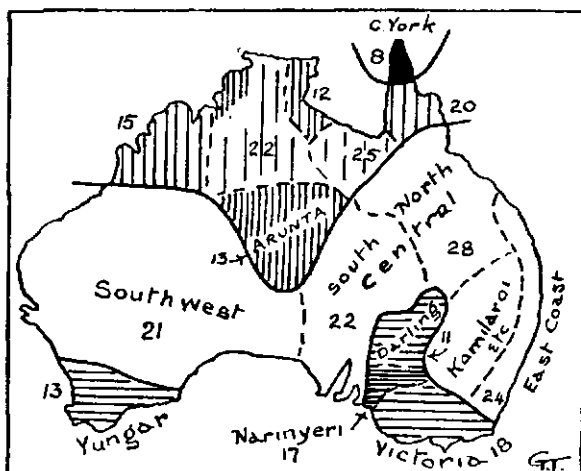


FIG. 26. Language relations in Australia. C. York is most isolated. Narinyeri in south and Arunta in north are considerably isolated. The others have affinities in varying degree. (Data from Kroeber.) Figures show number of similar words out of 33 roots found in the various languages.

alone. Thus the Cape York speech is perhaps not part of the Australian family at all. The Narinyeri (South Australia) is very well marked off from most of the southern languages, though nearer perhaps to the Darling and Victoria speeches. So also Yungar (West Australia) is somewhat different. The languages left white in the map are less specialized. In the north the tribes south of the Gulf have languages slightly akin to the southern group; but the Arunta speech is quite well marked off from the others. Kroeber is satisfied that there is a general similarity throughout the continent, which seems to him to demonstrate the essential homogeneity of the Australians. Needless to say, this does not prove that the aborigines did not enter in several separate migrations; for we have clear evidence of language similarities (in other large land masses) between members of very different migrations.

¹ Kroeber, *Languages of Australia*, Royal Society of N.S.W., 1923.

(f) The Date of the Migrations into Australia and Tasmania.

A valuable paper by Sir Edgeworth David on the geological antiquity of the aborigines has just been published,¹ upon which the following notes are partly based. The evidence may be discussed from several points of view. The geological, biological, and cultural aspects are all worthy of consideration. Perhaps one of the chief features is the presence of the dingo in Australia, and its absence in Tasmania. The dingo was introduced into the mainland before some of the extinct marsupials died out, and almost certainly entered with the Australian aboriginal. The nearest of the dog tribes to the dingo seems to inhabit

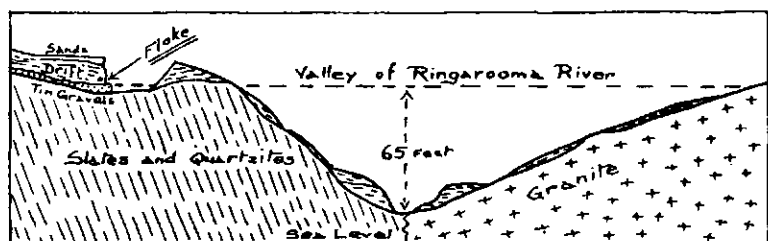


FIG. 27. Vertical section of Peaty Drift 65 ft. above the present Ringarooma Valley, Tasmania, in which a Tasmanian artefact was discovered. (After Sir Edgeworth David.)

Syria rather than Eastern Asia, so that this animal may have accompanied the black fellow from Central Asia. The dingo seems to have been responsible for the extinction of the marsupial tiger and 'devil' on the mainland. They have survived in Tasmania owing to his absence.

The Tasmanians had a 'balsa' or raft, as we have seen. They could readily have crossed from island to island; even to-day the largest gap in Bass Straits (from Victoria to Deal Island) is less than fifty miles. We know (from Mr. Hedley's work) that the marine molluscan fauna has not yet traversed Bass Straits, but that the east and west types are readily separated. Any primitive tribe would take to its rafts as a last resort from the sustained attacks of a stronger race, and some few of these craft might have reached Flinders Island, whence land extends nearly continuously to Tasmania. Finally, if the

¹ 'R. M. Johnston Memorial Lecture', Royal Society of Tasmania, 1924.

Tasmanians have been in these latitudes (akin to Falmouth, England) for many thousands of years, it is difficult to understand why they have not become somewhat bleached from their very dark, almost black, colour.

On the other hand, there is strong evidence indicating a far-distant date for the first inhabitation of Tasmania. Sir Edgeworth David describes a retouched chalcedonic flake which was found 10 ft. below the surface in the gritty, peaty drift over the tin gravels of the Doone Mine in north-east Tasmania. The undulating floor on which the gravel rests is 65 ft. above

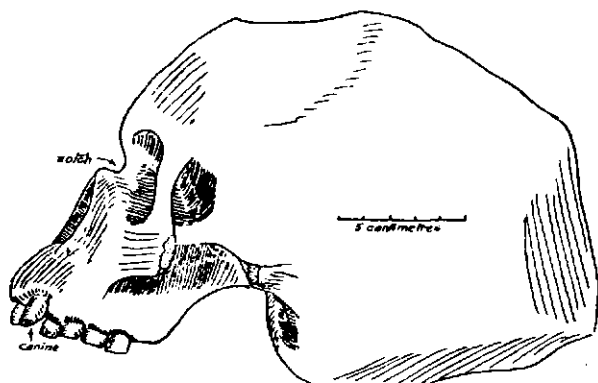


FIG. 28. Sketch of the Talgai skull (Warwick, Q.) illustrating the strong prognathism, and very large canine teeth. (N.B.—The skull is crushed.)

the present river. Evidently a great amount of erosion has taken place since the peaty drift was deposited, and Professor David thinks it dates back at least to the Wurm glaciation and perhaps even to the Riss period.

There can be no doubt that the Tasmanian entered Australia before the Australian aboriginal and before the dingo. The Talgai skull with its huge faceted canine teeth seems to show a very great age for the Australian aboriginal in Australia.¹ In the Wellington caves the dingo is found associated with the extinct *Thylacoleo*. David thinks that the geological evidence is in favour of the Tasmanian aboriginal having arrived in Tasmania between twenty thousand and one hundred thousand years ago.

¹ In similar strata fossils of Pleistocene marsupials in the same condition have been found near Talgai. Vide S. A. Smith, *Philos. Trans. Royal Society of London*, 1916.

(g) *Status of the Australians.*

One of the difficult problems of ethnology is to discover the relative positions of the Australians and negroes in the ethnological scale. It seems to me that the geographic evidence is helpful here. We may assume that the lower Melanesian (who is described in the next section) is comparable with the lower African negro. Thus Keane gives the following data :

	<i>Cephalic index.</i>	<i>Cranial capacity.</i>	<i>Facial index.</i>	<i>Hair.</i>	<i>Skin colour.</i>
Central Africans	71.2	1,424 c.cm.	70	Woolly	Chocolate to sooty.
Papuan	70.4	1,412 "	69	"	"

They have been so long separated that we can expect little resemblance in their culture ; but the keloid scars, drum language, and totems are common to both families.

If we now follow the migrations back (see Fig. 23) to Asia, we find that the *Dravidian folk* of India, who are certainly nearer the Indo-European than are the negroes, form the 'stratum' which next overlies the Veddah-Australian type. Indeed, many 'inliers' of the Australian types are preserved in India, such as the Nairs of the Malabar region, the Todas, Badagas of the Nilgiri Hills, and the Mundas of the north. We do not find any negro people in Asia or Indonesia, except negritoës, until we reach the Papuan region in the island of Flores. It seems clear therefore that the Papuan negroes were largely confined to the Indonesian islands long before the Australians left the mainland, and indeed it is possible that the negritoës were abundant in Asia long after the Papuans had left. Putting it the other way : if the Papuan were higher in the scale than the Australian, we should expect to find 'inliers' of Papuans in South India and the Australians entirely 'pushed to the wall', whereas the contrary is the case.

We may assume, then, that the distribution supports the view that the Australian with his wavy hair is ethnically higher than the Papuan with his woolly hair.¹ No doubt the isolation of the Australian kept him at a very low state of civilization ; moreover, his habitat produced few fruits and grains which

¹ Blood tests by Dr. Tebbutt and others show a remarkable similarity between the blood of the Australian aborigines and that of West Europeans. This indicates an Australoid stratum in Paleolithic Europe.

might lead to the development of agriculture, and no animals which corresponded to the herds of the primitive pastoral peoples. Hence he remained a primitive hunter living from hand to mouth.

It is hard to see why the Papuan never entered Australia, since the negrito reached both Australia (as the Tasmanian) and Papua (as the Tapiro, &c.), but it must be remembered that some ethnologists consider the Tasmanian to be a variety of the Papuan. Probably the folding of the East Indian region and the drowning of the flat lands of Sunda and Sahul determined the paths of the various migrations, and we must leave the elucidation of this problem to a later date. Something like the following may well have taken place.

Perhaps we may assume a negrito migration at a very early date, when it was easy to get into Papua and also into Melanesia and Australia. Then the Papuan hordes moved to the south after Australia was shut off. They entered Papua at a time when we may imagine extensive deserts in Northern Australia for reasons given earlier. They drove the Tapiro into the hill-jungles. Later the first horde of Australians arrived in a Pleistocene Ice Age, when the Sunda and Sahul areas were dry land. They moved down the central rivers to the south-east. They mixed with the negritos in the south to some extent, producing the Tasmanian type. The next migration drove the Tasmanian farther south, and was in turn driven into the thick forested regions of New South Wales by the latest migrations.

The continent was now closed to further migration from Asia, and the tribes reached a state of equilibrium. But the environment gradually changed for the worse in southern Australia. The attractive central portion, the ancient corridor, became almost desert, the thick forest of inland New South Wales became open, grassy plains. But it is possible that the tribes were 'anchored' to their tribal grounds, and so we find the anomaly of later and probably higher patrilineal migrations occupying poor ground while the earlier matrilineal tribes have (or had) some of what is now the best country in Australia. Still we find the later migrations were beginning to invade the east coasts, as is apparent in the map (Fig. 25).

(h) Papuan and Primitive Melanesian.

Quite distinct from the Australian aboriginal in many ways is a group of people whose present range is from Flores (400 miles east of Java) and the Moluccan Islands on the west to Fiji and New Caledonia on the east. They thus occupy the islands on the eastern rim of the Banda Deep (see Fig. 15). In Melanesia they are found chiefly in the southern and western isles. In all cases the skin is very dark, in some parts even sooty in colour. The hair is extremely frizzy, the nose is often hooked and Jewish in appearance, the face long, and the skull markedly dolichocephalic (73). There is often a well-marked brow-ridge (frontal *torus*).

There is a rather well-marked distinction between the peoples of New Guinea in the west of this ethnological division and those inhabiting Melanesia to the east. The latter speak languages which belong to the common *Melanesian* stock; the former have quite different and very varied languages which are described for convenience as *Papuan*. (We shall see a very similar classification in Africa, distinguishing the Bantu negroes from those negro tribes, otherwise somewhat similar, who speak alien tongues.) Judging by analogy we may look upon all these long-headed negroes as of similar origin who migrated from Asia about the same time. But possibly those living in the small islands came under the influence of a great migration of later comers (the higher Melanesians) who spoke a new tongue which the primitive island folk adopted.

The salient feature of the organization of the primitive Melanesians is their division of each tribe into two exogamous groups. Each of these has a totem (which we may briefly describe as the tribal symbol), often one totem being light coloured and the other dark. This may refer to a racial mixture of aboriginal dark peoples with less dark invaders. Marriage takes place only between members of different groups, hence the name of 'Dual-Group Melanesians' is given to this stock. Descent was chiefly through the mother. Body scars (keloids) are thought to improve the appearance just as in Australia. Magic plays a very large part in their lives, and they inter their

dead in a crouched position. Secret societies of a complex nature terrorize the community, in which a ritual of masks and bull-roarers shows a culture stage little different from the Australian.

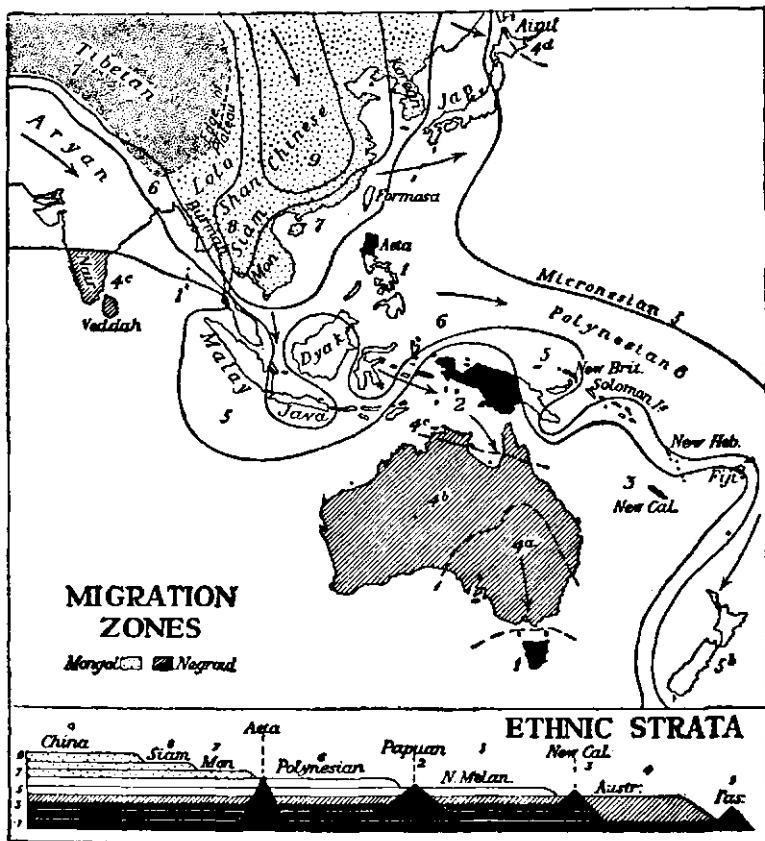


Fig. 29. Migration-zones illustrating racial evolution between Tibet and Tasmania. The section below shows in a generalized form the ethnic strata in the same region.

The Higher Melanesians. Living almost side by side with the primitive dual-group peoples is a much higher race which has unfortunately also been classified under the term Melanesian. They have few characters in common, though certain transition types are to be expected. The cephalic index is 76 as opposed to 78. There is no exogamy, and the physical features are

much more refined. These higher races are smaller and lighter coloured. The skin ranges from bronze to *café-au-lait*. The hair is usually rather frizzy, but may be ringletted or wavy. The usual beverage is 'kava', prepared by macerating a root like ginger; and much ceremony accompanies kava-drinking. In many respects they resemble the primitive peoples of Europe, the Ibero-Mediterranean peoples. Thus they tattoo in almost all the tribes. They indulge in skull-hunting, they built stone monuments, and the curious custom of the *couvade* is characteristic of them. (Couvade: on the birth of a child the father takes to his bed for a space of days or weeks and abstains from certain foods and practices.) All these customs characterized the earlier Western Europeans (such as the Irish, Basques, Corsicans, &c.), and may be traced in the earliest descriptions of them when in a state of barbarism. (See Appendix B.)

These higher Melanesians are found in the northern and eastern islands chiefly. Dolmens and stone circles mark their migrations and occur in New Britain, in Eastern New Guinea, in the Banks Is., in the Solomons, in Santo and Pentecost, in the New Hebrides (see table on p. 87).

Migrations of the Melanesians. We can only trace the Melanesian migrations from anthropometric or cultural evidence. Their legends are of no such value as those of the Polynesians for instance. Almost everywhere where the Polynesians settled we find traces of the lower races. It seems likely that they or their allies wandered from Madagascar to Easter Island. As regards the former locality, T. A. Joyce has shown that a small section, the Antimerina, who were the dominant people in the nineteenth century, 'is of fairly pure Malay (or Javanese) blood, and is composed of sixteenth-century immigrants, but the language belongs to a very early branch of the Malayo-Polynesian family. There is much to be said . . . for the view that the earliest and negroid inhabitants of Madagascar were Oceanic negroes.'¹ As regards Easter Island, although it lies 5,000 miles to the east, the evidence advanced in Mrs. Routledge's book² shows that the slit-eared statues differ little

¹ *Guide to the Ethnographic Collections in the British Museum*, p. 245.

² *Mystery of the Pacific*, London, 1919.

except in size from similar figures in Melanesia. Their bird-cult recalls that associated with the frigate-bird in the Solomons.

In the following table I have collected data as to the stone cult in the Pacific. The dolmens and cruder structures are found in Melanesia in islands where no Polynesians ever landed, as well as in those at present considered as Polynesian. The pyramids and marae may have been built by an early Polynesian migration.

The Polynesians. These interesting peoples comprise several ethnic stocks who are allied in much the same fashion as are the Alpine and Nordic people of Europe. In other words, they have a common language, culture, and environment, but are not in a physical sense people of the same race. There is the greatest difference between the dark, medium-sized, leptorhine, long-headed Maori and the fair, tall, somewhat platyrhine and very brachycephalic Samoan. The former approaches physically the West European, the latter is nearer the so-called Mongolian. This resemblance is no accident, but illustrates an important general principle. In effect, while one group of peoples was migrating to the western periphery of Asia (i. e. Britain), an allied group was migrating to the south-east and later reached about the same position with regard to Central Asia, e. g. outer Polynesia. Thus we find the peripheral folk of Hawaii (in the north-east) and New Zealand (in the south-east) linked together in certain physical and cultural aspects, although in the former case there is evidence of mixture with a mesocephalic type, and in the latter with an element with a strong Melanesian strain. Both peoples have heavy beards, which are absent in most Polynesians. Indeed it is almost impossible to distinguish some Hawaiians and Maoris from certain dark Europeans.

The Polynesians are as a whole some of the tallest people in the world; 5 ft. 10 in. is quite a usual height. The higher Polynesians have often a very light-brown skin; the Hawaiians and Maoris are a much darker brown. The hair is wavy to straight and of the same type as European hair, but always black in colour. There is a tendency to obesity. The face has regular features, so much so that many of the women are quite beautiful. The eyes are black. Tattooing is common and reached its greatest development in New Zealand. We note that the

Igorots of the Philippines and many of the highest Melanesian folk of New Guinea (whom the writer places in the same zone) were their rivals in this respect. Tattooing, indeed, is a marked character of the migration zone with a cephalic index near 76.

The Polynesians had a high social organization with powerful chiefs and women played a relatively important part in affairs. They had a strong religious sense, free from the gross beliefs of the Melanesians. The earlier migrations seem to have built large stone temple enclosures (*marae*), and in certain islands they erected truncated pyramids, as indicated in the annexed table. These stone monuments belong to a more elaborate cult than the dolmens and circles of the higher Melanesians, and are found in Micronesia (Ponape), Tahiti, Tonga, and elsewhere.

They had no knowledge of metals, and in most cases no pots. We must remember, however, that in many islands there was no clay, though this does not apply to the largest Polynesian islands. Carving is very elaborate, and elaborate plaiting and mat-making is characteristic. Their canoes were especially noteworthy and enabled them to sail over the whole Pacific. It seems possible that about A. D. 900 a Maori explorer discovered the frozen seas of the Antarctic some thousand years before Captain Cook reached the same latitude. New Zealand was first discovered about A. D. 650 by Polynesians who probably set out from Tahiti. Their legends refer to a land of Hawaiki; but this name is found throughout Polynesia under the form Savaii (Samoa), Avaiki (Raratonga), Havaii (Tahiti), Hawaii and Havaiki (Marquesas). It has even been suggested that Java and Saba (Sheba) are similar modifications.

Migrations of the Polynesians. There is little doubt that the Polynesian peoples represent a disrupted zone of races who originally inhabited the south-east of Asia. Judging by the general laws of migration we should expect to find their congeners still living in the highlands of India and Burmah on the one hand, and in Manchuria or thereabouts on the other hand. Many allies might be expected in America, and this is precisely what we find when we examine the physical and cultural evidence. In the annexed sketch-map these migrations are indicated. We may picture a time reaching back to

STONE MONUMENTS IN THE PACIFIC.

	MICRONESIA.				MELANESIA.							POLYNESIA.									
	<i>Carolines.</i>	<i>Ladrones.</i>	<i>Marshall.</i>	<i>Gilbert.</i>	<i>Bismarck Arch.</i>	<i>S.E. Papua, &c.</i>	<i>Solomons.</i>	<i>New Hebrides.</i>	<i>New Caledonia.</i>	<i>Fiji.</i>	<i>Samoa.</i>	<i>Tonga.</i>	<i>Society Isles.</i>	<i>Marquesas.</i>	<i>Paumotu.</i>	<i>Easter Island.</i>	<i>New Zealand.</i>	<i>Hawaii.</i>	<i>Fanning Island.</i>	<i>Pitcairn.</i>	
<i>Pillars .</i>
<i>Circles .</i>	.	x	.	x	.	x	.	x	.	x	x	.	.	.	.	.	.	.	.	.	.
<i>Dolmens</i>	x	.	x	.	.	.	.	.	.	.	x	.	.	.	.
<i>Images</i>
<i>Pavements</i>
<i>Maræ (enclosures).</i>	.	.	x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Vaults .</i>
<i>Pyramids</i>	.	x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Trilithons</i>

(Based on T. R. St. Johnston, Codrington, Perry, Seligmann, and others.)

the Azilian period perhaps, when the Polynesians and other tribes of the same stage of evolution occupied the habitat shown by the *ruled* areas. Later on, for thousands of years the Polynesians were slowly pushed to the sea by the Chinese and allied folk (shown by *dots*). For many centuries the Polynesians occupied Eastern China and Further India, and no doubt became expert navigators. Intense desiccation in Central Asia drove out most of the so-called 'Mongolians' and

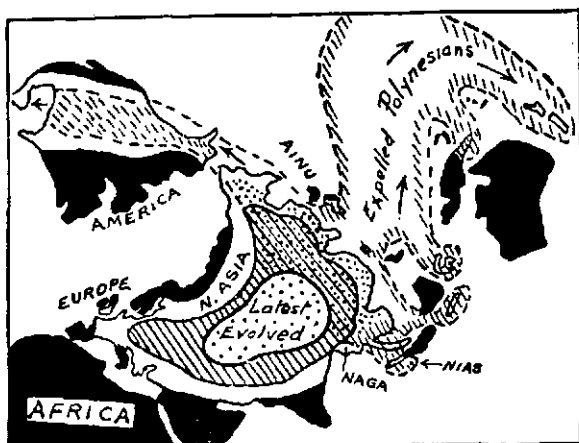


FIG. 30. The expulsion of the Polynesians from the ruled region in East Asia—by the latest evolved peoples of the centre (dotted). The black belts are primitive peoples of earlier zones.

they spread down into the coastlands, probably about 5,000 years ago. The Polynesians abandoned the mainland and migrated eastward. A few went south and settled in the Mentawai isles of Sumatra, for here the Nias tribes speak a Polynesian tongue. But most of them kept north of Indonesia and swept to the east without occupying the islands already fairly fully occupied by the lower races (negroes, Australians, and lower Malays), who are shown *black* in the map.

It seems probable that the Polynesians lost touch with Asia about 3,000 years ago.¹ They have no trace of Sanskrit words which were influencing the languages of Indonesia about 350 B. C.

¹ On the other hand S. Percy Smith (*Hawaiki, the Original Home of the Maori*) believes that the present stock can be traced to India about 450 B. C. See also E. C. Handy as to migrations from China.

But their culture, especially the ceremonial dances, recalls that of the Indonesian peoples. So also the languages of Java, Formosa, certain Philippine tongues, and Japanese have affinities. This aspect will be discussed in the Asiatic chapters.

It must be understood that there was internal warfare among the Polynesians. The later comers pressed forward and dispossessed the earlier. Thus we find that the Maori (an early type) was pushed farther and farther away by later types. No doubt this was one reason why he left Tahiti. His legends refer back to a date about A. D. 650 as the period when Ui-te-rangiora first landed on New Zealand. The discovery of Melanesian carvings in the bogs north of Auckland may, however, show that in New Zealand (as in many other Polynesian isles) a substratum of Melanesians was absorbed by the newcomers, a suggestion confirmed by physical anthropology. Certainly the Maoris and their allies, the Moriori (who occupied the Chatham Isles), contain many strains of Oceanic peoples, and the unravelling of their descent is occupying New Zealand ethnologists.

In a recent paper H. D. Skinner discusses the stocks from which the Maori tribes are derived. The earlier tribes settled in North Island, and their culture has strong affinities with the arts of the Massim people of Papua, the Sepik river, and the Solomons. This is indeed indicated in my recently published map,¹ where I have independently grouped the Maoris (zone 5 b) with the Massim. Thus the spiral ornament, the single canoe, the type of tattooing, and the adzes are all akin to these highest of the so-called Melanesians.

The Southern Maoris came later and are akin to the Moriori of Chatham Isles and in some respects to the far-distant Easter Islanders. They are more truly Polynesian, with double canoes, with outriggers, no pile houses, simpler carving, and Polynesian adzes.

As regards these outer 'Polynesian' islands, Dixon points out that Hawaii was first settled by folk akin to those of Indo-China and then by pure Alpine peoples of a later evolved type. Easter Island has a first 'layer' of Protonegroid, akin to the similar Melanesians, followed by his 'Caspian' type (akin to many Japanese). New Zealand has this latter stratum in the north with many later 'Alpines' in the south similar to those filling the central Polynesian Islands to-day.²

¹ 'Native Races around Australia' (Fig. 54), in *Australian Physiography*, 1923.

² *Racial History of Man*, 1923.

VII

THE CHANGING AFRICAN ENVIRONMENT

' Africa as a whole is a world-segment entirely distinct from all other continents. It is a great solid mass raised perpendicularly from the sea and, with the exception of the Atlas Mountains, has no true mountains or fold mountains of recent date, like the other continents. From north to south one dominant *motif* runs throughout, and can be recognized in the equatorial forests of Guinea or the Congo, or in the deserts of the Sahara or the Kalahari. Perhaps the *black man and the thorn tree* summarizes this African *motif*, though countless varieties of both exist.'¹

If we refer to the block diagram of Africa we see that the continent is logically divisible into two portions of almost equal area by a line joining the Congo mouth to the Red Sea near Suakin. Almost all the southern portion is a plateau over 3,000 ft., while most of the northern portion is under 1,500 ft. Of land below 600 ft. there is a considerable amount extending across the Sahara from Cape Verde to the Nile mouth; the other important lowlands extend along the east coast chiefly to north and south of the mouths of the Juba and between the Zambesi and Limpopo.

Of true fold mountains there are only the ranges of the Atlas in the north-west, which are of the same age as the Alps of Europe. In the extreme south-west near Cape Town are some ancient fold mountains. But Africa has been greatly affected by faults and probably also by broad warping (epeirogenic) movements. Volcanoes are abundant in association with these structural changes, and have built up the highest mountains such as Kilimanjaro, 19,320 ft., Kenia, 17,000 ft., Mfumbiro, 14,600 ft., Ruwenzori, 16,000 ft., and the Cameroons, 18,400 ft.

The highest land extends from Abyssinia down the east coast, and is associated with a unique series of lakes of which the chief are Tana, Rudolf, Victoria, Tanganyika, and Nyasa.

¹ E. H. L. Schwarz, *A South African Geography*, 1921 (which I have freely consulted).

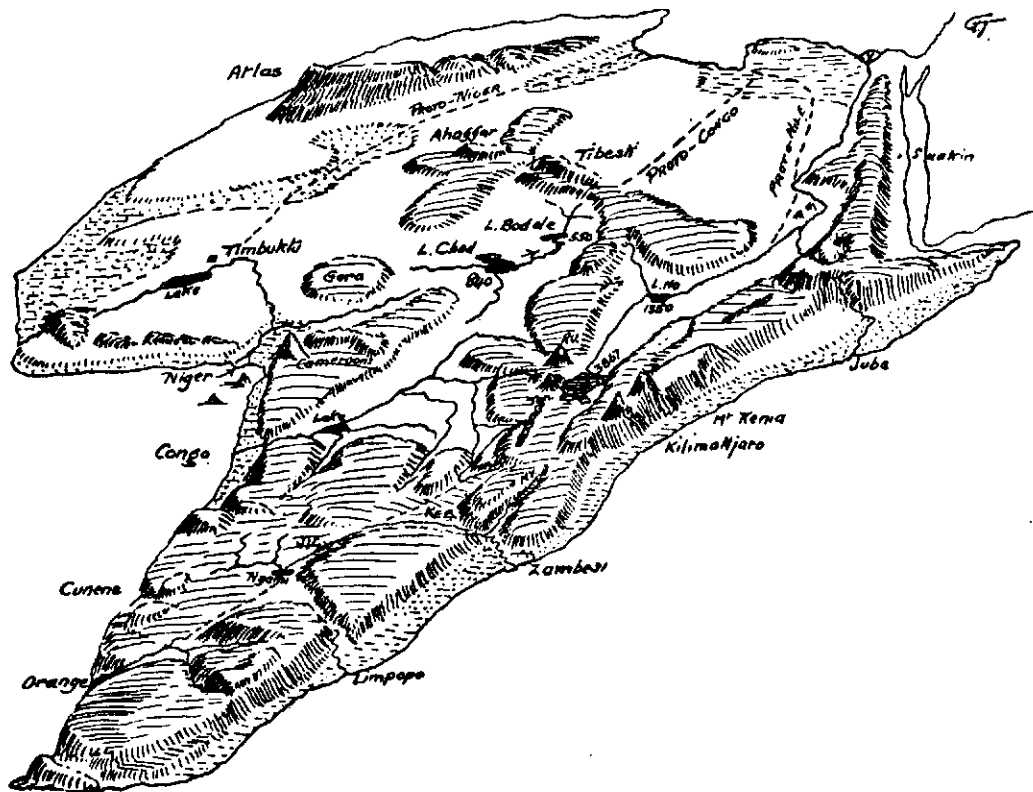


FIG. 31. Block diagram of Africa. Rivers after Schwarz.

These are perched on the relatively narrow plateau and clearly indicate by their precarious position the recency of their formation. Each is drained by a large river with a steep grade, and in a comparatively short time these lakes will be emptied unless further crustal movements supervene. Indeed Lake Tanga Nyika has been tapped by the Lukuga (a tributary of the Congo) since it was first discovered, and its surface has been considerably lowered.

To the north-west of the great plateau extends the great series of lowlands of North Africa, bounded by the Congo and Nile rivers. There are only two highland areas of note. One constitutes the Cameroons massif, and the other is an elongated series including Darfur, Tibesti, and the Ahaggar highlands. The Kong Mountains, behind the Gulf of Guinea, have shrunk in size as surveys progress and are really non-existent. Only the Futa Jallon highlands at the head of the Niger are worthy of note.

The drainage system of Africa is of great interest, and shows that remarkable changes have occurred within the last geological epoch. Except for the Nile, which itself has a very varied history, the main rivers all flow in arcs mostly along an east-west axis. Thus the Niger rises just behind Sierra Leone, flows towards the dry interior, and spreads out into huge swamps and lakes near Timbuktu, thus indicating a local base-level. Thereafter it sweeps round to the south-east and ultimately enters the sea through the somewhat higher region flanking the Gulf of Guinea. Schwarz is of the opinion that the Proto-Niger flowed from Timbuktu to the north via Lake Gurara and entered the Shotts of Algeria, and so reached the Gulf of Cabes. The Congo has a similar curved track, for it rises near Rhodesia, flows north beyond the equator, and then south to the great lakes and swamps of Stanley Pool (another local base-level) before plunging rapidly through the coast scarp to its outlet. Here again Schwarz postulates a Proto-Congo which flowed north to the Chad depression, and thence by the same route as the present lake waters to the Bodele swamps, and so across the Borku uplands to the Libyan desert. Here a well-marked series of low-level oases (e. g. Khufra) may

indicate the ancient silted river-channel which formerly reached the sea at the Gulf of Sidra.

The Orange river has a more direct course from east to west, but it seems probable that in the not far-distant past its northern affluent (Nasob) once brought water from near Lake Nyasa and Lake Benguela via the Okavango and Lake Ngami. Here again we have a vast series of lakes and swamps some 400 miles wide (including the Makari Kari region) which are now dry and silted up. Before 1820 these rivers were flowing and the swamps contained hippopotami and other animals which have long died out.

The Zambesi river appears to have captured much of the internal drainage only recently in geological history. It leaves the plateau by the Kebrabasa Falls, while the Victoria Falls are at 3,000 ft. elevation and some thousand miles from its mouth. The history of the Shire river, which links Lake Nyasa to the Zambesi, is particularly interesting as regards the changes in African geography. In 1889 it was possible to bring steamers from the sea to Lake Nyasa via the Zambesi and Shire, a distance of some 400 miles. Soon the lake sank through desiccation, and steamers could only reach Chiroma (180 miles from the lake). Then water failed above Port Herald, and now in dry seasons steamers can hardly reach the junction of the Zambesi with the Shire, 100 miles from the sea.

The Nile is the sole African river which has a south-north course. It rises in various streams which enter Lake Victoria (3,867 ft.) or Lake Edward. The two branches unite at Lake Albert (2,229 ft.) and flow north as the Mountain Nile (Jebel) to the great flat expanse of the Bahr el Ghazal (1,350 ft.). Here are extensive swamps, and floods may cover hundreds of square miles. This region is therefore a base-level analogous to the Lake Chad and Lake Ngami regions. Were it not for the Blue Nile (rising in Lake Tana in Abyssinia) no water would reach Egypt from the Nile. The volcanic flows of the Bayuda desert have caused the great bend below Khartum. From here the six cataracts mark a more rapid fall in the valley until Aswan is reached. It is of much interest that the

freshwater canal dug by the Caliph Omar 1,200 years ago is now 10 ft. above the sea at Suez, which gives us a fairly accurate measure of the upward movement in this corner of Africa.¹

If we accept the theory outlined above that the African drainage originally ran along south-north lines, then it seems probable that the changes occurred late in Tertiary times and were perhaps of the nature already described in the Australian sections. In other words, although Africa was not folded during the world-wide mountain-building, it may have been warped along a series of parallel corrugations. This would give rise to an alternation of lake-like expanses and raised water-gaps, which is just what the African topography suggests.

Commencing at the south we may postulate a N.W.-S.E. warp which beheaded the Orange river, led to the Ngami-Makari Kari lakes, and ultimately caused these waters to drain out to the east via the Zambesi. Then some 1,000 miles to the north another slight upward warp perhaps determines the Stanley Pool swamps at the mouth of the Congo, and the present divide between the Zambesi and Nile. Possibly a western extension of this warp has raised the Guinea coast.

The next up-warp has turned back the Niger in the west (forming the Debo Lakes) and the Congo, in the centre, preventing its entry to the Chad basin. The great Victorian lake may also in part be due to the eastern end of this buckle. In the next trough we find the Chad lakes cut off from the Libyan outlet by another warp; here also are the Nile lakes in the Bahr el Ghazal and possibly the great depression to the south of Algeria with the Gurara lake, which may be part of the Proto-Niger. It is suggestive that these corrugations are approximately parallel to the Alpine-Himalaya folds and also to the Andean folds of South America and the central submarine Atlantic ridge.

The African Climate.

Africa is the only continent which exhibits a large extent of land reaching from tropic to tropic. It is thus especially suitable for a discussion of seasonal climatic changes, but the diversity of the topography and its rather variable width make it not quite so satisfactory as Australia in some aspects of the problem.

We may consider the climatic environment, especially the rain belts, as consisting of an *atmospheric shell* or layer which

¹ The discussion given above is based on Schwarz, *South African Geography*, 1921.

is attached to the sun. Since the axis of the earth is tilted at 23° to the ecliptic, the earth really rocks back and forth under the sun through an arc of 46° . We usually say that the sun moves from 23° N. latitude to 23° S. latitude, but the above statement is nearer the truth.

We may therefore imagine Africa to swing north and south under this atmospheric layer. This layer is not uniformly endowed with moisture, but consists of a very wet belt approximately beneath the sun and very dry belts about 25° to north and south of the central position. On the polar sides of these two dry belts again, about 35° away from the central belt, are temperate wet belts. Africa is just long enough (north and south) to be affected by these temperate rains, as the continent 'swings' to its extreme limits of movement.

The salient features of the climate of Africa can now be readily realized. In January the earth's tilt has moved Africa northward so that the sun is over Rhodesia (see Fig. 32). The tropical rain belt is therefore chiefly concentrated in Northern Rhodesia. All Northern Africa in winter is under the northern desert belt except Morocco, which is swung so far north that it reaches the fringe of the north temperate rain belt. The southern end of Africa is also experiencing desert conditions.

In July the tilt of the axis brings Northern Africa under the sun. Guinea and Southern Sudan are now under the tropical rain belt. The northern third of Africa is in the desert belt, and South Africa is chiefly under the other desert layer. But the tilt to the south has brought the southern tip of Africa into the south temperate rain region, so that Cape Town and its vicinity get some rains in July (winter).

Thus the seasonal rainfall may be tabulated as follows :

<i>Region.</i>	<i>Season of Rain.</i>
Morocco, Algeria, &c.	Winter only (January).
Sahara	Always in desert belt.
Sudan	Summer only (July).
Guinea coast and Congo	Almost always tropical rains.
Rhodesia	Summer only (January).
Kalahari	Always in desert belt.
Cape Town, &c.	Winter only (July).

Actually, of course, the rainfall is not quite so simply arranged as Fig. 32 indicates. For instance, the Abyssinian highlands condense the rain by causing an upward deflection of winds.

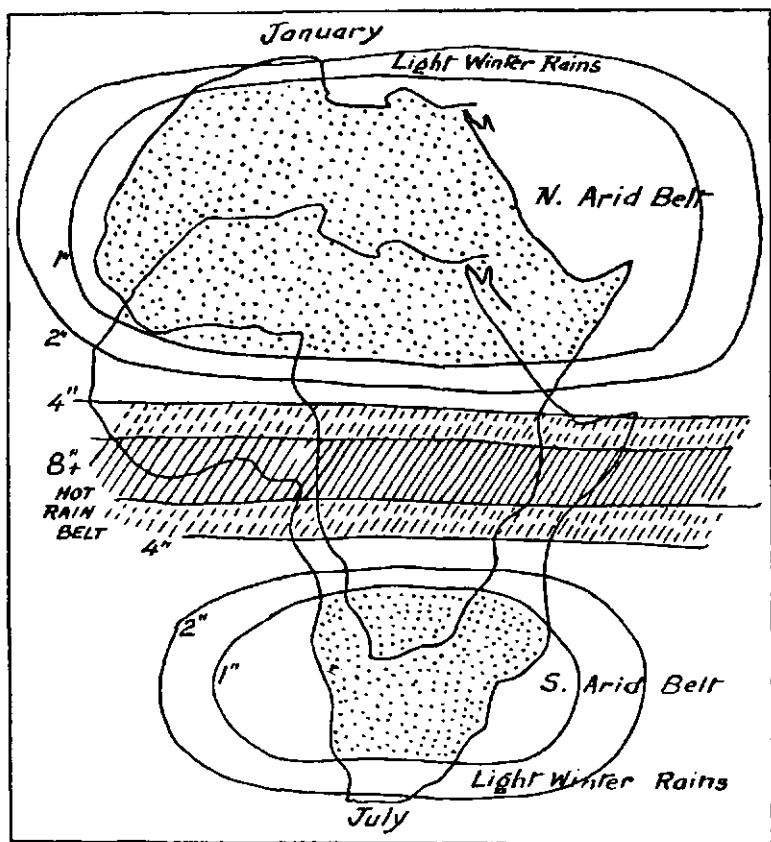


FIG. 32. The Seasonal 'Swing' of Africa beneath the Sun and Rain belts.

Further, the east coast of Southern Africa is wetter than indicated, because the constant onshore winds give moisture even in the desert belt. In the north, however, the great Asiatic lands effectually prevent any moist winds reaching the Sahara from the east.

Temperature conditions also swing back and forth, though

owing to differences in topography and in distance from the sea the temperature 'swing' is less regular than that of rainfall.

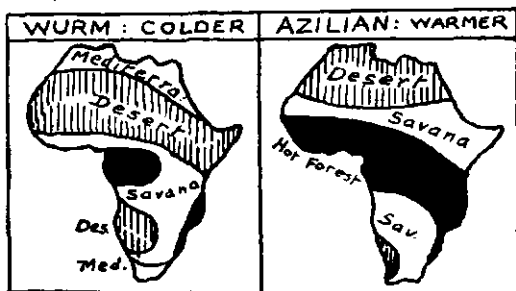
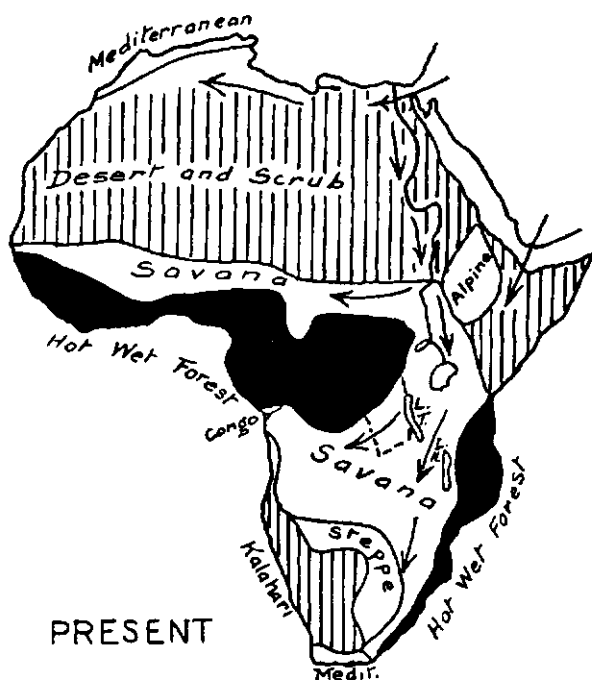


FIG. 33. Diagrams indicating the vegetation of to-day, and the Migration Corridors. Below is shown the trend of climatic changes in Wurm and Azilian ages. The latter was considerably warmer than at present.

The most direct response of Nature to climate is shown by the vegetation. This is shown in Fig. 33. The dependence upon rainfall is complete. From the point of view of primitive

settlement we may divide the regions into favourable and unfavourable as follows :

<i>Favourable.</i>	<i>Unfavourable.</i>
Savana.	Hot, wet forest.
Mediterranean.	Desert and scrub.
Alpine.	(Steppe.)

We see that South Africa is separated from North Africa by a belt of hot, wet forest, which near Lake Tanganyika nearly joins the similar east-coast forest.

Some maps (e. g. Bartholomew's) make the forest belt reach quite to Lake Tanganyika, while another tongue of forest surrounds Lake Nyasa, so that a 'corridor' only about 250 miles wide connects North and South Africa in these regions.

If now we bear in mind the great changes in climate in fairly recent times, e. g. Wurm Ice Age and Azilian Age, we have to do with periods both colder and warmer than at present. The evidence in Africa has not been worked out yet, but in the annexed maps I suggest what may quite possibly have been the environment in Africa during these two extreme types of climate.

Thus when Neandertal man lived in France in the Wurm Ice Age we may picture Africa as shown in the left-hand map. There would be a pleasant land in the North Sahara in which no doubt many primitive folk lived. Entry would be difficult into South Africa because of the continuous desert, even worse than at present. Any tribes which had previously reached South Africa would be free from attack from the rapidly developing peoples in Eurasia for the many thousand years of the Ice Age.

At the end of Paleolithic times (the Azilian Age in West Europe) the conditions in France grew warmer and much more attractive. This moving north of the warm belts was certainly also evident in North Africa. In these Azilian times, possibly 10,000 years ago, the Sahara desert extended much farther north than to-day. North Africa may have been nearly deserted, but on the other hand there would be a much more attractive region in the middle Nile and Sudan countries in which Asiatic folk could readily expand from a fertile Arabia,

especially as the Red Sea may not have broken through at Aden at this time. This expansion of peoples would not probably affect South Africa for many centuries, until cooling and desiccation had greatly constricted the forest belt, thus producing a corridor by which most of the peoples of South Africa entered their domain.

I think it probable, however, that small groups of primitive man had reached South Africa before the Wurm Ice Age in the form of negritos and pre-Neandertal types.

Some of the most striking evidence of comparatively recent changes in the African climate is discussed by Penck (*Scottish Geographical Magazine*, 1914). He points out that on Mt. Kenya are extensive ancient cirques 14,000 ft. above sea-level, while Gregory found old moraines at 10,000 ft. His conclusion is that the snow-line has ascended 4,000 ft. since the Ice Age, which probably indicates a warming of 10° or 12° Fahrenheit. On Kilimanjaro are similar traces of lower-level ice sculpture.

In the Sahara the ancient river channels and river alluvials prove that *at their sources* there was fairly recently a much better rainfall than obtains to-day. (We must remember that, if the Nile should cease at Khartum, the deep river valley at Cairo would not indicate bygone humid conditions on the *Lower Nile*, but at the head-waters). The shotts of Algeria are extremely salty, while 'pans' (or hollows due to arid erosion) nearer to the centre of the Sahara are quite empty. But west of Air the flat pan of Tesellamen is occasionally flooded, while the Lake Chad basin is only slightly saline and contains fish similar to those in the River Shari.

There are many empty pans found in the South Kalahari, and in North Cape Colony are typical salt-pans (playas). In North Kalahari, on the other hand, we find the great Etosha Pan (250 miles from Cape Frio) in which freshwater fish can exist.

Penck therefore draws the general conclusion that on the equatorial side of the great deserts are flat pans occupied with slightly saline or fresh water, while on the polar side occur strongly saline lakes. Again, in the north of the Sahara are *living* dunes of bare wind-blown sand, while to the south dead

dunes, fixed by sparse vegetation, border the desert on the equatorial side. The latter stretch far into the humid territory of the Niger basin. In the Kalahari the dunes are mostly 'fixed', especially on the northern side. All this leads us to assume that the area of extreme aridity in Africa once lay much nearer the equator than it does to-day, exactly as is found to be the case in America. (I have elsewhere shown that this is indicated in Australia also.)

Penck strongly supports the view that a general lowering of temperature, i. e. a decrease in the earth's heat supply, rather than an increase of rainfall was the chief cause of the Ice Age and of its chief phenomenon, *the shrinkage of the tropical zone*. In the interglacial periods the converse occurred, and laterites (implying alternating wet and dry seasons) were formed right up to the desert edge.



1. Melanesian negro from Buku Isle, Solomons



2. Pariyan woman (Australoid) from Mysore



3. Melanesian negro from New Ireland



4. Hima of Mporro in W. Uganda



5. Berg-Damara from S.W. Africa



6. Gold Coast negro (from Alabama)



7. Hottentot from Cape Colony



8. Orthognathic Cape Bushman



9. Prognathic Bushman from Kalahari

IV. AFRICAN AND MELANESIAN RACES

VIII

AFRICA—ETHNOLOGY¹

THE first point of interest in studying the distribution of the African peoples is that the same rule holds good which we have observed in the Australasian peoples. The most primitive groups are found in the regions most distant from Asia, or, what comes to the same thing, in the most inaccessible regions. If we refer to Fig. 34 we shall see that the inaccessible regions for the traveller from Asia are the centre of the Congo forest and the Kalahari desert.

Two important criteria, stature and hair-character, serve to separate these regions (shown in Fig. 34) from the remainder of Africa. In the Congo forest are the most primitive Negrilloes. Tribes with allied characters are found all along the equator in the Congo forests and also in the isolated forests just to the east of Victoria Nyanza.

In the Kalahari desert and adjoining are the Bushmen, who have the same hair as the Negrilloes and are also very short peoples. There are, however, important differences which can be most readily explained by assuming that the Bushmen are not a pure race, but contain a proportion of pygmy blood. Another complex group is the Hottentot race, which will be considered in some detail later.

The chief ethnic boundary in Africa is the line which separates the negroid peoples from the Hamitic and Semitic races. It is by no means a clear-cut line, but speaking generally there are marked changes in head shape, hair texture, nasal index, proportion of limbs, skin-colour, and language to the north and south of this boundary.

We may now compare the distribution of peoples in Africa with those in Australasia.

There is seen to be a very close similarity in the arrangement of these peoples. This is, I believe, what we should expect if we realize that we are dealing with exactly the same phenomena in each of the 'peninsulas' projecting from Asia. South of

¹ For typical photographs see Plates.

the equator both in Africa and in Australasia the environments are naturally arranged in similar zones according to latitude.

Race Parallels in Africa and Australasia.

<i>Environment.</i>	<i>Race.</i>	<i>Cephalic index.</i>	<i>Africa.</i>	<i>Australasia.</i>
(a) Hot, wet forests	Pygmies	Variable	Batwa, &c. (negrilloes)	Tapiro, Aeta (negritoos)
(b) Cooler lands in extreme south	Negrito hybrids	„	(Bushmen ?)	Tasmanians
(c) Equatorial forests and parklands	Lower negro	71	Peoples of Guinea and Upper Nile	New Guinea, South Melanesia
(d) Cooler parklands	Higher negro	73	Bantu-speaking Negroids	Australian
(e) Regions just to east of Region (c)	Hamitic and Semitic	75-7	Ethiopians, Berbers	Igorots, Higher Melanesians
(f) Islands farther to east	Early Alpine types	80 +	Antimerina of Madagascar (16th-century immigrants from Java)	Polynesians

Given these conditions, it seems logical to assume that the racial zones can only have resulted from similar peoples spreading out like waves from a common origin. This 'cradle-land' should be approximately between the two 'peninsulas', and all indications (as we shall see when we consider the racial distribution of India) point to a region of maximum evolution not far from Turkestan. It is not unlikely that the time factor was similar in the spread of these peoples. If they were all affected, as I believe, by successive climatic thrusts of world-wide significance, then it is at least possible that the Tasmanian reached his island about the same time that the Bushman reached South Africa, but this is at present too speculative a theory to be worthy of more than mere mention.

The Bushmen.

The origins and affinities of the Bushmen are not well understood. They are distinguished from the general type of African

negro by the fact that their cephalic index is much higher, i. e. their heads are much broader, and by the fact that they are orthognathous, i. e. the jaws do not project forward.

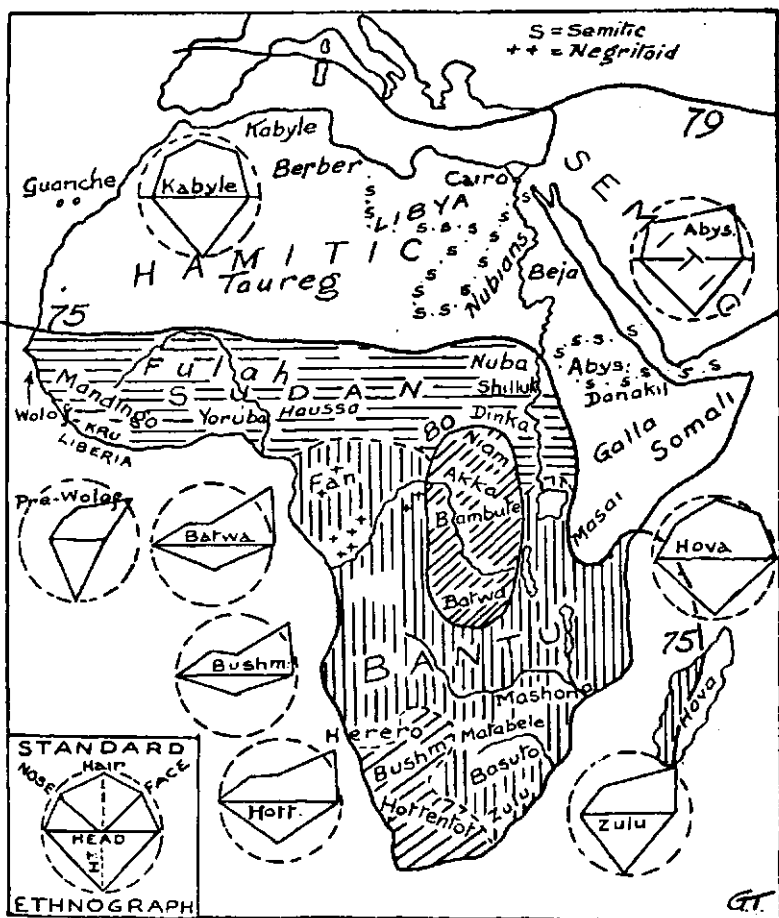


FIG. 34. Races of Africa with Ethnographs.¹ Lines with numbers show average cephalic index.

Further, the skin is yellow and so pale that a blush may at times be perceived! In other respects they are extremely primitive. They have the 'peppercorn' hair and the short

¹ Notice how closely the ethnographs of the Kabyle and Hova (or Antimerina) resemble that of the standard English.

stature (4 ft. 2 in. to 4 ft. 10 in.). Steatopygy characterized by large buttocks (especially in women) is very pronounced. Their language is unique, for they use 'clicks' in addition to vowels. There are four or five such sounds which are made by the tongue against the teeth or cheeks, &c., and are akin to those used by white folk to urge a horse to greater speed.

In their culture the Bushmen had no animals and grew no crops. They were in the primitive hunting stage and resemble in so many ways some of the Aurignacian folk of Western Europe that Sollas and others have little doubt of their being of the same race. Customs, weapons, steatopygy, small stature, and especially the artistic work of the two groups are exceedingly alike.

The Bushmen of Southern Africa¹ are reduced to about 26,000, of whom more than 2,000 inhabit the former German territory. There are about 4,000 of the pure San race in Cape Colony along the Orange river. The Kau Kau are about 5,000 in number on the east of the late German territory. These are small and unmixed. Near Ngami are 5,000 Kalahari Bushmen, and just to the north are 10,000 tall black-skinned Bushmen who are mixed with the Bantu.

Far to the north near Mt. Elgon (Uganda) a dwarfish type is met with, some 4 or 5 ft. high, in greatest contrast with the Turkana just to the north, who are often 7 ft. high. These folk and similar dwarfs among the Dorobo of East Africa and Doko of South Ethiopia suggest the Bushman type rather than the Congo pygmy (Johnston, p. 404). They are vestiges showing the route of the Bushmen; just as the Semang in Malaya show the corridor along which the Tasmanian marched.

The Hottentots.

The Hottentots differ from the Bushmen in being taller and intermediate in bodily structure between the Bushmen and the true negroes. Johnston considers that they result from a mixture of the Bushmen with some Nilotic negroes, which occurred so long ago that the type is now well established. Some authorities, however, believe that the Hottentot language, in its inflexions for number and gender, &c., shows affinity with the Hamitic languages, so that they possibly incorporate much higher blood than that of the Nilotic negroes. The Sandawi

¹ Johnston, *British Empire in Africa*, p. 249.

of former German East Africa speak a kindred language. However, steatopygy, pale colour, and clicks in the language ally them to the Bushmen, while the head index (74) may be due to a merging of Bushmen (77) with negro (72) or may be evidence of Hamitic descent (75), and most ethnologists consider them to be a cross between Bushmen and Bantu, with possibly some early Hamitic admixture. Moreover, their cattle are the long-horned type from North-east Africa, while the surrounding Bantu have only small-horned cattle.

Their distribution around the lower Orange river is shown in Fig. 34. But when the Boers invaded the Bushman territory just to the north the Hottentots moved with them. The Nama tribes dwelt on the coast and are the purer stock; the Korana have nearly died out, but occupied the upper Orange and Vaal. There are said to be about 200,000 Hottentots and half-castes (Griqua with Berbers, and Gonakwa with Kafirs) in South Africa.

Of particular interest, as linking the southern primitive people with the forest pygmies, are the *Strandloopers* of Natal and the *Vaalpens* of central South Africa. The former are long extinct, but their relics occur in caves along the coast.

The *Vaalpens* were described by a French traveller, Delegorgue, in 1847.¹ They were said to have a much darker skin than the Bushmen and to live in holes carved out of huge ant-hills. They were cannibals and had more abundant head-hair, while the men had thick beards. Their height was barely 4 ft. In all these particulars they differ from the Bushmen and come very close to the Congo pygmies. It is quite possible that a few of the latter fled south before the Bushmen instead of penetrating the thick jungles of the equatorial forest.

The African Pygmies.

Negrilloes

Apart from their short stature, these pygmies differ in nearly every respect from the Bushmen. They are usually much darker in colour, reaching chocolate tints. The hair is less kinky in the pygmies and is said to be brown at times. The body is covered with a fairly thick down. Steatopygy is rare,

¹ Johnston, *op. cit.*, p. 41.

but the two races have similar noses. The height of the pygmies is much less, the average for thirty Akka being 136 cm., and of ninety-eight Batwas 142 cm. (Bushmen average 157 cm.) The pygmies vary considerably in cephalic index, but it seems in many cases to be 79 or 80.

Their habitat extends across Central Africa. The Akka, Wambutti,¹ and Afifi live to the west of Lake Albert. The Batwa to the south of the middle Congo, the Babongo and Akua of French Congo; the Bayago and Babengaye of the Cameroons are other tribes who belong to the pygmy peoples. Less isolated by thick forests are short, mixed peoples who live in the east near Lakes Rudolf and Tanganyika. They may possibly have Bushman, q.v., rather than negrillo blood.

The Negroes of Africa.

This zone of peoples occupies practically the whole of Southern and Central Africa and much of Northern Africa up to the centre of the Sahara. This is a climatic region which on the whole is not at all attractive to other races, and hence we find the negro peoples suffering less from displacement than perhaps any other primitive races. All along the northern boundary they have been penetrated for centuries by inroads from the Hamitic and Semitic peoples of the north, but the vast central and southern block of negroes has not been greatly affected by recent race mixture.

The African negroes may be classified by physical differences into two or three groups; the true negro, who has also been called the Western Sudanese, the Nilotes or Nilotic negroes, and the Bantu-speaking negroids. Probably the last two should be classified together. The true negro is of sturdy build, tall stature, and a dark brown or black skin. The Nilotes are extremely tall, they are very narrow-headed, and have a retreating forehead. They are very slimly built, and the skin is extremely dark. There is considerable variety in the third group: the stature is less tall and the head usually dolichocephalic, although

¹ The photograph of the negritoes on Plate IV shows a group of Wambute, taken at Bomili in 1902 by Grenfell. The picture was kindly lent by Sir Harry Johnston.

certain mesocephalic groups do occur, and they have not that elongation of the head which is often so characteristic of the true negro. The forehead is differently shaped, the jaw less prominent, and the nasal index is lower. The lighter colour of the skin is also a distinctive feature. It seems probable that the Bantus represent a cross between true negroes and pygmies, Hamites, and possibly other stocks. The Nilotes certainly have Hamitic blood, and some of the tribes, despite their tall stature, have mixed with negrilloes.

There is also a large number of types like those which occur among the people speaking Fula, Mandingo, Hausa, or Masai on the northern and south-eastern borders of the two 'primary' groups, who show mingled negro and higher characteristics. The negroes belong to two linguistic classes; the very variable northern group, and the well-defined Bantu group of the south.

I propose to summarize some of the salient features of the very large number of West African tribes, which probably represent the ethnic stratum next above the Bushman and Negrillo tribes which have just been considered.

The Negro-Hamitic 'divide' is described as extending from Cape Verde to the River Juba via Timbuktu, Lake Chad, Khartum, and thence originally to Massowah. The inrush of Galla and other higher tribes has, however, pushed it south, so that it now extends down the Nile to Lake Albert and Lake Victoria, and thence across to the Juba river. All along this boundary the true negro has adopted much of the culture of his aggressors, so that we find the not uncommon anomaly of very primitive folk with primitive languages having much greater command over the arts and crafts than is the case with much higher peoples (e. g. Bantu peoples to the south). Some far-reaching 'Negro Empires' developed in the Sudan due to this admixture with the higher civilizations, but farther south these negroes, where unaffected by outer culture, are infinitely below the untouched Bantu in their outlook on life. Cruelty, superstition, and ignorance have nowhere worked such evil as among the coastal tribes of West Africa.

In the extreme west, as we should expect, are some of the most primitive of all, of whom the Wolofs of the Lower Senegal

may be taken as a type. They have extremely black skins and are very tall. A stature of 6 ft. 6 in. is common at Dakar. The head is markedly dolichocephalic with an index as low as 69. Another primitive feature is the complicated language (there are said to be twenty-four forms for expressing the 'definite article'), though such absurd complexity was considered by the early philologists to be a mark of late evolution!

The Mandingo peoples inhabit French Guinea and Sierra Leone, and allied languages extend far east to the Fulah territory. They are skilled craftsmen and agriculturalists and were the founders of the ancient empire of Guinea, which was of great importance in the Middle Ages. They are fervent Mohammedans, and as an example of their enterprise we are told that a pilgrimage of 60,000 journeyed to Mecca in 1331, but practically all died from disease in the oasis of Tuat (south of Algeria).

One of the most interesting regions in Africa is Liberia, which was founded in 1820 as a means of settling freed American slaves. There was no real white control until 1909, when the United States took charge of the finances, and the history of Liberia has consisted of ludicrous political struggles between the freed slaves and native negroes.

The peoples of Ashanti belong largely to those groups speaking the Tshi languages, while to the east of the Volta river are the Ewe-speaking peoples of Dahomey. The lower Niger is largely occupied by Yoruba tribes.

The peoples of the Lower Niger are typical negroes—black skinned, tall, big bodied, with projecting jaws, flat noses, and long upper lips. It is the negro type in its most pronounced and exaggerated development. Even down to very recent times these tribes were much addicted to cannibalism. Their religious beliefs were closely associated with the incessant shedding of blood and reached a climax in the abominable practices of Benin.¹

Here is said to be the 'Land of the Fetish', a word which is said to be derived from the Portuguese implying idol worship. According to Ellis, who studied deeply the Guinea languages,

¹ Johnston, *op. cit.*, p. 337.

a *fetish* is something tangible and inanimate which possesses a power in itself and is worshipped for itself; later, however, he wrote, 'So far from fetishism being peculiarly characteristic of the religion of the negro of the Gold Coast, I am of opinion that that religion is remarkably free from it.' Rattray (*Ashanti*, p. 90) confines the term 'to all those objects we should loosely call amulets, mascots', &c. The whole religious system is very complicated and has been described in detail by Rattray (*loc. cit.*). In some respects, however, the *Obeah* worship known among the negroes carried to the West Indies better expresses their religious beliefs. The propitiation of the powerful invisible and intangible deities is the basis of the *Obeah* cult.

The Nilotic Negroes of Eastern Sudan are much intermingled with Ethiopian peoples; but in Darfur and the region of the Ghazal and Djebel Niles there are pure negro or rather negroid tribes. Among these are the Shilluks, who have mixed with the Hamites (north-west of Fashoda), who number about a million. Along the Djebel Nile to the south of Lake No are the same number of Dinka, while expert metal-workers like the Bongo live on the slopes of the upper Ghazal to the south-west. These peoples are probably physically akin to the Bantus.

The Bantu Negroes.

This great group of peoples is united by a common type of language, more closely related than are the Aryan tongues of Eurasia. Seeing how rapidly speech varies amongst people without a fixed literature and a high civilization, it is remarkable how close this relationship is among all the types of Bantu speech between the Cameroons and Natal. This would seem to show that the original date of the dispersion of the Bantu languages over the whole of the southern third of Africa must be relatively recent, perhaps not much more than 2,000 years ago.¹ The syntax of the Bantu speech is marked by dividing objects into seventeen groups, each with appropriate 'declensions'. Particles are characteristically *prefixed* to the roots instead of suffixed as in most Aryan words. Thus

¹ Johnston, *op. cit.*, p. 44.

'(ki)ntu-(ki)ema' means 'a good thing', while '(bi)ntu-(bi)ema' means 'good things'. A similar method obtains in the extreme west of Tropical Africa, showing some affinity between the negroes of the western and southern 'wings' of the negro migration.

The history of migrations into Africa may be dwelt on at this stage in our study. The zonal distribution seems to indicate that the Negrilloes and Bushmen were the first comers. Next came the main body of true negroes who have kept to the hot forests for the most part. These are certainly of different stock from the broader-headed, lighter-coloured Bushmen. Then on the north-east of the Sudan and Guinea negroes we find the Bantu and Sudan negroids (Nilctes).

Probably the chief stimulus determining the later migrations in Africa was the invasion of North Africa by the Libyan and Berber tribes from the east. These people are akin to the 'Mediterranean' or Iberian folk of Southern Europe, and we can get some idea of their arrival in North Africa if we realize that it almost certainly long-preceded the arrival of these 'Iberians' in France and Britain.

Now Magdalenian man in France is by many authorities allied to the Libyan-Berber population of Africa. The period of Magdalenian man in France was the last minor Interglacial, which may be set down at some twenty thousand years ago. It seems to me that this date is not too far back for the entry of the Libyan people into Egypt.

At that time there were many of the dwarfish stock in Upper Egypt who were supplanted and absorbed by the Libyans, together with large numbers of the negro peoples. From these elements were built up the early Egyptians who some ten thousand years ago were advanced enough to leave permanent relics of an important Neolithic civilization.

On the border-line of these two different races, the primitive negro and the Hamitic-Iberian, we find the Bantu and their congeners. Johnston believes that they are largely hybrids due to more or less of a mixture of Hamitic blood with the primitive negro, and Haddon suggests that there are Negrillo and other elements as well as Hamitic. This is probably the best solution of their origin, but it does not seem clear to me that the Bantu were not first differentiated in Asia and entered Africa as

a separate migration. One would expect them to stand between the negroes and the Hamitic folk as the result of either theory of origin. An analogy may be helpful. We know of a series in the evolution of the horse from *Eohippus* (Eocene) through *Mesohippus* (Miocene) to *Equus*. Supposing, as might have occurred, that all kinds were alive to-day; it might at first glance be difficult to decide if *Mesohippus* was due to a mixing of *Eohippus* and *Equus*, or was a separate stage in the gradual evolution of *Equus*. I think it possible that the Bantu group corresponds to *Mesohippus* and is not merely a mixture of races.

Of course many of the negroes who speak Bantu are physically like the Sudan or Guinea negroes, and are probably ethnically the same. But this is not true of many of the higher Bantu tribes such as the Zulu, and it is their evolution which still seems to me to be in doubt. Probably the key to the problem will be found amid the relics of negroid folk still remaining in Asia. We know of negroid peoples in Persia (near Susa), although these may be the descendants of imported slaves (see chap. 15), and possibly in Baluchistan and Burma. What are their affinities? Are they negro, Bantu, or Dravidian?

Johnston places the cradle of Bantu speech to the north-west of Uganda. He thinks that the Bantu remained there until iron and copper weapons gave them a tremendous advantage over the southern tribes. Thus two thousand years ago they started on their last great advance and reached to the Cameroons and to the great lakes. By about the seventeenth century they had conquered almost all Africa between latitudes 3° N. and 25° S.

It seems clear that these great Bantu migrations were controlled by an aristocracy relatively few in numbers who were members of this higher type, intermediate between negro and Hamitic. The Fula people seem to be akin to this 'aristocratic' Bantu type.

The Bantu people are generally distinguishable from the Niger negroes by somewhat larger stature, broader heads, and less prognathism. The nose is more prominent and narrower. There are numberless tribes whose names often begin with the prefix Ba- (denoting many), cf. *Ba-ntu*. Thus the *Balolo* live in the bend of the Congo on the south side and comprise ten million people. They are skilful ironworkers and laid out their towns with very symmetrical plans. Across the Congo to the west is the large group of *Fan* tribes, a tall, slim people with marked Caucasian features

and resembling the Fula of Nigeria. They were, however, cannibals. On the coast north of the Congo live the *Mavambu*, who have hooked noses and remind one of the so-called 'Black Jews' of the Solomon Islands. They are keen traders. The head-waters of the Kassai (6° S.) are settled by the *Baluba* and allied tribes. Most of these Western Bantu people wear ornaments in the lips, file or pull out the incisor teeth, and tattoo.

On the east coast in the Zanzibar region the Bantu have mingled with the Arabs and speak Swahili, which is a lingua-franca in east and central South Africa. The Bantu inland from Zanzibar have been much affected by the powerful *Masai* tribes living just east of Victoria Nyanza. This famous race invaded the Bantu countries south of the equator some three or four hundred years ago and extended their settlements as far as 7° S. latitude. They speak a language allied to the Nilotic speech.

The Bantu best known to us are found south of the Zambesi. In Southern Rhodesia are the *Mashona* and *Matabele*. To the south-east of Lake Ngami are the *Betchuana*. In Damaraland are the *Herero*. North of Natal was the home of the *Zulus*, and in the mountains to the west are the *Basuto*.

The *Mashona* belong to the *Nyanza (Lake)* group of Bantu. They are settled agriculturalists who have been easily dominated by *Zulus*, *Betchuana*, &c. In the eastern portion the women insert a flat ring (*pelele*) into their upper lip.

The *Matabele* are *Zulu* people who fled from *Chaka* in Natal early in the nineteenth century. Led by *Moselekatse* they ravaged the *Betchuana* and ultimately settled north of the *Limpopo*. Later they attacked the *Rhodesian* settlers.

The *Betchuana* and *Basuto* are closely allied in appearance and language. The northern tribes under their ruler *Khama* are flourishing, largely because they prevented alcohol from entering their territory (*Johnston*, p. 244).

The *Zulu Kafir* peoples are the most southerly of the Bantu peoples. The term *Kafir* was applied by the Arabs and means 'Unbeliever'. The name is now applied only to the *Zulu* people on the boundary of Cape Colony. They differ little from the *Swazi* and *Zulus* to the north.

The history of recent *Zulu* migrations is typical of many of the race movements in Africa. In 1787 was born the *Zulu Chaka*. He learnt something of the military discipline of the British (from *Dingeswayo*) and then attacked the northern *Zulus*. The girl captives became wives of the conquerors, the youths entered his army. All the remaining hostiles were killed. From 1819 to 1893 (when *Dr. Jameson* defeated the *Matabele*) all the south-east of Africa was bathed in blood

owing to the aggression of tribe against tribe. Thus, some flying Zulus ravaged Portuguese territory. Another branch conquered the tribes as far north as Tanganyika. A third attacked the Basuto to the west, while the Basuto in turn (under a woman-leader) fell upon the Betchuana.

Another crowd of refugees, partly Betchuana mixed with relics of all the southern peoples, took refuge in the rugged mountains west of Natal. Here, under the enlightened rule of Moshesh, has grown up a stable and progressive nation of *Basutos* (see Johnston, *op. cit.*).

IX

THE HIGHER RACES IN AFRICA

The Fula People and their Empires.

To the north of the country of the Sudan negroes lies a most interesting region extending between latitudes 9° and 17° N. which is inhabited by the most progressive of the negroid peoples. They are usually assumed to be hybrids between allies of the Caucasians and negroes (see, however, p. 110, *supra*). Of these peoples the Fula tribes are the chief. Their language has many suffixes akin in character to the Bantu prefixes. Thus Ful-be = Fula people, Ful-de = Fula language. The pure Fulas are a handsome, tall, light-skinned people with hair growing in ringlets.

There are many lands suggested as the source of the Fula people. One story places it in the highlands behind Cape Blanco, whence they were driven by Libyans down into Senegambia. Other stories say they came from Fezzan (south of Tripoli), or from Arabia, or even from Persia and Egypt as the dispersed army of Cambyses (500 B. C.). We are dealing with what is to-day a union of many diverse stocks, and whatever may have been the habitat of the main Fula people, probably strains from all the above cradle-lands are associated in the Fula tribes.

Their chief interest to the student of Anthropogeography lies in the fact that in Western Sudan grew up great empires which rivalled in extent the empires of Charlemagne or Napoleon, and yet in Africa white folk were ruled by black monarchs belonging to these Fula races.¹

During the seventh century the Arabs under Okbar conquered North Africa, and in A. D. 666 he reached nearly to Lake Chad. As a consequence of these raids the Berber (Hamitic) people of Mauretania were driven south and a great mixture of peoples arose on the southern edge of the

¹ I have based this account of the Melle and Songhay Empires on that very interesting book, *A Tropical Dependency* (1905), by Lady Lugard.

Sahara. The culture of the peoples along the Niger seems to have been derived very largely from the Spanish and Moorish kingdoms, and in fact Timbuktu was more closely in touch with learning than were many of the north-western countries of Europe during the early Middle Ages.

In 757 Tafieta was founded by these black peoples in the Atlas region as the northern trading outpost of the Fula peoples, whose capital was at Ghana, some 350 miles W.N.W. of Timbuktu. (Later this name was replaced by Aiwalatin (or Valata) and again by Biru.) By the European

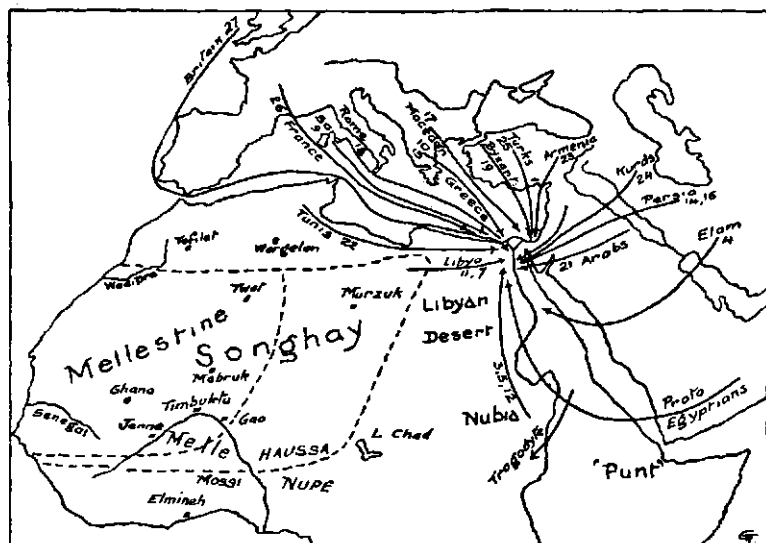


FIG. 35. The Fula Empires of North Africa. (Also) The Invaders and Rulers of Egypt. The figures show the order of invasion.

the kingdom of Melle (or Mellestine) was usually reached via Tafieta, for during the eighth and ninth centuries the Tripoli route seems to have been too arid.

In 1055 certain Moslem Berbers who lived near the Senegal sacked the pagan city of Ghana and then, marching north, ultimately conquered the south of Spain. (These Morabite Tauregs founded Morocco in 1062 and Timbuktu in 1087.) In 1153, however, Ghana was still ruled by pagan blacks, who dealt fairly with Moslem traders in their midst.

The great kingdom of Melle extended from the Atlantic to 6° E. longitude. On the north it reached the foothills of the Atlas and nearly to Ouargla (Wargelen). On the south it extended to the unhealthy forests and swamps of the West

Coast hinterland. The artesian wells of Tuat were in the Melle kingdom, and the empire increased in power and renown to the fourteenth century. The emperors made pilgrimages to Mecca, and in 1337 the Moslem king of Morocco sent an embassy with presents to his powerful black rival the king of Melle. In 1352 the famous traveller Ibn Batuta visited Melle and records that 'the blacks do not confiscate the goods of the white men who die in the country, even though it may be a question of immense treasure'. In fact Berbers and blacks enjoyed perfect equality.

Meanwhile another group of Fula peoples had founded Gao on the Niger, some 300 miles east of Timbuktu, and both these towns were conquered by Melle early in the fourteenth century. But by 1355 the Songhay peoples of Gao were coming to the front. They are described as possessing the gentle nature of the Sudanese combined with the virility of the Arab, inoculated with intellectual germs of a long-forgotten civilization. In 1468 they took Timbuktu, and in 1477 the large town of Jenne, 200 miles up the river. We are told that the learned black professors of the University of Timbuktu had dwelt so long in comfort that they fell off the camels which were to carry them to safety in Aiwalatin!

Under Sonni Ali and his successor, Askia the Great, the Songhay Empire extended throughout Mellestine and far to the east to Augila (in Barca), Tibesti, and Lake Chad. But events in Europe so altered the course of trade and civilization that Songhay was left in a backwater in which it gradually stagnated. In 1471 the Portuguese landed at the port of El Mineh ('The gold mine'). In 1492, the year of Columbus's great discovery, died Sonni Ali, and in 1497 Vasco da Gama rounded the Cape of Good Hope. 'The Sudan of the Arabs was visited no more by the outer world, and a civilization in touch for nearly a thousand years with the most highly cultivated centres of European life was silently buried in the sands of Africa.'

Early Egypt—its Races and Invaders.

It seems probable that uncivilized Paleolithic man occupied the basin of the Nile before the rich deposits of silt were laid

down. Possibly the rainfall was heavier and the current swift enough to wash the silt right to the sea. Nowadays this silt region is larger than Belgium. It is 33 ft. deep and, assuming a deposition of 4 inches a century, it therefore started ten thousand years ago. At any rate, rude flints of early Paleolithic appearance are scattered on the uplands and long antedate the earliest civilized relics of about 8000 B. C.

There is some rather indefinite evidence of a 'stratum' of folk allied to the Bushmen having occupied Egypt before the arrival of the slender Brown Race who still constitute the bulk of the population. Artemidorus (270 B. C.) describes the Troglodytes of the Eastern Desert as nomads, naked but for a skin, carrying clubs and bows. They practised crouch burial and covered the grave with a heap of stones surmounted by a goat's horn. The latter is a well-known custom of the Bushmen. Their women blackened their eyebrows, which would indicate perhaps a light complexion like that of the Bushmen. Some female slaves of this dwarf race have been found in the earliest graves of the true Egyptians. Statuettes of the familiar steatopygic type are also found in these tombs. [This evidence must, however, be used with caution, as the 'steatopygy' of the statuettes may be merely an accumulation of fat and not true steatopygism.]

We owe our most accurate knowledge of the early ethnology of Egypt to Elliot Smith, who examined the anatomy of the skeletons found in graves of all ages along the Lower Nile. The Proto-Egyptian (i. e. about 8000 B. C.) was a man of small stature, usually under 5 ft. 5 in. He was slender and somewhat effeminate in build. The hair was dark and just like that of the Iberian folk of to-day, usually very dark brown and wavy. He usually wore a small beard. Probably the eyes were brown or nearly black and the skin of a coppery-brown colour. Over the whole domain from Britain to Somaliland in Early Neolithic times there extended this broad belt of Mediterranean or Iberian peoples belonging to the Hamitic group. The skull was long (C. I. 78) and ovoid when viewed from above. The nose was small but relatively broad, chin pointed and jaw weak, the face short and narrow.

In the fourth millenium B.C. the Nile valley was much less habitable than now. The delta was small and the elongated river-terraces were largely marsh. The peoples north of the First Cataract (Aswan) first learnt to drain the marshes on a large scale, but the wilder southern tribes conquered them (largely owing to the fact, in Elliot Smith's opinion, that they were the first to discover the art of casting copper).

From 4000 B.C. until about 2800 B.C. Egypt and Lower Nubia were occupied by one race of the type described above. But the southern tribes (who had much negro admixture) lagged behind in civilization. They were akin to the Beja (Bisharin) peoples of to-day (see Fig. 34).

Northward movements into the Lower Nile probably occurred throughout all this period and even earlier. The earliest civilization seems to have been largely indigenous; the ivory trade shows that even then they were in touch with the true negroes much farther south. Some of the earliest records deal with the peoples of Punt (Somaliland) and show that there has been no marked change in the ethnology of the people for the past five or six thousand years. Elliot Smith states that in Egypt this pre-dynastic people was probably the nearest approximation to a 'pure race' that we know of. About 2 per cent. were definitely negroid, and perhaps another 3 or 4 per cent. displayed features which suggest the influence of negroid admixture.¹

The modern Arabs of Yemen and Hejaz to a large extent conform precisely to the Proto-Egyptian type, though certain different types are much more common amongst them than amongst the Early Egyptians. But during the Early Dynastic period there entered into Egypt a very definite alien strain of the type called Armenoid. Before the time of the pyramid-builders the peoples of Lower Egypt were being modified. At Giza (near Cairo) skeletons much more sturdy than those of the earlier folk were obtained in which the brain-case is larger, the forehead broader, and the skull wider. The jaw is much heavier, with a longer, narrow ramus. The cephalic index of these alien people was 76-7, while Upper Egypt at this time

¹ *The Ancient Egyptians*, Elliot Smith, 1923, London.

had the old long-headed folk with head index of 73-4. The brain capacity of the Lower Egyptians at Giza was 1,530 c.cm., while in the Proto-Egyptians it was less than 1,400 c.cm. 'The marked aggrandizement of Egyptian achievements at this time must have been due in some measure to the stimulation of this big-brained foreign element.'

We may now consider the archaeology and culture of Egypt.¹ About 10,000 B. C. these Proto-Egyptians used hand-made pottery, produced fine flint work, and used a little copper for pins and chisels. They were bold traders and pushed far north and east. They worshipped Osiris at first, but later became sun worshippers. As we have seen, they were invaded first from the south and later by the dynastic people. These latter folk are of extreme interest. While the Egyptians were apparently using flints chiefly, invaders with somewhat more elaborate weapons were crossing the Red Sea from the east, probably from Elam (South-west Persia).² These Alpine (or Armenoid) folk brought in writing, cylinder seals, and started tombs which developed into the Pyramids. They first occupied Upper Egypt and started the first dynasty in the Delta about 5000 B. C. Khufu (Cheops) built the greatest structure of all time and inaugurated the grandest period in the history of Egypt. In Petrie's words, 'These Alpine peoples conquered by ability, not by numbers or mere force, . . . for even in their capital they were not more than one-tenth of the men around.'

By 4000 B. C. Egypt was ruled by Syrian kings, and a little later western invasions prevailed. But about 3500 B. C. Southern Galla tribes (akin to the early Proto-Egyptians) swept down the Nile and founded the famous XIIth Dynasty. About 2500 B. C. the Hyksos or Shepherd kings from the east again gave a stable if primitive government to all the region from Crete to Bagdad. About 1550 B. C. the Egyptians reversed the tide and conquered Syria. In the last three thousand years there have been many changes in the rulers of Egypt, Elam, Syria, and Ethiopia invading the Delta just as in earlier times. About 330 B. C. Greek influence predominated, to be conquered in turn by Rome. Neither of these invasions made the same

¹ Based on Flinders Petrie in various publications.

² See Fig. 35.

impression as the Arabic conquest in A. D. 640, which changed the religion and language of the Egyptians and so, naturally, greatly altered their outlook on life. In 1917 the population included eleven and a half million Moslems and about one million Christians, of whom most belong to the ancient Coptic Church.

Thus the great interest of Egypt to the student of race movements lies in the innumerable attacks made on this region through ten thousand years by invaders from all sides. These invasions have not greatly altered the racial constitution, for the modern fellahin on the whole are remarkably like the Proto-Egyptians of 8000 B. C. We may tabulate these foreign rulers as follows, as a series of strata with the latest above :

SUMMARY OF FOREIGN INVASIONS OF EGYPT

<i>Date.</i>	<i>Rulers and Influences.</i>
A. D.	
1875	British control starts.
1801-1875	Egyptian rule.
1801	British eject French.
1517-1798	Chiefly Turkish rule.
1250-1517	Mamelukes (originally Turkish slaves).
1171-1249	Saladin the Kurd and his race.
(1073-1121	Armenian governors).
969-1171	Fatemid caliphs from Tunis.
641-868	Arabs chiefly governing from Bagdad.
619	Persians.
B. C.	
B. C. 30-619 A. D.	Rome and Byzantium (Greek largely).
332-30	Ptolemies (Alexander's successors).
343-332	Persian rule.

<i>Dates</i> <i>only approx.</i>	<i>Dynasty.</i>	<i>Rulers and Influences.</i>
B. C.		
405-340	28-30	Egyptian rulers under Greek influence.
527-405	27	Persian dynasty (Cambyses, Darius, &c.).
600	26	Necho conquered east to Euphrates (Greek influence).
1100-600	25-21	Partly Libyan, Ethiopian, and Assyrian kings.
1203-1102	20	Rameses attacked by Dorians from Greece.
1328-1203	19	Exodus of Jews under Moses.
1587-1328	18	Amenhotep, Tutankhamen, &c. (used Sardinian mercenaries).

<i>Dates only approx.</i>	<i>Dynasty.</i>	<i>Rulers and Influences.</i>
B. C.		
About 2000	15-16	Hyksos, Shepherd kings from Syria.
„ 2500	13-14	Partly Libyan kings from the west.
„ 3000	7-12	Partly Galla kings in the south and Syrian in north.
„ 3500	4-6	Khufu and Pyramid builders.
„ 4500	1-3	Menes and other legendary kings.

<i>Dates only approx.</i>	<i>Race.</i>	<i>Place of origin.</i>
B. C.		
About 5000	Armenoid	Elam or Mesopotamia.
„ 7000	Nubian invasion	From Upper Nile.
„ 8000	Proto-Egyptians	From Arabia via Nubia ?
	Allies of Bushmen	Unknown (by analogy, from Asia).
	Paleolithic negroes	„ „ „

The salient feature of Egyptian history is surely that it has benefited by a unique series of external stimuli throughout fifty centuries. We have here an assured food-supply for hundreds of thousands of fairly industrious and docile fellahin, but it is only rarely that the native Egyptian seems to rise to the head of affairs. It seems to the writer that the Egyptian civilization is more largely due to this combination of assured food and central geographical position than to any inherent merits of the Egyptian people as a whole. We shall find later that civilization started many centuries earlier in Persia and adjacent countries. Using modern South Africa as an illustration, we find to-day a civilization which might be described in Flinders Petrie's words quoted above. There also the invader is numerically weak, but his brains and initiative are vastly more important than the massed effect of the millions of aboriginal Bantu. Until we know as much of the early history of other countries in the south of Asia¹ as we do of Egypt, it does not seem logical to the writer to assume (as does one school of anthropologists) that all the early civilizations originated in Egypt, yet we are told that they were carried thence to Mesopotamia, Sumeria, India, Java, and even to all the regions of the New World.

¹ Recent discoveries at Mohenjo-daro in Scinde show a civilization (of 3000 B. C.) superior to that in Egypt, and probably derived from a similar Proto-Sumerian source.

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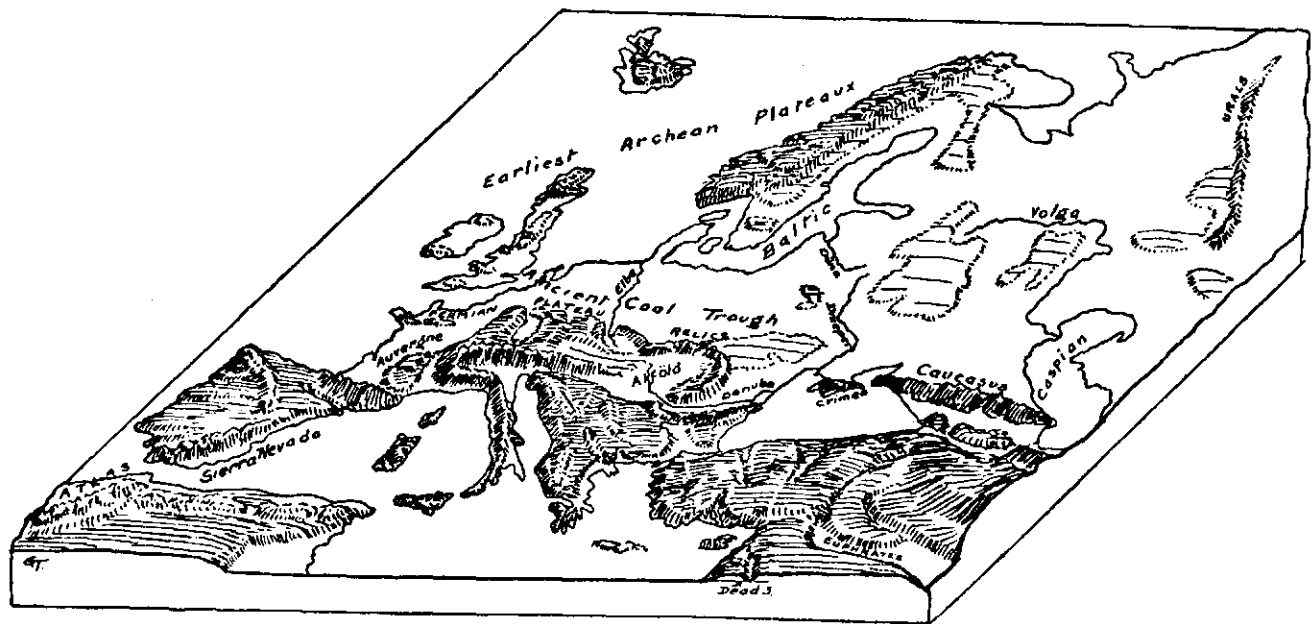
(a) *The Build of Europe.* It is instructive to compare the build of Europe with that of Australia which has been discussed previously. No land areas could well be more different. Australia is isolated and uniform, with a considerable tropical area; Europe is entirely in the temperate belt, and consists of a westward extension of the Asiatic plains merging into the wonderful series of European peninsulas. By this arrangement an equable marine climate penetrates far into the continent, while the dominant westerly winds are also able to carry rains far over the lands.

The past history of Europe is controlled by the development of earth-waves extending east and west, which have greatly affected the topography during the great earth-building periods of geological time. As we have seen in other land masses, the ancient mountain zones are gradually worn down to become the plateau-blocks of later ages. Thus the ancient plateaux of Scandinavia and the highlands of Scotland are the relics of mountains built up in the earliest (Archean) periods of the geological record.¹ (Probably this old level land-surface has risen lately *en masse*, for the topography is rejuvenated.)

Some 200 million years later a series of swamps, freshwater lakes, and shallow seas formed a long zone from Glasgow to Poland, fringing a continental mass to the south. Here grew or were deposited great masses of vegetation which ultimately became the great coal belt of Europe. (This controls present-day settlement.) Somewhat later, about the dawn of the Permian, a new mountain-zone arose from Brittany across to the Crimea. Relics of this folding occur in the ancient blocks forming the Armorican plateau of Brittany, the Auvergne region, the Black Forest, the Bohemian highlands, and the South Russian uplands of the Ukraine.

In Jurassic times (perhaps 80 million years ago) the centre, south, and east of Europe was largely a region of warm seas with numerous coral reefs. In Early Tertiary times the lands were disposed somewhat like to-day, save that the old 'coal geosyncline' or trough was still beneath the seas—while the Mediterranean was larger than at present.

¹ The times and ages in the geological record are shown along the top of Fig. 3. Eocene, Miocene, Pliocene, Pleistocene are the Tertiary divisions.



• FIG. 36. Block diagram of Europe.

In middle Tertiary times (perhaps ten or fifteen million years ago) the latest mountain-building period of Europe was initiated. This third rampart arose still farther south than the Permian buckling, and was accompanied (or perhaps caused) by a downward warping to the south in the Mediterranean region. A series of mountain arcs was formed which are indicated in the block diagram (Fig. 36).

Starting from the Central Alps, one curved fold runs round the Lombard Plain and continues south as the Apennines to Sicily. Thence it crosses to Africa and is prolonged as the Atlas folds to Gibraltar. Here it returns to Europe as the Sierra Nevada. The Pyrenees Range is a somewhat isolated fold of similar age between the Sierra Nevada and the Alps.

Passing eastward from the Alps is a pair of folds, one passing to the Western Balkans as the Dinaric Alps, the other to Vienna and so across the Danube to the Tatra and Carpathians. This fold curves round the Alföld Basin of Hungary, crosses the Danube again at Orsova, and extends to the Black Sea. It is perhaps prolonged to the east by the Crimean highlands and the magnificent Caucasus, which includes the highest mountain in Europe (Elbruz, 18,470 ft.).

It is interesting to note that some of the most fertile areas of Europe are in these silted basins, below the towering peaks of the late earth-folds. Incidentally we may note that regions like Africa and Australia lack both the fertile basins and the magnificent scenery of these last folds, though they gain in stability and the comparative absence of earthquakes and volcanic action.

Somewhat similar downward buckles or basins in the south have been drowned by the Mediterranean Sea. Thus the Atlas-Apennines include the Western Mediterranean basin. Probably here is the present-day source of unrest which is producing the Alpine chain, parallel to but farther south than the ancient ridges of Permian and pre-Cambrian times. Flanking the Mediterranean region are the active volcanoes, while an older line, across Central Europe, marks an earlier belt of weakness on the line of folding.

It seems probable that the most striking phenomena of the

Alpine folding occurred in the Tortonian phase of Upper Miocene times. Grenville Cole gives a graphic picture of the three overfolds which constitute the Swiss and Austrian Alps.

The first, moving from the south, buckled up and then 'fell over' to the north in the Helvetic region. The second ('Lepontine') arose a little to the east and with the same direction and action seems to have '... flowed onward, carrying its limestone front through the gap of Canton Vaud, and spreading out in the Helvetic depression like the edge of a falling wave. The third earth-wave, the East Alpine, rising still farther south... rose across the Lepontine sheet and flowed northward to the confines of Bavaria. . . . So much occurred within a single epoch, and probably in a few thousand years, that some of the movements must have been visible to the eye of man, had so discerning a creature appeared upon the scene.'¹

(b) *Present climate of Europe.* The salient climatic control in Europe is the presence of a low pressure area near Iceland. This is most intense in winter, and leads to a vast stream of warm moist air entering Europe from the south-west in the winter. Thus the temperatures in the west are kept remarkably high for the latitude, so that the Orkney Isles (lat. 60° N.) have the same winter temperature (40° F.) as Constantinople in latitude 40° N. The inland and eastern regions are dry, and indeed only the mountain areas receive much rain owing to their deflecting upward (and thus cooling) the western winds.

In summer the dominant control is perhaps the high pressure to the west of Spain, whereby the most usual winds in Central Europe are north-westers and northerlies. The isotherms lie now more normally east and west than in winter. In the east of Russia is the only portion of Europe with a truly continental climate. The lower Volga region experiences four months of very low temperature (24.4) in winter. All the remainder has an 'insular' climate, i. e. the extremes of climate do not differ greatly from the average conditions.

From our special point of view of changing environment, however, it is important to note that the rainstorms are associated with moving low-pressure systems (cyclones) rather than with steady winds. In Europe, as elsewhere, these tracks of

¹ Grenville Cole, *Growth of Europe*, pp. 170-3.

the 'Lows' (as they are usually termed) are fairly well marked, and differ somewhat from season to season. Indeed, as I shall show in a later section, these rainstorm tracks have probably

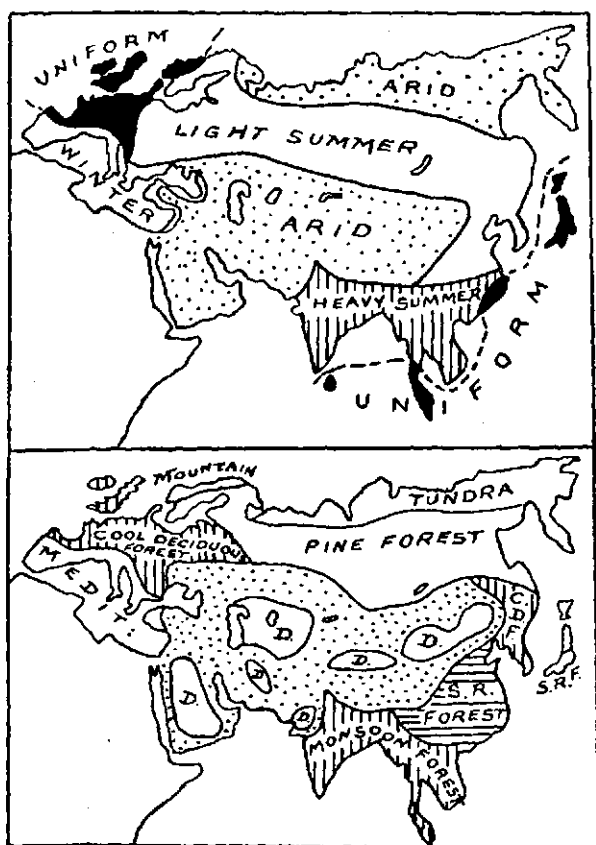


FIG. 37. Seasonal rainfall and vegetation of Eur-Asia, somewhat generalized. In the lower figure the dotted areas are steppes, D. is desert, and S.R.F. is summer rain forest. (Partly from Hardy.)

varied remarkably during the life of man in the European environment.

As a result of the varying rain controls we find that Europe can be divided into four regions. In the north-west is an area receiving fair and almost uniform rains through the four seasons.

Through most of the north and centre the rainfall is chiefly in summer. On the Mediterranean coasts the rain is typically in winter ; while only in the far east and north-east is there any real shortage of rain, thus constituting some restricted arid regions.

(c) *Vegetation of Europe.* The natural vegetation may be considered briefly under six headings, following Hardy's classification.¹ Of little significance to man, whether prehistoric or modern, is the *tundra* flora which fringes the Arctic ocean. Nor is the special *mountain* vegetation of Norway of importance. A great belt of *coniferous* forest extends across Europe north of latitude 60°, where the short summer and the five months of frosts prevent the growth of broad-leaf forests. Even to-day the population is very sparse in these pine forests, and the region has never been important in man's history.

The remaining three zones of vegetation are of great human interest. In the arid east is a wedge of *steppe lands* projecting from the gigantic steppes of Asia into the heart of Europe, almost to South Poland. This has been the path of entry of almost all the Asiatic peoples of Neolithic times and later. These grass-lands are determined of course by the absence of rain during the cold winter. The grass grows rapidly in the spring and early summer, and is parched during the succeeding dry months. Here, however, is a vast area of rich black soil (*chernoziom*) which is now being converted into wheat, maize, and beet fields. A similar steppe is found in the sheltered fold-basin of Hungary, while South-east Spain is so dry that analogous conditions prevail.

This wedge of steppe lands is approximately driven between a broad belt of *deciduous forest* in North-west Europe and a narrow belt of *Mediterranean flora* to the south-west. The latter was naturally the easier type of country for early man to traverse. With the wet winter and hot dry summer, forests do not develop on any large scale. The trees are usually low, thorny, and evergreen. Creepers are rare, but shrubs and bulbs are abundant. The chief forests consist of patches of live-oak and pines ; but planes and deciduous oaks are often found. Great

¹ Hardy, *Geography of Plants*, Oxford, 1920.

injury has been done in these countries by the ruthless clearing of these slow-growing forests. The soil is thus washed off the hills, the streams are either flooded or silted up, and the whole country slope laid waste.

The leading states of Europe are found in that region which was once heavily forested with *deciduous trees* with broad leaves. But the 'interference of man, mostly by cutting or burning forests, for smelting, agriculture, or cattle and sheep-raising, has entirely altered the original covering' (Hardy). The oak

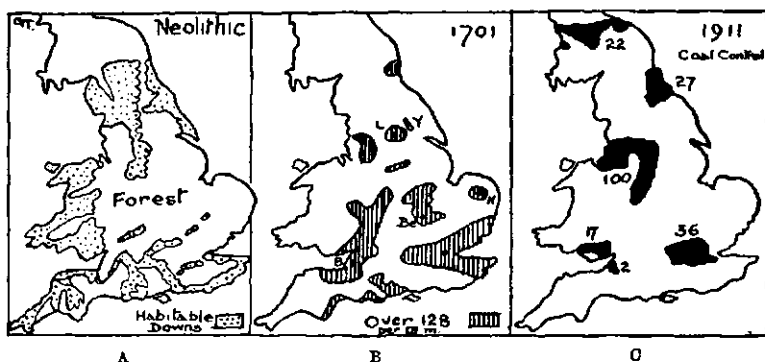


FIG. 38. A, open country suitable for folk without metal tools (Fleure and James). B, dense population with handicrafts. Six towns over 10,000. C, dense population on coalfields. The number of towns over 10,000 noted (After Muir).

and beech are dominant trees, with chestnut, birch, and ash next in importance. Beech forests exclude all underwood, but other types are more open. In early European history traffic through this forest belt was largely confined to the large rivers; but heather moors occupy large portions of poor soil and peat-bogs develop in poorly drained localities.

In Britain vast forests once covered large portions of the land. The beech woods and oaks occupied the lowlands, while pines clothed the higher slopes from 700 ft. up to 2,000. Fleure and James give an interesting account of the way in which Neolithic man in Britain was confined to the drier open country. Wolves and wild boars occupied the forests, and ague infested the swamp-lands. He settled chiefly in the uplands, especially in those of Wales and in the limestone downs. The chalk was

useful for earthworks, and contained the flints used for his tools. Springs and pastures were abundant on these downs. Kent, Hampshire, the Mendips, Devon, the Cotswolds, and Western Wales were probably the most closely settled portions of Britain in these times (see Fig. 38 at A).

The Thames Valley and the Midlands must have been very inhospitable to folk without metal tools to cope with the forests. The remarkable migrations of population in England, from the Downs, thence to the forested and agricultural lands in the Middle Ages and up to 1700, and later to the coalfields, are illustrated in the three small maps given in Fig. 38.

Prehistoric Changes in Environment. In another section (p. 133) I give a *résumé* of the well-known changes in the European environment during the Great Ice Ages. The later chapters have been clearly discussed by C. E. P. Brooks in the *Quarterly Journal of the Meteorological Society* for July 1921. In this paper he gives a novel correlation of the changing environment with the changing position of the storm-tracks during the last 30,000 years in Europe.

The last (Wurm) Ice Age was of much less extent than the two preceding ones. Valley glaciers occurred in North Ireland and North Scotland, while the Scandinavian Ice Sheet reached to Central Germany and just covered Denmark. A strong Anticyclone (or High) would lie over the Ice Sheet, giving powerful east winds over Germany and Holland. As a result ancient 'horse-shoe' dunes (with the front to the east) were built up in these latitudes, and still exist.

Brooks gives a climatological map of Europe for this period, which he dates from 30000 to 18000 B.C. The cultural stage was the Magdalenian period, the latest stage in France when Paleolithic men dwelt in caves. Reindeer were abundant. According to Brogger, the climate of Southern Norway, where the ice met the sea, resembled the present climate of Northern Greenland or Spitsbergen, with a mean annual temperature of about 17° F. (see Fig. 39 at left).

On the retreat of the ice, its edge seems to have remained over the Baltic for some 8,000 years. About 10000 B.C. it lay along the southern coast of Sweden, and during the next

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2,000 years it withdrew to about 59° N. About 8000 B. C. a great moraine¹ was piled up about the latitude of Stockholm. Then came another period of very rapid retreat, occupying nearly 3,000 years, followed by a further halt near Ragunda about 5000 B. C. After this the ice-sheet split into two portions and the glacial period is regarded as over.

Brooks gave the following table summarizing the changes deduced from geological and biological evidence, chiefly in North-west Europe.

<i>Phase.</i>	<i>Climate.</i>	<i>Date.</i>
		B. C.
1. Last great Glaciation	Arctic	30000-18000
2. Retreat of glaciers	Severe continental	18000-6000
3. Continental	Continental	6000-4000
4. Maritime	Warm and moist	4000-3000
5. Later Forest	Warm and dry	3000-1800
6. Peat-Bog	Cooler and moister	1800 B. C.-300 A. D.
7. Recent	Becoming drier	A. D. 300 ON

In the Continental Phase the Baltic became a closed fresh-water lake (the Ancylus lake). At this time the south-west Baltic lands stood 400 ft. higher than at present. Later, however, the climate became relatively dry, and warm conditions supervened in Scandinavia, which had a rich forest flora.

A rapid movement of submergence then set in, and the Litorina sea developed in the Baltic area. These marine conditions raised the temperature 3° F. above their present level in Sweden. The cyclonic storms with their heavy rains now moved along the Baltic track. The present small ice-fields of Norway for a time practically vanished. This occurred about the Middle Neolithic period in North-west Europe.

By 3000 B. C., or towards the close of the Neolithic period, England and Ireland were elevated considerably, and part of the North Sea was land. This gave much drier conditions to Britain, and probably the Gulf Stream effect being lessened tended in the same direction. The cyclone track migrated north, and the bogs in Ireland, Scotland, and Germany became dry enough to support *forests*, while in Russia steppe conditions obtained (see Fig. 39 at right).

¹ These moraines are indicated in Fig. 39.

The Irish bogs dried so completely that they were extensively inhabited. In Donegal a two-story log-house of this period has been excavated. (Since its building 26 ft. of bog has been deposited above its floors.) This dry period apparently corre-

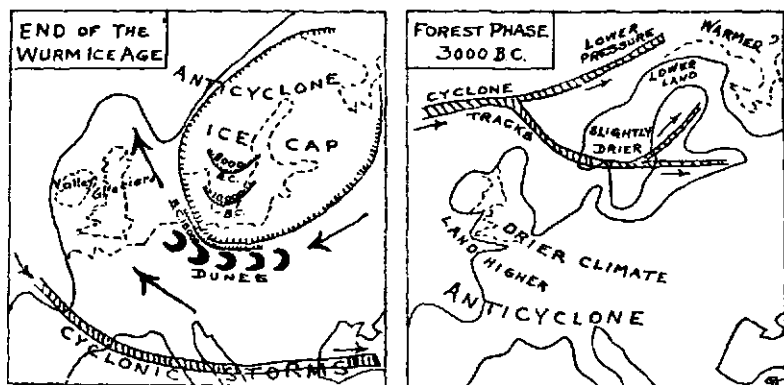


FIG. 39. Climatic changes in North-west Europe (based on C. E. P. Brooks). The storm belt (wet) is far south of Britain in the Ice Age, but to the north in the Forest Phase.

sponds to the legendary Heroic Age of Ireland (about 2000 B. C.), when the vigour of the Irish reached a level never since attained.

This dry phase was followed by the *Peat-Bog Phase* as the present distribution of land and sea was reached. Probably all lands in these latitudes were somewhat wetter than in the phase just before or since. In the years since A. D. 900 bogs in parts of Ireland, Belgium, and parts of North Germany have ceased to grow, showing that conditions are now becoming drier again. Scandinavia is rising and the Norwegian glaciers are slightly increasing in size.

XI

RACES IN PREHISTORIC EUROPE AND EARLY MIGRATIONS

(a) *Time and Distribution.* The great importance of Europe in our study of race migrations lies in the fact that in this corner of the Old World the sequence of the ethnological 'strata' has been correlated with that of the latest geological strata. We are thus able to tell how the climates and lands varied in character while the first primitive tribes were peopling Europe. Since it seems probable that similar migrations were occurring all round the heart of the Old World, we can get an approximate idea of the history of similar migrations in regions remote from Europe.

This is not the place to enter into the vexed question of the actual length in years of the later geological ages. We may assume that 30,000,000 years have elapsed since the beginning of Tertiary times. The end of Pliocene time and the dawn of the four Great Ice Ages are variously set down as from 100,000 to 840,000 years ago. Since the estimates by later investigators usually indicate longer and longer periods, we may take it that the Pleistocene (Ice Ages) period lasted about 800,000 years.

The period since the last Ice Age—usually called Recent or Quaternary—is set down at about 50,000 years. Estimates differ with locality, for the Norwegian Highlands, Iceland, and Greenland still contain large Ice-caps dating from the Ice Age period.

The following table (arranged approximately to scale, and so apparently cramping Quaternary time) shows the salient features. It is based in part on that given in Osborn's *Men of the Old Stone Age*.

It is to be noted that the adjoining table is based on data collected in the deposits of Western Europe, i. e. on the outer

PLEISTOCENE AND RECENT HISTORY.

	<i>Years, approximate.</i>	<i>Ice Age, approximate.</i>	<i>Descent of snow-line in Alps.</i>	<i>Stone culture.</i>	<i>Human races in Europe.</i>	<i>Flora, &c., West Europe.</i>
PLEISTOCENE	Quaternary		Warmer than now	Neolithic Upper Paleolithic Lower Paleolithic	Alpine Cro-magnon Neandertal	Reindeer Steppe fauna
	100,000	WURM	1,200 metres lower			
	200,000	Third interglacial	Warmer than now	Acheulean	Neandertal	
	300,000	Riss	1,400 metres lower	Chellean	Pittdown ?	Cold Tundra
	400,000	Second interglacial	Warmer	Chellean ?	Heidelberg ?	<i>Elephas antiquus</i>
	500,000	MINDEL	1,500 metres lower	Chellean ?		
	600,000	First interglacial	Warmer . . .	. . . .	. . . .	<i>Elephas Meridionalis</i>
	700,000	GUNZ	1,200 metres lower			
	800,000	. . . .	. . . .	. . . .	Pithecanthropus (Java)	
	Pliocene during 5 million years ?	. . . .	. . . .	. . . .	. . . .	Warm forest

margin of the Eurasian continent. We may assume that man evolved in far distant lands—most of the evidence points to Central Asia—and that many long years elapsed before he reached Western Europe *after he had evolved elsewhere*.

It is only in later records that we can see clear examples indicating the duration of this *period of migration* from Asia to Europe. The following table perhaps makes the matter clearer.

Approximate Table illustrating *differing chronology* in Asia and Europe.

Year.	West Europe.	East Europe and Egypt.	Mesopotamia and Turkestan.	China.
B. C. 55	Caesar		539 Cyrus	550 Confucius
		1100 Homer	1300 Moses	
		1800 Abraham		
2000	BRONZE COPPER	Hyksos BRONZE Crete	2750 Sargon	First 3 Em- perors
4000	. . . . .	. . . . . COPPER Menes	BRONZE 5500 Nippur and Eridu	
6000	. . . . .	. . . . .	COPPER	
8000	. . . . . Neolithic	. . . . .	Sumer ?	
10000				
12000				
14000		Neolithic	Susa ?	
16000	Magdalenian ?			
18000	. . . . .	Upper Paleo- lithic	Neolithic	
20000	. . . . .	. . . . .	Upper Paleo- lithic	

From this table we see that the Neolithic period started about 17000 B.C. in Mesopotamia, but about 10000 B.C. in Western Europe. So also the Bronze Age began about 5500 B.C. in the East, but only about 1700 B.C. in Middle Europe.

A very interesting table (due chiefly to Montelius) illustrates the same point in greater detail :¹

MOVEMENT OF BRONZE AGE ACROSS EUROPE.

<i>Culture.</i>	<i>Scania.</i>	<i>Mid Europe.</i>	<i>Hungary.</i>	<i>Greece.</i>	<i>Egypt.</i>	<i>Turkestan.</i>
	B. C.	B. C.	B. C.	B. C.	B. C.	B. C.
Iron	—	—	—	1000	—	—
Bronze	1900	2000	2000	2500	3000	4000
Copper	2500	2500	3000	3000	5000	6000

Hence the migration-period for the Neolithic culture across Europe from east to west (see earlier table) was about 6,000 years, for copper about 2,500 years, and for bronze 2,000 years.

These culture movements took place when Europe was fairly well populated as compared with earlier ages. We may, therefore, postulate very great lapses of time for the spread of earlier cultures, such as those characterizing the Paleolithic peoples.

It is increasingly difficult to synchronize events as we move back to Paleolithic times. Yet Pumpelly² dates the *founding of cities* in Persia and Turkestan before 10000 B. C., at which time some authorities place the Magdalenian (Paleolithic) culture in West Europe. The above tables certainly indicate that true civilization spread to Egypt from Sumeria and Turkestan. If this be true the Alpine peoples certainly were the first founders of a real civilization.

(b) *Early Races in Europe.* The first race discovered in Europe (unfortunately only represented by a single lower jaw) is the Heidelberg type, which may date back to the First Interglacial Age (*vide* Geikie). It may be described as a primitive, more powerful, and ape-like ancestral form of Neandertal man.³

The next type is that found at Piltown in Sussex, associated with very early flints of the pre-Chellean type. It represents a different type from Neandertal man *with its rugged brow*, for it has a smooth forehead. The skull is broader, but very thick. The jaw, however, is ape-like. It has been suggested

¹ See table on p. 177 in *New Stone Age*, by Tyler, 1921.

² See Pumpelly, *Explorations in Turkestan*.

³ Osborn, *Men of the Old Stone Age*, p. 100.

by some ethnologists that this type evolved into modern man, while the more recent Neandertal man became nearly extinct. The links between Neandertal man and the negroids seem, however, to the present writer to be too strong to be dismissed without further evidence than we possess to-day.

During the latter part of the Third Interglacial Europe was inhabited by Neanderthal man, whose remains have been found over wide areas of Central and Western Europe. They were no doubt driven somewhat south on the advance of the Wurm Ice Sheet; but they seem to have spread north again after this period right through the epoch characterized by Mousterian cultures. Thus relics of this race have been found in Spain (Gibraltar), in the Dordogne of France (La Quina, Le Moustier, La Chapelle), in Belgium (Spy, La Naulette), in Croatia (Krapina), in Bohemia, and in Germany. Also artefacts of this race have been found in Britain (Kent's Hole and Crayford), and especially in the type district of Le Moustier on the Vezere river (in the Dordogne) some 100 miles east of Bordeaux.

Thus from 125000 B. C. perhaps to 25000 B. C. Europe was occupied by these folk. They had large narrow heads (cephalic index 73) with overhanging brows and retreating foreheads. (The lateral prominences on the eyebrows are found to-day in some Australian aborigines.) They had very wide, ape-like noses and long upper lips. The chin receded strongly, the jaw was prognathic, and the teeth very strongly developed. The skull-cap was flattened (platycephalic) and narrow or extremely dolichocephalic. The face was long, while the nose-bridge receded more than in any race except the Australians. There is little doubt that the Australians are nearer to the old Neandertal folk than are any other peoples. At the same time one could hardly expect exact agreement, when they are separated by such intervals of space and time. Hence the writer does not agree with those who see no meaning in the large number of these similarities in anatomy, especially when it is supported by the evidence of the migration zones and strata.¹

The geographical factors point to a widespread 'Australoid' stratum throughout Southern Asia, and this seems to 'march' with the Neandertal stratum in Europe in a fashion which strongly supports the view that they are variants of the same primitive type. Further, the Broken Hill skull from Northern

¹ At Brunn twelve skeletons of Australoids were found. Dixon mentions Australoids in Beira, Tras-os-Montes, Teruel, Sardinia, Calabria, and Ireland.

Rhodesia is admitted to link the African negro with Neandertal man ; while the Wadjak skulls of Java are relics of very ancient Australoids there.

We may remember also that the tamed dingo of the Australians seems to be more closely allied to the Syrian dogs than to any species nearer Australia (*vide* Wood-Jones). This would seem to lend support to the theory of a common cradle for Neandertal and Australian peoples.

Although the Neandertal peoples were largely displaced by the Cro-magnon folk, yet in several European localities there are villages where the primitive Neandertal type remains as an *Inlier* amid later peoples. Thus Hrdlicka thinks that such folk still persist along the valley of the Danube. Collignon finds living relics of this primitive race amid the Cro-magnon folk of the Dordogne, and Fleure has recognized them on the moors of Central Wales. They constitute, however, only an infinitesimal proportion of European peoples.

It seems almost certain that true negroids entered Europe either before or with the next invasion, that of the Cro-magnon folk. The Grimaldi skeletons (found near Monte Carlo) bear many resemblances to the negroids, i. e. in their cephalic index (69), their jaws, chin, nose, teeth, and cheekbones. Yet amid the ninety skeletal relics of the Cro-magnon folk only two negroid folk are known. Sollas is of the opinion that they indicate a 'stratum' of Negritoes akin to the Bushmen, who lived in Western Europe during the dawn of Aurignacian times. The evidence is mainly based on the small statues and rock paintings (found in Spain and France chiefly) which certainly point to a race akin to the Bushmen. At Willendorf (near Vienna) a statuette of a nude woman is steatopygic and has hair apparently of the peppercorn type. Similar negritoid figures come from Brassempouy and Lespugues in the South of France, but the evidence of these statuettes must be used with considerable caution.

With the decline of the Neandertal people we find an extensive invasion by the Cro-magnon peoples who arrived in Upper Paleolithic times after the last great glaciation. They entered Western Europe probably about 20,000 or 30,000 years ago.

They exhibit no negroid characters, but seem to have reached Europe from Asia along the shores of the Mediterranean; probably chiefly via North Africa, but also perhaps via Italy. They followed in fact the same 'corridor' as did the Arabic invasion much later in the seventh century A. D.

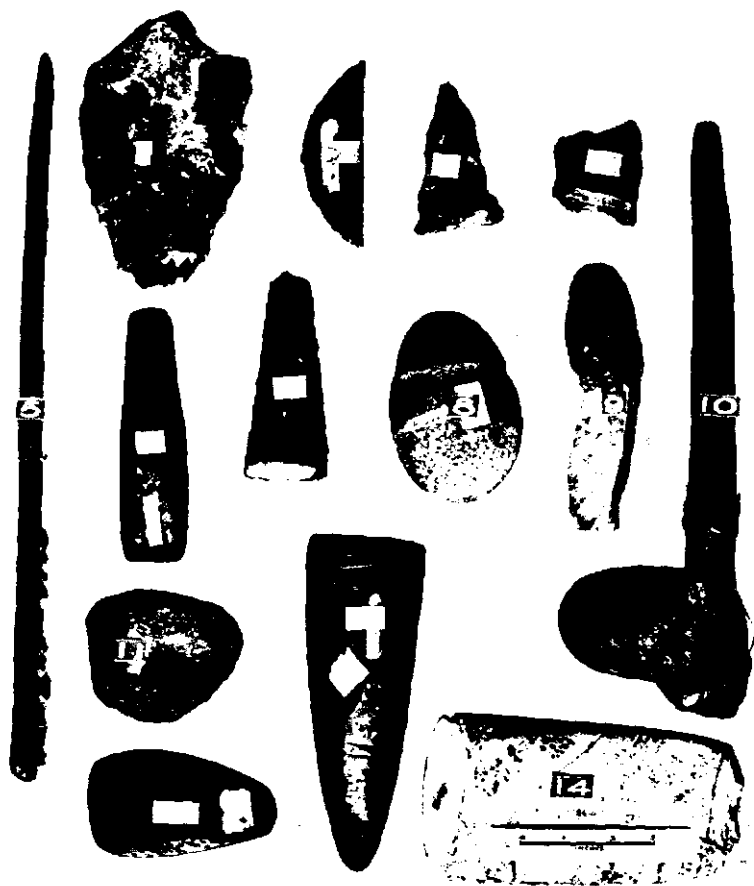
The chief characteristics of the Cro-magnon type are as follows. They were mostly of high stature, especially the first comers, ranging from 5 ft. 10 in. to 6 ft. 4 in. A shorter type, however, occurs at Chancelade (Dordogne) which was only 4 ft. 11 in. high. The skull contained an unusually large brain, though the head index was very low (71). The forehead is very broad, which is most unusual in connexion with a narrow skull; and the head is therefore *disharmonic*. The nose is narrow, and the upper face vertical, as in modern high types of men.

This wonderful race is characterized also by great artistic ability. 'More than 20,000 years ago there sprang up an art never since surpassed in its own field except perhaps by the Greeks.' So writes Osborn, and the following table based on his work epitomizes the growth of Art.

EVOLUTION OF ART.

B.C.	West Europe, environment.	Age.	Incised figures.	Sculpture.	Painting.	
15000	Forest	Azilian	None	None	Coloured pebbles	
20000	Steppe	Magd. {	Upper	None	None ?	Conventional
			Mid	Fine ivory	Slender figurines	Polychrome Bisons
25000			Lower	Deep outlines	High relief	Flat tint
30000		Solutrian	Engravings	Bone sculpture		
35000		Aurignacian	Stiff profiles	Heavy human	Linear tracings	

The Cro-magnon people reached their highest development in Magdalenian times. Their homes extended from the River Ebro through France and Germany to Poland, but this highest type does not seem to have spread along the Northern Mediterranean coasts. As the forests extended northward, and as the reindeer



V. EVOLUTION OF STONE WEAPONS, ETC.

1. Chellean boucher from N.W. Europe (6 inches long).
2. Solutrian crescent knife from N.W. Europe.
3. Late Paleolithic tranchet from N.W. Europe.
4. Very primitive spokeshave from Tasmania.
5. Flint saw (cemented with wax), N. Territory (Aus.).
6. Very advanced Polynesian adze (curved edge), Cook Is.
7. Neolithic axe from Denmark.
8. Half-finished tomahawk from Bourke, N.S.W.
9. Flaked knife with resin handle (tip broken), N. Territory.
10. Polished tomahawk hafted in withy, N. Territory.
11. Mortar for breaking shells, Victoria.
12. Cornute stone (grave-marker ?), Bourke, N.S.W.
13. Highly polished axe, Fiji. (4 inches long.)
14. Axe made from giant shell (Tridacna), Caroline Is.

The approximate order of evolution is 4, 11, 1, 2, 9, 5, 3, 8, 10, 13, 7, 12, 14, 6.

retreated to the north after the last Ice Age, this race dispersed into many colonies. It was also displaced by new races coming from Asia. Yet Cro-magnon folk still remain abundantly in the Dordogne, where the same disharmonic proportions are found in the Frenchman of to-day. The cephalic indexes of many of the living range from 72 to 75 (which is equivalent to 70 to 73 on the Cro-magnon skulls). There is naturally no entire modern district in France with an *average* less than 76. This type is very abundant also at Oleron and Lannion in Brittany, and in the hills of Thuringia. It was prevalent among the extinct Guanches of the Canary Isles, and is still very common among the living Berbers of North Africa.

Sollas¹ has put forward weighty arguments in support of the theory that the modern Eskimo and associated Algonkians have an ethnic connexion with the Cro-magnons of Western Europe. I shall hope in a later section to show that they all belong to the same migration-zone, which seems to me strongly to support the theory of Sollas. He instances the similarity in the arrow-straighteners, hair-pins, pendants, snow scrapers, line-engravings, &c. He would associate the Eskimo with the short Chancelade type, and the Algonkians with the taller more common type.

In early Neolithic times we reach a period when the major races of Europe entered that continent. There seems little doubt that these newcomers (who form the major stratum in Southern Europe) made use of the ancient corridor along the Mediterranean shores. They are perhaps most typically represented in their primitive state by the Somali and Galla peoples of to-day, and we may picture similar folk moving throughout most of the lowlands of Europe in early Neolithic times. They constitute the *Mediterranean* race, which is found still in the majority in Southern Italy, Central Greece, Corsica, Sardinia, Western Spain, Portugal, Wales, Devon (?), Ireland, and Western Scotland. Peoples akin to these are almost wholly responsible for the megalithic monuments; and by these and other evidences can be traced through Asia, East Indies, and America.

As the conditions improved in Central Europe, the northern

¹ *Ancient Hunters*, 1915, Chapter XII.

routes via the Black Sea and the Danube and via the Russian steppes came into use. The first broad-headed people (C. I. 86) arriving in Europe probably moved west along the Danube, thus traversing the great forests. Their skulls have been found at Ofnet (East Bavaria) and these probably slightly antedate Neolithic times. They also occur at Furfooz (near Dinant) and Grenelle (Paris). These were the advance-guard of the great Alpine waves from Central Asia.

Of equal interest are the folk who arrived during this transition period (at the dawn of the Neolithic Age) in the Baltic region. They were ignorant of agriculture and pottery. They had a bone and horn culture, which was ornamented with crude animal drawings. These are very unlike the earlier Magdalenian art, but resemble those found in the Ural and Altai regions. Their artefacts have been recovered in great numbers from the marshes of Maglemose (of West Zealand) in Denmark. They have been doubtfully classified as the first Nordic folk to enter Europe. One school of ethnologists, however, thinks that the Nordic peoples are a mixture of Mediterraneans and later Asiatic peoples, while another believes that they are merely 'bleached' Mediterranean peoples. Probably all these stocks are represented. We may here also refer briefly to the Ainu (of North Japan) as primitive members of the same migration zone, characterized by the same abundance of hair and same cephalic index as the Nordics.

We must realize that much of the ancient population of East Europe was long-headed and closely allied to these so-called Nordics. Thus in Russia in the kurgans (or tumuli) of the Stone Age, three-quarters of the skulls were narrow. In the eleventh century about half the people were of this type, while to-day the population is Alpine and only contains 10 per cent. of the narrow-heads. Similar changes have occurred in Lombardy and Swabia.¹

We have now to discuss briefly the arrival of the main bulk of the broad-headed Alpines, and then that of the allied Slav peoples. The chief feature of the distribution of the Alpines has given them their name. They constitute a wedge which

¹ See Mosso, *Mediterranean Civilization*, 1910, p. 408.

extends across the Alpine regions of Europe, separating the northern 'Nordics' from the southern 'Mediterranean' people. They occupy the rugged mountainous and unattractive areas to a very large extent. This is in itself a sign of primitive occupation. It is, however, not to be supposed that these Alpine folk advanced by the difficult mountain passes, scram-

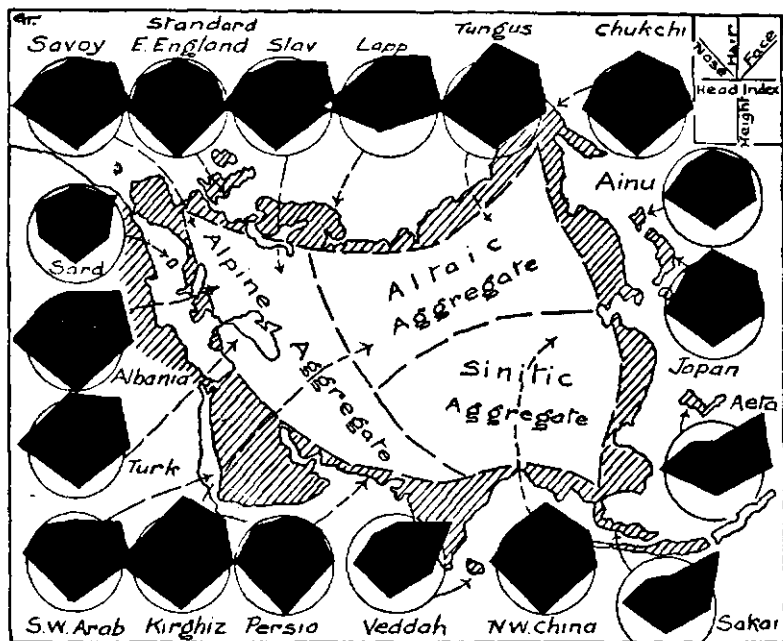


FIG. 40. Map of Eurasia showing the three linguistic aggregates of broad-headed (Alpine-Mongolian) peoples in a generalized fashion. Around the margins are ethnographs of the chief races. The standard graph is that of East England, which just touches the circle. The criteria are given in the upper right corner.

bling from crag to crag like a chamois! They moved west along the Danubian corridor in all probability and were gradually pushed into the hills by later, perhaps more highly civilized tribes, who made use of the same tracks.

We may distinguish many waves of brachycephalic (80+) peoples. From their distribution and isolation it seems likely that the Albanians (88) and the Rhaetians (of the Eastern Alps) were some of the earliest broad-head races to settle in large

numbers. They are surrounded by peoples of distinctly different type. The 'point of the Alpine wedge' is composed of the Provençal folk with allies in Brittany (83). They probably constituted a second wave. Later came the Swabian and Lombard waves, to be followed by the Western Slavs (85) and Magyars (84). But these latter bring us down to historic times.

In concluding this brief review I would emphasize the fact that no explanation of European race-origins can be successful which is not based on maps which show how the racial zones of Europe link up with those in Asia. This aspect has been somewhat ignored in the past, and, in part, seems to have led to the narrow-headed folk of Western Europe occupying too large a proportion of space in that portion of ethnological literature which deals with race-classification.

(c) *Early history of European Migrations.* Owing to the discoveries of Sir Arthur Evans and others in Crete, evidence is accumulating about racial migrations in early times in Southern Europe, but there are many gaps still to be filled in in Central and Northern Europe. Very soon after the beginning of the Minoan period the Alpine roundheads were beginning to enter Crete. In the regions bordering on the Northern Aegean there seems to have been a series of migrations, one soon after 2000 B. C., one about 1450, or a little before, and another one about 400 years later. There is reason to believe that these movements may be associated with other ethnic movements in the Western Mediterranean, which may have been due to the migration westwards of tribes who were dispossessed in the east.

About this time we may imagine all South and West Europe sparsely settled by Iberian (Mediterranean) races speaking a language probably akin to Basque or to Berber. In the far north it seems likely that there was a widespread group of Finnish people, who came in from Asia and had settled in the lands from Perm across to Sweden. They also spoke a non-Aryan language. It seems almost certain that they preceded the broad-headed Slavs, but it is not clear what were their relations with the narrow-headed folk whose remains occupy the Kurgans of Russia.

Probably during Neolithic times, about the twentieth

century B. C., there entered the first groups of the great Aryan migrations. They almost certainly came into Europe from Turkestan and the Pamirs, while the Finns came from the Altai region to the north. There may have been small migrations at first possibly of very broad-headed people akin to the Cevenoles of France, or to the Albanians. But the numerous tribes constituting the main body of the Keltae of France

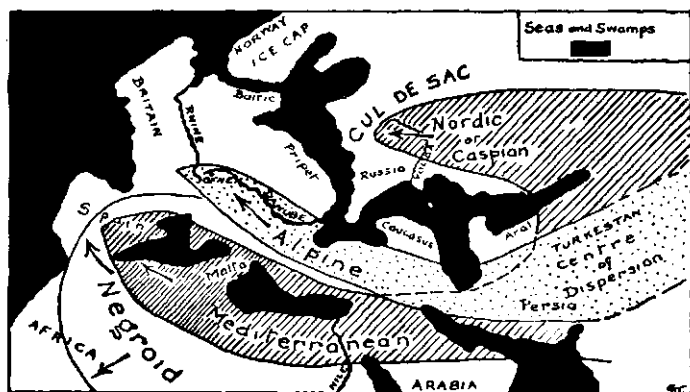


FIG. 40 A. A generalized diagram illustrating the order of migration of the early races into Europe in Paleolithic times. The Negroid (Neandertaloid? &c.) entered first, by the south. The Mediterranean folk used the same route—the north being relatively impassable. Their northern wing (the Caspian or Proto-Nordic folk) was probably held in a cul-de-sac by the seas, swamps, and forests of Central Europe at the end of Paleolithic times. The more cultured Alpines were the first to use the Mid-European track when it became available at this time. Perhaps some thousand years later the Proto-Nordics reached Germany.¹ (See also p. 158.)

followed on, probably preceding the mixed Teuton stocks who constituted the Nordic migrations.

About 500 B. C. we find that the Teuton tribes were settled primarily in South Sweden, Denmark, and the Baltic coasts. The Keltae were chiefly in the French lands, and had already perhaps sent over one migration to Britain. Some authorities believe that this first or Gaelic migration was derived from the western Keltae, while the second migration (of the fifth century) spoke Brythonic (i. e. British or Welsh), and was composed of Belgæ from the eastern domains of the Keltae. Both of these migrations were somewhat broad-headed people, who conquered the Iberians (Silures) in Britain. They imposed their languages on them, and then

¹ See 'Race and Nation in Europe', *Australasian Journal of Philosophy*, 1926.

apparently largely merged into the bulk of Iberian narrow-heads. At any rate the Keltic language is now spoken by no broad-head people except in the peninsula of Brittany. But it has replaced what may have been ancient Iberian languages in Ireland, Scotland, and Wales.

No doubt by this time the Russian plain in the south was occupied by the early Slavs. The westernmost tribes were known as the Wends (Veneti) and spread right into modern Prussia, where a small group still remain near Berlin. About 400 B.C. Rome was just rising into prominence, largely as the result of a merging of Northern Alpine peoples with the old Iberian folk of the Etruscan and Mykenean civilization.

For the next 2,000 years the European peoples swayed back and forth as the result of invasions of territory largely on the eastern side. The change of environment which brought this about is discussed in the later chapters on Asia. Thus about 400 B.C. the Keltae moved south-west into Spain and thence eastward into Italy. A century later some allied tribes marched down the Danube and reached as far as Asia Minor, where they founded 'Galatia' (possibly a form of 'Keltae').

The colonies of Carthage (largely Iberian) yielded to Rome about 200 B.C., and for some 500 years Rome carried her civilization, her laws, and language into all the Romance regions of Europe. It must not be forgotten, however, that the Latin tongue is fairly close to the Gaelic (or early Keltic), for they both belong to the 'K' group of Aryan languages (see p. 162, *postea*). Hence the change in speech was not very marked in the case of the Western Kelts of Spain and France.

In the third and fourth centuries of our era, the Slavs spread out on the west and south, extending to the Baltic, to the Elbe, and to the Balkans. They displaced the Germans (Teutons) who moved against the Keltae. Thus all Western Europe was in a state of disorganization. The Germans (Anglo-Saxons) occupied Eastern Britain, and allies entered North France, Bavaria, and Lombardy. The Keltae moved forward as before into Spain and West Italy.

Somewhat later the first of the modern Asiatic invasions occurred. The Hun migration is believed by Dr. Wislocki to have originated far away in North China. About A.D. 84 a group of Hun peoples was driven west to the Aral region, and they fought with and incorporated many peoples allied to the Finns near the Caspian Sea. About A.D. 372 they crossed the Volga, and under Attila they marched through Europe to be

flung back near Troyes (France) in 451. No doubt many typical 'Mongol' people (see p. 191) took part in this invasion; but all sorts of Western Asiatic tribes were incorporated in the Hun hordes, including many Slav and Finnish peoples. For

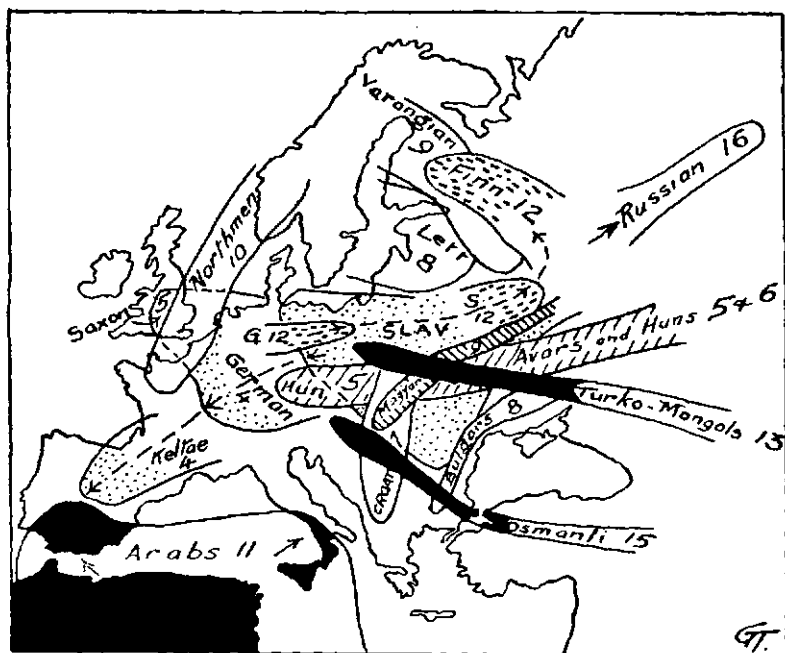


FIG. 41. Racial migrations from fourth to sixteenth century: fourth century, Slav, German, and Keltæ; fifth, Saxon; fifth and sixth, Avar and Hun; seventh, Croat; eighth, Bulgar and Letts; ninth, Magyar and Varangian; tenth, Northmen; eleventh, Arab; twelfth, German, Slav, Finn; thirteenth, Mongol; fourteenth and fifteenth, Turks; sixteenth, Russian.

instance, the Bulgars came from the Aral region, and in the sixth century deviated to the south through Southern Russia to their present habitat in the Balkans.

In the seventh century the Croats and Serbs crossed the Danube into the Balkans, there forming a South Slav community. The Letts are allied to the Finns, and moved into West Russia in the eighth century; while the Magyars (also allies of the Finns) came to Europe from the original homeland of the Altai or adjacent Baraba steppes. The Magyars occupied the Alföld plain of Hungary in the ninth and tenth centuries, thus separat-

ing the Western Slav outpost of the Czechs from the Southern Slavs (Serbs and Croats). About this time also the Varangian kings from Sweden were ruling the Northern Slavs of Russia.

Of special interest to the English is the descent of the Northmen from Norway into Northern France or Normandy. They invaded England in the eleventh century and conquered the mixture of Alpine, Nordic, and Iberian peoples who inhabited Britain. The south-west of Europe soon afterwards suffered from the assaults of the Arabs from Africa, who overran Spain and Southern Italy in the eleventh century. A retrograde movement of the Germans led to the Slavs pushing eastward upon the Finns in the twelfth century.

In the thirteenth century occurred the invasion of Russia by the Turco-Mongols. They reached as far west as Silesia. In the next two centuries the Osmanli Turks advanced up the Danube as far as Vienna, and have only recently been driven back to their last European territory around Constantinople.

With the discovery of America was inaugurated a series of migrations of a very different type, and we may close this chapter by a brief reference to the little-known migrations of the Russians into Siberia. These took place during the same time that the English were trying to settle North America. Tobolsk, however, was founded in 1590, many years before Virginia was permanently settled, but long after the Spanish and Portuguese had built towns in America.

XII

THE RACES OF FRANCE AND BRITAIN

LET us consider in some detail the constitution of the races inhabiting the region between the Pyrenees and the Scotch Highlands. This includes most of those peoples who have been in touch with Britain during historic times (see Fig. 44).

At the western end of the Pyrenees we find a most interesting people, the Basques. They are linked together by a community of interest which is based upon a most remarkable language. Basque is utterly unlike any other in Europe, and is usually accepted as representing the tongues spoken by the folk in Europe before the great invasion by the speakers of Aryan languages. Quoting Ripley, we may note that Basque is 'characterized by 'terrific complexity'. Thus the verb habitually includes all pronouns, adverbs, &c. 'AZPILCUELTA-GARAYCOSAROYARENBERECOLARREA' is one complex word, signifying 'The lower field of the high hill of AZPILCUELTA'. This merging of ideas into one word is quite characteristic of other early languages, notably among the Amerinds of North-east America, and of the Abkasians in the Caucasus.

This complex structure may well represent a stage in the early development of the Aryan speech, which survived among some allies of their primitive forerunners who had long ago migrated from the homeland. An exactly parallel case is the survival of primitive Norwegian in Iceland; or, shall we say, the presence of Shakespearian dialects among the folk in the rugged hills of Eastern U.S.A.

But a curious anomaly is that the Basque tongue is used by broad-head Alpines (87) in the north of the Basque territory in France, and also by narrow-heads (77) near Bilbao in Spain. Who were the original speakers of Basque? All the facts of distribution indicate that it was the native speech of the Spanish Basques. This is supported by the distinct similarities which exist between Basque and the Berber speech of the Atlas Mountains, where the folk belong to the narrow-head Mediterranean race. Probably the 'Alpine' Basque-speakers of France for a lengthy period

made common cause with the Spanish Basques against a northern enemy and so adopted their language. This is an example of linguistic retrogression, which may also be noted in other parts of the world.

Possibly as a result of isolation there is a preponderance of rather pointed chins and of broad brows throughout the Basque area. This facial trait may have been recognized among the early Basques, and so may have been intensified by the strong national feeling of the race, which may easily have led to such features being an attraction in marriage.

Leaving the Basque people, let us proceed northward. We find on the east in the hilly Cevennes a fairly uniform group of short dark broad-heads (86) known as Cevenoles. They are the veritable apex of the Alpine wedge which was thrust into Europe from Asia at some time in the Neolithic period. From the Cevennes eastward to the China Sea we are dealing with broad-heads of one type or another; and to this great body of cognate peoples the term Alpine-Mongolian may provisionally be given. We find that in France, as elsewhere in Europe, they are confined largely to the mountain areas. This inevitably suggests that they were early immigrants who have been driven into unattractive regions by stronger and later immigrants (see Fig. 42).

A little to the north and west of this 'Alpine wedge' is a most interesting group of peoples who have settled for ages in the Dordogne valleys. They comprise folk with very narrow heads, who are dark in colour and of low or medium stature. It is precisely here that the most remarkable relics of Paleolithic times have been found in the limestone caverns; and it is here that the most primitive peoples of France still survive. We may accept the conclusions of Collignon and others who believe that the Cro-magnon types have been preserved here with little change for some fifty thousand years at least. Near Perigueux half the people have a head index about 77, which is the lowest of any district in France.

Proceeding north once more we find an entirely new race becoming more and more abundant. These people occupy the valleys and cluster about the towns. They are obviously later comers, since they still occupy the 'corridors of migration'. They are tall fair people with heads of medium width (80 or 81), and belong to the Frankish tribes of the family commonly

known as Nordic. Their distribution shows that they came in from the north-east, probably by way of the northern plains of France and Germany.

Our next stage brings us to the coast near Brittany. Here again we come on a most interesting problem, one of the most difficult in European ethnology. The Bretons are largely dark



FIG. 42. Map showing the correlation of the component nations of Europe. The broken lines on the map represent linguistic boundaries. (From *Geographical Review*, 1921.)

broad-heads (some districts averaging 86), but they are by no means a pure Alpine stock. Their language is Brythonic, allied to the Welsh speech. It is believed that many of the Bretons were driven from the West of England by the Saxons about the fifth century A. D. Hence the similarity of language, but there is very little similarity in race between the Cornish and Welsh 'Brythons' on the one hand, and the Breton 'Brythons' on the other. Do the Bretons speak the language their ancestors brought from Asia in the great Aryan migration? Or have they borrowed the language of the ancient Welsh migrants? Or

have the dominant stock in Wales changed their language? We shall discuss this question shortly (see p. 162).

Crossing the Channel we reach Britain. Here we find three major languages still spoken by three zones of people. To the west is a fringe in Ireland and the Scotch Highlands who speak Erse and Gaelic. (Ancient Erse may be described as the ancestor of Gaelic.) In the intermediate zone is the Cornish-Welsh-Manx group, of which Cornish is now extinct. In the east is the Anglo-Saxon group, now spoken as English in the south, and 'broad Scottish' in the north.

These three zones undoubtedly represent thrusts from the east, the 'primitive being pushed to the wall'. Here again detailed ethnological investigation shows little connexion between physical anthropology and language. It seems possible (though not certain) that the typical Anglo-Saxon of Central and South England, a fair tall person with a medium skull (78), speaks a modern form of his original Aryan tongue. But what of all the peoples to the west? Certainly the dark short narrow-heads of Devon have changed their language. They are Iberian folk akin to those of North Africa, and in all probability they spoke something like Basque or Berber in early Neolithic times. The same is probably true of the similar folk (with a head index about 75) who occupy South Wales and formed the Silurian tribes.

We shall do well to follow Fleure and James in attempting to elucidate this complicated problem.¹ It is difficult for Britishers to realize that their islands were a refuge for a debris of broken tribes pressed out from Europe, akin in some ways to the shattered tribes found in similar positions all round the Old World land-mass.

Welsh Stocks. Fleure has investigated in great detail the stocks found in the somewhat inaccessible regions around Aberystwyth in West Wales. His conclusions are somewhat as follows. In the south are numerous folk belonging to the short, dark, primitive Iberian stratum; but in the hills there are still older peoples. Near Plynlimon is a 'nest' of extremely narrow-headed people who still show some of the features of Neandertal man! They have very flat skulls, low foreheads, and marked glabellas, with a head index often as low as 73.

¹ *Journal of the Anthropological Institute*, London, 1916.

In addition to these two long-head types there are two broad-head groups. One of these is a dark type, found near the coast, and like the maritime rovers of the Mediterranean Neolithic settlements. There is further a tall fair or red group of Alpines with high noses and prominent brows, who exerted a peculiar influence on Britain in Early Bronze times. Fleure speaks of them as a 'turbulent, noisy, mobile, aristocratic people' whose exploits filled the history of those times. They seem to be allied

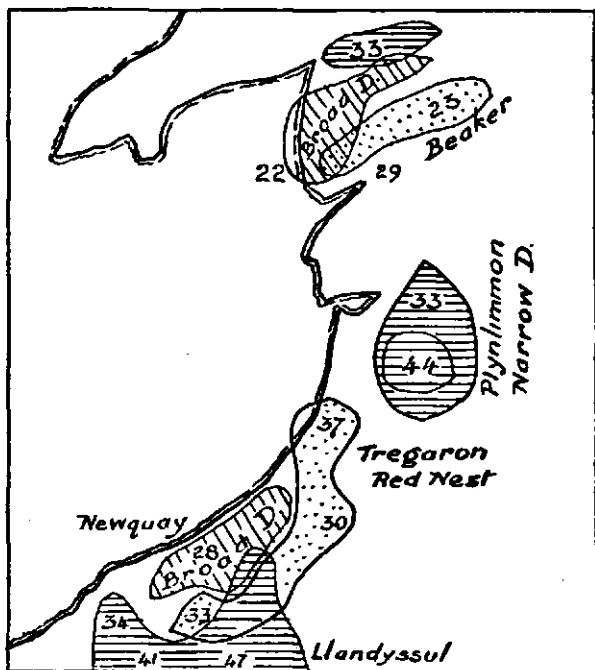


FIG. 43. Three racial components in West Wales. Figures give percentage of the local census. (After Fleure and James.)

to the folk buried in Round Barrows, who used beaker-shaped utensils. They occur widely in Western Europe, notably at Borreby near Copenhagen. They perhaps entered West Wales along the valley of Bala Lake.

The racial history of our own islands seems to have been something like this. It is probable that the type in the Plynlimon region is directly descended from the very long-headed Aurignacian type. Secondly, there is a type belonging to a generalized stock which can hardly be distinguished as either Mediterranean or Nordic. The Long Barrow men, whose average cephalic index is about 72, are of this strain. Thirdly, members of the Mediterranean stock probably introduced the early Neolithic culture. Finally, there are at least three different types of roundheads, all ulti-

mately connected with the Alpine race, but differing somewhat from them. The most distinct of these types are now usually termed the 'Beaker Folk'. They are also sometimes called 'Bronze Age People' or 'Round Barrow People'. Their average cephalic indexes vary from 80 to 84, the latter figure being more frequent. At present there are practically no skulls in our museums belonging to the Early Iron Age, but it is probable that during this period the Nordic type became more and more frequent in Britain. The Nordic-Alpine type of the population has since that time been usually overlaid by strata not dissimilar in type. Finally, there is evidence that 200 years ago the cephalic index was 77; to-day it is probably about 79.

Place-Names. An investigation of the place-names of Britain is of considerable interest, as showing how the various migrations have displaced preceding languages in common speech, but have preserved the original place-names. [This is, of course, a world-wide phenomenon. Thus in Sydney no full-blood aboriginal now lives within 100 miles of the city; but names of leading suburbs such as Woolloomooloo, Maroubra, Cronulla, or of the National Park—which is Kuring-gai after the old tribe—keep alive our memory of the vanished race.]

Canon Taylor suggests that the syllable 'etan' in Britannia, Aquitania (Dordogne), Lusitania (Portugal), and Mauretania (Morocco) is a non-Aryan word, and means 'country' in some language akin to the earlier Iberian speech.

Avon and Esk are two Gaelic (?) words common in Saxon Britain. Pen (mount) corresponds in Welsh to 'Ben' in Gaelic. It is found not only in Wales but in the borders of Scotland, which were originally occupied by *Welsh* people. In many ways it is clear that the Goidelic (Erse and Gaelic) people were driven west by the Brythonic (Welsh), who again moved ahead of the Saxons about the fourth and fifth centuries A. D.

It is quite possible that few of the genuine Brythonic people of the Aryan migration from Asia speak their own language. They taught their speech to their conquered subjects, but it is not unlikely that only the latter speak Brythonic, though, as stated formerly, maybe the Bretons escaped the merging which befell their congeners.

Indeed, it seems possible also that the Gaelic had a similar history. It is so like Brythonic (the two are allied something like Latin and Greek) that the original speakers may not have been very unlike. If we postulate moderately broad-headed

Brythons (like the Breton) as the first Welsh speakers to enter Britain, then it seems hardly likely that the dark narrow-headed Scotch Highlanders were the *original* Aryan Goidels or Gaels. Rather would the first speakers of Gaelic be like the ancient Gaulic broad-heads of France. However, sufficient has been written to show the complexity of the problem, and the danger of trusting language as a key to race. We return to this question on p. 162.

In summary we may picture the Cro-magnon and later Paleolithic folk as giving rise to the Silurian (Mediterranean) substratum. This was invaded in Neolithic times by Goidelic folk who impressed their language on the Silurian clans. Much later, and in Fleure's opinion not many centuries before Caesar's visit, entered the Brythons, whose arrival repeated the history of the Gaelic changes. Then the Romans made a brief conquest which was of little ethnological consequence. For several centuries the Romano-British governed the country; but they were in turn overcome by the Anglo-Saxons (in the fifth century) and slowly driven into the borders or into France.

Britain of to-day really seems to be chiefly occupied by the original Silurian stock and the later Saxon immigrants, and these have mingled with each other and with the various strains of broad-heads mentioned above.

XIII

A. THE CLASSIFICATION OF THE RACES OF EUROPE

IN the foregoing chapter dealing with the races in and near Britain we have met with types belonging to the three major ethnical divisions. Thus the folk of the Dordogne and of Western Britain belong to the lower Mediterranean race, the Franks and Saxons belong to the so-called Nordic race, and the Cevenoles are members of the Central Alpine race.

The following table (see Fig. 42) shows that there are some forty distinct ethnic 'tribes' in Europe. It has seemed logical to divide them up into five major classes: primitive Iberian (akin to Mediterranean); Nordic; and then to make three groups of the Alpine peoples. Of the latter the speakers of non-Aryan languages may first be separated off, remembering that they are mostly just as true 'Alpine' tribes in an ethnical sense as the others. Secondly, we may divide the Aryan Alpines into broader- and narrower-headed Alpines.

If we plot these races as shown in the map (Fig. 42), there is seen to be a regular arrangement in these zones of peoples. All round the western margin are the very narrow-headed Iberian (Mediterranean) folk. These form the lowest stratum and it still persists in Scandinavia, Western Britain, South-west France, Portugal, and Upland Spain, and in parts of Italy and Greece, and forms an element in the coastal population of all the Mediterranean.

Next comes the Nordic zone, most prominent around the Baltic and North Sea. But allied folk have wandered into Spain and are found scattered in groups in the Mediterranean region.

The great central wedge of Alpine peoples is connected with the central peoples of Asia, though the common practice of separating Europe from Asia has hidden the close continuity. The main body of Alpine peoples are of moderate stature, rather dark with brown or black hair, and with a cephalic index

CORRELATION OF THE COMPONENTS OF THE CHIEF NATIONS
OF EUROPE (GENERALIZED).

<i>Country.</i>	<i>Primitive Iberian (Cephalic index 75-7).</i>	<i>Nordic and Teuton (Cephalic index 77-80).</i>	<i>Brachycephalic Alpine (Cephalic index 81-4).</i>	<i>Hyper-brachycephalic Alpine (Cephalic index 85-8).</i>	<i>Asiatic—non-Aryan (Cephalic index 81-7).</i>
Ireland	Pict ?	Goidel ?			
Scotland	Goidel ?	Some Saxons	Shetlands		
Wales	Many in south	Brython ?			
England	Many in west	Saxon	Kent		
France	Basque Dordogne	Norman Gascon, &c.	Cevenole	Savoyard	
Germany		Prussians Saxons, &c.	Bavarian (Austrian)	Swabian	
Spain	Basque	Andalusian, &c.	Few Galician		
Portugal	Central Spanish Portuguese				
Norway	Few in mountains	Bulk of people	Few in S.W. (Finn)		Lapp (87) Finn (81)
Sweden					
Switzerland				Swabian Ladin, &c.	
Italy	Coraic Etruscan	Sardinian Sicilian	Lombard Umbrian	Savoyard Ladin, &c.	
Greece	Pelagian	Type Greek	Many Slavs	Albanian	Turk (85)
Bohemia			Czech and Pole		
Poland			Many Croats	Croat and Serb	Turk (85)
Serbo-Croatia					
Hungary		Some Teutons	Magyar of Plains	Magyar of Carpathians	Magyar (largely Alpine now)
Rumania			West Rumanian and Wallachian		
Bulgaria			Bulgar		Turk
Russia		Some Teutons	Lithuanian Slav Pole		Finn (81-2) Cossack (84)

about 84. They constitute the South Germans, Austrians, Eastern French, Lombards of Italy, Swiss, Czechs, Rumanians, Serbs, &c. ; and also such non-Aryan folk as the Magyars and possibly the Finns.

In the same general category also come the main body of the Slav races of Russia and Bulgaria and Greece. The remaining ethnic stocks are not yet fully correlated. They are the Lapps who are early comers, allied to the Samoyede tundra-dwellers of Asia. The Lapps are thus remote from any European stocks. Their language is somewhat akin to Finnish, but this does not indicate a common ethnical origin, for the Lapps have a remarkably high head index (87), while the Finn, in addition to many other physical differences, has a relatively narrow head (81).

The Turk is linguistically and culturally remote from the European races ; but, in part owing to the habit of the Turkish warriors of marrying European women, the resulting Turkish race (in and near Europe) is ethnically very close to the neighbouring Alpine folk of Europe. Moreover, probably the original Turkish invaders were largely made up of tribes akin to the earlier European settlers.

There remain only a few very interesting peoples in the mountain regions around the Adriatic. They are characterized by extremely broad heads (88). In the west is the (Savoyard-Ladin) Trieste group. In the east are the Albanians. These are certainly very early migrants into Europe.

Having now briefly discussed the racial affinities of the European peoples we may compare the previous classification, which is not unlike that advocated by Ripley, with the schemes of Deniker and others.

It will be seen that Deniker places more reliance on hair-colour than on skull index. The latter character surely withstands a variable environment better than does the colour of the hair. Moreover, his four sub-races (sub-Northern, Vistulan, North-west and sub-Adriatic) differ only to a small extent from four of his major races (Nos. 1, 2, 5, and 6). Of the six major races the Iberian (No. 3) and Nordic (No. 1) are much the same as those given in the two first columns of my long table of the ' Components of the Nations of Europe ' (p. 155). The

DENIKER'S TEN ETHNIC STOCKS IN EUROPE

	<i>No.</i>	<i>Name.</i>	<i>Locality.</i>	<i>Cephalic index.</i>	<i>Stature.</i>	<i>Eyes.</i>	<i>Skin.</i>	<i>Other names.</i>
A. Fair Haired.	Ia	Northern	North of Europe	76-9	Very tall	Blue	Ruddy	Nordic, Cymric, Germanic
	Ib	Sub-Northern	North Germany	80	Tall	"	"	"
	IIa	Eastern	Russia	82	Short	"	White	Slav
	IIb	Vistulan	Poles	82	Very short	"	"	"
B. Dark Haired.	III	Iberian	Spain, Perigord, Corsica, W. Italy	75	Very short	Very dark	Tawny	Iberian Mediterranean
	IV	Cevenole	Central France, Alps, Hungary	85	Short	Brown	Darker	Alpine Rhaetian Celtic
	Va	Littoral	Tiber to Biscay	79	Tall	Dark	"	Cro-magnon ?
	Vb	(N.W. Race)	Ireland and Wales	76 ?	"	"	"	"
	VIa	Adriatic	East Adriatic, Ladin, Albania, Ardennes	86	Very tall	"	Tawny	Alpine
	VIb	Sub-Adriatic	N.E. France, Bohemia, Lombardy	84	Tall			Lorraine

other three main groups (Nos. 2, 4, and 6) are Alpine stocks of which the Eastern and Cevenole are merged by the writer into the narrower-headed Alpines, and the Adriatic agrees fairly with the broader-headed Alpines. Deniker's 'Littoral Race' (No. 5) is one of small numbers and importance which may well represent a fairly direct survival of the Paleolithic peoples, as he suggests.

A more recent book by Roland Dixon¹ has raised novel issues. I have here epitomized his conclusions as regards classification in general and as to the racial stocks in Britain.

In 1923 he published a study of racial distribution which agrees in many fundamental principles with my own views, published in 1919; he also groups the races of men according to head index, but uses nasal index in addition. Thus he obtains four main types, each of which is subdivided according to whether the skull is low (primitive) or high. In his maps, however, he ignores this subdivision.

The relation with more familiar classes and with those in this book is indicated in the table on p. 159.

We note that there is no place in Dixon's major groups for the zone of peoples with a head index between 73 and 82, which is the place usually filled by the Nordics. The oft-quoted racial purity of the Nordic races (78) is replaced by a mixture of Asiatic, negro, and 'Dago' types.² The writer hastens to add that he believes a virile, intelligent race might result from such mixture, and it is probable that the Nordic type developed in this way.

Dixon's views as regards Britain may be summed up somewhat as follows: the Piltown skull is a blend of 'Mongoloid' and 'Proto-Australoid' types. The Paleolithic relics seem to belong chiefly to the 'Proto-Australoid' type. The dawn of Neolithic times was marked by many 'Long Barrow' people of 'Mediterranean' type; while the 'Caspian' type is less frequent. 'Palae-Alpine' folk are well represented, however. During the Bronze Age, with its Round Barrows, the skulls were largely of Dixon's 'Alpine' type, but some of the 'Ural' type appear also.

¹ *The Racial History of Man*, New York, 1923.

² Dixon thinks that the Nordic race is primarily a mixture of Group 2 and Group 3 in his table.

RACES OF THE WORLD ; ACCORDING TO ROLAND DIXON.

<i>Dixon-class.</i>	<i>Usual name.</i>	<i>Locality.</i>	<i>Skull.</i>	<i>C. I.</i>	<i>Nasal index.</i>
1a Palae-Alpine	Negrito, broad-head	Philippines Burmese Valais	High	83	54
1b Mongoloid	Primitive Alpine (?)	Lapps Bushmen Switzerland	Low	"	"
2a Proto-Negroid	Negro	Gaboon Iroquois Papua Brazil	High	72	55
2b Proto-Australoid	Australian	Australia California Sicily Ostiak	Low	"	"
3a Caspian	Iberian	Russia Eskimo Sardinia Japan	High	72	44
3b Mediterranean	"	Egypt California England India	Low	"	"
4a Alpine	Alpine	Swiss Hawaii Araucans Czech Armenians	High	84	44
4b Ural	"	Swiss Kalmuk Basque Venezuela	Low	"	"

The Saxon invasions brought in large numbers of 'Mediterranean' type with a considerable 'Caspian' element, but the 'Angles' have an unexpectedly large 'Proto-Australoid' element, while the West Saxons have a strong 'Alpine' strain. The old crypts of the Middle Ages in Kent show a similar marked 'Alpine' constituent in their skulls. From London, however, the crypts show a majority of 'Mediterranean' and some 'Proto-Australoid' and 'Mongoloid' forms. These are probably a survival of pre-Neolithic British people.

Thus the Teutonic or 'Nordic' type of other ethnologists is stated by Dixon to be 'an ancient blend of Mediterranean,

Caspian, and Proto-Negroid types,¹ . . . England has escaped the general brachycephalization to which the large part of the mainland has been subjected '.

It is not so much the classification suggested by Dixon which is of interest as the way in which he demonstrates that the types ramify all over the world. This is a thesis which the writer had already promulgated four years before in the *American Geographical Review*, 1919. In a later chapter the bearing of this evidence on race migrations will be discussed more fully.

B. RACE AND LANGUAGE IN EUROPE

Since nationality is almost entirely a question of common environment we shall do well to consider some aspects of this factor at the present stage of our discussion. We may profitably contrast France with the Austrian empire of yesterday. In France we see at least four different races living harmoniously together, united primarily by a common language. These are the primitive Iberian of the Dordogne, the 'Nordic' Frank of the north-east, the dark Breton of the north and of the Cevennes, and, finally, the extremely broad-headed Savoyard in the east. Although now dwelling in harmony their cultures and languages must have been extremely diverse in the past.

Before 1914 the Austrian Empire consisted of five distinct nations, unhappily linked together and controlled by an alliance between the Western German-speakers and Central Magyars. Thus on the north were the Western 'Slav' races of Bohemia, Moravia, and Silesia. On the south were the Southern Slav races of Bosnia and Serbia, speaking different languages and of different religions from their cousins in the north. On the east were the Rumanians, who speak a mixed Romance-Slav language. The Magyars (pronounced Moj-yar) speak an Asiatic tongue allied to Kirghiz and Manchu. The dominant Austrian race (in Vienna and Tyrol) speaks German and is almost identical with the South German (see Fig. 42).

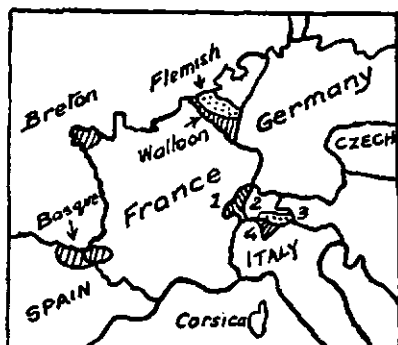
Yet if we examine these peoples by anthropometric criteria, as given on Biasutti's charts, we find that they all have the same

¹ The origin of the Nordics is discussed in Fig. 40A. It seems clear to the writer that much mixture with Alpine blood changed the Caspian (72) into the Nordic (78).

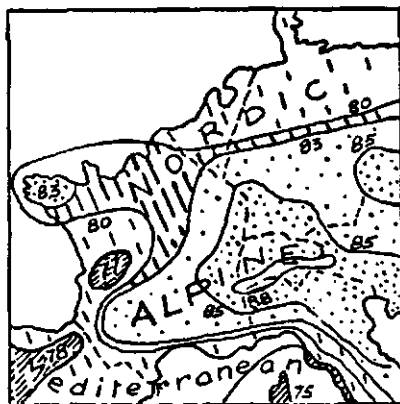
cephalic index (about 84). They all have a similar colour of the skin and hair. The hair is wavy throughout. The stature is uniform except that the South Slavs are a little taller than the rest. The limb proportions are the same throughout. The facial index shows that all have broad faces, while the nasal index is uniform.

We must come to the conclusion that ethnically all these varying nations are really brothers in one family, however much they have varied in their widely separated journeys from the same Asiatic cradleland. Differing religions, cultures, trade rivalry, methods of printing (i. e. Roman or Russian type), and above all language differences have kept them apart and intensified national jealousies. It is not any specific race-difference which has done this, for it is non-existent. If these peoples could forget their past animosities they could amalgamate in one or two generations into a strong common nationality founded on practically identical racial origin.

It therefore will be well to examine the question of the European languages to see something of how some of these artificial barriers have arisen. We may consider the Aryan ¹



1. French Swiss. 2. German Swiss.
3. Romansh Swiss. 4. Italian Swiss.



Isopleths = Head Index.

FIG. 44. Language and Nationality (upper map) versus Race (lower) in Western Europe.

¹ 'Aryan' is used in the broad sense to include all the allied languages from Gaelic to certain Indian languages.

languages first. They are usually subdivided into two main groups, conveniently known (by the words for 'hundred') as the 'kentum' and 'satem' groups.

The main groups and sub-groups are illustrated in the following table in a somewhat generalized fashion.

THE ARYAN LANGUAGES

	<i>Group.</i>	<i>Language.</i>	<i>Word for 5.</i>	<i>Word for 100.</i>	<i>Distribu- tion.</i>
Primitive Kentum languages	K languages	(Tocharese)	?	?	Outer Western Zone
		Gaelic	Kuig	Keud	
		Latin	Quinq	Kentum	
Later ? Kentum languages	P languages	(Oscan)	?	?	Inner Western Zone
		Welsh	Pump	Kant	
		Teuton	(Pimp)- Finf	Hund	
		Greek	Pente	(He)-Katon	
Latest ? Satem languages	Alpine ¹	Persian	Panch	?	Central Zones
		Lithuanian	Penke	Szimta	
		Sanskrit	Panch	Satem	
		Galcha	"	"	
		Slavonic	Pietz	Sito	
		Armenian	Pese	"	

We can see in this table and in the adjoining figure a general resemblance between the zones of language and the zones of ethnological allies. When we consider how a language spreads through a conquered people, we can hardly expect to find that race and language are bounded by the same limits. But it is logical to find a similar *order* of development and order of zoning in the languages as in the races.

Thus the Slav languages and Slav peoples are found in Russia, and it seems certain that the typical Russians were the original users of this language. As we have noted, it is not unlikely that the present speakers of Welsh (Brythonic) were not the original introducers of the language into Britain. (Possibly the Bretons of Brittany were.) Some French philologists believe that the typical Nordic folk also learnt their Aryan speech from the Alpine round-heads, and there is much to be said for this view.

¹ The 'satem' languages are spoken entirely by Alpine races. The 'kentum' languages are now spoken largely by Mediterranean or Nordic races.

We can illustrate this difficult problem of race and language by a reference to the island of Hayti. Some two centuries or more ago French planters introduced African negro slaves into the island. They learnt French and forgot their own language. About 1800 the negroes murdered or drove out almost all the French and ruled (or misruled) the island for many years, using French speech. In the near future we may expect American enterprise to control the island and settle the coastal plains, while the negroes may move inland into the higher land. One may imagine an American (ignorant alike of ethnology and French) learning with surprise that the true language of the negroes was quite forgotten; that it was a very primitive non-Aryan language, and that they learnt their

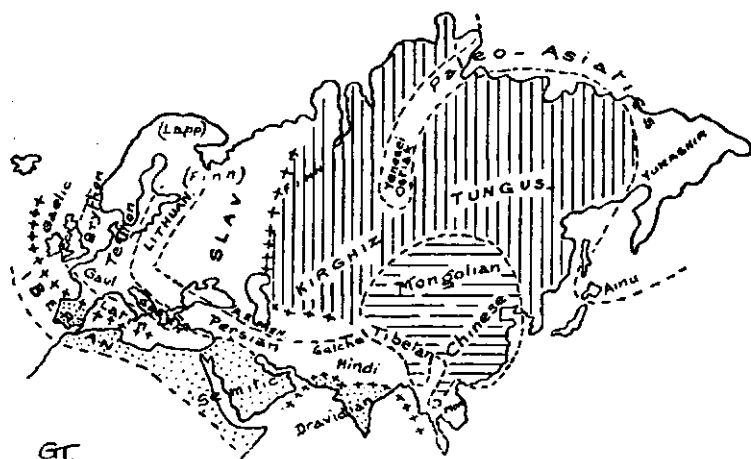


FIG. 45. Generalized diagram showing 'zones of language' which agree generally, though not in detail, with racial zones.

present tongue during the relatively brief sojourn of a conquering race which has since vanished. No doubt this kind of thing happened in Britain when the Silures learnt Welsh.

Whatever be the relation between race and language the general order of the zones of language may be reconstructed, and is indicated in Fig. 45. We see that Gaelic is in many ways nearer to Latin than to Welsh.¹ Similarly, we find it probable that the Gaulic people of France spoke a tongue not very different from Brythonic (or Welsh), and resembling in its essence the classical Greek. The rather later Teutonic languages are also more akin to Greek than to Latin.

¹ From the table on p. 162 we see that Latin and Gaelic are K languages, while Welsh and Greek are P languages.

One may see one way in which a language changes by comparing Dutch and German. Thus the older word is the Dutch *vrogher* (sooner), while the softer, later form is *fruher* in German. So also the older form is the Latin *septem* (seven) while the later is the Greek *hepta*. We shall see very clear illustrations of this principle in discussing the original forms of Chinese words.

There would seem to be little doubt that those philologists who consider Gaelic as practically the most primitive Aryan speech are correct. We should remember that these border languages often agree with 'buried' or forgotten speeches in regions nearer Asia. Thus the ancient Tocharese inscriptions of Bactria (Turkestan) are stated to belong to the K group of Aryan speeches. So also Lithuanian is fairly closely akin to the 'buried' Sanskrit of India. In effect we can study the development of languages by beginning at the outer margin of such a series as the Aryan zones (see Fig. 45) and carrying the study to the languages nearer and nearer to the centre of evolution (in Asia).

Another illustration may make this clearer. Shakespearian dialect is said to be well preserved in the eastern mountains of U.S.A. Why is this so? Not because Shakespeare came from U.S.A., but because migrants from England in the sixteenth century went to U.S.A. and stagnated in certain rugged regions there for three centuries. Meanwhile English in Central England had advanced very materially under the stimuli of contact with new peoples and ideas. We may note that it has been seriously stated that Sanskrit originated in Lithuania! This is against all the evidence of racial and linguistic distribution, and we may be sure that Lithuanian is a 'migrant Sanskrit' preserved for centuries by isolation. So also Icelandic preserves the original Norwegian. In fine, we may see here another example of the great *Law of Zonal Evolution*—that the primitive forms are found precisely where they did *not* evolve; and that the *centre of evolution* is where the stimuli were strongest and where the latest form now occupies the summit of a series of buried 'layers of evidence' arranged in the same order as the zones.

In an earlier chapter I have shown the value of using the

geological terms, 'outlier', 'inlier', &c., in connexion with these ethnic problems. Much confusion has resulted because many languages have been preserved by three major methods, which result in what may be termed fossil, highland, and migrant varieties. The last is the most important and the other two are often wanting. For instance, Sanskrit is a *fossil* language buried under later strata of Prakrit, Pali, Pushtu, &c. Probably its *migrant* form, as stated above, is best represented in Lithuanian, but it is most important to realize that the Galcha mountaineers on the Hindu Kush (Siah Posh dialect) have preserved a very close approximation to the ancient Sanskrit (see Fig. 9). Thus Galcha is the *highland* form.

In the map of Europe the Basque region is an inlier of Iberian speech, which projects through the surrounding waves of Romance languages. The Pelasgian relics in Greece are inliers amid the much later languages which constitute Greek. In China the Lolo peoples occupy an inlier amid the encircling Mongolians. The Galcha are probably inliers among Mongolian peoples (see Fig. 9).

Outliers are more numerous in Europe, and the three Asiatic languages are Lapp, Finn, and Magyar. Their congeners are to be found far away in Siberia, but we know that for a time these tribes extended right across Russia. They all belong to the great rival group of Ural-Altai languages which flank the Aryan tongues on the north-east. Present-day Asiatic members are the Kirghiz and Tungus (see Fig. 45). The Lapps entered Europe in days long preceding history. The Finns were in Russia and Finland when we first know anything of the history of North Europe. The Magyars were a later horde akin in race and language who entered Europe in the ninth century. They were a later swarm than the Finns, who probably came from the same cradleland near the Altai Mountains (see Fig. 9).

We may conclude this brief discussion of the racial aspects of the languages of Europe by referring to the concept discussed in an earlier chapter (p. 32). We may postulate two races, say the Primitive Aryan and Primitive Altai tribes living not far apart in Central Asia. In the course of evolution and migration these primitive tribes widely separate, and their components evolve and differentiate very greatly. The interesting deduction is that the linguistic analogies between the two great groups

may be found to be closest in the case of the very distant races preserving the most primitive characters of each. Thus Gaelic (Primitive Aryan) may more closely resemble some primitive Altaic tongue on the periphery of North-east Asia than do any intervening Aryan and Altaic languages.

So also the allies of Aryan and Semitic tongues are not to be found in Mesopotamia where the two touch, but very probably in Scotland and in Abyssinia, for there should be found the primitive speeches of tribes who may have lived near each other in earlier days.

This may be illustrated by a hypothetical table.

A. Primitive Asiatic speech before separation of Altaic from Aryan.

B. Primitive Aryan, akin to Gaelic
most spoken in Scotland.

C. Moderately evolved Aryan,
e. g. Teutonic.

D. Advanced Aryan, e. g. Slav.

B. Primitive Altaic (akin to Finn
or Yakut), spoken probably
in North-east Asia.

C. Moderately advanced Altaic,
e. g. Magyar.

D. Advanced Altaic of Central
Asia, e. g. Tungus ?

On the theory of zoning the primitive common Aryan-Altaic speech might be best preserved and studied in the Gaelic on the one hand, and, say (for the sake of argument), Yakut in far Northern Siberia. So far as I know, no one has used this principle for investigating the common ancestry of languages widely separated to-day.

A somewhat similar line of argument should be useful in discovering the relations between the Aryan and Semitic tongues. Here again there is little affinity between, say, Syrian and Greek, but I can imagine that *Gheez* (an ancient Semitic tongue in Abyssinia, on the outer boundaries of the Semitic zone) might show certain distant similarities to *Gaelic*, the most primitive Aryan language.

XIV

THE CHANGING ASIATIC ENVIRONMENT

(a) *The Build of Asia.* Our study of Europe (the north-western 'peninsula' of Asia) will prepare us for the chief topographic features in the latter continent, while the southern portion of Asia in some respects recalls African topography. The huge continent consists of four broad belts running approximately east and west. In the north centre is the Angara 'shield' mentioned in an earlier section. On the west this is buried under the silts of the Siberian plain carried down largely by the rivers Irtysh, Obi, and Yenesei. On the east the 'shield' is somewhat more elevated and is naturally considerably dissected in consequence.

All round the southern margin of the great 'shield' is a broad zone of elevated land, which in far-past geological times was crumpled against the shield. But it has long been more or less levelled by erosion, and the last phase of earth movement was to break it up into a series of fault-blocks, especially in Mongolia, Manchuria, and China. Indeed, as we saw in Europe, the region between the latest axis of folding and the resistant shield in the north has been the scene of gigantic foldings in the earlier geological epochs.

The next belt consists of the weaker, more mobile portion of the Asiatic land mass. The great sea of 'Tethys' extended across Asia in Mesozoic times,¹ and this yielded to the folding forces, which reshaped the world in late Tertiary times. No story in the geological record is more interesting than that which recounts the birth and uplift of the giant Himalayas. Moreover, this region is precisely that in which, according to many ethnologists, man's cradleland was situated. We may well, therefore, consider in some detail the changes which have taken place in Turkestan, Tibet, and India since Eocene times.

During the Eocene there seem to have been deep seas through North-western India and through Southern Turkestan. In these were deposited

¹ See foot-note, p. 122. Mesozoic includes Triassic, &c.

vast beds of the giant foram *Nummulites*. These are now found 18,500 ft. above sea-level, near Ladak on the Upper Indus. According to Pascoe, whom I quote largely in the next few paragraphs,¹ considerable movement has taken place since the Pleistocene, and it is more than probable that such movements are still progressing (see Fig. 47).

The great Ganges earth-trough subsided since Eocene times, and is now 20,000 ft. deep, though filled with river deposits to a height above sea-level. At this time, perhaps, there were two seas, one north of the Himalayan region through Ladak, and separated by a long land-belt from the 'Indo-Gangetic Sea' to the south (see Fig. 47). In the Miocene this southern sea became a brackish gulf, and later perhaps a series of lakes. In the Pliocene there was probably a great river, the 'Indo-Brahm', flowing from Assam to the Arabian Gulf. There seems to have been fairly high land connecting the Deccan (or Gondwana) Plateau with the Garo Plateau of Assam. The Ganges outlet did not develop till very late in Tertiary history.

Meanwhile in Tibet a parallel river seems to have developed which led the drainage down into the Oxus (or Aral) Sea. 'An interrupted hydrographic line (extends) from Pemakoi to Gilgit, represented to-day by the Tsangpo river, the Manasarowar lakes, the uppermost reaches of the Sutlej, the Indus, and the Shyok, and perhaps the Gilgit river beyond. It seems more than likely that this was once a continuous drainage-line sloping westward. At the present time the Indus at Bunji, where it abandons its north-west course and turns southward, is 3,400 ft. lower than the Brahmaputra, where it leaves the same geotectonic line. In spite of its immense elevation the Tsangpo is a sluggish, navigable river south of Lhasa, and has cut no deep basin for itself in Tibet. The Indus, on the other hand, has cut its bed to a low level on the Tibetan Plateau. That portion of the modern Indus which runs just below Bunji is of no very recent construction, as shown by the colossal depth of its gorge, which is nearly 17,000 ft. The steepness and narrowness of the gorge are witnesses to its immaturity, but its immense depth and the hardness of its rocks place a limit to our conception of its youth.' (The present writer would point out that the depth of the gorge depends primarily on the amount of uplift, and he is prepared to believe that most of this enormous cutting may have occurred in the Pleistocene.)

Very interesting changes have occurred in the Indo-Gangetic plain in Pleistocene and later times. Probably the Tsangpo first emptied into the Irawadi, then into the Megna, and then still farther west into the present Brahmaputra. Possibly folding near Calcutta led to the upper 'Indo-Brahm' river

¹ 'Early History of the Indus and Ganges', *Quarterly Journal of the Geological Soc.*, 1920.

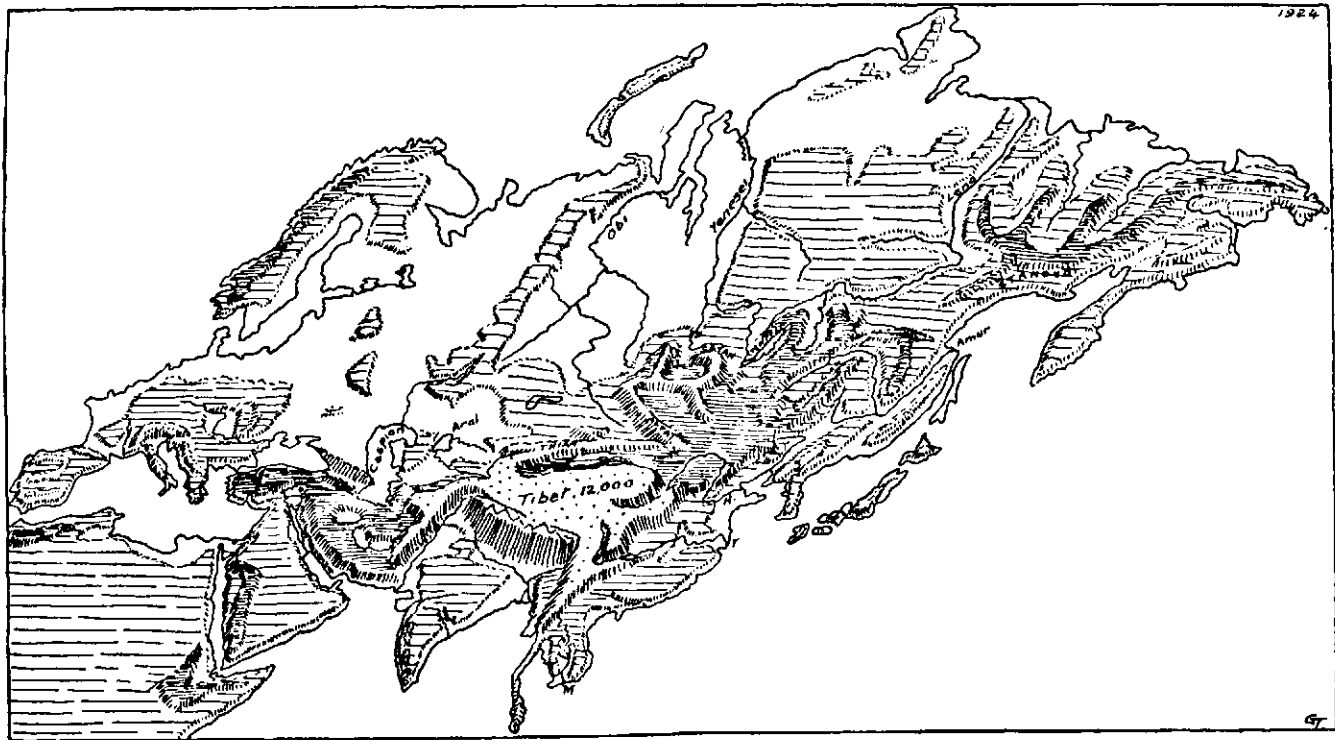


FIG. 46. Block diagram of Eur-Asia.

being captured and joining the Tsangpo. The Ganges is now capturing the (present) upper Indus tributaries. Old Hindu legends indicate the capture of the Saraswati by the Ganges, while much more convincing is the fact that the common dolphin of the Indus (which never enters the sea) is found in the upper Ganges also. So also some of the *Chelonia* in the two basins are identical.

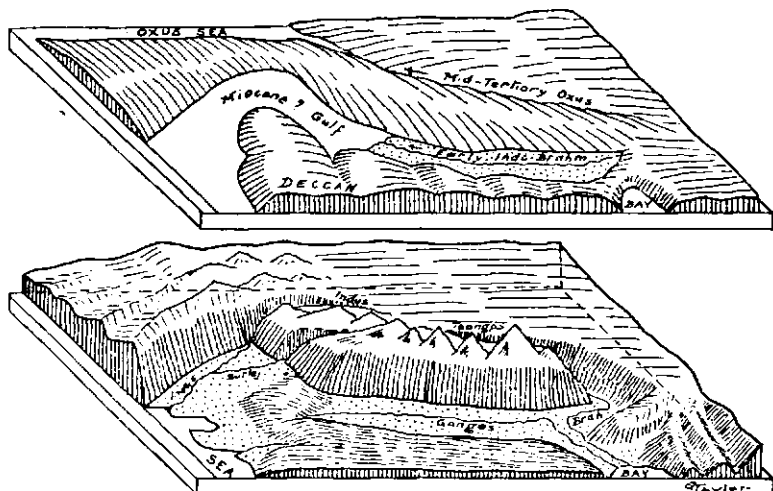


FIG. 47. Evolution of the Himalayas. Mid-tertiary topography above, present topography below. Data partly from Pascoe

This lately crumpled portion of the Asiatic continent is of course an extension of the 'Alpine' chains of Europe. The latter seem to have developed chiefly in the Miocene period, while the Himalayas are usually referred to the Pliocene. The juvenile drainage scheme,¹ and the volcanic action at the Burmese end of the chain, seem to indicate that the eastern end is still the most active portion of the whole system. The almost constant earthquakes and the immense series of volcanoes (over one hundred in number) somewhat to the east in Java point to the same conclusion.

The plan of the Tertiary fold-ranges is that of two more or less parallel chains 'knotted' at the Pamirs and spreading widely apart at the east end. This conformation has separated

¹ For instance the six crowded rivers shown in Fig. 23.

the north from the south of the continent to a much greater degree than obtains in any of the other great land masses. Only at one place (south of Merv) is there a low pass of 4,000 ft. from the Siberian lowlands to the Indian Ocean. Through here, as we shall see, the Alpine races poured into India.

Between the two chains extends a long series of elevated basins and plateaux. This sequence may be conveniently indicated in a table (partly based on J. W. Gregory) as follows :

THE BUILD OF THE ASIATIC FOLD-MOUNTAINS

Structure.	West.			Central knot.	East.	
Northern Chain	Caucasus	Elburz	Hindu Kush	Pamirs	Thian Shan	—
Central Basin	Black Sea Kur Valley	Iran	Seistan	—	Tarim	—
Southern Chain	Taurus	Zagros	Suliman	Pamirs	Himalaya	Burmese Alps

To the south of this somewhat complex series of late Tertiary folds lies a number of huge crustal hollows of which the chief are the valleys of Mesopotamia, of the Indus, and of the Ganges. The Persian Gulf links the valleys together. These basins were formed when the mountains arose, and in some respects resemble the 'deeps' of the ocean, where the mighty tectonic (folding) mechanism is in operation. These hollows have in three cases become filled with thousands of feet of river silt, and so support immense populations, especially as the rivers, which naturally occupy the central portion, are suited for irrigation.

Finally, the peninsulas of Southern India and Arabia are relics of ancient crustal blocks which have been land surfaces since Paleozoic times. It is probable that they were much larger not far back geologically speaking, as witness the anomalous drainage of the Deccan. All the rivers rise high on the west coast and flow to the east. In a short time this state of things must change, owing to capture by the steep western streams. Hence we may deduce the *very recent origin* of this very 'insecure' type of topography.

It is customary to invoke an ancient continent or 'Gondwanaland' in the Western Indian Ocean to account for similarities in the flora and fauna of India and Southern Africa. But to the writer the sequence of events which leads to the somewhat similar types of primitive *man* occupying Cape Colony and Ceylon (without any *direct* land-bridge between) is also likely to explain the similarity in the plant and animal life of older date. In other words, perhaps all were pushed south from Central Asia, but, given time enough, one reached South Africa and the other Ceylon.

(b) *Climatic Control.* The salient feature in the climate of Asia is the large area of the land mass. If we realize that Africa (from a climatic point of view) is hardly separated by the Red Sea, then the centre of the Afro-Asiatic continent lies in the south-west of Asia, not far from the Sea of Aral and Turkestan. This determines two important climatic factors. The first is the locality of the great desert belt, and the second is the position of the low-pressure centre in summer (Fig. 37).

Any country which owes its rainfall largely to winds carrying moisture from the sea exhibits the following characteristics. The rainfall depends on distance from the sea coupled with the elevation of the land. The winds supplying Southern and South-west Asia are chiefly the southern monsoon winds which blow in the warmer months of the year. They are in effect the surface currents of air which supply the place of the air rising at the North Indian low-pressure area. As the air strikes against the great mountain barriers described above they deflect it up rapidly into cooler layers, and so it is chilled and cannot hold its moisture content. On crossing the ranges (from the south) the air tends to sink on the northern side. Probably something of a Föhn effect arises, causing a drying wind which parches the plains of Turkestan and Tibet.

The aridity of East Persia and Scinde is not easy to understand at first glance. As Kendrew¹ states: 'It is a striking fact that the Thar Desert (Scinde) lies almost exactly in the centre of lowest pressures (during the monsoons) and the scantiness of its rainfall is a cause for surprise. It is the result of the previous history of the winds that enter it.' These are

¹ *Climates of the Continents*, Oxford, 1923.

shown in the accompanying figure, where all the winds are seen to be dry, for the south-west winds hardly cross enough sea to gather the necessary moisture. The Gulf of Cambay is practically the northern boundary of the south-west monsoon winds of summer.

This zone of arid and desert lands extends across Asia from the Sahara to Manchuria. It is not due to the trade winds, for they never reach inland Asia, but to the peculiar topography of Asia. The deserts are in fact 'Rain-Shadow' deserts, due to the belt of gigantic mountains which cause the inland

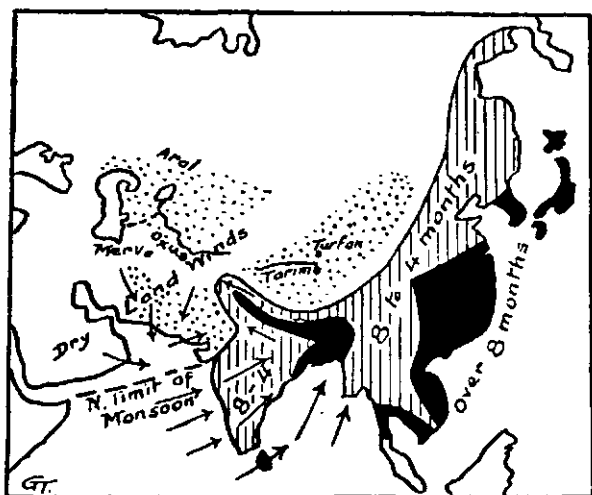


FIG. 48. Winds (in summer) and Rain in Asia. Long monsoon season black; shorter monsoon ruled. Deserts dotted. (After Kendrew.)

plateaux and basins to lie in the shadow as far as the rain-winds are concerned.

We may turn to Ellsworth Huntington's research¹ for a graphic account of the climatic changes in the huge arid region, 3,000 miles wide, between the Caucasus and Mongolia. He states that the most widespread proof that there have been climatic changes in Tibet during the last two or three thousand years is found in the death of vegetation over large areas. Ancient routes have been abandoned and no pastoral occupation exists where old records tell us it was once very important.

¹ *The Pulse of Asia*, 1907, and later publications.

Thirteen rivers running into the Tarim Desert have now ceased to flow long before their valleys reach the ruined Buddhist towns of a thousand years ago. The modern towns are all much higher up the rivers, and are much less important than the ancient settlements (see Fig. 48).

The history of Lake Lop Nor (which receives the river Tarim) shows that in the first century A. D. the lake was probably seventy miles across; it is now only five or ten. From the third to the sixth century the region was intensely arid and six towns were abandoned. From the ninth to the sixteenth century conditions were better, and towns have sprung up, but in the last few centuries arid conditions have arisen once more.

Turfan lies 200 miles north near the Eastern Thian Shan Ranges, and possibly below sea-level. It shows the same sequence of events, for in the first century it was densely populated, and again from the ninth to the fifteenth century. In the other periods it was nearly abandoned or settlement greatly decreased.

In the southern deserts Huntington shows that the same changes occurred. In Seistan (South-west Afghanistan) ruins are incredibly numerous, and mighty cities of the dead crowd the desert region. In 325 B. C. Alexander returned from his invasion of India by way of Persia. His general Krateros led one large army with many elephants through Seistan without any special difficulty. To-day a small caravan of twenty or thirty camels can scarcely find water and forage on the same route. Yet the ruins of strong forts show that this long continued an important trade route.

The variations in the Caspian Sea have been studied by many writers. Probably not far back in prehistoric time this sea extended a long way into Russia, and was certainly connected by a gulf to the Aral Sea some 500 miles to the north-east.¹ Old strand lines at Baku, 600 ft. above the present level, have a very recent appearance. On the eastern side at Jebel, Huntington has recorded strands at 230 ft. level and at 150 ft. The town of Merv to the east shows vast ruins for which there is not adequate water to-day.

Before the time of Christ the route from India seems to have led down the Oxus river into the Aral 'Gulf' and so into the Caspian Sea. In A. D. 500 a wall was built to repel the

¹ Compare Fig. 40 A (p. 143).

Huns, but it is now partly under the waters of the Caspian, so that the sea was even lower at that date. In A. D. 900 it was 29 ft. higher than now. In 1221 the Oxus river still reached the Caspian by one arm of a bifurcation near Khiva. The other arm still enters the Aral Sea, but the supply to the Caspian ceased about 1550 (see Fig. 48).

It is of great interest that, when these desert regions were flourishing, Kashmir, to the south, seems to have been so cold and snowy that agriculture was impossible. Its peoples were then nomads who were obliged to drive their flocks southward in winter into the warm plains of India. The general change of wet and dry periods since 300 B. C. is illustrated in the

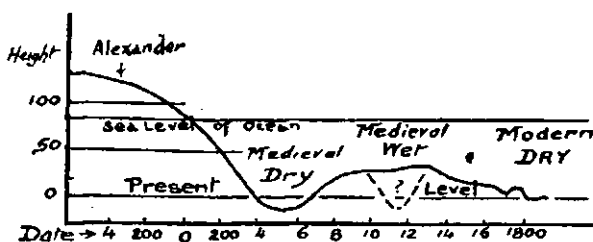


FIG. 49. Approximate changes in level of Caspian Sea (From Huntington.)

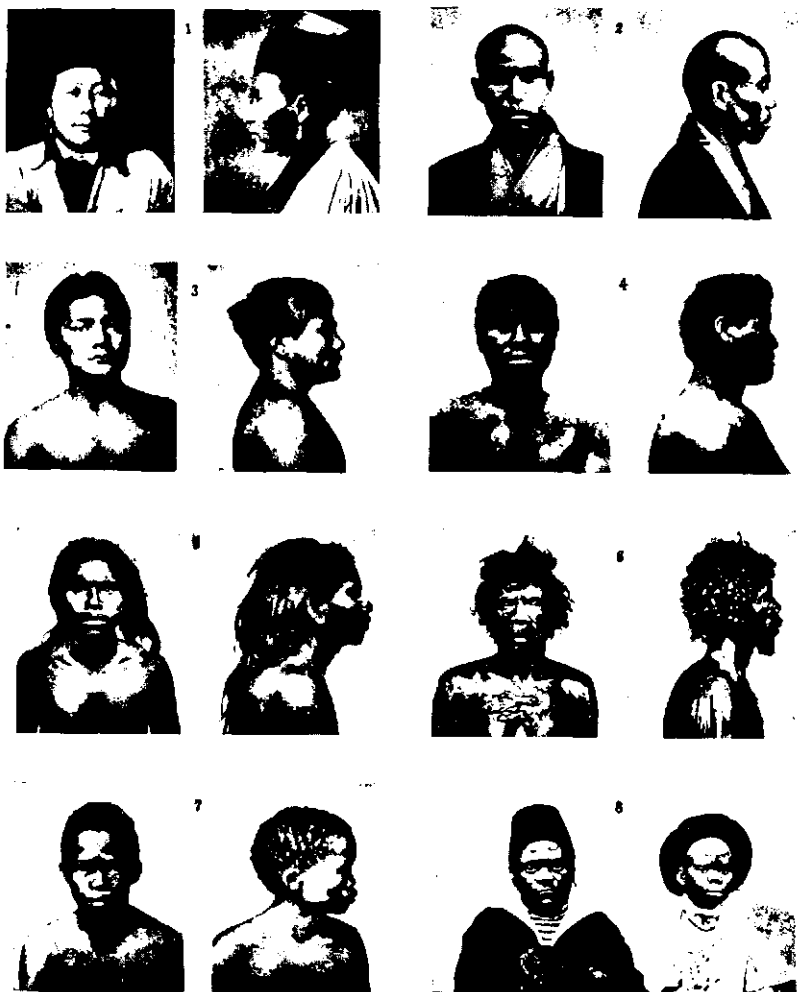
accompanying graph, which shows the fluctuations in the level of the Caspian Sea.

*The Vegetation.*¹ While the vegetation agrees in some respects with that of Europe, the distribution resembles that of North America. The tundra zone occupies the Arctic lowlands and grades into the Taiga, where thin forests of pine border the open tundra and gradually become denser to the south. This pine forest extends to latitude 55°. On the west it gives place to the zones fringing the central deserts. First come the grasslands, along latitude 50°, then the scrub-lands, and in the centre the deserts. The latter extend from Western Manchuria, with intervals, to the Red Sea. The chief deserts are the Gobi in Mongolia, the *Tarim* in Turkestan, *Seistan* in Persia, and the Arabian desert. Due to its great elevation the Tibetan Plateau (12,000 ft.) really rises into 'Arctic' climates, and in

¹ See Fig. 37.

some respects resembles the open tundra. The southern arid margin is another zone of steppes, which merges into forest as the wetter regions of the south and east are approached.

In Manchuria and North China is a cool deciduous forest like that of Europe, with beech, oak, poplar, and willow. Central China had luxuriant forests of bamboo, banyan, camphor tree, &c., which have largely been cleared by man. In the south true tropical trees occur such as mahogany and ebony; and thick jungles alternating with huge swamps are characteristic of the hot, wet south-east portion of the continent. The seasonal rainfall of India leads to fairly open savannah woods, save on the wet south-west coast and along the Himalaya Scarp. A Mediterranean flora, due to the wet winter, grows in Asia Minor and adjacent countries.



VI. RACIAL TYPES

(from the *Guide to the Races of Mankind*, 1921. By kind permission of the Trustees of the British Museum)

The numbers agree approximately with the order of evolution

1. Tatar from Western Asia, 85 (Latest race).
2. Japanese (Altaic type), 79.
3. Gilbert Islander (Micronesia), 82.
4. Fuegian (S. America), 79.
5. Veddah, Pre-Dravidian (Ceylon), 75.
6. Australian, 74.
7. Bushman boy (S. Africa), 73
8. Negrito from Ituri R. (Central Africa) } (Earliest race).

(*Figures are cephalic indices*)

XV

THE RACES OF SOUTHERN ASIA

(a) Introduction.

(c) Peoples of India.

(b) Negritoës.

(d) Races of South-west Asia.

(a) *Introduction.* The central regions of the Old World are found to be typically the home of 'brakeph' (i. e. brachycephalic) peoples. These extend to the northern, eastern, and western margins.¹ There are 'dokeph' peoples in Tibet, sporadically in China, and in the south there is a broken rim of 'dokeph' peoples in Mesopotamia and India; while along the Yenesei in the north, and on the festoon islands and ridges of Japan and Kamchatka, there are also rather mixed 'dokeph' peoples (see Fig. 40).

In this continent, as in most others, language affinities have generally been used as the chief racial criteria. They are as dangerous as skin-colour, but real anthropometric criteria are now replacing colour and language. The work of the Italians Giuffrida-Ruggeri and Biasutti is of special value to Western Europeans, for they have made available many Russian data which are not readily accessible.

To the student who has carefully followed the preceding 'distribution' evidence, the profound significance of the fact that a 'brakeph' skull occurs throughout the area at the 'centre of evolution' will be apparent. It indicates that the broad-head stocks are a later product of evolution than the narrow-heads.² (This thesis was first elaborated, I believe, in my paper on 'Climatic Cycles and Evolution' in 1919.)

Using the usual language-subdivisions, we find that 'brakeph' Eurasia is divided into three almost equal areas (see Fig. 40). In the west is the Alpine 'aggregate', in the north is the Altaic 'aggregate', and in the south-east is the Tibeto-Chinese or Sinitic 'aggregate'. Thus the most primitive Alpine peoples are probably to be found in the West European 'wedge', the

¹ See the Frontispiece for the general distribution of Asiatic Races.

² See the discussion on pp. 27 and 28.

most primitive Altaic tribes probably in the Finn and Yakut wedges, while the most primitive Chino-Tibetan group is likely to be found amid some of the mountain clans in the Shan states or thereabouts.

In this continent, as elsewhere, the languages in the *inner* portion of their respective areas are probably spoken by the races among whom such speeches were evolved. But on the *margins* we may suppose that the later language has generally overlapped the proper ethnical boundaries. This has certainly happened in Europe, India, and China, and presumably on the northern margins also.

One characteristic of two of these great Asiatic 'aggregates' is the *epicanthic fold*. This is a curious doubling of the upper eyelid, whereby a fold of skin is drawn across the inner corner of the eye in a more or less complete manner. The distribution has been plotted by Biasutti, and is given in the adjacent map. It is most pronounced in the Tungus-Manchu region of East Asia, where a very large proportion of the inhabitants exhibit it. In Northern Siberia, China, and Japan about two-thirds of the people show this feature. In Borneo, Burmah, Turkestan, and the coasts of Behring Straits (on both sides) it varies from 60 to 30 per cent. It is found among the Eskimo in the same proportion. It only occurs sporadically in Western Siberia, and in America and Polynesia. It seems to the writer to be one of those readily apparent but insignificant facial differences which have caused ethnologists to segregate the Eastern peoples, and so to lose sight of their biological affinities with the 'Alpines' of Europe and America (see Fig. 50).

A false 'epicanthic fold' is found among the Bushmen and Hottentots of South Africa. In both cases it may be due to the great development of the cheekbones—which perhaps leads to a stretching of the skin of the eyelid—but I have seen no satisfactory explanation of this curious feature.

(b) *The Negritos*. After this introduction dealing with the major racial groups of Asia, we may study in more detail the various peoples, beginning as heretofore on the margins. It is in the tropical jungles and distant islands that we should expect to find the most primitive living races. Not because they originated here, but because they were driven here by past climatic changes and migrations, remained here, and *stagnated here*.

The evolution of man seems to proceed extremely slowly in the easy conditions of the tropics, with its readily collected

fruits and its unfavourable heat, humidity, and tropical diseases. It is often assumed that because *Pithecanthropus* was found in Java, therefore man developed from the ape in this region. But Matthew's study of the higher mammals (which is explained later) is opposed to this theory; as indeed is the whole evidence of Race Evolution and Distribution.



FIG. 50. Distribution of the 'Mongolian Fold' (see a).
Sections of fold and normal eyelid at b and c.
(After Biasutti.)

The most primitive folk in Asia are probably the Semang of Perak, the Mincopies of the Andaman Islands, and the Aeta of Luzon in the Philippines. They are negrito people whose characteristic features have been described earlier (pp. 68-73). This negrito 'stratum' is represented by 'inliers' throughout the south-east littoral of Asia and in the adjacent islands (see Fig. 29). They are 'brakeph' peoples who seem to be in general surrounded by 'dokeph' tribes, and they do not seem to have any obvious relation to the great Alpine-Mongolian aggregates of Asia. Dixon (1928) attempts to unite the 'brakeph' negritos with the early Alpine peoples (whom he

calls Palae-Alpine). They have similar horizontal head indexes, which is a basis for argument, but in almost all other particulars, e. g. hair, skin-colour, stature, nasal index, and zonal and strata distribution, they are far apart. In my opinion the theory of a separate primitive stock seems to explain their origin most simply ; but the problem is very difficult and must be left to the future.

The following table, based on Giuffrida-Ruggeri,¹ gives the anthropometric data of these negritoes and of other primitive Asiatic negroids.

<i>Type.</i>	<i>Race.</i>	<i>Locality.</i>	<i>No.</i>	<i>Head index.</i>	<i>Nasal index.</i>	<i>Stature.</i>
I	Mincopi	Andaman	100	82	90	1,484
	Aeta	Luzon	—	81-5	95-106	1,460-1,500*
	Semang	Perak	20	83.5	101.9	1,461
II	Sakai	Perak	20	77.7	97.1	1,507
		Sumatra	19	76	—	1,562
	Toala	Celebes	28	79	86	1,490
	Veddah	Ceylon	23	82.2	—	1,573
III	Dravidians	S.E. India	6,528	75.2	82.4	1,623
	Munda	S.W. Bengal	100	74.5	89.9	1,589
IV	Ainu	N. Japan	55	—	83.4 (55)	1,579 (213)
			70	76.5	—	1,581
V	Toda	S. India	115	73	76	1,680

* Where two figures are given they represent extreme range of tribal means.

As we shall see, there is a submerged stratum of negrito peoples allied to the above certainly in South-eastern and possibly throughout Southern Asia, e. g. in Persia and Arabia, and possibly in Japan.

(c) *The Peoples of India.* In many ways India is of particular interest to the student of racial distribution. It is close to the probable centre of human evolution ; and yet the whole range of man's development is represented in this southern peninsula, shut off on all sides by the sea or by very high ranges and plateaux. The racial 'isopleths' (contours) are naturally crowded together in India, and racial mixture is probably

¹ *Outlines of the Anthropology of Asia*, 1921, translated by Chakladar.

universal. But by reference to bordering regions where the zones are broader and not so 'ragged' it is possible to trace out the migration-zones in India with some success.

The most primitive peoples are the Mincopies of the Andamans already mentioned. Next come the Veddahs, just where

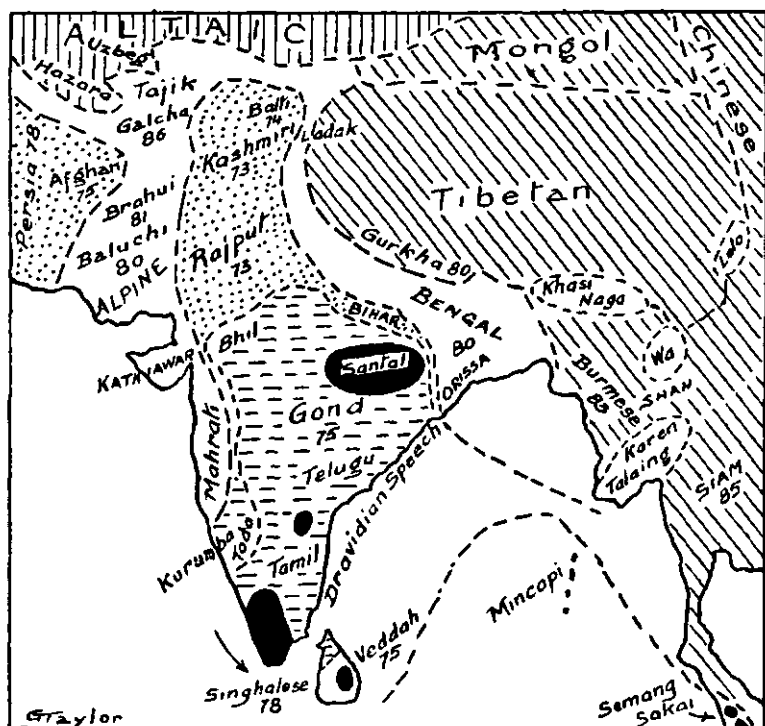


FIG. 51. Races of India, based on Ruggieri.
Figures refer to head index.

one would expect them, in the tropical jungles of the island of Ceylon. Their measurements are given in the preceding table. About 4,000 of them were reported in 1901, who lived mainly in the centre and south-east of the island. As mentioned earlier, they are fairly closely allied to the Australian aborigines.

Ruggieri (op. cit.) mentions four skulls from the vicinity of Madras with a head index below 60! Thurston describes them as prognathous and with the receding forehead of the

negro rather than of the Veddah. These skulls are of considerable interest in connexion with the affinities of the Lower Melanesian negro with the African negro ; for not many links are known in the wide extent separating the two groups.

Many other fragments of tribes in India are allied to the Veddahs, such as the Santals, Mundas, Kols, &c., all of whom have similar characters to those of the Veddah in the table. They have been conveniently named pre-Dravidians.

The Veddah-Australoids were apparently followed into India by the Dravidian peoples who are found in the purest form perhaps in the Southern Indian jungles. Of these are the Kota, Badaga, and Kurumba peoples of the Nilgiri mountains of South India. They have almost leptorhine noses (index 75), and are somewhat taller than most of the so-called Dravidians with a nasal index from 84 to 94.¹

It seems probable, as Ruggeri suggests, that the Dravidian language was imposed on aboriginal Veddah types by relatively few invaders of the Kurumba type. These latter were in many ways akin to the Ethiopians of Eastern Africa.

The Aryans in their invasion were mostly opposed by primitive Veddah-Australoid tribes (or Dasyus) with low stature, dark skin, and broad noses. The Bhils and Gonds, in or near the Vindhya hills, who bore the brunt of the Aryan attacks, have just these features. Some of these tribes in Chota-Nagpur still speak the primitive Munda-Kol languages, though the great bulk of the Lower Indian races speak higher languages like Tamil or Telugu of Dravidian type. On the other hand the Bhils have learnt an Indo-Aryan tongue. A very interesting tribe is the Toda people of the Nilgiri hills. They are characterized by their hairy appearance, thus resembling the Ainu and the Australian. But in other characters these tall 'dokephs' differ from the latter, and they may have closer affinities with certain Mesopotamian peoples.

The north of India has been invaded by light-coloured 'dokeph' peoples fairly closely akin to many in Western Europe.

¹ It is interesting to note that Richards has recently pointed out that the main distinction between the Dravidian and pre-Dravidian peoples is in the nasal index, the former being consistently more leptorhine than the latter.

Many Persians and Kurds have these features also, which may be traced from India to the British Isles. The 'ethnographs' of the Persian and English are almost identical. There is also a group of 'brakeph' light-coloured peoples who are identical with the Alpine peoples of Europe. Galchas, Tajiks, and Armenians link these to the Europeans.

It seems clear that the ancestors of these Aryan folk came to India from the Bokhara region via Persia. They are concentrated chiefly in Punjab, Rajputana, and Bihar. In these regions there are only about 2 per cent. broad- and 73 per cent. narrow-heads. In Eastern Bengal, however, the Brahman folk with Aryan speech show 35 per cent. broad-heads. These latter are assumed by Risley to have much Mongol (i.e. Eastern) blood, but Chanda thinks that they are really derived from Pamir (i.e. Western) *Alpines*. There is no linguistic evidence in Bengal of a Mongol invasion, whereas it is highly probable that their broad-head character is due to an invasion by Pamir Alpines through the low pass south of Merv. This would be of the same type as so often invaded Europe in Neolithic times¹ (see *Indo-Aryan Races*, 1916).

ARYANS OF ASIA (after Ruggeri)

Type.	Race.	Cephalic index.	Stature.	Nasal index.	
General type	A	Indo-Afghan	74	1,645	69
	B	Indo-Persian	81	1,663	71
	C	Mediterranean	78	1,680	66
	D	Armenian	87	1,680	67
	E	Georgian	83	1,650	60
Local types of	A	Rajput of Bihar	72	—	72
	A	Sikh (Punjab)	73	1,709	69
	A	Balti (near W. Tibet)	75	1,617	68
	B	Brahman (Bengal)	80 +	—	—
	B	Mahrati (W. India)	80	1,613	75
	B	Brahui (Baluch)	82	1,659	71
	D	Galcha	86	1,669	67

Chanda believes that when this Alpine migration (B, above) arrived in India, they found the middle Gangetic plain in possession of the 'dokeph' Aryans (A, above).¹ They therefore

¹ This association of 'dokeph' Aryans (Caspian, 73) and Alpines (82) resembles that of the races in North Europe as the Nordics were developing (see pp. 158-60).

passed by and reached Orissa in the east, and Kathiawar and the Deccan in the west.

(d) *Races of South-west Asia.* We find much the same order in the zones of folk in Arabia, Mesopotamia, Persia, and Turkestan. All round the borders of the Indian Ocean there seem to be relics of a negroid or negrito stratum. Husing (1916) suggests a race of negritoos as the most ancient population of the coasts between India and the Persian Gulf. He thinks that elements of a Dravidian population are found in the interior of Persia. Dienlafoy found negrito or negro people near Susa in South-west Persia.¹ Ruggeri suggests that the 'brakeph' Arabs of Yemen (C. I. 83) differ from the Arabs of Muscat (C. I. 78) owing to some of this negrito blood, which is also shown by their lower stature and curly hair.

The next zone is the Semitic Aggregate, which is characterized by languages constructed on a plan entirely different from the Aryan, but not so remote from the Hamitic tongues of North Africa. Semitic consists essentially of triliteral words, such as *fatat* (bend), which are changed internally, e. g. *filat*, *fulatu*, &c., much as we add inflexions. Somewhat similar methods are employed in Efate (Melanesia) and Tagala (Philippines) according to Macdonald,² and probably these belong to the same migration-zone. Many of the Arab peoples are probably ethnically akin to the Gallas and Ethiopians on the west and to the Dravidians proper (Badaga, &c.) of India on the east.

The Jews of Syria are a special development of the Semitic group. Their facial characters, i. e. large nose, protruding lips, and eyes, may be in part due to a more or less unconscious tendency of a 'peculiar people' to perpetuate types in which the race facies is marked. (We see perhaps the same tendency in the Basques. Again, no doubt golden hair, blue eyes, and a fair skin were unusually popular among the youth of the Nordic race, and so tended to be perpetuated for similar reasons.) There is of course little ethnic relationship between

¹ An early Neandertaloid skull has recently been found in Galilee akin to that of Krapina.

² *The Oceanic Languages*, London, 1907.

the original Semitic Jews of Syria and the Russian Jew of Poland and the vicinity. Ripley explains this diversity mainly by an extensive proselyting movement among the Southern Russians in the early centuries of our era. Indeed he affirms that the ' Jews are not a race, but only a people. . . . In long-headed Africa they were dolichocephalic, in brachycephalic Piedmont they were quite like the Italians of Turin, and all over Slavic Europe no distinction between Jew and Christian existed.'¹

A very interesting region of mountain lands extends from the Black Sea to the Tibetan Plateau. It forms the border of the two great racial aggregates, the Aryan and Altaic. Through the centuries these two groups, debarred by totally different languages and cultures from sympathetic comprehension of each other, have been warring, raiding, and destroying. Thus has arisen what I have termed a ' shatter-belt ' of broken tribes, who have retreated into the Caucasus Mountains and there resisted the racial amalgamation which is the lot of the agriculturalist, and to a less degree of the pastoralist of the plains.

The groups in the Caucasus and thereabouts comprise many peoples and many tongues. Only the Ossetes of the central northern slopes approach at all closely to the Aryans. They are not far from the Russians in race and language. Close to the Black Sea are the Kabards and Abkasians, who speak a curious agglutinative speech. Its nearest allies are in far-off North America, though Basque is slightly akin in structure. The suggestion that these Caucasus people might be related to the North Amerinds was once scouted as impossible, but the present writer sees no inherent difficulty. Their zonal position to the west of the centre of dispersion agrees well enough with that of the Amerinds far to the east in Canada. It may be noted that Roland Dixon finds the same type of skull in these two regions, which corroborates my suggestion of 1921.

Space does not permit of reference to all the other interesting peoples hereabouts. The Armenians seem to be an Alpine people characterized by a specially flat occiput. They are doubtfully allied with the ancient Hittites. Passing to the slopes of the mountain ridges leading up to the Pamirs, we find other Alpine peoples so like those described from Savoy in

¹ Ripley, *Races of Europe*, p. 397.

France, that they are termed 'Belated Savoyards'. They have in effect lagged behind (as 'inliers') in the march to the west. Among these are the Galchas of the Hindu Kush. In the north-east of Persia and in Turkestan blonde features are quite common. Among the Tajiks of Samarkand, says Ujfalvy,¹ 38 per cent. have blonde beards. Chestnut hair is very common in Persia, as it is among the West European Alpines. The skull measurements are identical; and indeed among these Alpine peoples we have, I think, types of the latest evolved races in the world.

We must note that in Turkestan Sergi states that a stratum of 'dokoph' skulls with non-Mongoloid features was found in the excavations. Tavorshi also found a similar type among the modern Turkomans. They have been described by Haddon as 'Proto-Nordics'. No doubt they are close to Dixon's 'Caspians'.

The chief interest to the student, however, in these regions of Persia and Turkestan is that the earliest history of civilization has been investigated here perhaps as completely as in any other part of the world.

At Askabad (near Merv) Pumpelly found the following strata:

TOP.	14 ft.	with Iron-Age relics
	15 "	" " Copper (and Lead) relics
	70 "	" " Wheel pottery
BOTTOM.	45 "	" " hand-made pottery.

At Susa (150 miles north of Basra) 26 ft. of upper debris is said to represent the interval since 4500 B.C. Below this is another 50 ft. of debris, which reaches back to an estimated date of 12000 B.C. At first wheel-made pottery is found; then rough, thick pots lie below this; and finally, in the oldest layers, are crude cuneiform designs.

On the ever-growing delta of the Euphrates a Sumerian civilization grew up, much earlier than that in Egypt, possibly when the sea reached inland to Eridu about 6000 B.C. To the east is Susa, and still farther to the east an Indo-Sumerian civilization has recently been discovered in Scinde and Punjab (p. 121). Hence Egypt becomes an *outlying* Western civilization; and the writer has long believed that an Alpine race of Proto-Sumerians will be found to have developed the *first* civilization in or near Turkestan, perhaps at Askabad.

¹ *Explorations of Turkestan*, 1907.

XVI

THE RACES OF EASTERN ASIA

Japanese Race Origins. One of the most remarkable chapters in the history of Race Evolution is that dealing with Japan in the last seventy years. The ports were only opened to foreign trade in 1860, and yet in this short period Japan has advanced from an isolated medieval empire into the leading manufacturing nation and most formidable military power in the Pacific. That this is due in no small degree to the environment of Japan and to the races which inhabit it, no one will deny. The population of the empire is now seventy-seven millions, and its density is only surpassed by that of the United Kingdom, Belgium, and Holland.

Dr. Munro gives the following account of the chief racial stocks in his book *Prehistoric Japan*. There seem to have been at least two primitive races in Japan. The chief were the *Ainu*, who for many years resisted the Japanese invaders throughout the southern islands. They slowly retreated, during the first ten centuries of our era, to the north. They are now found only in Yezo (10,000) and Sakhalin (2,000). Their head index is about 77, and they are a short people (1,579 mm.). The skin is fairer than that of the average Japanese; but the chief feature is the tremendous development of hair on head, face, and body. The eyes are wide-set and brown (occasionally hazel) in colour. The Ainu have legends of 'Pit-Dwellers' in the country before them, but most authorities think that these were akin to the Ainu, though Tsuboi refers them to the Eskimo, or their allies.

The typical Japanese stock seems to have entered from Korea in various migrations of tribes classed as *Yamato*. They were acquainted with iron, and made use of the wheel for pottery. For a time they used dolmens and caves for the dead (like the Maori), and their entry was not long after the Bronze Age. The main influx of this taller 'Alpine' or

Manchu type was probably between 1000 and 500 B. C., though Bishop makes their entry some five hundred years later. Munro inclines to the belief that much of their culture (like that of the Chinese) came ultimately from Sumeria or Akkadia or thereabouts.

The other great invasions seem to have come from the south, and consisted of shorter races possibly akin to the Malay Dyaks. Munro refers to them as *Kumaso*. Bishop thinks they migrated from the Yangtse delta, then held by Indonesians, and much recent work is inclined to associate these stocks rather with those of Southern China than Malaya. They were a well-knit sturdy group, with broad chests and long bodies. They form perhaps the most abundant stock in Japan to-day. Munro suggests, however, that there was possibly a *negrito* stock in South Japan in the early days, from whom some of the *Kumaso* folk may have been derived by race mixture with higher types. Munro is confident that the Japanese aristocracy was partly of 'Caucasic' or Iranian stock; and concludes that the 'Japanese are not a race but a loose mixture of variously assorted racial features, which in times past have found their way to this "Ultima Thule" of Asia'.¹ (See also the note on p. 195.)

There is seen to be a close parallel between Britain and Japan in race as in environment. The bulk of both nations probably consists of tribes of the Iberian zone, conquered and governed by an aristocracy consisting of Nordic or Alpine races. In Japan the Alpine Yamato seem to be more important than the Iberian *Kumaso*. In Britain the Nordic elements were probably most numerous among the conquerors, but we must not forget the preponderating amount of Alpine blood in the Brythonic and West Saxon invaders. Surely, in view of the great racial mixture which has produced the two most enterprising peoples of our times, it is folly to quote that dictum as to the 'vices of half-castes' which we still hear on all sides!

The Races of South-eastern Asia. This aggregate consists of a dominant Chinese group with outlying Tibetan and Siamese

¹ The most recent work of Japanese archaeologists has slightly modified Munro's conclusions. Excavations have shown that the earliest inhabitants of Japan, if not Ainu, at least resembled them closely in physique. At least three periods in the Stone Age (Neolithic) can be recognized, and the people of Mongoloid affinities seem to be the latest invaders of Japan: their invasion almost certainly belongs to the third period. Ancient graves have so far failed to confirm the hypothesis that a primitive *negrito* stock ever inhabited the Japanese islands.

families. Here again there is a very broken fringe of primitive tribes in the islands and mountains, which is too involved for more than a brief reference (see also Fig. 29).

From the point of view of skull-shape, the broadest skulls



FIG. 52. Ethnology of China and Siam. The entry of the Chinese round the huge plateau of Tibet (black) is shown: leptorhine, long-face peoples centre in the north-east lowlands; the short, dark, platyrrhine (crosses), broad-face people in the south-west highlands.

are found inland on the north-west margin¹ (except for a group in Siam). Thence the head becomes narrower to the south-east, following the general rule of 'zones around Turkestan'. It is important to note that the great Chino-Tibetan group of languages includes stocks of many different types, and we have the same difficulty in deciding which were the *original* speakers of any given language as in Europe. The dominance of the

¹ In the Tarim basin, according to Biasutti.

Chinese Empire has certainly led to a great 'Sinification' of all the scattered tribes of Yunnan and the South of China (p. 177).

In many respects the Chinese are worthy of the highest respect of the student of races. The same racial type appears in chalcolithic deposits, and Chinese culture has been virtually continuous, in fact, since the dawn of history. With each century more and more of the surrounding tribes have become amalgamated with it, and it is for this reason that it is the great rival of white dominance. The empires of Elam, Egypt, Babylon, Persia, Macedon, Rome, and Spain have waxed and waned, and their peoples have become scattered and almost negligible; yet the 400 millions of China still remain consolidated and ready for the awakening that is coming. This is due in part to their environment remaining much more favourable than that of many of the other empires—where desiccation or disease has contributed to their decay.

At almost any period anterior to the last hundred years the Chinese held a worthy place among the nations, so that none should blame them if they condemn the arrogance of the upstart nations of to-day. Their philosophy,¹ methods of agriculture,¹ industry, and honesty are only lately receiving the serious attention which Western nations should give to them.

Their empire is so huge and populous that we must first ascertain where the typical Chinese folk dwell. Their earliest legends and prehistory indicate that they came east from the Tarim Basin about 2600 B. C. Even before this date they had written characters which had superseded knotted cords (like the quipu of the Incas) for the purpose of keeping records. The matriarchate had died out, marriage was properly instituted, and musical instruments were invented. Much higher culture than this is connoted by the study of astronomy and the weaving of silk.

About 2600 B. C. they migrated through the 'Jade Gate' into the Upper Hoang Ho Basin, and for 2,000 years their capital was in Shen-si. There are in existence bronze bowls dating from 2000 B. C.,² and a large

¹ See King, *Farmers for Forty Centuries*, and Russell, *Problem of China*.

² These early legendary dates can hardly be confirmed by archaeology. There were Chinese people but not a Chinese culture in Honan probably at the close of the third millenium B. C.

number of beautiful works of art in jade date back to 1000 B. C. Their culture seems to have equalled that of any occidental empire. About 800 B. C. they invented phonetic writing, and about 550 B. C. lived two of the world's greatest teachers, Confucius and Lao-tse, while Mencius was two hundred years later. The Great Wall was built before 200 B. C.

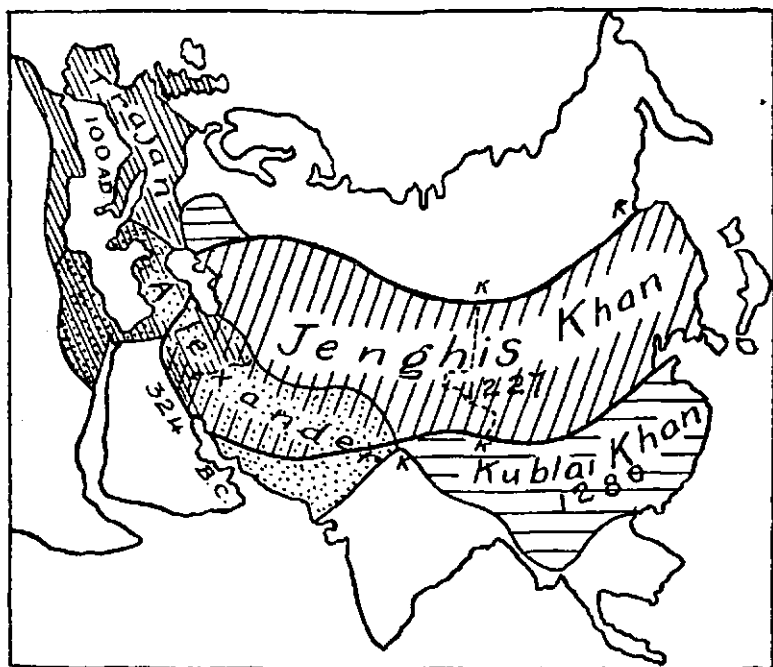


FIG. 53. The Mongol Empire of Jenghis Khan, 1227, compared with those of Trajan and Alexander (dotted). In 1280 the Mongols also occupied China and South-east Russia. Kublai Khan's north-west boundary shown by K K K.

About 120 B. C. their empire extended to Yunnan. In A. D. 30 the capital was moved eastward to Honan, and other cities, including Sian-fu and Kai-fong-fu, were capitals while China was growing. Although a city on the site of the modern Peking was the capital of the Kin dynasty, the city was not finally established till 1264, when Kublai Khan, Jenghis Khan's grandson, made it his metropolitan city. It has remained the capital ever since. Marco Polo's record deals with the Mongol period, when the Mongols and Chinese conquered half the known world.

We have seen that the earliest civilization may well have been developed by broad-heads akin to the Chinese in Turkestan or thereabouts. This is almost the only region in Central

Asia which has not been ruined by dessication during the last few millenia, and presumably it was also the richest land in the happier days of the past (see Fig. 37).

We find a common tradition among the Chinese and the Akkadians. (The latter were the successors of the Sumerians, who were almost certainly linked with the early Turkestan settlers, and physically were Alpine-Armenoids.) Thus the Babylonian priest, Berosus (third century before Christ), describes the earliest dynasty as consisting of ten kings and enduring for 432,000 years. This is exactly the same legend as in the Chinese story. The Sumerian art, town life, and religious ideas are also said by Lacouperie to be closely akin to those of the Chinese.

As the Chinese advanced into the fertile lands they hold to-day, they certainly found the latter occupied by races of non-Mongolian stock, akin to the Indonesians and Polynesians, although T'ing is inclined to ally them with the Mediterraneans.¹ There are many relics of such peoples in China to-day, some of which have not yet fully recognized Chinese rule. They have been enumerated by Von Brandt. Thus we find the Lolo in the great south bend of the Yangtse; the Miao in the mountains to the south-east of this bend, who number fifty tribes. Some of these are said to have migrated to Formosa in the thirteenth century. In the two southern provinces are the mountain tribes of the Hakka. The Hoklo have been driven to the south-east coast, and number two million. In Burmah are the Lishau tribes, akin to the Lolo (see Fig. 52). The Ikia are somewhat allied to the Siamese and live in the Sikiang basin. The Yao are found on the coast near the island of Hai-nan, while the Sai live in the latter island. The Moso live on the borders of Tibet and Yunnan in the deep valleys, while an allied tribe is the Minchia, who are abundant in Yunnan.

The relations of the folk in the south-east of Asia can be studied along the lines suggested by H. R. Davies in his valuable book on *Yunnan*. He divides the tribes hereabouts

¹ Andrews has found Mousterian and Azilian implements in the Gobi desert. Neolithic pottery akin to that dug up in Turkestan is also found in China.

linguistically into four main groups which are summarized in the following table.

TABLE OF SINITIC LANGUAGES

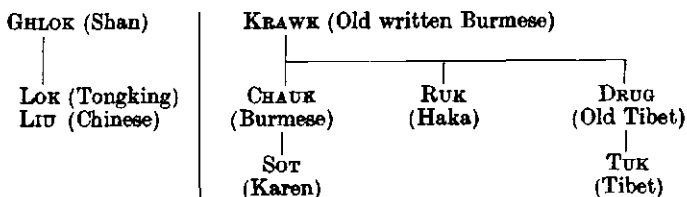
I	Mon-Khmer Family	(a) Miao (b) Minchia (c) Wa and Palaung
II	Shan Family	(a) Shan (b) Siamese
III	Chinese Family	(a) Mandarin (b) Many local dialects
IV	Tibeto-Burman Family	(a) Tibetan (b) Hsi-fan (c) Lolo (d) Burmese (e) Kachin

These classes are of course by no means the same as the anthropometric classes, which we hope will some day be elucidated in this very mixed Asiatic area; but they are a step in the right direction. All the above Sinitic languages are monosyllabic, and the words are not inflected; but it is clear that the words have been shortened by a process of phonetic evolution. Words that originally began or ended with two or three consonants together have been whittled down to words of two or three letters. Thus *brgyad*, as written in the old Tibetan, is now pronounced *gye*; *lchags* in the old writing has turned into *chag* or *cha*. In Chinese the modern Mandarin dialect has lost the final *k*, *t*, and *p*, which are still retained in the older spoken languages. (The same thing has happened to the final *gh* in some words in English as spoken, and to the *t* and *p* in northern French.)

Professor Lacouperie contends with great reason that all these languages were once polysyllabic; and there has been a very suggestive difference in the rate of 'decay' (or evolution) of the words. Thus in (old) written Tibetan and in some of the Lolo dialects words beginning with two or three consonants are fairly common. In spoken Burmese and Siamese they are comparatively rare, while in Shan and Chinese they have disappeared altogether. If we glance at the migration zones we see that the more primitive peoples (Tibetan and Lolo) have the complex words, and the more advanced (Chinese) has the simpler, more 'economic' method of speech.

This change is specifically illustrated by Davies. Thus Tibetan has a word *gru* for 'boat'. This changed to *kru* and *hru*, and so to *hle*

(Burmese) or *li* (Kachin). Another set of changes gives *rua* in Siam and *ho* in Shan. Similarly the old Siamese form *huang* (yellow) gives *long* in Shan and *huang* in Chinese. A very good example is the genesis of the words for *six*.



Davies gives a very interesting summary of the relations between race and language. If it is correct to suppose that the Miao and Yao speak languages of the Mon-Khmer family, it may perhaps be inferred that these tribes are the original type of the Mon-Khmer race. The Wa and other tribes have got their darker and broader faces and their small stature from admixture with some other race whom they found in Southern Yunnan and Indo-China.

It seems probable that the Lolos in their migration south have (in turn) mixed with Mon-Khmer tribes, and even perhaps with other shorter and darker races. In fact in some cases non-Lolo tribes may have the Lolo language imposed on them by a conquering race. It is impossible to believe that the independent Lolos of Szechwan (a race as tall as people of any European country, with comparatively fair complexions and often with straight features) can be of the same blood as some of the tribes of the south of Yunnan. Yet the languages of the Lolos of the north and of the short, dark Wonis of the south are very closely related to each other.

When we return to the anthropometric data we find that the historical record is the key to the racial distribution. The head index of China east of the great plateau is 80 or 81. But these lower lands can be divided approximately into halves by a line from the upper Hoang Ho to Formosa. To the north lies the region inhabited by Alpines (81) with moderately narrow noses (leptorhine), with rather long faces, with straight hair, and with light brown or olive complexion. To the south of the line are found peoples who become more platyrhine

(broad-nosed) as we move into the Burmese hills, and less platyrrhine to the north-east, where the nose is almost European. To the south-west they also become a darker brown, and the hair becomes more wavy, while the stature is much lower.

The ethnological history therefore would appear to be that of the other marginal portions of the Old World. We find that a region once settled by dark, short, platyrrhine, wavy-haired tribes (possibly with a distinct Australoid tendency) is invaded by taller, fairer Alpine peoples who have entered from the north-west, round the margin of the great Tibetan plateau. The racial function of the huge and prolific Chinese population is (in the words of a Chinese writer) gradually to absorb all the peoples which it impinges upon, or which may for a time conquer it. This has happened in the South of China. It has happened to a less extent with the Manchus in the north, and with the Yunnan tribes in the south-west. It is beginning in the Malay States and in the East Indies.

This slow incorporation may become the chief racial phenomenon in all the lands bordering the Western Pacific in the future. We find that the same thing has happened in Central Europe, where the allied broad-head Alpines are spreading at the expense of the Nordics and Mediterranean peoples. It may be that it is inevitable, for if the Alpine races be equipped with somewhat higher racial attributes (as some ethnologists are inclined to believe), then the differences, however slight, may be enough to ensure its final supremacy.

Note on Anthropometry in Japan (see p. 188).

Matsumura's recent work on Head-Shape and Stature in Japan shows that relatively *tall* broad-headed folk (Alpine ?) occupy the north, centre, and west of Hondo. The long-heads (Caspian or Iberian ?) live around the Inland Sea and on the actual west and north-east coasts of Hondo. The *short* broad-heads (negrito ?) live in small groups in the extreme south of Kiuſhū and in the extreme south and west of Hondo.

XVII

THE CHANGING ENVIRONMENT IN NORTH AMERICA

General Topography. An examination of the topography shows that there are two centres of great elevation, one in Greenland and one in the Western United States. Of these the Greenland Plateau consists of a vast compact area all over 5,000 ft. high, and covered with a thick ice-cap; while the western region is built up of a series of ranges and elevated intermont basins, which have been developed in connexion with the late Tertiary mountain-building period.

The history of man in America in all probability commenced after the topography had reached comparative stability. Probably no one seriously entertains the theory that the American Indian (Amerind) originated in America; and the great majority of ethnologists concur that his ancestors entered late in the Pleistocene period from Asia. Early in 1924, however, some skeletons discovered near Los Angeles seem to date from interglacial times, but nowhere else is there undoubted evidence of early man in America.¹

It has been pointed out by W. M. Davis that the North American topography resembles that of Europe as the left hand does the right hand. On each side of the Atlantic Ocean is an ancient 'shield' or crustal block. The Laurentian Shield of East Canada corresponds somewhat in age and position with the Scandinavian Shield. The Great Lakes resemble the Baltic seas. The ancient ranges of the Appalachians agree with the ancient relics of the Hercynian chain across Europe. Farther from the ocean in both continents are the great plains, while the young mountain chains of the Western States correspond in age with the 'Alpine Storm' of Central and South-eastern

¹ Referring to the cranium found at Punin in Equador, 1923, Anthony says, 'Weighing all the evidence carefully, I think serious consideration must be given to the implied contemporaneity of this cranium with the Pleistocene species of the Punin beds.'

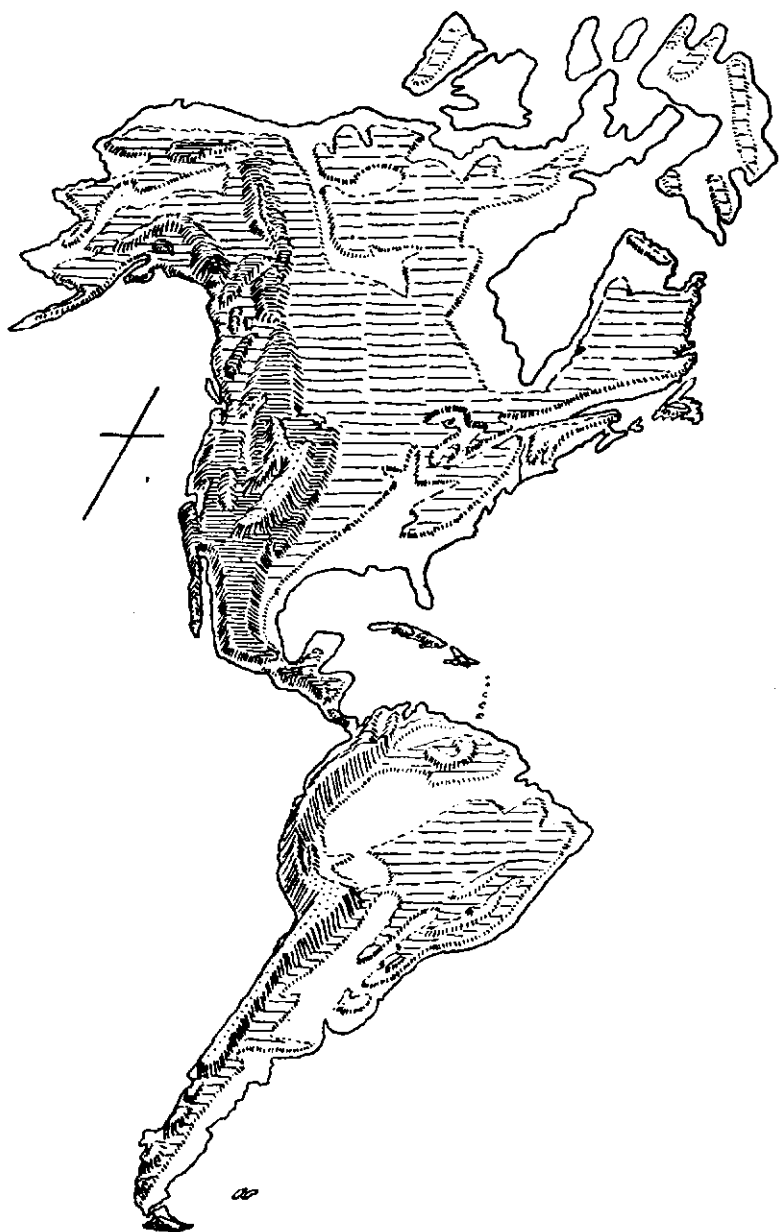


FIG. 54. Block diagram of America.

Europe. The West Indian islands and seas, moreover, fairly agree with the arcs and deeps of the Mediterranean.

The Rocky Mountains are, however, fairly complex. In the States they rise boldly from the High Plains of the centre to heights of 15,000 ft. Then broad upland basins (such as that of Utah) extend across to the Sierra Nevada—which is often bounded by faults, and contains high peaks also. Farther west again is the well-marked trough of the Valley of California, separated from the sea by the Coastal Ranges. Great sheets of lava have poured out in the north-west States, and beautiful volcanic cones, draped in glaciers as on Rainier and Shasta, rise to 15,000 ft. in this region. The hydrography shows that the elevation belongs to late geological epochs. The Colorado Canyon is a classic example of rejuvenation. One of its tributaries, the Virgin river, is supposed by some authorities to have originally risen in Wyoming and flowed south through the Salt Lake region to join the Colorado, thus cutting right across the Rockies. So also the Columbia extends practically across the mountain belt, proving that the rivers are not yet adjusted to the late Tertiary movements.

The growth of the American topography is, however, of great secondary importance to man. The great ice-sheets which dominated Canada and Northern United States spread out in accord with the topography and gave rise to an environment which still controls man's activities to a very considerable extent. A clear summary of the conditions is given by Brooks in his *Evolution of Climate*, on which the following account is based.

The Pleistocene opened with extensive elevation of the whole North American continent, which raised the Rocky Mountains several thousand feet above their present level, and extended the continental area over much of the northern Archipelago. Newfoundland was also raised 1,000 ft. The high mountains in the west were the first to develop large glaciers, which coalesced into an ice-sheet perhaps 5,000 ft. thick. It extended south-east into the United States, and at the same time perhaps another ice-sheet moved south from Labrador. An interglacial period probably followed in which the Asiatic hairy mammoth roamed through North America.

The Kansas glaciation followed, when the ice-sheets reached their greatest extent. The Keewatin region (west of Hudson Bay) also developed a very large ice-sheet at this stage, when the climate, though severe in winter, was not unsupportable in summer. Even as far south as Florida the effect of the glaciation was felt, for northern plants which migrated then still remain on the colder slopes of the hilly southern country. There

followed a long interglacial stage which perhaps endured for 200,000 years and which may correspond to the Mindel-Riss Interglacial of Europe.

Various less clearly defined Ice Ages succeeded, which were followed by a period of dry steppe-like conditions, when the great American loess sheet was deposited. The Peorian interglacial is supposed to have lasted for 60,000 years, and then came the last or Wisconsin glaciation. It has been calculated that 20,000 years have elapsed since the ice finally abandoned the Niagara region.

Climatic Control. The migrations of early man and the recent white settlement of America both mainly depended on the three great geographic controls of topography, temperature, and rainfall. The usual maps of temperature give a misleading idea of conditions in the West of America, for the isotherms are invariably reduced to sea-level temperatures. The chief noteworthy example is in Mexico, which has a large area with less than 60° F. for the average annual temperature, while the ordinary map gives it as 80° F.

A second feature is the large extent of land in Canada and Alaska with an annual range of temperature (hottest to coldest month) of more than 50° F. This means that these regions have a hot summer, where the temperature often reaches 90° F. For instance, Stefansson quotes 100° F. as having been registered at the official bureau at Fort Yukon, which is north of the Arctic Circle in Alaska. On the Coppermine river, about fifty miles north of the circle, Stefansson describes one period of three weeks when there was not a cloud in the sky, the sun beat down upon them the twenty-four hours through, and the heat rose to the vicinity of 90° F. in the shade without dropping lower than 60° at night. Those three weeks, he adds, were certainly equal in opportunity for plant growth to six weeks of Texas, and they were by no means the whole summer.¹

In winter (January) the isotherm of freezing (32° F.) approximately extends from New York to St. Louis and Denver. All to the north is frost-bound, and extremely low temperatures (such as 62° below zero in Montana) are known in the heart of the great land mass away from the equable temperatures of the ocean.

Turning now to the rainfall, we find that conditions are somewhat the same as in Europe. There are two regions of

¹ Stefansson, *Northward Course of Empire*, 1922, p. 35.

heavy and uniform rainfall, in British Columbia (due to the constant westerly winds) and in the Eastern United States. Of true winter rainfall there is only a small patch on the Californian coast. The centre of the continent from Great Bear Lake to Mexico has a purely summer rainfall, and east of this there is also a considerable amount of rain in spring and autumn also. Similar conditions obtain in Mexico.

The arid regions (under 10 in.) occur in the north in the area between Lake Athabasca and Baffin Land, and in the south-west in Arizona and Nevada.¹ While the desert in this part of America is of small proportions compared with, say, that in Sahara or Australia, it is by no means negligible, as Bowman has recently pointed out in the following words :

'A desert has become by definition, not naked sand or rock, but a place of small rainfall, with a sparse and specialized plant and animal life. . . . Because settlement (in central U.S.A.) has steadily pushed back the borders of the American desert, it is sometimes supposed that the word "desert" can be discarded entirely. . . . As a matter of fact we have an extensive area, as truly desert as Sahara or Atacama' (*Desert Trails*).

Vegetation. The vegetation responds directly to the seasonal rainfall. In the north is the tundra, extending along the coasts of Alaska and Northern Canada to Ungava Bay. According to Stefansson (op. cit.) there is, however, very little snow on the tundra. 'In winter it is thinly snow-covered, and the grass in most places can be seen sticking up through the snow. In summer it is green with grass and golden with flowers, and there is never a speck of snow.' He estimates that in Northern Canada there are one and a half million square miles of land suitable for grazing caribou (reindeer) herds.

The southern edge of the tundra is very ill defined and merges slowly (as a taiga) into the great coniferous forest. This taiga extends much farther south than in Asia, probably (as Hardy suggests) because of the chilling due to the proximity of the extremely cold Ice Cap of Greenland.

We may divide Southern Canada and the United States into two halves corresponding to the seasonal rainfall map. The

¹ The official *Atlas of the Vegetation of the United States* (1924) names as desert almost all Nevada, most of Utah, and half of Arizona and Wyoming.

western *arid* and *summer-rainfall* regions consist of scrub and steppe lands respectively; the eastern more or less *uniform rainfall* regions are (or were) occupied by dense broad-leaf forests, probably the finest of their kind in the world. Oak, walnut, hickory, chestnut, alder, willow, poplar, elm, magnolia, laurel, maple, and many others flourish in profusion. No doubt these forests in the east formed a safe refuge for the early 'dokeph' Amerinds, where they retreated from the thrust of the later Alpine peoples. We shall see that the Indians of the Plains and Highlands (i.e. the great corridor of migration)

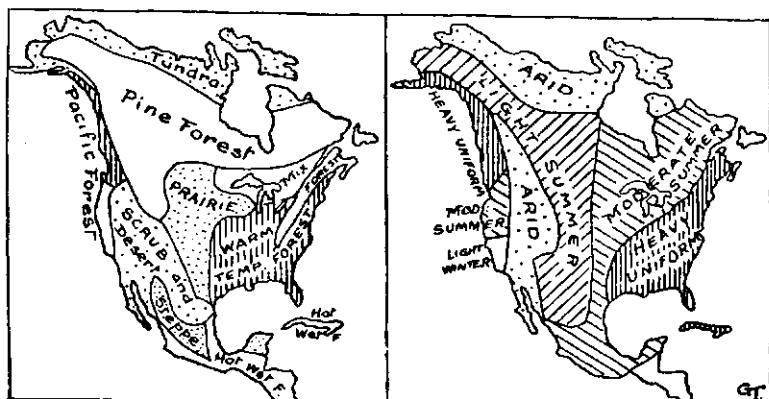


FIG. 55. Generalized Vegetation and Rainfall in North America.

were chiefly broad-heads, while the Indians of the dense eastern and northern forests were chiefly 'long-heads'.

Along the western coasts there occur heavy forests usually of conifers such as spruces and firs, among which are the *Sequoias*, the largest trees on earth. In these steep and inaccessible valleys dwell a large number of shattered tribes displaced to the west by the hordes of more powerful Plains Indians.

Recent Climatic Changes in North America. Some of the most important evidence as to these changes has been collected by Ellsworth Huntington in his book *Climate and Civilization*.

Owens Lake is situated in Southern California, and receives its waters from Owens river. The last overflow is determined to have occurred about two thousand years ago, by estimating the amount of salt which

has accumulated in the lake. Two thousand years ago the climate of the region was so moist that the lake expanded to two and a half times its present size. About the same time the adjoining Pyramid Lake rose to 70 ft. above its present level and overflowed also.

The various lake beaches show that these rises and falls of the water have been intermittent, and it is possible to correlate the wet and dry periods with the quick and slow periods of growth of the very ancient trees of the neighbouring forests of the Sierra Nevada. Huntington deduces a very dry period about A. D. 650, followed by a rather wet period at A. D. 1000, an extremely dry period at A. D. 1250, and a wet, stormy period (deduced from gravel beaches) about A. D. 1350. Far away in Lake Lop Nor in the north of Tibet we have seen that the waters rose with great rapidity about this time, showing that there were similar changes in similar latitudes in both hemispheres.

Even more apposite, however, is Huntington's study of the effect of environment on race in Yucatan and Guatemala. Here lived the Mayas, who had developed a civilization in some respects higher than that in any part of the world except Western Europe. Their calendar was more exact than that used until recently in Russia. Their writing was phonetic, and in this respect ahead of the Chinese script. The most surprising feature of their civilization is that this region is now a hot, damp, malarial lowland, where agriculture is practically impossible, and where only a degraded handful of Indians now dwell. Even these are subjected to repeated attacks of malaria.

Huntington's explanation seems to be the sole possible one. He believes that the climate has changed owing to a shifting of the rain-belt. Unfortunately he cannot correlate the climate with *early* Maya history, for we do not know their dates accurately enough.

The seventh century A. D. was a period when the Maya civilization was at a low ebb. At this time the Californian trees grew very slowly; rainfall here was scanty since the southern *desert* belt had now moved north. As a natural corollary the southern tropical rain-belt also moved north from Southern Guatemala into Yucatan, giving for a time conditions something like those of to-day.

The forests became rank, agriculture would be difficult, disease would be rife, and the vitality of the Mayas in Southern Yucatan and thereabouts would be sapped. 'From A. D. 900 to 1100 the California trees grew rapidly. At such a time the desert belt had moved south, and on its southern border favourable *drier* conditions would prevail in the home of the Mayas. At that time occurred the last great revival of

architecture and the construction of the great buildings whose ruins now adorn Southern Yucatan.'

Huntington goes farther and demonstrates that these swings of the dry and wet belts are most probably in accord with the variations in solar energy. I cannot do better than quote his own words on this important subject.¹

'The changes of the eleven-year cycle (of solar heat) seem to be of the same nature as those during the larger cycles (of climate) both in historical times and in the geological past. To go back to the glacial period, the northerly areas of increased storminess at times of many sunspots correspond with the places where the main ice-sheets were formed. The areas of diminished storminess coincide with the places where the loess was deposited. (Referring to the map reproduced in Fig. 56.) In the south-west of the United States the dotted area showing great increase of storminess at times of many sunspots is the region where scores of old lake strands indicate that the rainfall was once so abundant that dry basins were filled with water. Abundant ruins in the same region,

where it now seems impossible for people to get a living, are located in exactly the area where storms increase at times of many sunspots.'

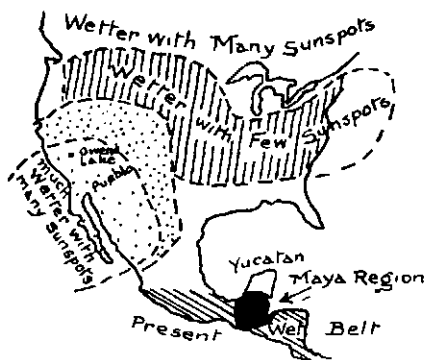


FIG. 56. Sunspots and Rainfall in North America. Under present conditions (with few sunspots) the ruled areas are wetter and the dotted areas are arid. When sunspots are abundant the dotted area becomes wetter and the ruled areas dryer. (Data from Huntington.)

No doubt there are other cycles in the sun's intensity besides the familiar cycle of eleven years. Huntington believes that another cycle of about one hundred years is indicated, with a minimum about the present date (1924) and maxima about 1870 and 1970. It must be remembered of course that in certain regions these periods will be marked by greater dryness as the arid belt will then move over them. Some such change in the environment probably accounts for the deterioration of the Pueblo civilization in the arid United States. It is now too dry there, just as it is too wet in the Maya region.

¹ *Climatic Changes*, 1923.

XVIII

THE CHANGING SOUTH AMERICAN ENVIRONMENT

It seems probable that South America was the last continent to be reached by primitive man. We have seen that there is some evidence for the Tasmanian having entered Australia in mid-Pleistocene times. But it is not likely that such primitive types entered America. One must, however, remember the American migrations of the Asiatic mammoth, which may have been followed by early man. Further, there are the recently found Los Angeles skeletons to be considered (see also p. 196).

The changing environment in the southern continent during late Tertiary times has not therefore much affected man. But the effect of the modern environment upon primitive and civilized man is as marked here as elsewhere, and in one particular South America is unique. I refer to the very narrow corridor which connects the northern portion of South America to the southern portion. This is due to the close proximity of one of the highest plateaux in the world to the largest and most impenetrable of tropical forests. We may therefore briefly discuss the salient features of South American physiography.

The topography consists firstly of a large Brazilian 'shield', possibly once united to the smaller Guiana 'shield', but now separated by the broad trough of the Amazon. The second feature is the long belt of lowlands which extends from Buenos Ayres northward to the mouth of the Orinoco. The divides between the La Plata, Amazon, and Orinoco are exceptionally low. We are told that the deflection by a falling tree may deviate the streams into one or other of the two first rivers. We know of the remarkable bifurcation of the Cassiquiari which links the Amazon to the Orinoco just south of the Sierra Parima (see Fig. 54).

The third great feature is the Andean range with its numerous ridges, plateaux, and basins. Data as to the age of the uplift are much less certain than in the other 'Young Mountains' of

the world. But E. W. Berry (in 1917) gives evidence leading him to suppose that the Bolivian Andes may have risen to a minimum of 13,500 ft. since late Tertiary or even Pleistocene times.¹ The wonderful gorges of the tributaries of the Upper Amazon, such as those of the Urubamba investigated by Bowman,² are also indicative of rapid uplift. At the Pongo de Mainique the huge river is only 50 ft. wide in a gorge bounded by 4,000 ft. cliffs, yet it is so deep that there is little current (see sketch-map inset in Fig. 57).

Far more significant than any of the highlands of North America is the extensive Peruvian and Bolivian Plateau. This vast area extends north and south for some 1,500 miles, with an average width of approximately 200 miles. Almost all of this plateau is over 10,000 ft. high. It thus ranks with Tibet, Greenland, and Antarctica as one of the four great plateaux of the world. On the west it descends steeply to the coast, and thence down into such deeps as the 'Atacama Pit', nearly 25,000 ft. below sea-level. The total difference of height from the mountain-tops to the bottom of this giant scarp is therefore 45,000 ft.; and it thus rivals the similar lately formed scarp of the Himalayas.

Some characteristic features of the Andean Plateau in Peru are illustrated in the following block diagrams, which are based on data given by Bowman in his remarkable book. The highest zone is occupied by shepherds, one hut in use being 17,000 ft. above sea-level to the south of Pasaje. The high pastures extend up to the snow-line (generally at 15,000 or 16,000 ft.) and occupy the old *undissected plateau* surfaces. There is a zone of better rainfall about 10,000 ft., and here woodlands and mountain farms occur (see Fig. 57). Potatoes will grow here in spite of repeated frosts. Barley and wheat are also staple crops (Fig. 57 middle).

The glacial cycle has been very marked here, within 12 degrees of the equator. Great glacial troughs have been cut in the plateau to depths of as much as 7,000 ft. Often the flat floor of these canyons is covered with gravel and is too arid for agriculture except by irrigation from the wetter heights. In this latter case sugar, bananas, and cacao are grown at elevations from 5,000 to 8,000 ft. (Fig. 57). There is evidence in many places of several stages in the glacial cycle. Thus two miles below Choque-tira (see Fig. 57) the valley at 11,500 ft. is filled with much dissected moraine and outwash. One mile below the village is a second moraine,

¹ 'Age of the Bolivian Andes', *Proc. Nat. Acad. Sci.*, vol. iii, 1917.

² *The Andes of Peru*.

and just above the village is a third of very recent origin. Cirques and hanging valleys are common, while moraines are forming at the snouts of the small glaciers on Mount Panta (Fig. 57 lower).

Sievers states that there were at least two distinct glaciations in Peru. The present limit of the glaciers here is about 15,200 ft., but during the first glaciation they descended to about 11,000 ft., and during the second to 12,800 ft. These data corroborate the evidence at Choquetira.

Climatic Data. The present climates of South America are naturally very diverse. Nowhere in the world do the isotherms bend so sharply as along the narrow but high Andean chain. Current isotherm maps (reduced to sea-level) are far from the reality here, for they show us the Bolivian Plateau with an average temperature of 75° F., while in truth La Paz (one of the chief cities) has an average of 49° F., and a June temperature of 44° F.

The rainfall conditions vary very remarkably in accord with the swing of the sun and with the diverse topography. As regards season, the Amazon and Orinoco basins being nearly under the sun all the year round have a heavy uniform rainfall (see Fig. 58). The greater part of Brazil has a summer (and autumn) rainfall, though it becomes fairly uniform in the south and in Uruguay. Almost all the west coast and the Patagonian region has a low rainfall, below 15 in. There is an interesting exception, however, in the south coast of Chili, which receives a very heavy rainfall from the constant westerlies. Near Valparaiso is a typical 'Mediterranean' rainfall confined to the winter.

*Vegetation in South America.*¹ The region of heavy tropical rainfall supports the densest vegetation in the world. An equable high temperature through the year and even through the day of about 80° F. gives the very conditions for maximum growth, and here indeed we find the supreme effort of plant life. The Amazon acts rather as an irrigation agent than as a means of drainage; so that on the banks of the rivers there springs from the slimy mud a rank and dense growth of tall trees (including the Para rubber-tree) which form, under an

¹ Based on Hardy's excellent handbook, *Geography of Plants*.

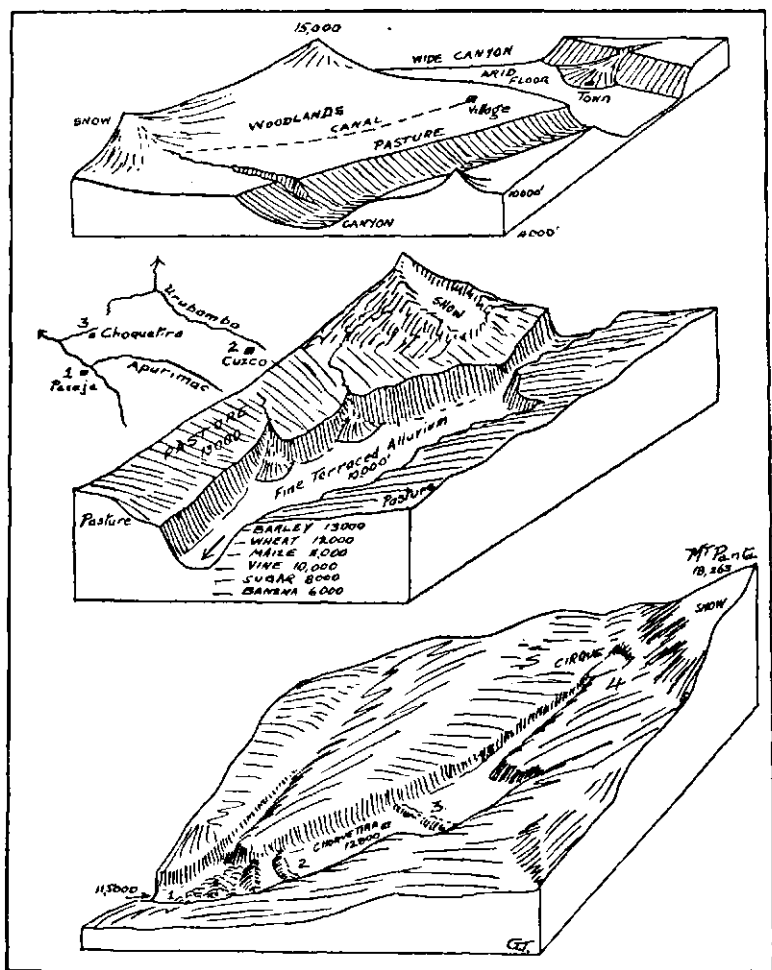


FIG. 57. Block diagrams illustrating the environment in the Peruvian Andes near Cuzco (see map inset). The upper figure shows the upland farms near Pasaje, the middle figure illustrates the basins of Cuzco and the levels at which various crops grow: and the third shows the glacial features near Choquetira. (Data from Bowman.)

unbroken canopy, a green wall impenetrable from the outside. Beyond these flood-forests is the typical *selva* on firmer ground. It is taller than the former, and here the Brazil-nut tree is common. The vast crescent of Andean slopes on the west is called the '*Montana*'. Here the thick *selva* rises up to 4,000 ft., and above this to 7,500 ft. is the dense rain-forest of palms, lianas, ferns, and bamboo (see Fig. 59).

This dense mass of forest therefore extends right across South America from the mouth of the Amazon almost up to the Andean Plateau. It is likely to be almost the last terrain conquered by man, for, as Bowman forcibly puts it :¹

'The tropics must be won by strong hands of the lowlier classes, who are ignorant or careless of hygiene, and not by the khaki-clad, robust young men like those who work at Panama. . . . It is pleasant to think that the forest may be conquered. It is nonsense to say that we are now conquering it in any comprehensive and permanent way.'

From 8,000 to 10,000 ft. are woods of palms and some deciduous trees, while a woodland zone of smaller trees resembling rhododendron reaches up to 11,000 ft. It is this less thickly clad region above 7,000 ft. which forms the corridor for migrations from the northern portion of the continent into the south.

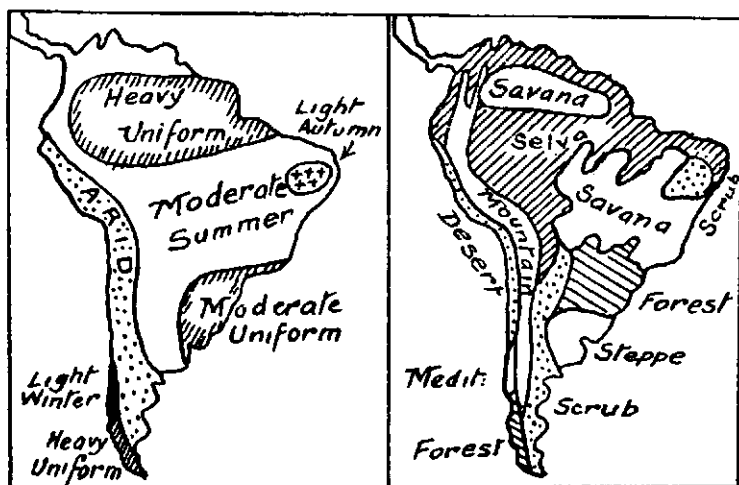
As we pass southward this open Alpine country naturally descends nearer sea-level. The Argentine Andes have parkland woods above 8,000 ft., though gnarled quenoa trees are found even up to 12,000 ft. Continuing along the eastern slopes of the Andes there follows a truly arid strip extending far southward. This district has known prosperous times, when nearly every valley had its lake and its area of cultivation, and supported a fairly large population with a comparatively high degree of civilization. Whether by natural or human causes, or a combination of both, this state of things ceased to be after the invasion of the Europeans.²

There is no doubt that on the *Pacific* slopes of the Peruvian Andes the belts of vegetation and cultivation of the Incas and Quichuas were broader than now. This change also is probably due to a marked deterioration in the rainfall.

¹ Bowman, *Andes of Southern Peru*, p. 35.

² Hardy, *Geography of Plants*, p. 165.

To the north of the selvas are the grass lands of the Orinoco basin. It is difficult to understand (in view of the uniform rainfall) why this region is not heavily forested. Possibly the grass lands are a heritage of earlier and drier steppe conditions, and the forest has not yet recovered its hold, though the rainfall has become much heavier. This open country has no doubt led to the rapid migration of the Caribs from the main corridor far into the domain of the earlier Arawak tribes. South of the



FIGS. 58 and 59. Generalized seasonal rainfall and vegetation of South America.

Amazon selvas are similar *savanas* extending through Southern Brazil, in accord with the marked seasonal rainfall. As the rain becomes more uniform in Uruguay and thereabouts, forests of *Araucaria* become common. To the south again come the grass lands of the Pampa with a fair rainfall, chiefly in summer. Here man has little difficulty in rearing his flocks and herds and in growing valuable crops, so that here settlement has progressed more rapidly than anywhere else in the continent.

The great Andean ranges have sheltered Patagonia and West Argentine from the westerly rain-bearing winds. They lie in a rain-shadow which gives rise to a vast arid or desert region

extending along the flanks of the mountains on the east. The shingle plains are sparsely clad in bushes with thorny or leathery leaves, with much salt bush in the numerous marshes. To the north of this region the east becomes the rainy side of the mountain barrier, and the rain-shadow desert shifts to the west. Here one of the driest tracts in the world extends from Coquimbo almost to Guayaquil. The following figures (from Kendrew) for Iquique illustrate probably the lowest rain record in the world.

INCHES OF RAINFALL AT IQUIQUE

<i>Jan.</i>	<i>F.</i>	<i>M.</i>	<i>A.</i>	<i>M.</i>	<i>J.</i>	<i>July.</i>	<i>A.</i>	<i>S.</i>	<i>O.</i>	<i>N.</i>	<i>D.</i>	<i>Annual.</i>
0	0	0	0	0	0	0·02	0	0·03	0	0	0	0·05

A quotation from Brooks, *Evolution of Climate*, sums up the scanty literature on the changing conditions in the lowlands. The Pampas formation consists of 200,000 square miles of deposits allied to loess. These seem to indicate former steppe conditions prevailing on the equatorial side of the Patagonian ice-sheet of the Pleistocene. But before the greatest cold these were partly forest clad, as is indicated by the remains of giant ground-sloths. The proximity of the great Andean glaciers, with a more or less permanent anticyclone lying over them, probably led to very arid conditions in these southern lowlands, so that the sloth and also the horse completely died out in South America.

XIX

THE RACES OF AMERICA

It has been customary to classify the Amerinds (i. e. American Indians) in one of two ways. Either they are assigned to the *Mongolian Race*, or they are separated as a special race or sub-race—the *American Race*. The original idea that they were specially characterized by a red colour has long been given up as a useful criterion, though there is a tinge of red in some tribes amid the almost universal brown colour of the Amerind races. In 1919 I stated that the three or four major zones of migration were represented in America almost as fully as in any other part of the world. Though perhaps the majority belong to the higher Alpine races of man, there are submerged strata allied to the negroid, and many large tribes more properly allied with the Iberian peoples.¹ (*Climatic Cycles and Evolution*, pp. 305-14.)

All these have been subjected to the American environment for thousands of years, so that a certain common 'facies' tends to unite essentially distinct peoples, just as we have seen in Europe. Common cultures and the spread of dominant languages have affected the Amerinds much as they did the Europeans. But just as we must drop the term 'European' as an ethnic name, so we must realize that the Amerinds are composed of many quite diverse stocks. In fact the general history of the migrations into America is extremely like that of Europe. Seeing that they started from a common centre, we may possibly use our fairly accurate knowledge of European races to help us to elucidate the meagre history of American races. In both continents we find only a very small proportion

¹ Haddon's classification is interesting in this connexion. He has the following types: Paleo-Amerind or Lagoa Santa type, whom he classifies with the curly-haired 'dokeph' peoples, such as Indo-Afghans and Nesiots. Secondly, he divides the straight-haired inhabitants of America into Eskimo, Northern Amerind, and a third group. The first are grouped by themselves; the second with the Chinese and Paleo-Asiatics; and the third, which he divides into Neo-Amerind, Tehuelche, and north-west coast Amerind, with the Turki, Mongols, and Southern Mongoloid. (*Races of Man*, 1924.)

of negroid stocks, chiefly as relics in the margins. In both the Iberian zone is fairly well marked on the edge farthest from Asia. In both by far the most abundant peoples are the Alpine races, which moved in last from Asia.

Let us glance at the ethnic criteria. The head index is fairly well tabulated. We find regions of 'dokephs' concentrated chiefly around Hudson Bay and in Eastern Brazil. Of these the Karayas (73) and Botocudo (77) of Brazil are among the lowest. But the Greenland Eskimo (77) and the Hurons of East Canada (77) are on the same level, while many Arawak tribes (78) of the Brazilian selvas have heads very little broader.

Bordering these two areas of 'dokephs' are wider belts of moderately broad heads, such as the Algonkians (79) of Canada and many of the Brazilian Indians. In the far south the Yahgans (79) of Tierra del Fuego belong to this zone. The remainder of America, i. e. the western side, is predominantly broad headed.

If we consult Biasutti's maps, we can generalize somewhat for the remaining criteria, which are indicated in the following table, and also on the 'ethnographs' on Fig. 60.

<i>Race.</i>	<i>Locality.</i>	<i>C. I.</i>	<i>Nasal index.</i>	<i>Stature. mm.</i>	<i>Hair.</i>	<i>Skin.</i>	<i>Face.</i>
Eskimo	N.E. Canada	75	c. 72	1,500	Straight	Brown	Broad
Algonkian	S.W. of Hud- son Bay	79	c. 74	1,700	Nearly straight	"	"
Salish	S. British Columbia	83	74	1,650	"	Light brown	"
Apache	W. Texas	83	80	1,700	"	Red brown	Very broad
Mexican	S. Mexico	79	80	1,600	"	"	"
Botocudo	E. Brazil	77	80 ?	1,600	"	Light brown	Broad
Arawak	N. Amazon	79	80	1,600	"	Brown	"
Quichu	Peru	82	74	1,600	"	Red brown	Long
Tehuelche	Patagonia	83	72	1,750	"	Brown	Very long
Yahgan	Tierra del Fuego	79	?	1,600	"	Light brown	Very broad

Some uniformity is apparent in the character of the Amerind *hair*, which is most nearly like that of the Burmese and Indo-Chinese, and not so straight as that of the folk of the centre and east of Asia. But there

are numerous sporadic examples of curly hair. In regard to other criteria there is great variation, which would be much more strikingly displayed if the small 'relic-tribes' could be inserted in the above table.

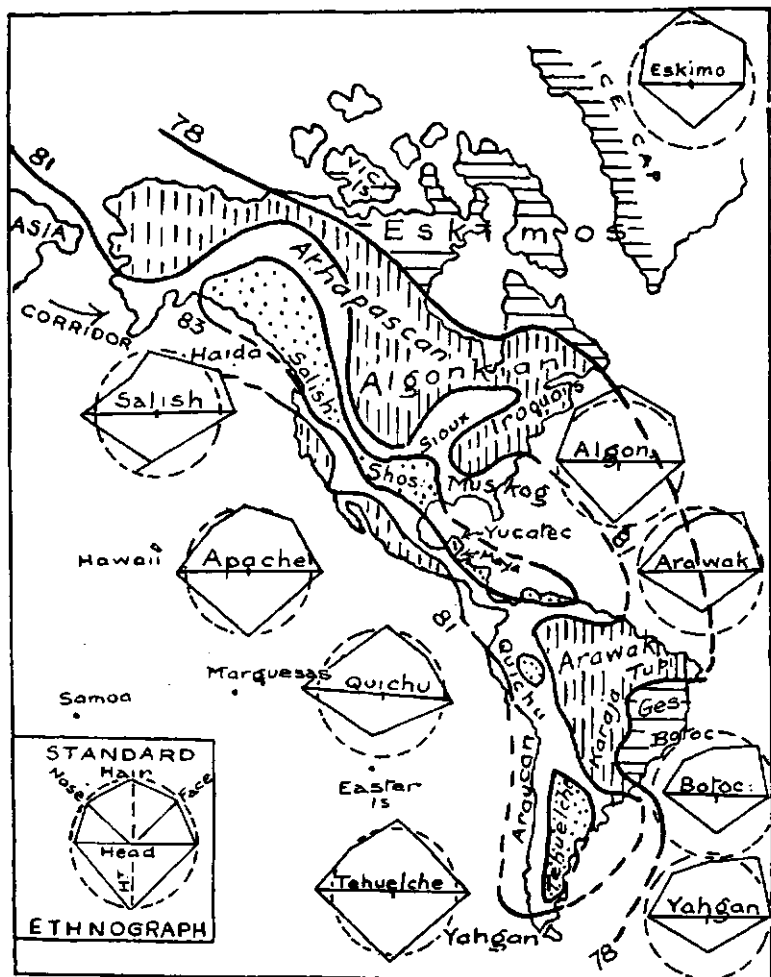


FIG. 60. Races of America and Ethnographs.

The *nasal index* seems to vary in a curious fashion with the temperature! There is a region of somewhat platyrrhine peoples extending from the Columbia river (near Seattle) to the La Plata in the south-east. All Canada and Eastern United States in the north, and Bolivia and Argentine in the south, are mesorrhine. The frozen north and Patagonia are markedly

leptorhine. The *facial index* is distributed in much the same way. Central America shows *very* broad faces, and almost all North America and Brazil is settled by broad faces, while narrow faces are found only among the Eskimo and Patagonians.

Stature has not quite the same distribution. It is true that broad noses, broad faces, and low stature characterize Central America; but the North American is typically tall except for the Eskimo, who is quite short. In *skin-colour* the distribution is not readily correlated with the other criteria. British Columbia and East Brazil are 'light' poles, while Mexico and West Peru are 'dark' poles. The majority of the Amerinds are of the same colour as the Burmese, i. e. brown, darkening to red-brown at the 'dark poles'.

There seems little doubt that almost all the aboriginal peoples of America entered by way of the Behring region. Possibly some few may at times have been blown ashore in ships from the Pacific. There is some legendary evidence for such a landing in Mexico, and the similarity between the architecture of Yucatan and Cambodia is remarkable. The temple pyramids in both cases are approached by four stairs with serpent balustrades. The altars are similar. There are even similar Atlantean figures supporting the doors, and some of the figures show whiskered men. Even more remarkable is the identity of the signs of the Zodiac in Asia and in Peru. The ram becomes the llama, the bull is the stag, the twins are man and woman, the crab is the octopus, and the scales are forks, &c. The Maya signs are somewhat similar. All this would seem to indicate that the Central American civilizations borrowed from China or elsewhere within the last few millenia.

It is not improbable that the Norsemen of Pre-Columbian days penetrated somewhat farther into North America than is currently supposed, for signs of their journeys are reported almost from the heart of the continent. It is not likely that they contributed much to the Amerind stock.

We may reconstruct the migrations into America on the lines of those into the other 'world-peninsulas'. No doubt the first comers would be primitive tribes few in numbers and not likely to resist the onslaught of the later hordes. We have seen that most of the negroid peoples in the Old World seem to have been driven towards the equatorial regions, where the hot environment no doubt tended to prevent the negro from

evolving into something higher. From this point of view we should hardly expect that the most primitive peoples would be present in large numbers in the north-east of Asia, which was the 'jumping-off place' for American migrations. At any rate (if we except the Los Angeles skeletons) the most primitive skeletons in America appear to be like those of Lagoa Santa (in East Brazil), marked by dolichocephaly and short stature. Middens in this region contain similar later skulls. Moreover, the hair of living Amerinds, such as the Karayas of Matto Grosso (C. I. 73), the Bakairas (of the Xingu river), and some Arawaks, is often wavy or frizzy according to Deniker. So also are some Fuegians. Sullivan, in his report on the Punin cranium, says, 'Either we have in certain parts of America skeletal remains of a type basically related to those found also in Australia and Melanesia . . . or we have a remarkable case of parallelism.' This certainly indicates the presence in the far past of negroid peoples in the American continent.

Among these primitive tribes the Botocudo are of interest. They dwell in the mountains about 200 miles north of Rio de Janeiro. They are of low stature (1,590 mm.) with a head index about 76. Their skulls, according to Deniker, are very like those of the prehistoric peoples of Lagoa Santa, and their features resemble those of the Fuegians. The brow-ridge is prominent, and the sunken nose is narrow at the root. We may be sure that a fairly large migration of these primitive peoples, whose anthropometry recalls that of the Australians and Ainu, entered America far back in the history of man. These are Haddon's Paleo-Amerinds.

Of distinctly higher type would seem to be the Eskimo peoples, who represent probably some of the earliest inhabitants of North America. They appear to mix readily with neighbouring peoples, hence we may assume that the more remote eastern Eskimo were purer than the western, at any rate until the Danish settlers arrived. The Greenlanders appear to have longer heads and less stature than the tribes to the west. According to Deniker, the eyes are straight-set and black, the nose is rather prominent, the face round, and the mouth rather thick-lipped. Jenness compares some rarer types to the

'Melanesian', which seems to show that some strain of negroid blood is present, but definite physical evidence is at present lacking.

I have mentioned in an earlier section that their culture is notably like that of the Upper Paleolithic folk of France, while the disharmonic skull (long head and somewhat broad face) recalls that of the Cro-Magnon type at that date. It is suggestive that the first migration into America may well have been of a Botocudo or Australoid type (the Paleo-Amerind), followed by an Eskimo migration with an Aurignacian culture. This is of course just the succession in Europe—that western peninsula of Asia—and is due to the changing climatic controls. It is possible that the same controls may have led to the same migrations entering the 'eastern peninsula' which we call America. We know that many Asiatic animals entered North America towards the close of the Pleistocene, and nothing is more likely than that the Asiatic races accompanied their usual prey.

Following these primitive peoples came great hordes of dolichocephalic peoples, of which there was probably more than one migration. They entered America probably in the Azilean times which succeeded the last great Ice Age. Climates seem to have been warmer then than now. It is possible that the Behring Straits had not developed, so that the cold Polar current was absent also. In this case a broad 'corridor', with a climate in summer like that of Scotland, would tempt the Asiatic peoples to cross. Moreover, there was no doubt pressure on the south from the developing Alpine peoples in Central Asia.

One can therefore picture a 'stampede' of peoples into this glorious region of America, where the country improved in climate and food supply the farther they moved to the south. Only a few helpless Mousterians would flit through the woods ahead of them, for we may imagine the Eskimo keeping to the north in the environment to which he had become accustomed.

Thus occurred the entry of the groups of people who now occupy Brazil, such as the Ges, Tupi, and Arawak races. In the north there spread out to the east the Algonkian and Athapas-

can races, although these have certainly been altered by later contacts. The great American corridor seems to have been along the foothills of the Rockies and Andean ranges, between the rugged mountains and the thick forests of Eastern U.S.A., or the thicker selvas of the Amazon. These folk are in many ways akin to those of Western Europe and to the lower Polynesian races, as I have explained in an earlier chapter.

The fourth group of peoples were the brachycephalic races with head indexes from 82 to 88—Haddon's Neo-Amerinds. They seem to have moved along the western plateau of America right down into Patagonia, where they are typically represented. They have, indeed, made but two important incursions from the main corridor. The first is the great Shoshone-Muskogean migration, which has taken 'brakeph' Amerinds to Florida and Lake Michigan. The second is the Carib incursion along the north coast of South America.

The last migrations have apparently been by far the most violent. They have found the world already occupied by more or less settled tribes, and in consequence a tremendous clashing and breaking up of races has occurred. This is especially marked in those regions for which I suggest the name *Shatter Belts*. The main line of disruption occurs all along the great corridor from the Malayan region through China, Eastern Siberia, and the western coast of America. Here the debris of primitive tribes is scattered like scum left by a great wave. Down the coast of British Columbia and California are four times as many distinct tribes as in the rest of North America. The small dolichocephalic tribes of California have been pushed to the west by the stronger brachycephalic folk. The important tribes of Athapascans of New Mexico are long-heads, as are also many of the Piman tribes of Mexico (see Fig. 62).

Probably each of these shattered American tribes has a counterpart in the broader territory of the eastern peoples. We know that this is true of the Athapascans of Oregon and of the northern plains. It is highly probable that the Salishan folk were originally connected with some of the (Sioux?) tribes of Iowa and Dakota. The Seri (76) of the Gulf of California have survived very remarkably, and the congeners of these Iberian people will probably be found in the extinct Hurons of the far east, or possibly in the Tupi-Guarani people of South America. Similarly

we get Pano (in the Huallaga and Marañon basins) in the north and Yahgan in the south of South America, Bororo in Matto Grosso, and Tehuelche in Patagonia as probable disrupted pairs in the southern continent.

In South America there is another shatter belt, where the more primitive tribes are driven down against the impenetrable forests of Brazil from their old highland homes. A crescentic belt of mingled tribes is shown by Chamberlain in his ethnological map of South America. It starts in Colombia between the Chibcha and Carib regions. It continues southward between the Aymara and Arawak (forest) tribes. It curves round to the east about the Tapuyan tribes of Eastern Brazil.

Two significant features are apparent in the distribution of peoples described above. The first is the association of short, rather dark, somewhat platyrrhine peoples with a tropical environment. These tribes are rather less broad-headed than the majority of the Amerinds. Their position *across* the main corridor into South America may imply that here there took place a degeneration of higher types, though I do not think this likely. Alternatively there may have been a movement away from such regions, consequent on a change of climate, on the part of the more 'brakeph' peoples. We may note, however, that many 'brakephs' occur here also, such as the Yucatecs of Mexico. It is, however, noticeable that the founders of the great Maya civilization of Central America were 'brakephs', and that the Aztecs, who were long-headed, were certainly later invaders from the north.

The second noteworthy feature is the isolation of groups of extremely 'brakeph' tribes, far removed from each other and from their homologues in Asia. Among these are the Plains Indians (88) of the central Mississippi Valley¹ and some of the Peruvian Indians (88). Possibly head deformation may account for these hyper-brachycephalic tribes, but it may be a case of local evolution due to an unusually stimulating environment. Here again we must await local research.

¹ Whereas the majority of the Plains Indians have a cephalic index of about 79.

THE SHATTER-BELT OF THE WESTERN COAST OF NORTH AMERICA

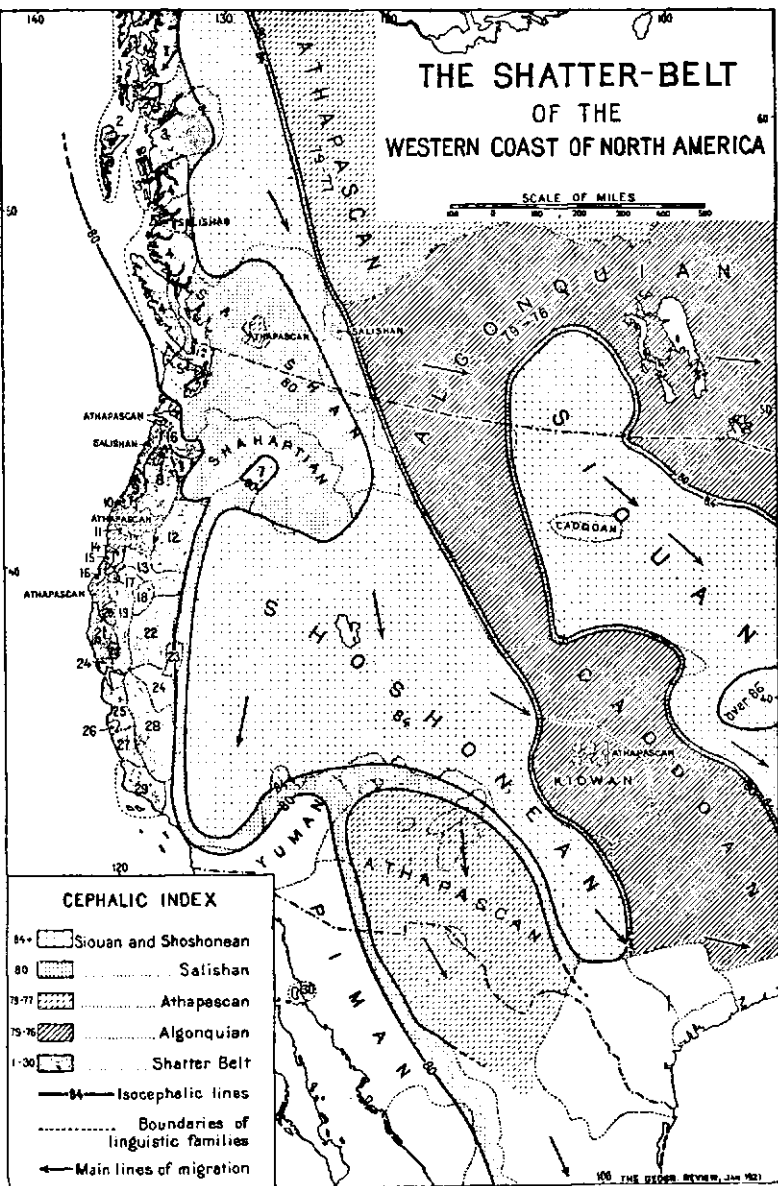


FIG. 61. Ethnically and linguistically the term 'shatter belt' is applied to a region, marginal to main routes of migration, occupied by a 'mosaic' of tribes. The tribal distribution shown above is from the map by J. W. Powell (revised), accompanying *Indian Population in the United States and Alaska, 1910*, Bureau of the Census, 1915. Notice especially the Athapascan portion of the mosaic separated from the main tribe by the migration of brachycephalic Siouan and Shoshonean along the main corridor (Seri tribe = 30). (*Geog. Review*, 1919.)

THE MIGRATION-ZONE THEORY OF RACE EVOLUTION

Section (a). Evidence from the 'Strata'.

Section (b). Mechanics of the Migrations; Keith's Hormone Theory.

Section (c). The Biological Confirmation.

Section (a). Evidence from the 'Strata'.

IN the preceding chapters we have discussed the world-plan and the zoning of the races which inhabit the various continents. The evidence so far accumulated may be summed up in eight propositions and principles somewhat as follows :

- I. The great land-masses consist of a central continent (Asia) with three peninsulas—Eur-Africa, Australasia, and America.
- II. Each 'peninsula' contains zones of peoples, which are more and more primitive as we move away from Asia.
- III. *First Principle of Race Evolution.* The most primitive races are found 'pushed to the periphery', i. e. in Tasmania, Cape Colony, Greenland, and Brazil.
- IV. *Second Principle of Race Evolution.* The last evolved races are found in the centre, where stimuli leading to evolution have been greatest throughout the ages.
- V. *Third Principle of Race Evolution.* Where the racial evolution has progressed farthest the 'buried strata' of more primitive tribes will be most numerous. (This 'buried' evidence includes skeletons, artefacts, place-names, folk-lore, &c.)
- VI. *Fourth Principle of Race Evolution.* The order of evolution is the same, whether we move outwards from the centre of evolution across the zones, or downwards at the centre of evolution through the 'strata'.
- VII. It follows that the primitive races are found alive precisely where they did *not* originate.

VIII. The evidence in Europe, Africa, Southern Asia, and Australasia shows an age-long *centrifugal movement* from Central Asia (Turkestan or thereabouts). American evidence is more complex but of the same kind.

We may, however, examine here further evidence as to the validity of the 'Third Principle' mentioned above. This involves a general study of the 'strata' throughout the world.

In Europe *Neandertal* man is certainly the earliest race of which we have sufficient relics to deduce a fairly abundant population. He is found fairly generally through Southern, Western, and Central Europe. Nowhere else have ethnological investigations been carried on systematically, but the presence of the more or less similar Neandertal or Proto-Australian skulls or skeletons in Rhodesia, China (*vide* Matsumoto¹), Java, and Talgai (Queensland) show that he must have ranged over the whole of the Old World except perhaps the cold northern portions. We may therefore label this race, always associated with early Paleolithic artefacts, as Stratum 1 in our survey of the Old World (see Fig. 62).

Next in order in Europe would seem to be the *Negrito* race, of which more and more evidence is accumulating every year. We may call it Stratum 2. Artefacts of Aurignacian type are commonly associated with this race. We may not agree that similar Aurignacian tools and drawings elsewhere always indicate the presence of a negrito race; but indeed the *living* types are very widely spread peoples, so that they may well have *introduced* this type of culture all over the world. They are often the earliest races, as we may deduce from their invariable position in the inland inaccessible portions or in the marginal islands of the territory which they share with other folk. Their artefacts and drawings have been found in an uninterrupted belt from Europe to Southernmost Africa. Drawings of a similar nature are also found at Raigarh in Central India (*vide* Mitra).

¹ Matsumoto's statement is, however, based on the evidence of a single sacrum, and must be accepted with great reserve. The work of Teilhard and Licent, however, in the Orsos bend of the Hoang Ho suggests that we need not despair of finding Neandertal skulls in this region.

In the map they are seen to be the sole people to have reached Tasmania; they are the lowest stratum all through the East Indies and Melanesia, and also in India. But later research will doubtless find Neandertal man, or even earlier ape-man, in many places where the Negritos now seem to be the earliest peoples.

The third stratum, which also is world wide, and which probably extends to America, is the *Australoid*. It is of course universal through Australia, Indonesia, South-East Asia, and South India. Types akin to the Australian were common in early Paleolithic times in Europe. It is, however, difficult to decide whether some early peoples were more like Australians or Africans (Negro). Indeed one skull from Mugem (Portugal) is described as 'Negroid and Australian'. As regards Australia itself, Dixon comments on the African affinities of the *Northern Australian* aboriginal.

We may label the fourth stratum *Negroid*.¹ These people must have been quite abundant in Europe towards the close of the Paleolithic. Boule quotes their skeletons from Brittany, Switzerland, Liguria, Lombardy, Illyria, and Bulgaria. They are universal through Africa and through Melanesia, while the Botocudo and the Lagoa Santa skulls of East Brazil show where similar folk penetrated to the New World. A Mousterian station near Krasnoiarsk in Siberia, associated with the mammoth, probably shows their presence in North Asia (Boule).²

The Cro-Magnon folk of Upper Paleolithic times belong to an early level in the Iberian stratum (5). Their broad faces and narrow skulls are found in the Canary Isles, in North Africa, and among the Eskimo of Greenland. Many of the earlier Amerinds also probably contain much Cro-Magnon blood, and no doubt many other races—possibly the Yenesei Ostiaks—are kinsfolk.

As regards the main Iberian stratum, it is universal except in those peripheral portions of the world where the more primitive negroid peoples still hold their own. The chief point of interest is that these peoples once occupied almost all the territory which is now Alpine (or held by the allied Mongolian).

¹ Possibly the Negroid developed before the Australoid (see p. 80), but both have strong affinities with the Neandertal type.

² *Human Paleontology*, 1923.

They seem to have been the great megalith-builders, and they carried the late Paleolithic and early Neolithic civilization all over the world. This happened long before the Egyptians settled down to mercantile and city life, in the opinion of the

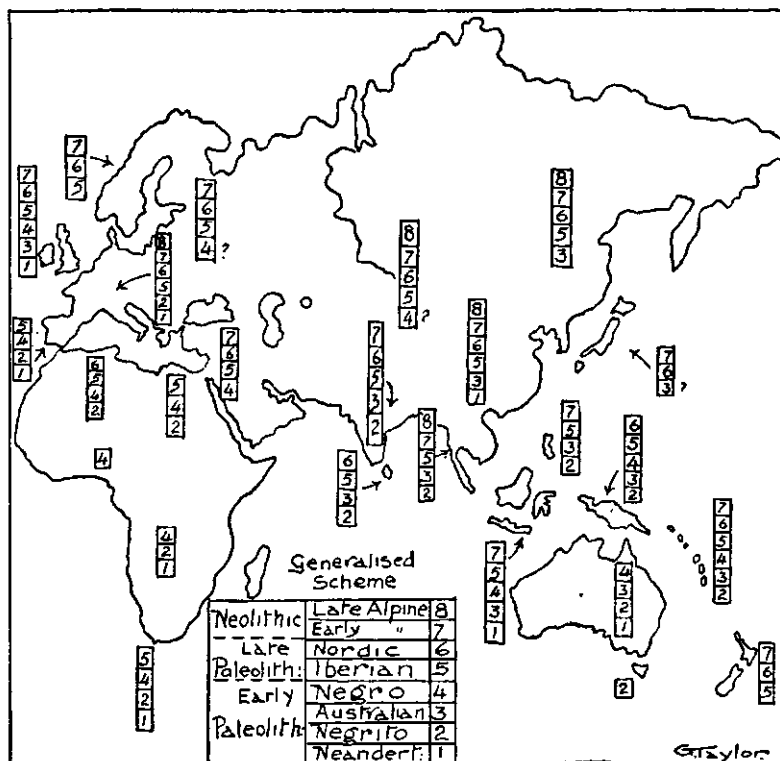


FIG. 62. Racial strata showing order of evolution—generalized. (Stratum 1 is lately reported from Syria and Mongolia.)

writer. Hence we find many features akin to Egyptian culture, which had a common Asiatic ancestry with the latter, but was in no sense directly derived from Egypt.

All through Siberia, Manchuria, and Mongolia are innumerable artefacts, mostly Neolithic; but, as Boule remarks,¹ this culture is here less clearly separated from the Paleolithic than in Europe. This seems to the writer to indicate the *gradual growth* in the original Asiatic homeland of Neolithic civilization,

¹ Ibid.

as opposed to the fairly sharp break found in Europe when Asiatic newcomers brought in the Neolithic culture.

The Nordic stratum which I have labelled (6) is perhaps a specialized upper zone of the Iberian. It occurs typically in North-West Europe, but Proto-Nordic types are found sporadically from Turkestan to Northern Japan. In Bohemia, Russia, Poland, and Germany, the Nordics preceded the Alpine inhabitants of to-day. Using the term 'Nordic' in the widest fashion for fairly tall peoples with a head index about 78, we may assign many of the highest Melanesians and the earliest Polynesians to this stratum. Haddon, however, is inclined to associate his Polynesian type I with the Nesiots, but admits a 'light-skinned, mesorhine, wavy, or straight-haired' element among the Melanesians.

The two latest strata are Alpine or Mongolian. They are the most abundant of living races; but have by no means the widest range in man's history, if we realize that the earlier strata (Nordic and Iberian, &c.) are still represented 'beneath' the Alpine races. Thus near Lake Baikal in the heart of brachycephalic Asia there have been found ancient narrow skulls, and the same is true of the Kurgans (mounds) of Siberia which are certainly Proto-Nordic in type. In fact the overwhelming of 'dokeph' peoples by 'brakeph' invasions is the salient feature of later ethnological history.

The 'ethnological record' as expressed by these strata is very like the geological record. It is very incomplete, but the order of succession is practically the same throughout. We see that the latest stratum (8) only occurs across the centre in the Old World. Here the greatest number of superposed strata will undoubtedly be found when enough ethnologists seriously attack the problem in Central Asia. Just as the geological record incorporates the history of the evolution of life, so the ethnological record must contain the history of racial evolution. I can see no escape from the conclusion that the Alpine-Mongolian is the latest type of man which has been developed from a type not unlike the late Iberian (or Nordic) race of man.

It should be specially noted in Fig. 62 that the connexion between the Negrito and the Alpine people is very remote. If,

as Dixon suggests, Negritoes developed into the Alpines, we should expect to find a zone of broad-headed hybrids between the Negritoes and Alpines. The contrary is the case, the Negritoes (whether broad-headed as in Asia, or comparatively narrow-headed as in Africa) are found as isolated groups among large numbers of dolichocephalic peoples. This is true in southern Australia, in Papua and Melanesia, in the Malay States, in Central Africa, and in South Africa. Hence I think that the simplest explanation is that the ancestors of the Negrito and Neandertal types developed independently from the primitive Catarrhine ape stock, in Pliocene or even Miocene times. They lived side by side in Asia until the immense climatic changes of the Pleistocene greatly quickened evolution. Whether the negro and later races developed in Asia from a Neandertaloid man, as seems probable to the writer, or whether there was a third 'Proto-Cro-Magnon' type must be left to the future to decide.

Section (b). The Mechanism of the Migrations.

It is obvious that any explanation of the causes of the racial migrations must be largely speculative. But such speculations, if based on the scientific truths already accumulated, are often of great value in suggesting the proper lines of attack in further research. In the preceding chapters I have demonstrated a zonal distribution of the four major races of man about Central Asia. These four races are the Negrito, the Negro, the Iberian (or Mediterranean), and the Alpine-Mongolian races.

We must seek, therefore, in the centre of the Old World for some great stimulus competent to produce such remarkable changes as those which distinguish the negro from the northern Chinese or Swiss-Alpine peoples.

It will be well at this point to turn back to the useful parallel furnished in the Evolution of Transport (p. 27). Here the 'zones of vehicles' were arranged around Sydney in a definite order—that of their 'evolution'. So also the strata beneath the centre of origin preserved the same order of evolution in 'fossil' form.

We see then that the zones and strata of the various 'vehicles'

depend on successive migrations from a common centre. At this common centre the brains and commercial enterprise of the community were concentrated, so that here the evolution of transport progressed most rapidly.

What corresponds to the 'enterprise of the metropolitan community' in our fundamental ethnical problem? Surely a great change in the human environment would lead to precisely those zones and strata which we see in the Racial map.

The solution of the problem seems near at hand when we find that in the centre of the Old World we have not only the greatest *range of climate* during the year but also the greatest *variation in climate* during the period of man's life on the earth.

The great Ice Ages in Europe without doubt obtained in Asia also, though, owing to the distance of Central Asia from the sea and the absence of highlands in North Asia, it seems certain that North Asia was not universally covered with Ice Caps such as occurred in North America and North-west Europe. In Europe we find *four* well-marked Ice Ages. In Asia three are reported by Oldham in Kashmir, while two are well marked throughout the mountain areas of the centre and north. It seems probable that *four great advances and retreats of the polar cold*, in accord with the much better known phenomena in the west, may yet be discovered to be the salient features of the environment of early man in Asia.

I have discussed in considerable detail what seems to me a reasonable 'working hypothesis' of racial evolution in 'Evolution of Race and Culture' (*Geographical Review*, 1921), but I will repeat the gist of the thesis here.

In the first place the migrations were probably extremely slow, and were made quite unwittingly by the primitive peoples concerned. They would all be hunters, preying on wild animals or upon wild fruits and grains. With the onset of any Ice Age the forests, steppes, and tundras move slowly but *en masse* to the south. A fall of temperature of twelve degrees Fahrenheit is the maximum effect. This temperature range (by the ordinary ratio explained in any textbook of climatology)¹ is normally equivalent to a journey of some 800 miles toward the

¹ Off China the world isotherms change 1° F. for about 1° of latitude.

Pole. Such a migration of vegetation would perhaps change half the Siberian forest into tundra, and change the whole central Asiatic desert belt into steppe, while much of the southern forest belt would gradually turn into desert.

This is shown in a very generalized form in the annexed sketch (Fig. 63). Primitive man probably developed in Asia on the borders of the warm steppes and woodlands. He would certainly migrate south to what are now tropical regions as all his food-supply moved south before the cold wave. After many thousand years the cold conditions would slowly pass away. The flora and fauna would move back to the north. A large part of the human race would probably go back also; but it seems a logical conclusion that some tribes would remain, in spite of the increasing heat and the changing environment.¹ Here we find the key to the first racial differentiation. Those tribes which remained in the tropic environment *stagnated*. There was no climatic stimulus, and no invigorating change of seasons during all the hundred thousand years of the ensuing interglacial period. In effect primitive man is here preserved right down to modern times.

Meanwhile the tribes migrating northward back to the inland regions would be subjected to a very different environment during the interglacial period. Here the primitive race in the course of one hundred thousand years evolved into a higher race. Another Ice Age commences and the same phenomena are repeated. This second Race (B) migrates south. It probably

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¹ Topographic changes, growth of forests, &c., would tend to isolate unenterprising tribes.

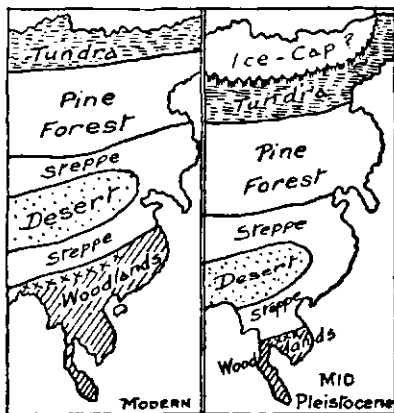


FIG. 63. Hypothetical diagram of East Asia, showing the movement of vegetation belts consequent on about 12 degrees fall in temperature. Crosses show approximately the zone of primitive man

now consists of much larger tribes, which have little difficulty in driving the unprogressive and unchanged portion of Race (A) farther into the tropics, and ultimately into the islands south of Asia (Fig. 64).

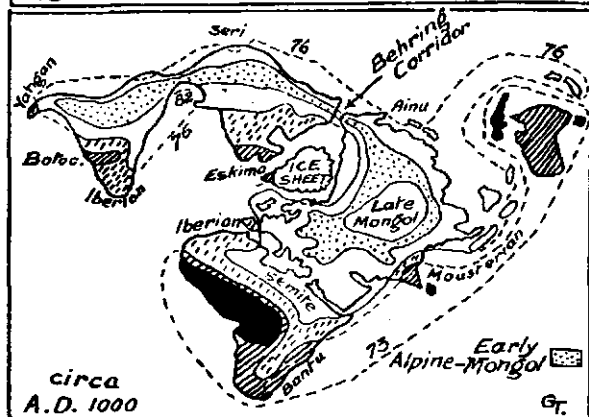
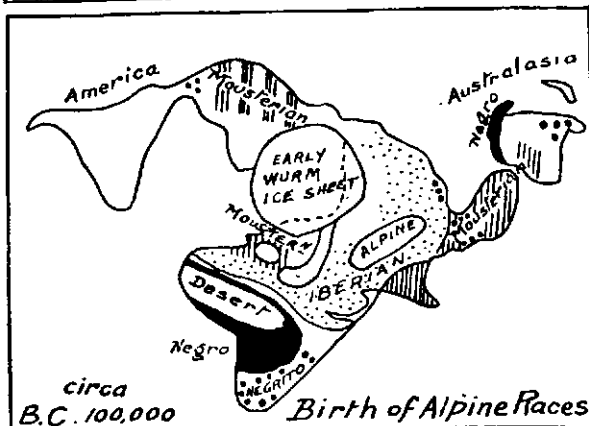
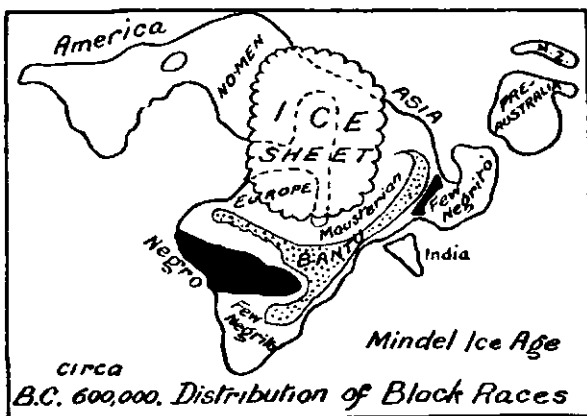
Again the Ice Age passes away, and Race (B) in large part returns, leaving, however, Race (A) and part of Race (B) as stagnant zones to the south of the Asiatic land mass, and so the process goes on.

It is not possible at this stage to correlate the evolution of the four major races with the four great Ice Ages, but the similarity in number is very suggestive; as if four great stimuli had produced four great and cumulative differentiations. But I have not, to date, read any other definite account which purports to explain what determined racial evolution and how the migrations occurred, so that I trust this theory which correlates the accepted facts of zones of peoples with the four climatic thrusts will receive due consideration.

I have discussed in an earlier chapter the relations between European and Asiatic prehistory. If man first appears in Europe in the Second Interglacial (as some authorities suggest) it seems likely that he moved out of Central Asia many millenia earlier, and that he spent the intervening time in crossing Western Asia and Africa. It seems possible that both the negritoes and Neandertal man occupied Asia during the First Ice Age. Perhaps the negritoes migrated as the result of this climatic thrust, and never returned to the 'Region of Maximum Evolution'.

Neandertal (Mousterian) man may have moved out after the Second Ice Age and reached Europe about the time of the Third Ice Age. He was the chief inhabitant of Europe during the Riss-Wurm (or Third) Interglacial. But during this time one may postulate that the allied negroid folk in Asia were evolving into the Iberian peoples (Fig. 65).

The Third Ice Age drove many of the earliest Iberian peoples out of Asia and they appear in Europe, as the Cro-Magnons and their allies, just before the last Ice Age. The fourth climatic thrust is perhaps responsible for the migrations of many later Iberians and of the early Alpine-Mongolians, who appear in



FIGS. 64-66. Generalized maps indicating the outward march of the migrations from Asia. N.B. The Bantu zone may be due to a mingling of races. 'Mousterian' means Australoid. (For intermediate maps see *Geographical Review*, 1921.)

Europe (in Ofnet and elsewhere) in Azilian times after the last Ice Age had passed away. The result of these alternating periods of evolution and migration is that the races of man have become arranged in a series of somewhat complicated zones about Central Asia. This is illustrated in the Frontispiece, and is the basis of the scheme of classification given in the table on p. 43.

Keith's Hormone Theory.

The necessary climatic stimulus acting upon the plastic human organism would thus seem to be discovered. We know that evolution has occurred along the lines indicated by the change from the long-headed, curly-haired, platyrrhine negro to the broad-headed, straight-haired, leptorrhine Alpine. What has been the physiological agent which has moulded man? The research and discussions of Sir Arthur Keith have, I think, indicated the method used by nature.

Sir Arthur Keith¹ points out that many of the criteria used by ethnologists have been definitely proved to be affected by various glands in the body. Of these the chief are the pituitary and pineal glands within the cranium, the thyroid gland in the throat, and the adrenal glands near the kidneys. Abnormal growth of the pituitary glands leads to the development of a large chin, nose, and brow. These features, of course, characterize the Neandertal peoples. Furthermore, in European folk the nose and chin are normally larger than usual in man, perhaps as a result of slight stimulation of the pituitary. The adrenals affect the colour of the skin, and it may be that the original black colour of primitive man has varied in accord with changes in the adrenals.

A poorly developed thyroid leads to stunted growth, to undeveloped nose and hair, and to a flat face. These are characteristic of some of the so-called Mongolian peoples (though not of the most progressive races of Central and East Asia), and it is possible that decrease in thyroid has affected the people of East Asia as a whole.

¹ 'Evolution of Human Races in the Light of the Hormone Theory' (1922), *Johns Hopkins Bulletin*.

So also the Hottentot and Bushman differ from the negro along lines which might be explained in part by deficiency of thyroid.

The adrenal further controls sex characters such as hairiness of the face and body. These are characteristic of European and Australian people, whereas the negro and 'Mongolian' folk are perhaps immature in this respect. It is, however, important to note that Sir Arthur Keith specifically describes the Mongolian race as one of the most recently evolved.

Speaking generally, a rather moist, warm climate probably constituted man's early environment. The change to a moist, cooler climate in the Central Asiatic region may have stimulated one set of glands and hormones¹ and so brought about the changes in facial and bodily form which distinguish the Iberian from the negro. Further changes during the long ages spent by man in the same locality seem to have been in the direction of aridity; this may have affected other glands and hormones, and so developed the stocky, broad-faced, straight-haired Alpine and Mongolian peoples. But this physiological aspect of the problem is one which I am not competent to discuss at all fully. I hope Sir Arthur Keith will follow up his early work.

We must remember that in all probability all these racial traits were determined in the million years spent by the developing stocks in Central Asia. It is the climatic changes *here* which are all-important. Most races (excluding perhaps the negroes and negritoes) spent, shall we say, nine-tenths of their biological life in Asia, and only one-tenth in the habitats where we now find them. It is this which makes references to *present-day* environments as factors in racial evolution and racial status appear of little value to the present writer as regards most races. On the other hand, present-day environment is, of course, the most potent factor in the *material* status of a people.

Section (c). The Biological Confirmation.

All these migrations, and indeed the evolution and differentiation of the races, took place far back in the prehistory of man,

¹ Hormones are chemical substances secreted by the glands which greatly affect human characteristics.

when he was almost entirely controlled by the same natural forces as dominate the brute creation. We should, therefore, expect to see something of the same phenomena in the evolution of the higher mammals. In that most stimulating work, *Climate and Evolution*, W. D. Matthew shows that this is the case. (Indeed, he goes farther and indicates what must be the general principles governing human evolution also.)

We may consider the evidence as regards the evolution of the tapir, rhinoceros, and horse. These all belong to one family of Perissodactyl mammals, and the general trend of evolution is from the tapir to the rhinoceros and thence up to the horse.¹ In our problem it is the distribution, with its illuminating zones and strata, which is of interest. We find that the tapir occurs living in South America and the East Indies. This would almost necessitate two centres of evolution according to the *old theories* of biology; just as some ethnologists, for similar reasons, still suggest these two regions as likely cradle-lands of the human race. The rhinoceros is found in South Africa and in India. In the last geological epoch (Pleistocene) the rhinoceros lived in North America also (Fig. 67).

The natural habitat of the horse includes the centres of the Old World and North America. In common with many high types of animal the horse vanished from America in late Tertiary times, perhaps owing to diseases due to trypanosomes.

We have here, therefore, three zones arranged about Asia in the order of evolution. The fossil evidence in the Old World shows the horse stratum over the fossil rhinoceros stratum and the fossil tapir stratum below both. If for the horse we substitute Alpine man, who has much the same habitat, and for the tapir, in the outer portions of the earth, the negro, we see that the analogy is so complete as to be almost uncontrovertible that the Alpine-Mongolian type is a higher form than the Iberian, but is probably descended from some type akin to the Iberian.

The biological evidence is also very suggestive as to the birth-

¹ For example, in the forefoot the tapir has *four* of the original five toes, the rhinoceros *three*, and the horse only *one*. The latter evolved in response to the changing environment (which no longer suited the jungle-loving rhinoceros) from a *more plastic* intermediate form.

place of man. We find in Tertiary times considerable evidence of a change of climate. In early Tertiary times there was a fairly *uniform* warm climate in mid-latitudes in the Old World. This was no doubt partly due to considerable changes in the earth's eccentricity, and in the inclination of the axis. I have discussed it in some detail elsewhere.¹ Then the climates become more *zonal*, as they are to-day, with the poles becoming colder (and possibly the Equator somewhat hotter) than in mid-Tertiary times.

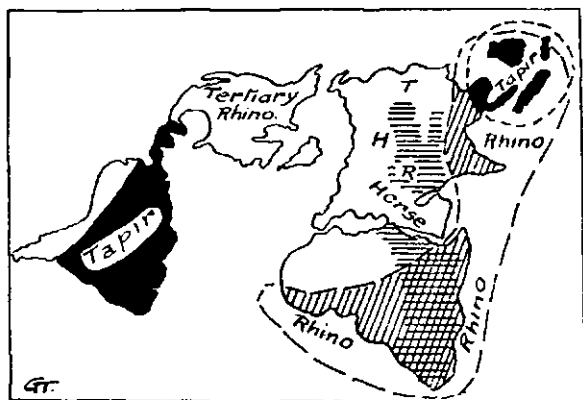


FIG. 67. Three allied mammals are arranged in the order of evolution about the centre of Asia. T, R, and H are the centres of dispersion for Tapir, Rhinoceros, and Horse. From a map by W. D. Matthew.

Eocene monkeys, according to Matthew (*loc. cit.*) occur in Central U.S.A. and in France, which indicates that at that time there were tropical forests such as those in which the lemurs live to-day. In Miocene times the forest belt has shrunk apparently, for the fossil anthropoids are found a little nearer the Equator, in Italy, around the Aegean Sea, and in Persia (see Fig. 68).

When we reach Pliocene times the fossil anthropoids are still farther south, and are found in Northern India and China. This may very well indicate the limit of the forested region of Pliocene times, though it is possible that it was not as hot and

¹ 'Climatic Cycles and Evolution', *Geog. Review*, 1919.

moist there as in the regions where the great apes are found to-day.

However, we are justified in assuming that the region between the Indian Ocean and the Aral Sea (i.e. Persia and Turkestan) was forested country with a moist warm climate. We know that the great plateau of Tibet and the Himalaya Mountains were not fully developed till the end of the Pliocene, and probably Asia in the Pliocene as a whole was much more at sea-level than it is now.

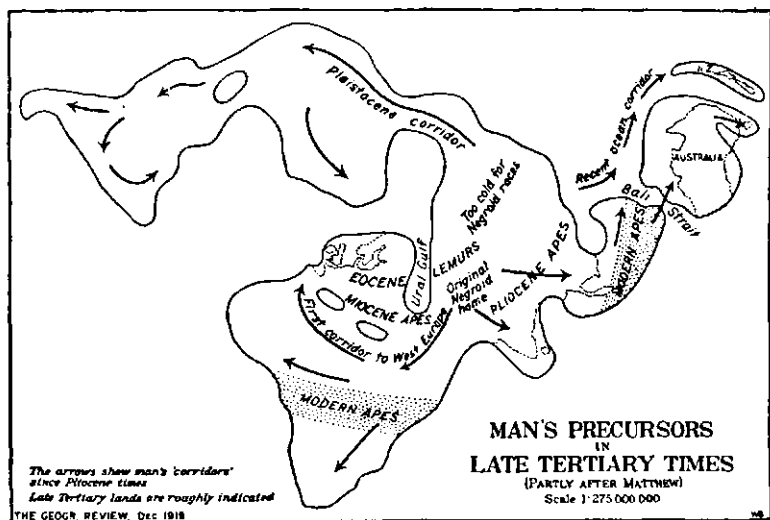


FIG. 68. Generalized map showing the distribution and migration routes of man's precursors in late Tertiary times (based partly on Fig. 7 in W. D. Matthew's *Climate and Evolution*). (*Geographical Review*, 1919.)

The sea-level temperature of Central Persia is about 75° now. If we imagine that the Pliocene temperature was 82° , we find that this agrees well with the temperature of the tropical forest belt. We may, therefore, assume that the apes and pithecanthropoids followed the thick forests as they gradually retreated to the Equator during the cooling of Miocene and Pliocene times. And indeed two monkeys of Miocene times, *Dryopithecus* from the South of France and North India, and the Indian *Sivapithecus*, seem to be nearest to the ancestral line of man.

From the general trend of this argument the location of such 'missing links' as *Pithecanthropus* in Java and *Eoanthropus* in Britain is seen to have not much bearing on the question of the human cradle-land. They are almost certainly examples of the last relics of a bygone type which have been pushed to the margin by later-evolved forms. Such primitive fossil types would be expected to occur on a circle *around* the actual cradle-land (just as the primitive negro and negro people are found on a curved zone *around* the original centre of evolution); but at a very *long distance* therefrom.

Since there are many ethnologists who are opposed to the belief that a changing environment is likely to be a major factor in determining racial evolution, the following remarks by Professor H. S. Jennings, of the Biological Department at Johns Hopkins University, may be quoted. 'It is particularly in connexion with racial questions in man that there has been a great throwing about of false biology. Heredity is stressed as all-powerful, environment as almost powerless—a vicious fallacy not supported by the results of investigation.' (*Prometheus.*)

III

THE PRESENT

**THE WHITE RACE IN THE AUSTRALIAN
ENVIRONMENT**

THE ATTACK ON THE AUSTRALIAN ENVIRONMENT

A. *Coastal Exploration.*

FEW chapters in the history of civilization show so clearly the effect of environment¹ on the white race as does that dealing with the three hundred years of Australian history. We may divide the subject into two parts. The first deals with the discovery and exploration of the new continent. This may be said to extend up to about 1865. The last sixty years have been a period of exploitation, and we are now capable of assessing the resources of the continent, and can now realize where nature is helping settlement and where she is thwarting it. In all other continents racial struggles have greatly complicated the issue, but in Australia there has never been an aboriginal problem of any importance, and there have been no struggles with any European power.

It is Australia's misfortune that, on the whole, her northern and western lands are distinctly unattractive. But it has often been pointed out that this certainly tended to keep Australia isolated from the civilized world until the British occupied it. This is perhaps a matter of congratulation only to the short-sighted. It would have been better for the world to have had a large area of fertile lands, than to have half that area preserved for a white race, which has to struggle for all time against the unfavourable environment of the centre, north, and west. Much may, however, be learnt from the history of the struggle up to the present time. We shall have no better key to future prosperity.

In the present chapter I make extensive use of a paper which I contributed to the Royal Geographical Society in 1914.

Almost the least-known portion of the Australian coast-line is along Cape York Peninsula in the vicinity of Cape Keerweer. Apart from one or two mission stations there is no settlement to this day, and the charts still show by broken lines the

¹ The effect so far is mainly economic, the racial change being barely perceptible. However, Hrdlicka's recent work on the evolution of an 'American type' should be consulted.

—are beneficially affected by the constant Trade Winds or by the rain-bearing systems known as the east-coast cyclones. It is noteworthy that this was a truly scientific expedition, and England has here reaped a rich reward from this but too rare example of her encouragement of science. For it was the authoritative reports of Banks and others which contributed largely to the founding of the first settlement in Australia. Cook reached Cape Everard in Victoria in 1770 and charted the whole east coast northward to Torres Straits. The 'First Fleet'

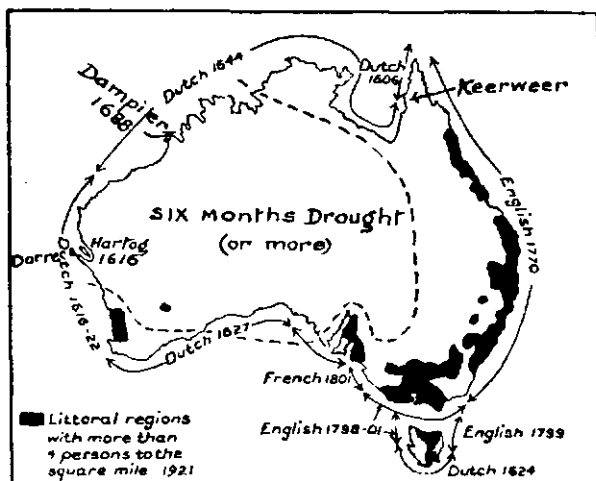


FIG. 69. Relation of coastal exploration to present close settlement.

arrived at Botany Bay in 1788, and local exploring expeditions led by Bass, Flinders, and others had filled in the gaps in the south-east by the end of 1801.

We may pause here to see how present settlement is related to the early discoveries of the coast of Australia. It is interesting to note that some sixty-four of the eighty largest towns in Australia (i. e. those with more than three thousand inhabitants) lie in regions whose coasts were discovered by the English. Of all the littoral explored by the Dutch, from Cape York round westward to the eastern end of the Australian Bight, only the small region of the southwest corner ('Swanland'), is suited to close settlement by people of our race.

B. Inland Exploration.

Largely as the result of a scientific report by Sir Joseph Banks, the vicinity of Port Jackson was chosen as the site of the first settlement in 1788. Here is a splendid harbour, but some other desirable attributes of a great city are unfortunately not present. The littoral here consists largely of a Triassic sandstone, very useful for building, but poor in plant foods. Further, most of the hinterland within one hundred miles has been elevated to varying degrees up to 4,000 ft. Profound 'dissection' of all the valleys has resulted, so that communication is extremely difficult.¹

Sydney is a city of nearly one million people. Yet at a radius of fifty miles there is a belt of country almost as uninhabited as in 1788, which shuts in the capital on all sides except for very narrow belts along the four railway lines. This very rugged hinterland to the west was not crossed for twenty-five years, when Evans reached the western slopes near Bathurst.

From the point of view of exploration we may divide Australia into a series of belts, more or less meridional in the east, but becoming concentric about the arid centre in the west (Fig. 70).

The first of these belts extends along the east and south-east coast. It is characterized by a series of very late Tertiary or post-Tertiary faults and folds, which have given rise to the eastern highlands. Great scarps and deep gorges are characteristic of this region on its coastal side, from Cooktown almost to Adelaide. Fault blocks have been identified throughout. Eleven of these arranged side by side seem to constitute the Victorian Highlands. Others determine Lake George and the Murrumbidgee Valley. Other fault valleys probably account for the 'Cassilis Gate', the low gap behind Newcastle. Far to the north the Atherton Tableland is another such fault block.

The early exploration is naturally concerned primarily with this difficult topography. Oxley in 1817-18 explored the central-western slopes and then crossed back to the sea over the New England Plateau. Hamilton Hume pushed to the south-west in 1824 and, crossing the fault blocks, reached the site of

¹ See the author's paper, 'Warps of the Sydney Littoral', Roy. Soc. of N.S.W., 1923.

Melbourne. Cunningham in 1827 marched north and, keeping along the less precipitous western slopes, crossed the Darling Downs Plateau and reached the site of Brisbane.

The next belt lies to the west of the highlands, and is characterized by vast plains with rivers draining in the wet season to Lake Eyre or into Encounter Bay (see Figs. 70 and 71).

In 1829 many rivers had been discovered, all flowing to the west. No large estuary had been observed anywhere round Australia which seemed adequate as an outlet for all this water. We can understand, therefore, that there was a general belief in a large inland sea. Thus we find Wentworth writing of this unknown portion of the Macquarie river: 'If it should be found to empty itself into the ocean on the north-west coast, which is the only part of the vast island which has not been accurately surveyed, in what mighty conception of the future power and greatness of this colony may we not reasonably indulge? . . . Its course cannot be less than five to six thousand miles.'¹

It is probable that the Macquarie's course was actually determined by a huge mediterranean sea to the west. In Cretaceous times such a sea occupied East-Central Australia. The Bogan, Macquarie, Namoi, Gwydir, Macintyre, and Condamine all head to the north-west instead of to the south-west (to which they ultimately drain).

Later all this area became dry land, and a region of subsidence developed in the south-west at Lake Eyre and all round the lower Murray.

Probably the Lake Eyre drainage scheme reproduces the early post-Cretaceous systems, but the rivers in the south-east were later deflected to the large Murray Sea. The east-coast rivers have all been greatly affected by late or post-Tertiary capture. Most of them originally flowed to the west, and have been captured by younger obsequent rivers which drain the faulted coastal slopes.

Mitchell and Sturt cleared up the mystery of the drainage of South-east Australia in the period 1830-6, and showed its general resemblance to the Nile Basin. The Murray rises in well-watered regions, and receives many tributaries in its upper course, some of which are fed with melting snow for a large part of the year. It gradually enters a region of lower rainfall (15 in. at Echuca, 12 at Wentworth, 10 at Morgan); and after the entry of the Murrumbidgee it only receives one tributary (the Darling) in the whole lower 800 miles.

¹ See the graphic account given by Favenc in *The History of Australian Exploration*, to which I acknowledge my indebtedness for much of my chronology.

The south-eastern highlands of Australia were explored by McMillan and Count Strzelecki about 1840; while the South Australian region of similar 'blocks and folds' was first crossed a little earlier by Eyre and other explorers.

The northern portion of the western slopes, and much similar country along the northern littoral, was opened up by Leichhardt and Mitchell between 1844 and 1848.

The remaining portion of Australia for the most part defied early exploration for three reasons. Firstly, sheer lack of water in the drier parts; secondly, marked unreliability of rainfall throughout; and thirdly, the special surface conditions of the sand-ridges of West and South Australia.

In 1844 Sturt made his gallant attempt on what is probably the least attractive portion of Australia. It certainly has the lowest rainfall, for near Lake Gregory this is only 5 in. per annum. He left Adelaide and marched up the Murray and Darling to Menindie. Then he turned to the north-west and passed close to Broken Hill. He carried his boat—to traverse the hypothetical inland sea—to Depot Glen near Mount Poole. Here died Poole, one of the party, and here Sturt was held up for six months until one of the rare tropical-trough rains (the only source of rain in these regions) fell in June 1844.

He discovered the 'gibber' plains (Sturt's Stony Desert) between the Barcoo and the Diamantina. These 'gibbers' are jasper-like fragments of the disintegrating Cretaceous cover of the Great Artesian Basin. He reached the real desert sand-ridge country, and in fact penetrated the true home of King Drought.

To the south—on the Strzelecki,¹ which Sturt explored—was built in later years Birkett's wool-shed, and for some years twenty thousand sheep were shorn at a time. But in 1916, owing largely to continued bad seasons, it had reverted to its former deserted state. The variability of the rainfall is as important a factor in exploration and settlement as the annual average, and has led to more disappointment and financial loss than any other of our disabilities.

In 1859 Stuart attacked the central regions of the continent, considerably to the west of Sturt's explorations. He was

¹ A rarely flowing creek 150 miles east of Lake Eyre.

fortunate in 'coasting' the edge of the Great Artesian Basin where its overflow appears in the form of numerous mound springs—as at Marree, Coward, &c. Thence he entered a region which in a wet season is watered for a short time by the flowing streams of the Finke. A large area of very ancient rocks rises

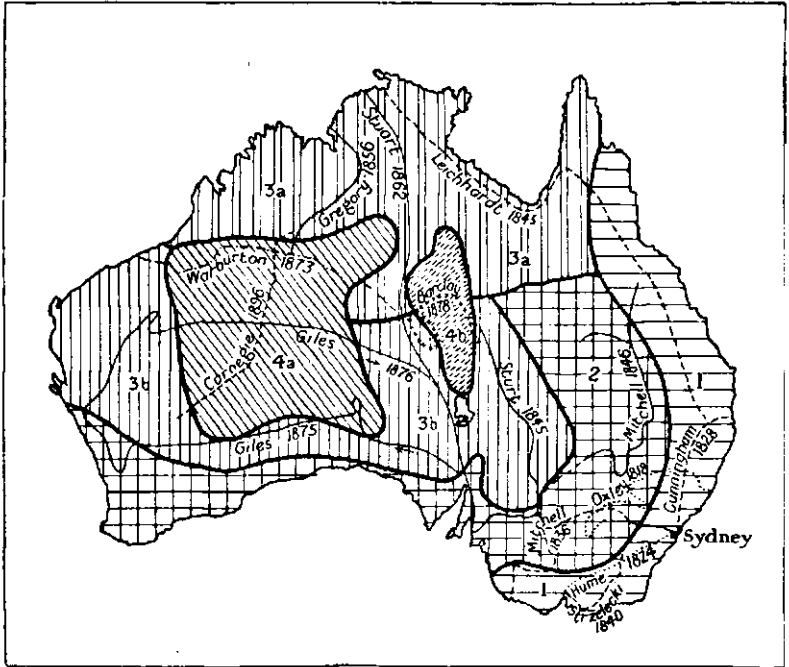


FIG. 70. Exploration of Australia in relation to environment.
(Generalized map.)

Belt 1. Region of very late Tertiary Folds and Faults (Cunningham, Strzelecki). Belt 2. Western Drainage (Oxley, Mitchell). Belt 3a. Unreliable rainfall (over 10 in.) (Stuart). Belt 3b. Unreliable rainfall (under 10 in.) (Sturt). Belt 4a. Great sand-ridge region (Warburton, Carnegie, Giles). Belt 4b. Arunta sand-ridge region (Barclay).

high above the sand-ridge regions to west and east, constituting the Macdonnell Ranges. Here are rocky pools, and relics of a happier environment in the past in the shape of Palm Valley with its eighty *Livistonas*. To the north the mulga (acacia) scrub defied him on two expeditions. But he reached the northern sea on his third attempt on 24 July 1862. His track is closely followed by the Overland Telegraph, which passes through

country suitable for sparse pastoral settlement most of the way. Unfortunately, both east and west of the telegraph line the country deteriorates, and a large stretch of 450 miles from Alice Springs north to Newcastle Waters is of very little value even for sparse stock.

By 1862 the whole of Australia was fairly well known—except for a solid block in the west, bounded approximately by lines from Broome (West Australia), south to the Bight, east to Lake Eyre, and north along the Overland Telegraph to Victoria river in Northern Territory. The Fitzroy and Sturt rivers had been traversed—but elsewhere this region was *terra incognita*. The primary control here is sheer lack of water. With an evaporation of over 100 in. per annum, a rainfall of 10 in. is not of much consequence. Worst of all, however, is the *uncertainty* of the rainfall. In the following table I give the rainfall in *two successive years* for a number of places around the region which last defied exploration :

VARIABILITY IN AUSTRALIAN RAINFALL (SUCCESSIVE YEARS).

<i>Place.</i>	<i>Average annual rain (inches).</i>	<i>Year.</i>	<i>Total in inches.</i>	<i>Monthly totals (inches).</i>
Barrow Creek (N.T.) .	12.1	1904	38.9	Mar. 13.42
		1905	3.8	„ 0.48
Alexandra (N.T.) (Barkly Tableland)	15.1	1902	5.7	„ 0.1 Dec. 1.6
		1903	34.0	„ 18.6 „ 10.7
Borraloola (N.T.) (near the Gulf)	28.0	1899	46.9	Jan. 12.9 Mar. 29.1
		1900	9.1	„ 4.9 „ 0.5
Wiluna (W.A.) . .	10.4	1900	28.0	Apr. 20.8
		1901	7.7	„ 0
Nullagine (W.A.) . .	12.7	1911	6.9	Mar. 0
		1912	18.3	„ 10.1
Onslow (W.A.) . .	9.0	1900	27.0	Apr. 11.0 May 10.2
		1901	2.6	„ 0 „ 0.5
Charlotte Waters (S.A.)	5.4	1908	12.3	Mar. 4.9
		1909	2.8	„ 0
Kanowana (S.A.) . .	4.1	1910	8.7	Nov. 0.5 Dec. 0
		1911	13.6	„ 6.0 „ 3.1

We see in the above table the reason why explorers give such contradictory accounts of the same region. After a fall of 10 in.

in a few days, this desert country springs into vitality. Advantage is taken of the unusually full water-holes and native wells to explore the country for pastoral or mineral resources. The explorer comes back filled with enthusiasm for what he has found. It is 'taken up' by some pastoralist, who finds that he may have to wait a dozen years for another similar rain-storm. Meanwhile, the vegetation is eaten off, until nothing

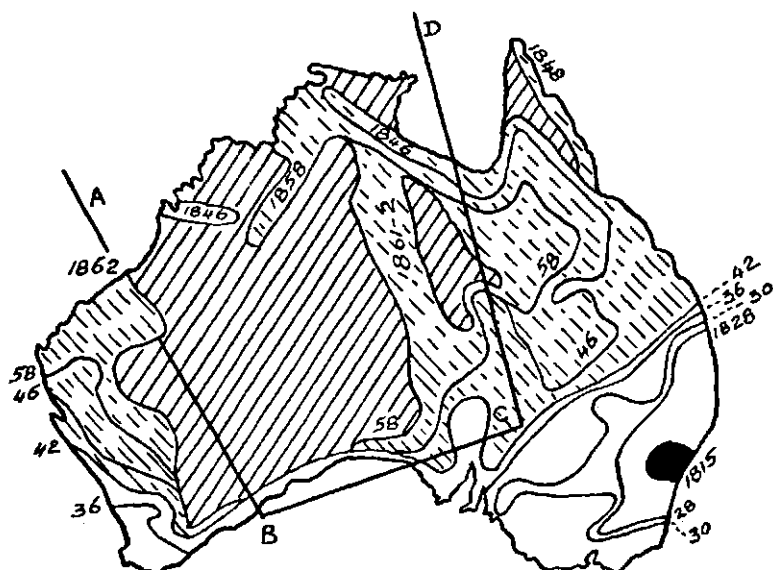


FIG. 71. Exploration Isopleths for Australia (based on K. Cramp). The trapezium ABCD contains only about 9,500 settlers, i.e. less than one-fifth of one per cent. of the population, though it includes 46 per cent. of the area. (Figures '58' &c. mean 1858 &c.)

but the mulga scrub is left. Stock are withdrawn and the region lapses into its old desert condition until the next unusually rainy season happens to arrive.

Obviously, casual visits are of no use in determining the settlement value of such country. Even the total rainfall is misleading—for in such a region with a short record of (say) fifteen years, we cannot tell what its real average rain may be. But we can gauge the *variability* of the rainfall (i.e. with regard to the mean rainfall) with some accuracy—and such a map was drawn by the writer in 1918 (see Fig. 84). As a result one may say

that the only clue to settlement in our arid and highly unreliable inland areas is to consult average total, seasonal, and reliability rainfall maps; and to pay little attention to casual visits by well-meaning politicians or easily misled propagandists.

Since about 1870 exploration has added little to our knowledge of Australia's resources (except in the form of mineral wealth). In 1873-6 the magnificent east-west journeys of Warburton, Forrest, and Giles only served to show how little Australia has to expect from this inner western region. In 1896 two parties under Wells and Carnegie cut across the earlier tracks—going from south to north. All gave the same report of everlasting sand-hills sparsely covered with spinifex grass and scrub and interspersed with mulga flats. Surface or shallow well-water is usually obtainable in small quantities—for much of it probably has a rainfall from 6 to 12 in. a year. But there is only scanty feed for stock in the best of it. The marginal country was taken up thirty years ago—but no pastoralist has ventured to occupy these desert sand-ridge areas. We may rule them out as far as present-day profitable exploitation of Australia's natural resources is concerned.

A recent book with the flamboyant title *Across Unknown Australia* (M. Terry, 1925) merely describes an interesting journey by car from Winton (Q.) to Broome (W.A.). Terry went through Camooweal and Newcastle Waters and so traversed *occupied* cattle-country almost the whole way (i. e. the belt labelled 'Less important cattle' in Fig. 72). I mention this book because it illustrates the non-scientist's usual lack of logic; for he somehow deduces from this journey that 'the sandy desert of the geography book is a myth'.

Early in 1926 Terry made a more ambitious attempt on the real desolate land farther south; but it is reported that his exploration has been abandoned owing to the difficulty in finding water.

XXII

AUSTRALIAN SETTLEMENT AND THE CHANGING POPULATION¹

Section (a). Zones of Settlement.

THE chief aim of these chapters is to focus attention on those portions of Australia which will best repay exploitation, and incidentally to arrive at definite conclusions as to the relative merits of various regions in the continent. To this end I have summarized the various economic characteristics in a map. This represents conditions as they are now, 130 years since the first settlement. It represents the best guide to future developments (see Fig. 72).

We see on the east a belt of land receiving 30 in. of rainfall, which is the zone of *intensive farming*. Here are most of the orchards, dairies, cattle; and, in the north, maize and sugar. But the close farming does not extend west of Cooktown, for the so-called *wet belt* of the north lacks rain for six months or more; and so far this moiety has not been tackled by the farmer.

The next zone (dotted) is the *intense sheep belt* of the south-east. Cattle and dairies occur here also, but in much fewer numbers. This belt is not noticeable in the south-west, but will no doubt develop there later on.

The next belt is the *great wheat belt* of the south, which extends from Geraldton (W. A.) to Roma (Q.). It is important to note that the wheat belt lies in drier country than either the chief cattle or chief sheep country, though this fact is not generally realized.

The *less important sheep belt*, which is fairly broad, extends from Pilbarra (W. A.) round the south and up to Camooweal (Q.) and is interspersed with cattle-country, especially on the drier and hotter margins. More or less continuous with it on the north is the *less important cattle belt* of Australia.

¹ Chapters xxii-xxv are based on portion of my Presidential Address to the Geography Section of the Australasian Association for the Advancement of Science, Wellington, 1923. A bibliography to this part appears at the end of chapter xxv, and the figures in brackets refer to this.

There is now left that great central oblong of desert and semi-desert country whose successful occupation constitutes the great geographical problem of Australia. Its limits extends from Broome to Kalgoorlie, and thence to Broken Hill, to Camooweal, and so back to Broome. The area contains practically 1,000,000 square miles. Until quite lately many people imagined that this central region constituted a great pastoral country. As near as I can ascertain, this huge area supports just over 1 per cent. of our sheep and just about 2 per cent. of our cattle. In other words, out of eighty-eight million head of stock, the arid quota would hardly be missed. I stress this because of its bearing on the problem of opening up the interior. We may subdivide this oblong block into the western useless sand-ridge region, and an eastern portion with wings surrounding the former.

Noting now the distribution of cattle, the immense importance of the dairying industry can hardly be exaggerated. Taking New South Wales as fairly typical of the cattle states, we find that practically half of the total cattle of the state are grazed in the small area of the northern rivers, extending from the Tweed to the Hunter. This is the region of heaviest rainfall.

There is a belt of very much less importance on the tablelands, and only a small proportion in the western plains. Hence as regards the great cattle industry, it is the farmer in the close-settlement regions, and not the cattle-baron of the arid interior, who is contributing by far the greater wealth of the Commonwealth. In Queensland the same thing is true. The great preponderance of cattle is found on the farms of the well-watered coast. The adjoining downs are less important, while the cattle in the lands too dry for agriculture are of very much less importance.

The control by climate is not so obvious in the case of manufactures, and is often quite unimportant in regard to mining. For very many years to come manufacturing in Australia will depend essentially on the presence of coal or of hydro-electric power. The great coal deposits all lie almost entirely along the coast, from Fingal in Tasmania through Morwell in Victoria, the Sydney-Newcastle region in New South Wales, and through Ipswich, Baralaba, and Clermont in Queensland. Without exception these districts would ultimately be closely settled if not a ton of coal were to be obtained, for they lie in the good agricultural regions.

Hydro-electric power is also dependent on a fairly heavy and regular rainfall, so that the chief centres must almost without exception grow up

in this same region of the well-watered east of the continent. Tasmania is in the lead at present, and many notable plants will soon have clustered near Hobart. The Victorian highlands and the New England slopes will soon, it is believed, have their strongly flowing juvenile rivers harnessed to the same end.

As regards metal-mining, many examples of close settlement based upon this industry will spring to mind. But already Australia is seeing the end of several huge mining settlements. Coolgardie and Cobar are

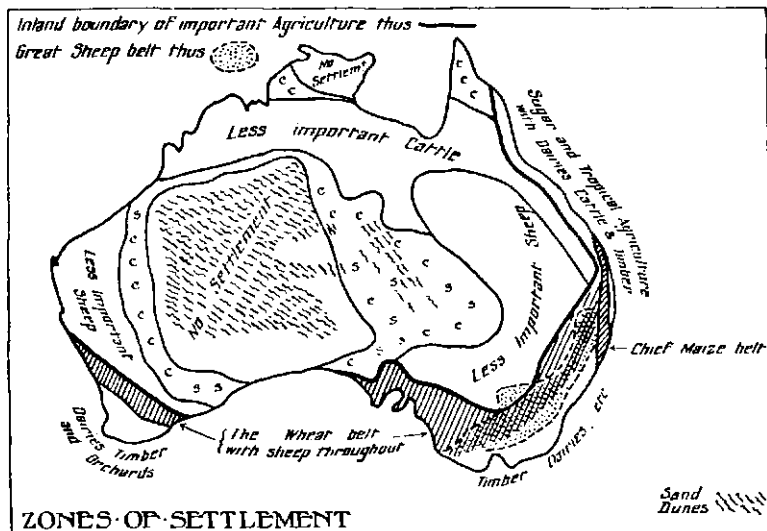


FIG. 72. Present-day zones of settlement in Australia (compare with Fig. 84). Note that the best sheep and cattle belts are in wetter country than the wheat belt. cc and ss indicate sparse Cattle and Sheep.

cases in point. Who can doubt that Kalgoorlie and Broken Hill will follow? They will have played their part in financing growing states, but they are 'robber industries', in the American phrase, and replace nothing where they loot Nature of her treasures. We should therefore hesitate to spend money in mining, if it means starving the agricultural section of the community. For the wise farmer, unlike the miner, leaves the land richer than he finds it.

It has been stated that the discovery of iron at Yampi (north of Derby, W.A.) and of wolfram, gold, and tin in the Territory will bring about close settlement in our empty tropics. I can see no reason why this should be the case. Close settlement is not brought about by folk depending on such a specialized industry. What close settlement is there in Panama as the result of the canal organization? Or in Nauru, or in hundreds of similar rich tropical areas? In general the women and children of the

labouring folk will be found to be left behind in temperate regions. Moreover, my impression is that to a large extent unattached migrants, who have no intention of settling permanently in such tropical lands, form the main bulk of the employees. Tropical meat-works form perhaps the sole exceptions, for they may provide more permanent employment than mining.

On the other hand, the sole asset of Australia which is rarely advertised by our publicists is the great coal belt mentioned previously. Here, indeed, Nature has given us riches which are unique in the Southern Hemisphere. I have shown elsewhere that the Newcastle field is eleventh among the world's coal-fields (6). There are only two other fields of note in the Southern Hemisphere—Transvaal (fourteenth) which is far inland, and Morwell, in Victoria (nineteenth). We may legitimately hope to see a belt of manufacturing towns spring up in the east of our continent; and, in fact, the mushroom growth of the coal-mining districts around Cessnock (near Newcastle) is an indication of what will occur at Morwell, Ipswich, and elsewhere. Indeed, around the Pacific there seem to be no accessible fields comparable with those of Newcastle for amount and quality; though, of course, inland in Shansi (North China) and in Western Canada there are very much larger coalfields. I need not point out how important is this asset of seaboard coalfields in connexion with the question of return tonnage in ocean trade.

Section (b). The Distribution of Population.

It has been pointed out previously that the population of Australia, with the exception of a few mining settlements, is almost wholly determined by the distribution of rainfall and temperature. By far the most interesting problem of the geographer is to discover those regions where settlement will pay most profitably. The key to the future is the immediate past, and hence I propose to dwell for a little upon the map of New South Wales shown herewith.

This does not show the actual population, but the *variation* in population—i. e. where it has grown or decreased. To make the data comparable they are given in percentages. Thus 100 per cent. *increase* means that the population has doubled between 1891 and 1911; while 50 per cent. *decrease* means that the region has lost half its population.

The most interesting isopleth¹ runs from Bourke to Balranald, for here the population has been stationary in spite of all the immigration in these twenty years (in New South Wales, 300,000 in six years, from 1906 to 1911). Generally speaking, in 1911 all the western lands had diminished in population, while all the eastern lands (except a belt from Cassilis to Bombala) had increased in population. We may ignore the three

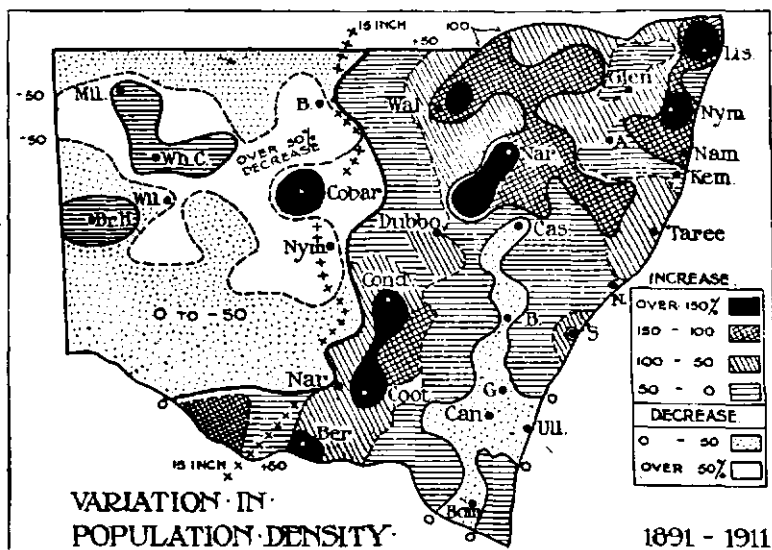


FIG. 73. Regions of increasing and decreasing population in New South Wales. Almost all the region (except three mining towns) below the 15-in.-rainfall line has decreased.

increases in the west around Cobar, Broken Hill, and White Cliffs, for these are based on that uncertain industry, mining. Such purely mining settlements, for reasons already stated, inevitably soon diminish greatly in importance, as indeed has taken place since 1911 in all these places.

The great increases have occurred in two regions. The chief belt extends from Berrigan to Narrabri, and is, of course, the western portion of the best of our wheat belt. The second region is the North Coast dairy and fruit region. Both of these are important agricultural lands, and they furnish the text for

¹ *Isopleth* is a line of equal distribution.

a sermon on close settlement. Left to itself, population grows naturally in agricultural regions; it grows feverishly—unnaturally, one may say—in mining regions; it grows only very slowly in pastoral regions.

It is important to note that the boundary of increasing population is very close to the 15-in.-rainfall line; which is again an important point for our administrators to remember. It would seem evident that the inducements for people to settle in the under-15-in. region were remarkably small in this period of twenty years. We must further remember that conditions become very much worse to the west of New South Wales, in Central and much of West Australia. In face of this, what folly can be greater than talking of the 'vast empty spaces' of Australia, as if they were anything to be thankful for!

The region of decreasing population between Cassilis and Bombala merits investigation. Probably the greater openings in the new wheat belt to the west, or in the metropolis and North Coast, have drawn the younger generation away. The southern part comprises that curious 'rain shadow' region extending from Yass to Bombala (2), while the northern portion largely consists of the rugged western portion of the 'Blue Plateau'.

Turning to the other states, we find that this centrifugal movement from the arid lands is general. We see it in South Australia, in Victoria, and in Queensland. I have not the necessary data for West Australia, while in Northern Territory the following figures speak for themselves as to the progress of settlement:

NORTHERN TERRITORY.

	<i>Inward.</i>	<i>Outward.</i>	<i>Total population</i>
1916 . . .	1,389	1,159	4,666
1917 . . .	1,501	1,370	4,803
1918 . . .	1,259	1,450	4,640
1919 . . .	1,159	1,273	4,547
1920 . . .	606	1,161	3,992
1921 . . .	516	770	3,734
1922 . . .	406	599	3,551
1923 . . .	438	468	3,555

What is the reason for this disconcerting 'drift to the cooler coasts'? I cannot explain it completely, but two factors in the

movement may be briefly discussed. I think it probable that in the earlier days of settlement the pioneers were quite unacquainted with an arid environment. They, therefore, pushed out boldly into the out-back country and attempted to make a living under conditions which were too difficult for the man with small means. I fancy that the courage of the earlier pioneers in some of our more arid regions really was the 'valour of ignorance'. There are not many regions (see the later section on 'Homoclimes') with a rainfall of little more than 10 in., an evaporation of 100 in., and an average summer temperature of 80°, where white settlers have made their homes; yet these are the conditions along the Darling. During this last decade the folk most concerned are realizing that they can do better in more attractive portions of the state.

A second suggestion, which I put forward with some diffidence, is that there is some evidence that the seasons have become rather less favourable during the last few decades. I have drawn up the graph given herewith where the dry periods (estimated in months with less than $\frac{1}{2}$ in. of rain) for the last fifty years are shown.

If we consider these dry periods at Bourke, they are grouped about 1878, 1889, 1902, and 1914. Furthermore, these unfavourable periods grow longer each decade. Six and seven dry months occurred around 1878, eight months occurred in 1888, seven and eight months around 1902, and eight and nine months around 1914, while ten months' drought was experienced

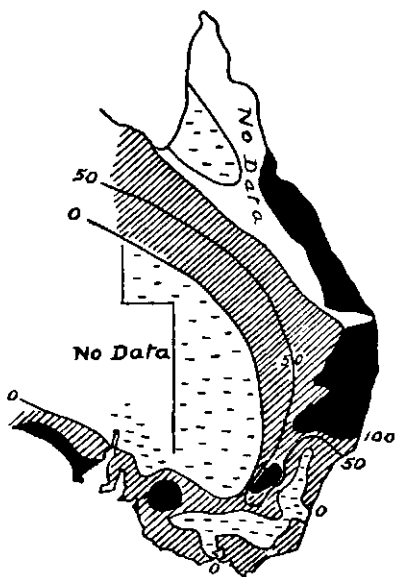


FIG. 74. Movement of population (generalized). Queensland, 1911-22; N.S.W., 1891-1911; Vic. and S.A., 1901-11. Decrease shown by dashes. 0-100 per cent. increase is ruled. Over 100 per cent. is black.

in 1922. Better periods cluster around 1870, 1883, 1894, and 1906. We may generalize, and state that there is a cycle of some dozen years' period shown here, with the amplitude in the cycle increasing continuously. One immediately thinks of the sunspot cycle of eleven years, where the same cycle (but with amplitude *decreasing*) is found. If the two curves be plotted there is some justification for the old idea that maximum sunspots (indicating greater solar energy) mean better seasons and conversely.

Huntington and others believe that there is a larger hundred-years' cycle in the sunspot activity (3). We are now (1924-5) almost at the period of least activity for a century, and we may therefore hope that the seasons will then begin to improve in those lands whose rainfall depends

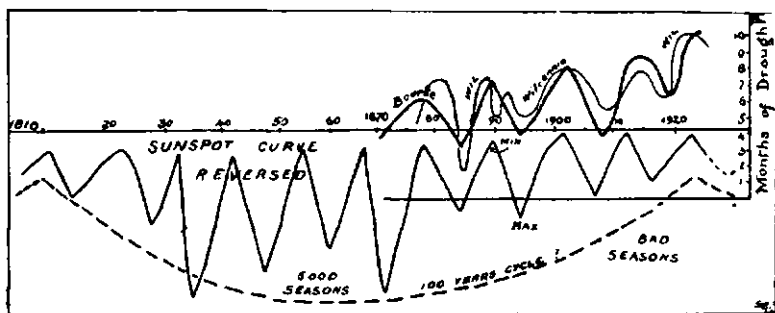


FIG. 75. Smoothed graphs showing the increasing dry seasons at Bourke and Wilcannia. A correlation with the sunspot cycle (curve reversed) seems to indicate that the seasons from 1924 will slowly improve until about 1975.

perhaps directly on increased solar activity. I have also elsewhere explained why I think that increase in solar radiation should cause greater movement of the rain belts in Australia (4). The arid region of New South Wales, which lies between the summer and winter rain regions, will naturally benefit greatly when these belts swing a little farther north or south from their average positions, and Bourke and Wilcannia lie precisely here. (A former investigation dealing with Powell's Creek, N.T. (5) did not show the phenomenon, probably because it lies well within the usual tropical rain belt, and not in the debatable land whose supplies depend rather on extra wide swings of the tropical or antarctic rain belt.) The graphs in Fig. 75 have since been corroborated in an official memoir on Weather Periods by Kidson (1925). This shows that the 'desert' country and the east coast have better rainfall when there are few sunspots. The north and south coasts and the inland parts of Queensland and New South Wales have better rainfall with many sunspots. Thus Bourke has a positive correlation of 0.59 and Powell's Creek has a very low negative correlation.

XXIII

HOMOCLIMES OF AUSTRALIA AND FUTURE CROPS

Section (a). Homoclimes of Australia.

I HAVE stressed the point that Australia, after a century of progress, should not be considered a newly opened country, for it is commercially fairly well exploited. Yet there are many older-established countries, and it is the province of the Australian geographer to learn from them how best to develop our Commonwealth. The method of homoclimes enables us to judge what may best be done with our less-developed regions. I have demonstrated a graphical method of comparing *similar climatic regions* in several earlier papers (7), but some of the results may be discussed here. The following table shows some of the homoclimes of our tropical regions. Thus Banana is the homoclime of Broome, and Durban of Brisbane.

AUSTRALIAN HOMOCLIMES

Australian locality.	Average temperature.			Total rainfall.	Rain:			Foreign locality.	Average temperature.			Rain:		
	Hottest month.	Coldest month.	in.		Wettest month.	Driest month.	Hottest month.		Coldest month.	Total rainfall.	Wettest month.	Driest month.		
Broome .	78.9	85.9	70.3	23	6	0	Banana (R. Congo)	77.9	81.5	72.5	29	6	0	
Nullagine	79.8	85.9	70.3	23	3	0	Collma (Mexico)	76.1	80.0	69.6	34	7	0	
Carnarvon	71.0	80.0	60.0	9	3	0	Olukonda (S.W. Africa)	72.0	77.0	51.0	19	5	0	
Wiluna .	70.0	85.0	52.0	10	2	0	Windhoek (S.W. Africa)	67.0	74.0	56.0	15	4	0	
Darwin .	83.0	84.0	77.0	62	15	1	Cuttack (E. of India)	80.0	87.0	70.0	55	12	0	
Daly Waters	80.0	87.0	60.0	27	6	0	Quixeramobim (Brazil)	81.0	83.0	79.0	27	6	0	
Alice Springs	70.0	84.0	53.0	11	2	0	Biskra (Algeria)	69.0	89.0	51.0	10	1	0	
Townsville	78.0	82.0	66.0	49	11	0	Calcutta	78.0	82.0	65.0	60	12	0	
Wyndham	84.5	88.3	76.2	27	8	0	Tinneveli	84.3	89.5	78.5	28	9	0	
Brisbane .	68.8	77.2	58.0	47	7	2	Durban	70.7	77.0	64.2	42	6	1	

In addition we may note that Perth has, among others, homoclimes at Capetown and Athens; Sydney at Wilmington (North Carolina), Monte Video, and Shanghai; Melbourne at Oporto (Portugal) and Valparaiso; Launceston at Falmouth (Cornwall) and Ancud (South Chile (8)) (see Fig. 89).

We need not here dwell on the economic possibilities of our cooler coast lands—no one doubts them. But there is a voluble

section of the community which believes that there is something much less unpleasant than usual about the tropical portions of Australia. A graphic way of bringing home to such folk the tropical character of much of Australia is to use the methods of comparison and superposition.

There is, I fear, no denying that the regions most akin in climate to tropical Australia as a whole are to be found in Northern Africa or Southern India. I cannot sufficiently stress the folly of those who, without adequate correlative knowledge, try to make forecasts of the development of Australia's *empty* lands from what has been done in the United States of America. A glance at Fig. 76 shows that we can only compare the United States with the southern *third* of Australia. The wonderful irrigation schemes of the United States are strictly comparable only with our own irrigation schemes of the Murray basin. They tell us nothing as to the development of the two-thirds of our empty spaces—e. g. the regions north of 30° S. latitude.

The most salient feature is the remarkable relation between the population and the rainfall. In the days of the great development of the United States (i. e. to 1900) the 20-in.-rain line very closely bounded the closer-settlement country. So also we must expect our closer settlement for many years to be controlled by this boundary. I have indicated the Australian temperate lands with 20-in. rainfall in the map, and it will be seen that we cannot expect more than about one-fifth of the population of the United States, as I have always maintained. Still, this gives us fifteen million more settlers¹ before we reach a saturation corresponding to that of the United States to-day.

Leaving temperate Australia, let us try to find homoclimes for tropical Australia. In earlier papers I have shown that we may compare our desert lands with the Scinde (or Thar) desert in India, while our hot, dry savannas and hot, moist coasts agree fairly with the peninsular portion of India (9). Unfortunately, tropical Australia is both drier and less elevated than tropical India. A more useful comparison can be made by placing Australia over Northern Africa (Fig. 77). This is

¹ Such research shows clearly that the future *noteworthy* population of Australia will inhabit the regions already *moderately* settled.

a most convincing demonstration of the fact that our arid interior is exactly comparable in position and origin with the desert of Sahara. I shall dwell on the differences in area and aridity in a later section. We see in Fig. 77 that the southern coasts of Australia agree with the regions of Algeria and Morocco, and these are all Mediterranean in climate and resources ; while Tasmania lies over part of France.

There is the closest similarity in the width and position of the steppe lands on each side of the most arid region in both continents. The north-south extent of the desert of Sahara and of the Australian desert agree. Of course the great east-

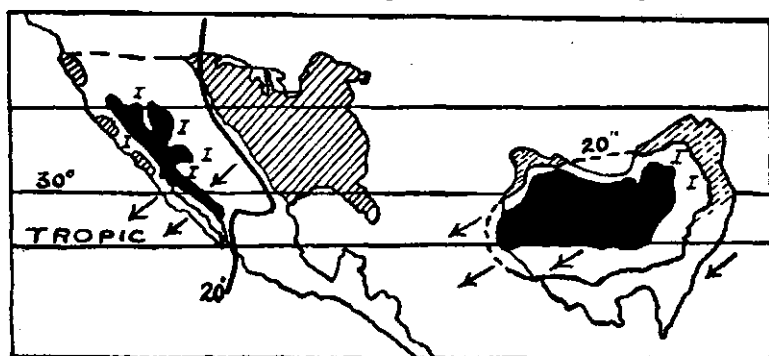


FIG. 76. Rainfall in United States and Australia (generalized). The ruled area in Eastern U.S.A. shows how closer settlement in 1900 stopped at the 20-in.-rainfall line. I I = irrigation.

west width of the Sahara is due to the presence of the huge land-mass of South Asia which lies to the east of Africa. If Australia were as wide along the tropic our desert might equal the Sahara in area and aridity (see also p. 20).

On the equatorial side we find that the savannas of Nigeria are homoclimes of those in Northern Territory. Here also rainfall and elevation are remarkably alike, but the inland African region is slightly hotter. On the other hand, it is watered by larger rivers than is Northern Territory.

It is important to note that some cotton-growing is carried on in Nigeria, and, as I show later, we may yet see cotton-fields in the Territory. Sorghum (and other millets) and tapioca (manioc) and groundnuts are largely grown also. While Darwin is not a particularly unhealthy place, it is significant that its

homoclime is the Bight of Benin, 'where few come out, though many go in'. But no doubt the absence of blacks and the rarity of tropical diseases, combined with the open coast-line of Darwin, make Benin a less close homoclime than the following table would indicate :

	<i>Temperature.</i>			<i>Rain.</i>		
	<i>Average.</i>	<i>Hottest.</i>	<i>Coolest.</i>	<i>Total.</i>	<i>Wettest.</i>	<i>Driest.</i>
	°F.	°F.	°F.	in.	in.	in.
Darwin (N.T.) .	82·7	84	77	62	15	1
Lagos (Benin) .	79	82	75·5	72	18	1

(As the table elsewhere shows for Sierra Leone, the wet bulb at Lagos may be unusually high. I have no data on this point.)

Section (b). Future Crops.

A geographer would find a visit to Eastern Queensland very interesting about this time. In that state we may observe the birth of a new industry. Without sharing the extravagant beliefs of some writers, I feel that Australian cotton may be one of our staple crops in the future. This new industry offers a problem in comparative climatology which illustrates how a new environment should be studied, so that I propose to dwell upon it in some detail (18).

The chief physical factors determining the successful location of cotton are temperature, rainfall, and soil. Satisfactory labour is, no doubt, as essential for successful production, but that will not be dealt with in this chapter. There is, of course, no doubt that cotton can be grown successfully in Queensland, for crops were produced there half a century ago. But the present inquiry is rather to discover where are the best regions in Australia for cotton-culture. The most satisfactory way appears to be to study in some detail the climates of the great cotton regions of the world, and then to find out where we have analogous regions (or 'homoclimes', as I named them some years ago). Recent statistics show that about 60 per cent. of the world's cotton comes from the United States of America, and 13 per cent. from India, so that these two countries include about three-fourths of the whole (Fig. 78). Let us consider the United States first. The cotton belt is very well

defined, and extends from Texas to North Carolina. It is of interest that the best homoclime of Sydney in North America is Wilmington, in North Carolina. The drier limit of the cotton belt is determined by a rainfall of 28 in., but almost the whole is grown with a rainfall *exceeding 40 in.* a year. The belt lies between the average annual temperature lines of 60° and 70° F.

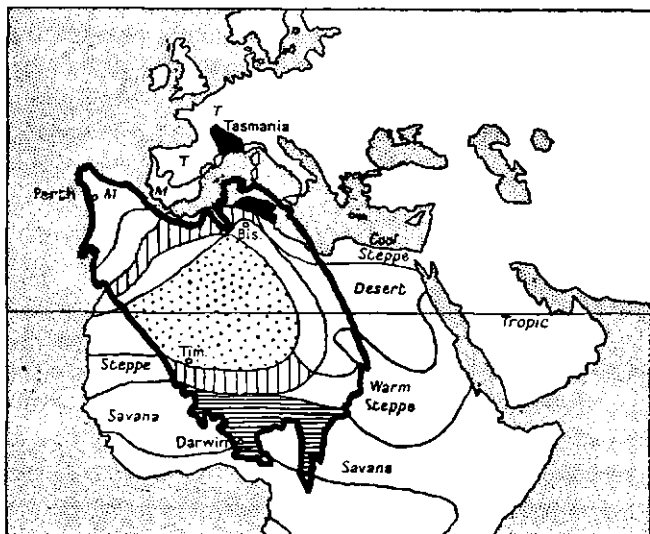


FIG. 77. Australia superimposed over North Africa, and showing the close resemblance in vegetation zones.

Where now in Australia do these conditions occur? We have only a narrow belt which is at all similar, and it extends along the coast from about Sydney to Bundaberg, and inland to the eastern slopes of the ranges. I show it approximately by the black area around Brisbane (B) in the figure. The immense east-west extension of the American cotton belt is due largely to the vicinity of the Gulf of Mexico. Australia has a large desert where the United States has a sheet of rain-producing ocean; so that Providence in this respect has been much kinder to the Americans. Further, the soils, as a whole, in the Australian region are unfortunately not as fertile as the rich 'black prairie' of Alabama, the delta of the Mississippi, and the 'black prairie' of Texas; but there is no doubt that large crops of cotton can and will be grown in this fertile but rugged coastal belt, where, moreover, sugar-cane (which likes a somewhat similar habitat) has long been grown extensively.

If now we turn to the world's second great cotton region, we find it is Berar, in Central India. Here conditions are very different from those

in the United States, yet cotton grows almost as well. The rainfall is somewhat lighter, varying from 25 in. to 40 in., but mostly over 30 in. The temperatures are much higher, the yearly average being over 75°. The main crop is shown as a T-shaped area in the map. Here again the map shows the vast area in India, with a rainfall over 20 in., as compared with Australia. The chief feature of the Indian region is the character of the rich soil called *regur*. It is largely due to the breaking down of the enormous flows of basic lava which covers so much of Central India. In Australia we have a large area of land in our tropics with between 30 in. and 40 in. rainfall. It extends across the root of Cape York Peninsula and through the hinterland of Darwin towards the Kimberley highlands. Unfortunately, the Barkly tablelands and the Fitzroy Valley in the Kimberleys, which contain better soils, have somewhat lower rainfall (about 25 in.), and this is very unreliable in the Barkly region (see Fig. 84 at D). The basin of the Victoria river seems to me as hopeful as any portion of the northern littoral. Indeed, I fear that the absence of fertile plains is the great difficulty in our northern hinterlands.¹

It will be noticed on the map, however, that a broad belt of much better country than the homoclime of Berar (which we have just investigated) lies between Cape York Peninsula and Brisbane. Cotton, luckily, flourishes with a wide range of climates, and many varieties will grow well in this intervening belt. Frost and a wet picking-period are very injurious. There is no likelihood of harm from the former anywhere north of Grafton.

The centre of the cotton-planting at present is in the little town of Wowan, near Rockhampton, which has about 33-in. rainfall. A good deal has been planted in the much drier valleys of Capella (24 in.), Emerald, and elsewhere. Although cotton grows here satisfactorily, yet those responsible should surely benefit by experience elsewhere, and make their chief efforts where the rainfall is well over 30 in.

In the United States the cotton is picked in August or later, which is there rather cool and dry. This month corresponds to our February, which is, unfortunately, a hot and rather wet month on our east coast, though conditions improve inland. In India the crop is planted in June, and picked about six months later, during the dry weather. In our northern regions we should therefore plant in November and December, and pick in the cooler dry months of April and May. October is the best month for planting in the south.

¹ The crop has increased from one million pounds weight in 1921 to 24 million pounds in 1925.

In conclusion, we may say that if labour difficulties (including the discomforts of life in our hotter tropical regions) can be overcome—and this is our chief obstacle—we have a continuous belt with suitable climate for cotton from Grafton round to Kimberley. But I know in Australia of no huge areas of fertile soil like the black prairies of the United States or the *regur* of Central India, so that I cannot see Australia rivalling these great producers of the world's cotton. However, so long as the world demands more raw cotton there would seem to be a good future for the industry in North-east Australia.

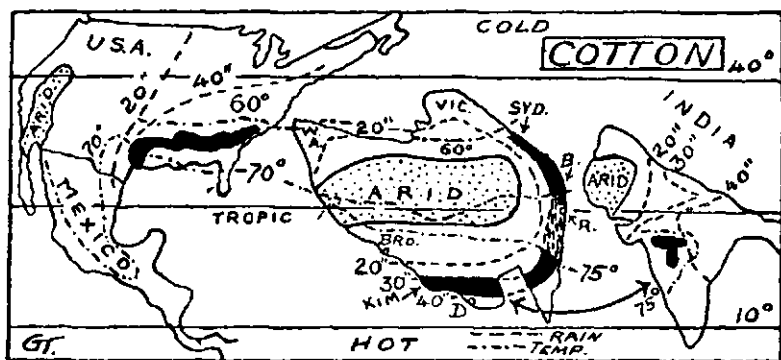


FIG. 78. The climatic belt in Australia suited to cotton extends from Sydney to Kimberley. The U.S.A. homocline is found between Sydney and Brisbane, the Indian homocline from Cairns to Derby (W.A.). (Soils are ignored).

As regards other crops, I have discussed the spread of the wheat belt into tropical lands in several publications (19). In 1915 I pointed out that Indian and Texan wheats grew under climatic conditions resembling those between Mackay and Charleville (19 B).

With regard to the *inner* (dry) boundary of the wheat belt, I have yet to be shown any region with a *total annual rainfall of less than 10 in.* where wheat is grown profitably. Many writers confuse this isohyet with the 10 in. *winter-rain* line, a very different matter. They also ignore the 6 in. or 8 in. preserved in the fallowed ground from the preceding year when they quote small rainfalls during the growing season.

Tea, coffee, and rice are considered in my paper on 'Geographical Factors controlling the Settlement of Tropical Australia' (*Geog. Soc. Brisbane, 1917*). Millet seems likely to be a valuable crop in inland Queensland.

In my journey through tropical West Australia I found no agriculture. In Northern Territory I know of only one recent crop, i. e. ground-nuts (largely produced by aboriginal help), which is noteworthy.

TROPICAL SETTLEMENT BY THE WHITE RACE IN AUSTRALIA ¹

It must be admitted by all students of our tropical regions that we must be cautious in drawing conclusions based entirely upon the number and condition of present settlers. There are approximately only 180,000 people north of the Tropic of Capricorn. These figures should be considered in four groups, distributed somewhat as follows :

A. Rich east coast lands of Queensland	. 100,000
B. Inland Queensland (chiefly in east)	. 70,000
C. Northern Territory . . . . .	. 4,000
D. Tropical West Australia . . . . .	. 5,000

We note firstly that this total is a very small one, about 8 per cent. of the total population inhabiting nearly 40 per cent. of the total area. Furthermore, nearly all the tropical population has clustered along the east coast. Why is this? Not because of better steamer and railway transport, as some would maintain, but because the climatic conditions change entirely to the west of Cooktown. And this is very important, for it indicates quite clearly that the lands fall off in attraction as we leave the *uniform* rain region of the east and enter the *winter-drought* region of the north and north-west (see Fig. 84 B, *postea*).

For many years we have been inundated with literature pointing out the many advantages of tropical Australia. We have been told that it is a region of luxuriant forests, of fertile soils, of flowing rivers, and abundant minerals. It has often been stated that we have no coloured problem, and that tropical diseases are negligible. It is asserted that the elevation of much of the Territory (and I deal in this chapter more particularly with the Territory and Western Queensland) is so great that the temperature is lowered to quite comfortable conditions. We learn that the health statistics show clearly that this region is at least as healthy as the rest of Australia, while the birth- and death-rates are quite satisfactory. Finally,

¹ A detailed description by the writer of the various districts in tropical Australia and the factors controlling settlement will be found in the *American Geographical Review*, 1919, pp. 84-115.

some writers boldly state that we have no 'tropics'—that if the Tropic of Capricorn were reasonable it would move north and take up a position beyond Thursday Island.

Our inquiring student is amazed to find that the white population of the Northern Territory has not progressed in twenty years; and that, as far as close settlement is concerned, the number of bona-fide farmers, after rising to the large figure of ten, has of late dropped to five or less (see p. 254).

I think most folk are very sceptical of all these glowing reports nowadays. And they do well to be incredulous. Rarely has so much misrepresentation appeared about any region of the world. It is very largely unconscious, and is due to the almost absolute lack of any critical or comparative knowledge on the part of those responsible. For the most part they have never seen any other region of a similar type, and one may safely assert that with one or two exceptions they have never studied any comparative climatology, which is the fundamental science concerned.

It has been my special concern for over a dozen years to study this question, and my research may be described as one long period of disillusionment. First, one found that there were no luxuriant forests—there never are where a period of six months' absolute drought occurs. Next, one found that the soils in the coast-lands, where alone the rainfall is abundant, are, as a whole, unusually poor. Many of the rivers in their lower reaches are occupied by the sea in their dry season, though heavy floods sweep down in the summer. The Tropic of Capricorn is, unfortunately, a rational climatic boundary, for our tropical coast-lands are as hot as any tropics in the same latitude, except perhaps the Sahara. There is no region in the same latitudes with such a paucity of elevated land, even the Sahara having wide plateaux, whereas Australia has only the small Atherton tableland. The Macdonnells and other regions over 2,000 ft. are right on the boundary of the tropics (10).

It is therefore evident that there are many geographical factors to be considered in this problem, which have inevitably affected settlers in our tropics, though perhaps they did not realize it. Health, communication, and soil-fertility appeal to every one, but climate, comfort, labour-supply, and markets

are not considered as exhaustively as they should be. Let us study each of these potent factors in turn.

Health. It is gratifying that the vital statistics of tropical Australia show it to rank very favourably among such regions. As I have pointed out, however, the data are few in number, and as regards the *agricultural* regions of the tropics the population considered is only about 100,000. Personally, I fear the value of these figures depends entirely on the character of this small percentage of people. Are they typical of Australia, or do they contain larger numbers of men in the prime of life and fewer invalids, old folk, women, and children than usual? Ellsworth Huntington and Wynne Williams, whom I shall quote later, definitely state that in tropical Queensland the population is a 'picked' one.¹

It is refreshing to find that a few quiet workers are busy with the problems of health in the tropics. Among others are Drs. Breinl and Young, formerly of the Tropical Institute of Townsville. Of especial value are two papers on tropical Australian settlement published in 1919 and 1921 (11). They describe, first of all, results in other parts of the world bearing on the problem. It has been shown that sunstroke is entirely due to heat combined with moisture. The mechanism in the human body, which so wonderfully keeps our temperatures almost constant, fails after prolonged exposure to such conditions. The great importance of the cooling due to perspiration is stressed throughout their articles.

We have here, I think, evidence in favour of the *wet-bulb thermometer* as the best available test of comfort on our tropical coast-lands. It imitates the human body in that it registers the temperature of the mercury as affected by the cooling of a wet linen jacket. Leonard Hill has improved on the ordinary wet-bulb thermometer by greatly enlarging the bulb, and by measuring the rate at which the thermometer cools (under the local conditions) from 110° down to 90°. This closely approximates to the cooling of the human body in the tropics owing to perspiration, &c. Breinl gives many readings, using Hill's katathermometer; and one would like to see this instrument

¹ See statistics at the end of this chapter. A valuable pamphlet by Dr. Cilento has just been issued officially, entitled *The White Man in the Tropics*, Melbourne, 1925. He is, however, more optimistic, I think, than the facts warrant.

much more widely employed. I point out in the next section that Darwin has nine months of high wet bulb, Rockhampton six months, Brisbane two, and Sydney none (not even in February).

It is extremely difficult to detect any marked physical change as a result of living in the tropics. Much of the so-called 'tropical anaemia' is no doubt due to hookworm and similar diseases. One must admit these, however, to be equally unpleasant, though probably they are tropical disabilities which science will render less dangerous in the future.

The chief definite disability resulting from tropical life is found to be *tropical neurasthenia*, which we learn is associated with depression, irritability, loss of mental activity, and power of concentration. As regards the actual health conditions, Dr. Breinl gives figures showing that seven per thousand of the folks on the North Queensland coast have been treated in the hospitals, three per thousand on the central coast, and two and a half per thousand in the Brisbane region. This would seem to argue against the tropics, especially as the hot inland districts show somewhat similar high figures. Dr. Breinl is satisfied, however, that this is due to the northerners having a sort of hospital 'habit', and not to their being more unhealthy. I am not convinced on this point. One would expect that the sparser settlement of the north would be much less able to use hospitals than in the relatively closely settled south. There is no doubt whatever as to the greater number of admissions from typhoid, dengue, alcoholism, and 'damage by violence' in the north-coast regions as compared with those in the south.

In discussing conditions in tropical Australia the eminent geographer, Ellsworth Huntington, makes some pertinent remarks (12). He points out that the proportion of men to women is disproportionately large in much of the tropics (145 to 100). Furthermore, the percentage of men in the prime of life (20 to 40) is 17 higher in Queensland than in England and Wales. Such figures mean we are dealing with a picked population, and that much better than average death-rates should be expected in consequence.

The matter was debated at the recent Medical Congress in 1920, and those qualified to give an opinion were, I understand,

by no means so unanimously in favour of tropical settlement as some reports would lead us to believe.¹ The best verdict to come to as regards the effect, whether good or evil, of the tropics on the health of Australians is the Scotch verdict of 'Not proven'.

Yet, if we get no definite guidance here, there are other ways of studying the effects of the tropics, which speak with no uncertain voice. Thus we may see what the mortality tables show us for the United States of America. I have stated that there is no tropical region in the United States, but the accompanying map given by Huntington (3) shows quite clearly the increase in the mortality in those states which most nearly resemble our tropics. The hot, wet coasts of the Gulf of Mexico are very much less healthy than the cooler states of the north (Fig. 79). This map is based on the returns of three of the largest companies. It includes individuals who are chosen from the better classes of the community, so that negroes and 'poor whites' are largely excluded.

Another suggestive graph by the same distinguished geographer shows that the best mental and physical work is done at temperatures between 30° and 70° F., and that there is a startling deterioration in all work done as the temperature rises above 70° F. The average temperature along the Tropic of Capricorn in Australia is 72° F., so that here we have the clearest evidence of a fundamental disability due to living in our tropics (Fig. 80).

In Fig. 81 I have tried to show graphically the climatic control of the infantile mortality in the chief states of the Commonwealth. Ninety per cent. of the Australian infantile population is here discussed, and I have assumed that the average climatic conditions of the states are those of the state capitals. (Since Knibbs has shown that the *centre of population* in each state is quite close to the capital, this introduces no error of importance.) The method used is that of Huntington (14). The death-rate for a month is plotted on the graph in a position determined by the climate at that period.

The graph indicates clearly—what is borne out by every one's experience—that the death-rate of infants is much higher at high temperatures than at low temperatures. It is of interest that the rainfall does not appear to be so directly related to the mortality as the temperature. The graph seems to show that a moderate summer rainfall is less healthy than a dry summer or a very wet one.

¹ See the report of the Congress in the *Medical Journal of Australia*, Sydney, 18 Sept. 1920, where a number of the grave difficulties are discussed.

Our tropics are remarkably free from the worst tropical diseases. Only malaria and hookworm are important, and we may anticipate their eradication by medical science. Some of my readers will have in mind the history of the Panama Canal. They will know that malaria and yellow fever no longer have the mastery of that tropical region. But it is not generally known how arduous is the struggle to maintain healthy conditions; nor has Panama much hope to give us as to close tropical settlement by true white settlers. I quote here from

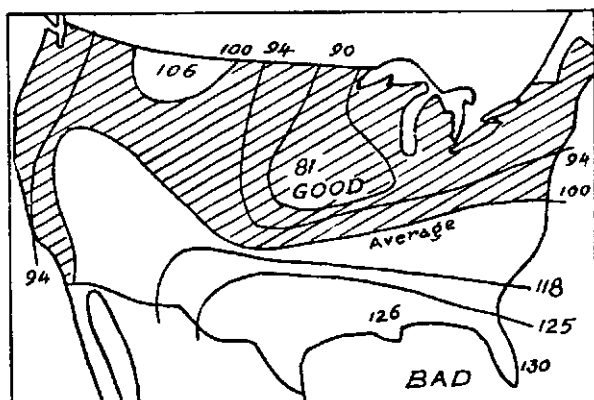


FIG. 79. Mortality and climate in U.S.A. based on three prominent insurance companies. Florida has the worst death-rate, and Nebraska-Iowa the best. (After Huntington).

the account by J. B. Bishop of the climatic and labour difficulties, which seem to me to be akin to those which we must be prepared to meet in our empty tropical lands. Mr. Bishop, who was Secretary of the Isthmian Canal Commission, writes in his book, *The Panama Gateway* (15) :

'Has this expenditure [of some two million dollars] made the isthmus a health resort? In the full sense of the word it has not. It has made it a reasonably healthful place of abode and work . . . only so long as stringent methods of health protection are enforced. Health statistics of the Canal Zone are misleading when used in comparison with like data of communities in the Temperate Zone. . . . In the first place, the American colony is a selected white community; there are no aged and infirm persons to swell the sick- and death-rates. In the second place, the health of the American colony is cared for as that of no other community on earth has ever been. . . . The visitor does not see those who have been

obliged to return to the United States because they could not withstand the climate, and there have been a great many of these.'

Mr. Bishop states that the death-roll among employees from all diseases during the eight years of American occupancy to 1912 was 5,141, including 284 Americans. Forty-nine American women and eighty-seven American children died also. This is a much higher figure than most folk realize; and the mortality during the earlier French régime, which struggled along without any modern knowledge of the diseases which they were combating, was only three times as much, as far as I can learn. There were seven thousand cases in the American hospitals (out of forty thousand employees)

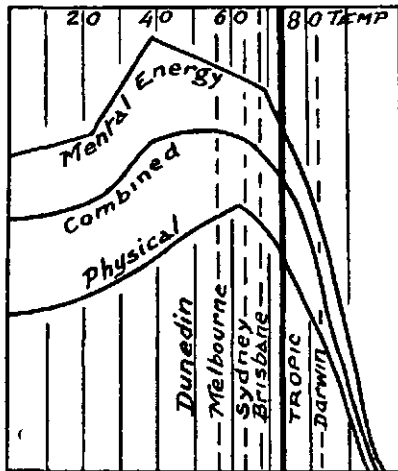


FIG. 80. The temperature control of mental and physical energy (based on Huntington). Note the poor position of tropical places in Australia.

during the year 1911-12; and Bishop adds that every clerk in his office had suffered from malaria, though all of them occupied screened quarters.

We may now pass on to discuss the next factor, that of *comfort*. Personally I believe that an adult male, employed in outdoor work, can live as *healthily* in our tropics as anywhere else. I do not think that this can be said of the women and children, who are even more important in the closer-settlement problem. But it is difficult to get convincing data, as I have stated before. When we come to the somewhat different but vital question of *comfort* there is no room for argument. It seems to me that this factor counts for more than health in this discussion. Admitting for the sake of argument that the

northern lands are as healthy as the southern, it still seems clear to me that few settlers will endure the uncomfortable conditions of the tropics as long as there is room for them in the south. There is only one exception to this rule, and that

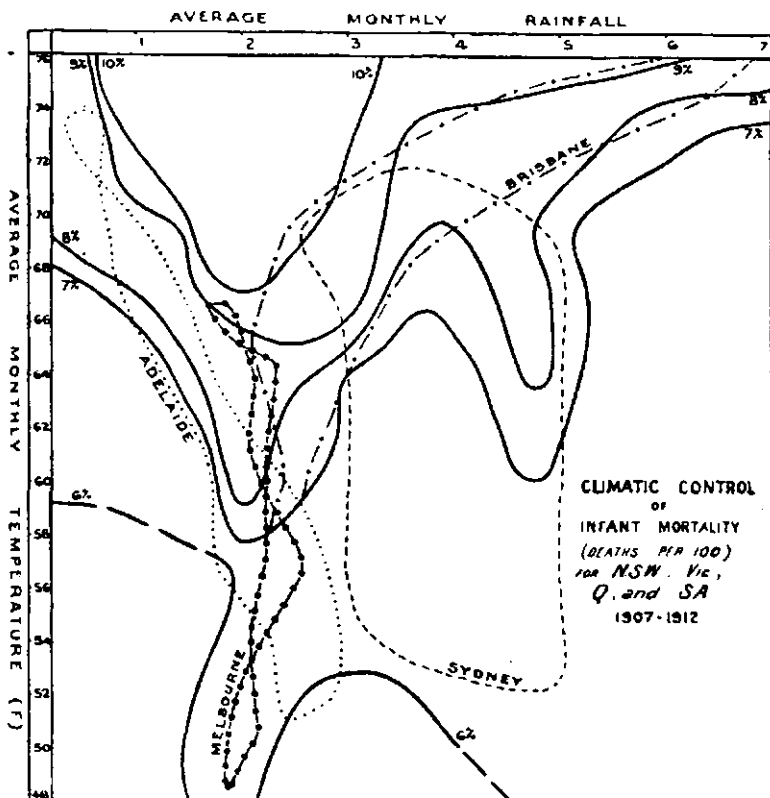


FIG. 81. Infant mortality in Australia. The heavy lines are isopleths which show how the death-rate varies with climate.¹

is where the tropics offer much more profitable economic fields than are open in the south. Let us briefly investigate these two factors, *comfort* and *special economic attractions*.

I have elsewhere discussed fully the best way of clearly showing the discomfort of the tropics, so that I will here only insert the following table, which shows the length of the muggy, uncomfortable periods in some of the chief northern localities

¹ The dotted closed curves are climographs for the chief cities (see references 7 and 31).

(16). Most folk dislike the hot, humid climate of Sydney in February. This is measured by the wet-bulb average of 65° F., so that an average wet-bulb of 70° F. is very much worse than anything experienced in Sydney. Notice the good average position of New York in the warmer months.

NUMBER OF MONTHS OF DISCOMFORT

(Based on Average Monthly Wet-bulb Data).

A.	B.	C.	D.
<i>Very comfortable climate</i> (45° to 55° W.B.).	<i>Sometimes uncomfortable</i> (55° to 65° W.B.).	<i>Often uncomfortable</i> (65° to 75° W.B.).	<i>Almost continuously uncomfortable</i> (over 75° W.B.).
Wellington (N.Z.) 8	Wellington (N.Z.) 4	Batavia . 10	Batavia . 2
Coolgardie . 7	Coolgardie . 5	—	—
Hobart ¹ . 6	Hobart . 3	Thursday Is- land . 6	Thursday Is- land . 6
Melbourne . 6	Melbourne . 6	Darwin . 6	Darwin . 6
San Francisco . 6	San Francisco . 6	Madras . 6	Madras . 6
Alice Springs . 5	Alice Springs . 6	Alice Springs 1	—
Sydney . 5	Sydney . 7	—	Sierra Leone 12
Perth . 5	Perth . 7	—	—
London ¹ . 5	London . 3	—	—
Cairo . 4	Cairo . 3	Cairo . 5	—
New York ¹ . 4	New York . 3	—	—
Brisbane . 3	Brisbane . 4	Brisbane . 5	—
—	Calcutta . 3	Calcutta . 3	Calcutta . 6
—	Townsville . 3	Townsville . 6	Townsville . 3

N.B.—Places with a large number of 'uncomfortable' months (e. g. Batavia) have naturally a larger number of unpleasant days *per month* than those with few uncomfortable months (e. g. Alice Springs).

This question of the grades of discomfort is still under investigation, but while better tests than wet-bulb temperature will no doubt be devised, yet I doubt if the relative positions of the places in the lists will be altered to any notable degree.

We are told that the discomfort factor is to be overcome by suitable housing, by electric fans, by private refrigerators, and so on. All these amenities are available to make life not unpleasant for the important official and his family. Thus one eminent authority has recently cited his healthy child, born in the Territory, as proof of the suitability of the country for infants. This particular case is no more convincing than if Peary were to advocate close settlement of Northern Greenland because his equally healthy daughter was born there. No; it

¹ These places have a few months in winter which are slightly below the optimum for comfort.

is the environment of the *labourer's* family which counts. I can see no hope of his wife receiving all the accessories (including domestic help) which are so necessary for the well-being of the average mother under such conditions.¹ All honour to the poor pioneer mothers who have brought up families successfully in the tropics. They are heroines; but I fear that the average immigrant or southern Australian of to-day shows little inclination, and indeed cannot be expected, to follow closely in their footsteps.

Housing. With regard to the steps taken by the residents to meet these conditions of heat and discomfort, it is distressing to find the general apathy. This has been ascribed partly to a sort of fatalism, and partly to the migratory nature of much of the settlement. The houses of the poorer folk in the interior are generally built entirely of corrugated iron. At times there is no ceiling at all. There is no attempt to modify the building in accord with latitude. Indeed, in many cases the houses would not be tolerated here in our cooler regions. The white ant has driven them to build on piles, which is one good deed to its credit, for this permits free circulation of air beneath the house; but the obvious plan of permitting a similar circulation of air above the ceiling and below the iron roof was never employed in any permanent house I saw. Yet the Government shacks for the navy along the line make this obvious provision to obviate the presence of heated, stagnant air over the whole house. Thatch is used at one or two stations; but *pisé* (mud), used so largely in tropic America, is said to be too expensive for small houses. An iron roof is, of course, almost essential for water-supply.

I would refer my readers who wish to gain a vivid picture of what the life of the poor woman in the north of Queensland means to a lucid paper read by Mr. Wynne Williams before the recent Country Congress in Brisbane (see *Brisbane Mail*, 3rd September 1922). Mr. Williams is the Land Commissioner at Cloncurry in North-west Queensland, and is carrying out valuable research in the living-conditions in the interior. He has lived for twenty-three years in North Queensland, and is one of our few writers who does not shun discussion of tropical disabilities. While he believes that with satisfactory housing (which is not found at

¹ Thus A. Despeissis writes of the Kimberleys in an official publication (1921): 'It is unpleasant to record that a long sojourn in Kimberley tells on the womenfolk, and . . . their health often becomes severely affected.'

present) the health of the women and children will not suffer, he writes: 'The hot weather commenced last year in September, and did not abate till the beginning of May. We have numbers of women whose lives have been confined day after day within these naked, scorching walls of iron for a period of eight months without respite. I consider that the effect of these conditions upon the race can be as easily imagined as described.' Farther on, touching upon another vital problem, he writes: 'Try and imagine a woman bedridden in the summer months on the western side of a galvanized-iron maternity home, when in my own home (which is one of the best-constructed houses in Cloncurry) I consider the rooms on the western side of the building unfit for occupation during the summer months.'¹

Economics. It is the economic factor which is still perhaps the most indefinite as regards the tropics. Sugar and many other tropical crops pay well along the east coast. White cane-cutters make good money in the sugar regions as far north as Cairns. They are the advance guard of the Anglo-Saxon race in heavy agricultural labour in the tropics. In the cooler, dry months the same men are engaged in meat-works and in various trades connected with the cattle industry. I do not propose to dwell on settlement here, save to point out that it holds out no great encouragement for settling the rest of the tropic coasts, where farming is a much more hazardous business owing to the change from a uniform to a seasonal and variable type of rainfall as we move westward (see Fig. 84 B).

The oft-quoted success of almost all economic tropical plants in the Botanical Gardens at Darwin speaks of the care of the Director rather than of the capabilities of the Territory. We can grow many plants in our Sydney Botanical Gardens which are not found to be payable on the local farms.

The Government has done wisely in planting experimental crops of various plants, such as cow-peas. But the great lack in our knowledge of this enormous tropical region is of the soils and their capabilities. This should be remedied forthwith.

The geographer would point out that the millions of tropical Asia are largely settled on great synclines or deltas filled with river-silts (as in India and China), or on volcanic debris (as in Java). None of these occurs in the Territory, as far as I know,

¹ At Marble Bar in West Australia in the summer of 1921-2 on an average the thermometer rose to 110 degrees every day for three and a half months. The *lowest* maximum was 103 degrees.

for the country is essentially a worn-down peneplain of erosion with tremendous surface deposits of sterile laterite, quartzite, and travertine. Dr. Jensen, one of our foremost soil experts, speaks in no uncertain voice of the poverty of the soil in the following words (17) :

'Coastal soils: Fertile soils exist only in small alluviated pockets, and in small coastal raised-beach areas. The former are subject to floods, and the latter of very small extent. Hill country: A few patches have a better soil (brown loam) suited for tobacco. . . . The pockets of good alluvial soil are subject to heavy flooding in the wet season. Inland country: The soils inland are for the most part rich in plant-food . . . but naturally (owing to leaching) the richness of the soil varies inversely as the rainfall. But neither would there [here] be sufficient water for extensive irrigation, nor would it be a feasible proposition, since the soil would very soon be rendered too alkaline to produce anything.'

This seems to me to rule out the Northern Territory as a region of any noteworthy close settlement.

STATISTICS OF TROPICAL SETTLEMENT.

1921.	Tropical Queensland.	Temperate Queensland.	All Queensland.	Australia.
Population .	181,397	574,575	755,972	5,435,734
Masculinity .	114	—	105	101
Women over 50 .	11.6 %	—	—	15.5
Women 20-30 .	35.4 % in tropical Australia	—	—	29.5
Births per 1,000 .	141	114	118	107
Infant mortality .	55	56	56	63
Male death-rate .	14	10.6	11.2	11.0
Female death-rate .	7.9	8.0	8.0	8.6
Total death-rate .	11.4	9.4	9.7	9.9

The above figures show that tropical Australia has a 'picked population'. It contains an undue proportion of men (146 in N.T. and 167 in northern W.A. to 100 women). It has relatively fewer old women and more young women—giving naturally a good birth-rate (per 1,000 women). The death-rates are satisfactory, though a little higher than in the rest of Australia. Huntington¹ points out that the death-rate of folk (aged 15-49) born in Queensland is higher (4.66) than that of settlers born in England (3.89) or in the south of Australia (3.90), wherever they reside in Australia. So also the Queensland-born have fewer children (3.8) than natives of other states (4.1 to 5.1). Sickly or delicate people do not stay in the tropics, nor indeed do they go there in the first place. It would appear, therefore, that tropical statistics do not show how *average* settlers would get on there. (The writer's whole purpose is to prevent the waste of public moneys on premature tropical experiments while there is so much fair land available in temperate Australia.)

¹ Vide *West of the Pacific*, 1925, pp. 364-6. (But see Wickens's counter-arguments.)

THE WHITE RACE IN AN ARID ENVIRONMENT

*The Deserts and Arid Lands.*¹

POPULAR opinion as regards the interior of Australia has oscillated in an interesting fashion during the exploration of our continent. The early pioneers noticed that many of our eastern rivers flowed to the interior. They concluded, therefore, that a huge stream, rivalling the Amazon, probably debouched somewhere near Kimberley (W.A.). This theory gave place to the belief in an immense freshwater sea in the centre of the continent (19a). Hence the early explorers gallantly carried boats in their attempts on the unknown inland regions of the continent. The journeys of Sturt, Stuart, Warburton, and others involved great privations, and led to very pessimistic views of the greater portion of the interior. Later it was found that the northern border of the arid country was excellent pastoral country, that the eastern portion was blessed with a wonderful artesian system, and that the centre contained some fair country in the ranges. This has caused the pendulum to swing to the other extreme, and a school of optimists has grown up who boldly state that the 'desert' of the older explorers is a myth, and that there is no reason why stock should not thrive in every section of the arid interior. Moreover, they point to many areas where agriculture will (in their opinion) pay.

Some fifteen years ago I commenced applying the methods of modern geographical research to this most important of the problems of Australian settlement. I regretfully came to much less optimistic conclusions than those usually current. It is no use when one is studying a region such as Central Australia to place much reliance on isolated reports. The factor which controls all settlement here is the climate, and more especially the rainfall, and this is the most erratic possible. So that in

¹ A more detailed account with a number of photographs will be found in the writer's paper, 'Frontiers of Settlement', in the *American Geographical Review*, January 1926.

our investigations we must keep certain geographical principles ever in mind, and especially must we realize that a knowledge of *averages* of rainfall is infinitely more important here than in better-favoured regions.

It is perhaps as well to commence our discussion of arid lands by agreeing upon a definition of the word 'desert', that term which is anathema to many Australian patriots. We may consider various opinions on the question. In a voluminous work entitled *Australia Unlimited*, the writer (E. J. Brady) scorns the term as applied to Australia. He justifies his attitude by a lengthy disquisition on the merits of the so-called 'Ninety-mile Desert' near the Murray mouth. This region has an average and reliable rainfall of some 16 in., and should not be classed with the great Trade Wind or Rain-shadow deserts. His remarks on this region, however, have no bearing on the true deserts of Australia, though he implies that the latter (in Australia) have been wrongly named in the same fashion.

Favenc has used the term 'vanishing desert' of Australia, in the sense that as the less favourable regions of Australia are more fully explored their desert character is shown to be a misnomer, so that ultimately all the deserts will be deleted. His optimism is not, I fear, justified, and neither Brady nor Favenc attempt to define the term 'desert' (see p. 200).

Of more serious discussions we have two classes, those of the botanist and those of the geographer. The former presumably often means by 'desert' a region where there is practically no plant-life. The latter, I believe, usually means a region where the plant-life is too sparse to be of any important economic value. Cannon has recently studied the arid country of South Australia, and has adopted an 'arbitrary classification' having 5 in. of rainfall as the criterion (20). This definition has no relation to Australian economic conditions, and is based on a much lower figure than in most definitions. Diels, a German botanist, has adopted $8\frac{1}{2}$ in.; Schimper uses 10 in. Milham, the distinguished American meteorologist, states that in the considerably cooler lands of the United States 'below 12 in. is a desert'. He agrees with W. M. Davis in this respect.

Various well-known geographers, who view our continent

with a knowledge of other arid lands, write as follows. Professor H. E. Gregory, who has travelled throughout Australia, says that we have 'one of the most extensive deserts in the world'. Colonel Lyons (the Egyptian authority) writes: 'Inland Australia has desert conditions as strongly marked as any in the world.' Professor Ward, the American climatologist, uses 20 in. as the major climatic boundary in the United States. Sanders, in a recent discussion of Mexican climates, defines below 20 in. as 'arid' and from 20 in. to 50 in. as 'semi-arid'. This gives little hope of much of Australia! ¹

I have left until the end the most useful definitions. Professor J. W. Gregory writes: 'The interior of South Australia is mostly a desert, using that term in its generally accepted modern meaning of a country with such an arid climate and such a scanty water-supply that agriculture is impracticable and occupation is found possible only for a sparse population of pastoralists' (21). This definition stresses the economic aspect, but leaves the physical controls vague.

To my mind the exact name we give to the locality is of much less importance than its economic value as contrasted with other similarly situated regions elsewhere. A desert by any other name is just as dry; and if certain sensitive West Australians were to call the arid centre of their state a 'Garden of Eden' it would not make it easier to develop it. I have for years pointed out that Central Australia is exactly akin to the Sahara in its geographic location. We know that even the Sahara contains 'no very long stretches without herbage here or there'.

Since, however, the aridity of a desert varies with the distance from rain-forming oceans, the smaller Australian desert is much less inhospitable than the Sahara desert. It has no district with a rainfall lower than 4 in. a year, while a large part of the Sahara appears to have less.

There has, however, recently appeared a discussion of the world's deserts by the eminent geographer and botanist Koepen. Here he discusses the controls governing deserts, and he

¹ Of lands under 20-inch rainfall, Australia has 66 per cent. (largely warm), Africa 54 per cent., Asia 67 per cent. (largely cool), and North America 52 per cent.

has produced a world-map where one may see at a glance the relative extent of the great deserts of the world (22). Koeppen realizes that evaporation is a great factor in the problem, so that 10 in. falling in the winter is worth much more than 10 in. falling in the summer. His conclusions for desert country as they apply to Australia are as follows :

RAINFALL AND LIMITS OF DESERTS (KOEPPEN).

Region.	Season of rain.	Average temperature.	Total annual rainfall.
North Australia	Summer rain	77° F.	17 in.
North-west Queensland	Uniform rain	77° F.	13 in.
West New South Wales	Uniform rain	68° F.	11 in.
Southern lands	Winter rain	59° F.	8 in.

We see, then, that Koeppen uses an average limit of about 12 in. ; but in hotter parts he includes 17 in. as desert, and in cooler parts nothing above 8 in. With the exception perhaps of the Murchison region of West Australia, these limits agree very well with the definition of J. W. Gregory.

However, the chief interest in Koeppen's work lies not so much in what he calls the Australian desert region, but in how it compares with regions *treated in exactly the same fashion* in the rest of the world. I have measured the areas given by Koeppen (see Fig. 82) in an approximate fashion. They are as follows :

AREAS OF DESERTS OF THE WORLD (KOEPPEN).

	Sq. miles (approximate).		Sq. miles (approximate).
1. Sahara	2,600,000	6. Colorado	200,000
2. Australia	1,100,000	7. Gobi	180,000
3. Turkestan	900,000	8. Kalshari	90,000
4. Arabia	480,000	9. Thar (India)	74,000
5. Argentine	400,000	10. Chili	74,000

We see that Australia contains the second largest area of extremely arid land in the world. His figures agree almost exactly with what I have adopted for many years as the combined area of either practically useless or very sparse pastoral lands. Thus I quote 590,000 square miles as useless lands, and 655,000 square miles as very sparse pastoral country, in the concluding chapter of my *Australian Physiography*.

From the foregoing account it will be seen that there is

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a great variety of opinion as to what constitutes the 'desert'¹ in Australia. In Fig. 88 I show the divisions of arid Australia which I have been using for some years. Before considering the exact limit of the desert, we may profitably discuss the following table, which gives the resources and population in the various arid and west tropical divisions, as nearly as I have been able to ascertain them. (The total population of Australia in 1924 was about 5,700,000.)

SPARSELY INHABITED REGIONS OF W.A., S.A., AND N.T.

Region.	Area.	Average rain.	Average evaporation.	Approx. population.	Cattle.	Sheep.
A. Western Desert	468,000	8	110	none	none	none
B. Arunta Desert	59,000	7	110			
C. Arid Highlands	153,000	9	100	600	130,000	6,000
Total, Arid Centre	680,000	—	—	600	130,000	6,000
D. L. Eyre Lowland	190,000	8	80	3,750	56,000	1,000,000
E. N.T. Coast lands	270,000	30	90	2,300	450,000	none
F. Kimberley, W.A.	124,000	25	90	2,200	536,000	170,000
Total, Central Belt	1,264,000	—	—	8,850	1,172,000	1,176,000
Percentage, Australia	40%	—	—	‡ of 1%	9%	1.3%
G. Far Western	365,000	8	80	11,000	150,000	2,740,000
GRAND TOTAL	1,629,000	—	—	19,850	1,322,000	3,916,000
Percentage, Australia	55%	—	—	‡ of 1%	11%	4.5%

Thus the 'Central Belt', with 40 per cent. of the area of the Commonwealth, contains only about one-sixth of 1 per cent. of the population, 9 per cent. of the cattle (less than one head per square mile), and 1 per cent. of the sheep (less than one sheep per square mile).

When we realize that almost all this region had been adequately explored by 1879, and that within a year or two the borders had been taken up by pastoralists, it seems obvious that it is not ignorance which has kept it empty. Railways long ago in 1891 led to the heart of the arid region at Oodnadatta, they cross its southern margin at Ooldea, they almost reach to the sand-ridge region at Laverton and at Marble Bar. Sparse settlement has long taken place through Central Australia in the belt

¹ The *official atlas* of Natural Vegetation in the United States, 1924, states: 'Between the Rocky Mountains on the east and the Cascade Sierra on the west and extending from the Canadian to the Mexican boundary lies the great inland desert.'

of better country between the two sand-ridge regions, for the overland telegraph was built through here in 1872. Viewing all these facts, it seems to me that there is only one explanation. Nature has been very niggardly in her gifts in the Australian hinterland. While it is impossible to say exactly

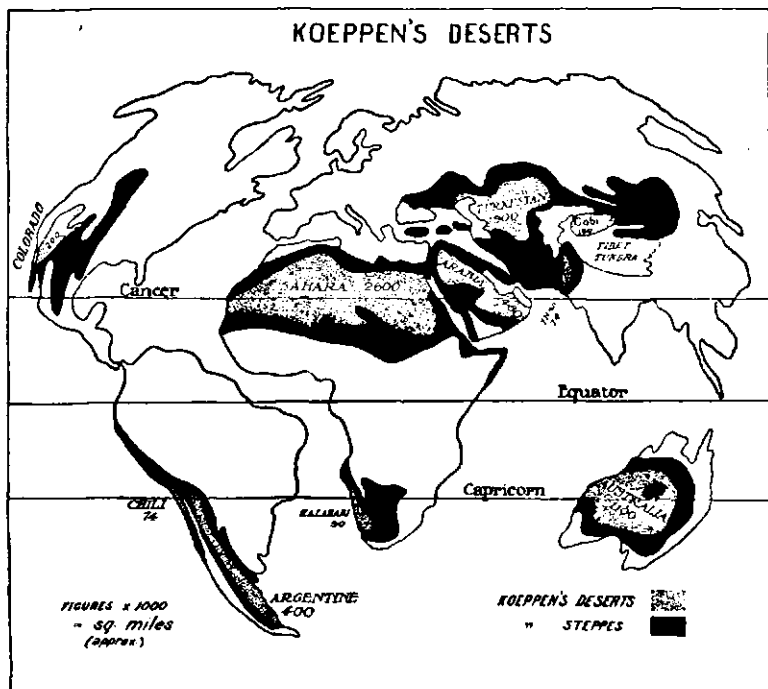


FIG. 82. Desert regions of the world as given by Koeppen. Similar climatic controls are used in every case. Note that Australia ranks next to the Sahara. (This map is on the Mollweide equal-area projection, with the oceans omitted. It thus shows the maximum land-area for a given space.)

where the limits of the 'desert' shall be drawn, we must surely include the regions of sand-ridges, which have repelled all settlement for nearly half a century, i.e. since the borders were occupied.

The layman's idea of a desert is usually erroneous, and is based on the extreme type seen near Cairo or the Red Sea. These moving dunes without vegetation are by no means characteristic even of the Sahara. Probably two-thirds of the

African desert consists of *fixed dunes* like our sand-ridge country; or of *Areg* ('gibber' country) like that at Oodnadatta; or of *Hamada* like the rocky areas of West Australia. Hence it is a matter of definition as to how much in excess of the two regions labelled 'Desert' in Fig. 83 would be given that name by foreign authorities on the desert environment. Some, like Koeppen, would certainly include the Far Western area of 350,000 square miles, as well as the 170,000 of the lowlands around Lake Eyre.

To the writer what matters is the *reasons* for the sparseness of the population (which is an unwelcome and unescapable fact) rather than the name we give the country; it is these reasons on which the attention of Australians should be concentrated.

The Arid Lands. Let us now consider in more detail the pastoral problem in relation to arid Australia. If we refer to the stock maps which I drafted in 1915 (19a) we find that cattle and sheep do well in certain regions of West Australia with only 8 in. of rainfall, while there is none in much wetter regions in Northern Territory. The explanation of this anomaly lies in the geology of the regions. A large portion of Central Australia is covered with sand-ridges, where very little permanent fodder grows, though even here it is possible to travel stock in suitable seasons. Let us therefore plot these sand-ridges, and we find that they cover a large part of arid Australia, and indeed agree fairly closely with the areas which are practically irreclaimable.

The sand-ridges extend from the south-east at Ooldea, on the Trans-Australian Railway, for a thousand miles to the north-west to the Indian Ocean at Wollal, near Broome (8).¹ In the south-west they begin near Wiluna, and extend almost to Tennant's Creek, on the overland telegraph line. They cover about half a million square miles. A second area lies between Lake Eyre and the Barkly Tableland (N.T.), and consists of about 70,000 square miles. The Arunta tribe dwell on the margins of this area. It may therefore be referred to as the Arunta desert. This kind of country therefore covers one-fifth of Australia, and merits a brief description.

The sand-ridges somewhat resemble those seen from the railway at Ooldea (S.A.), where some fifty miles of them are traversed. But here

¹ An excellent scientific account of this north-west corner of the desert is given by F. G. Clapp in the *American Geographical Review*, April 1926.

the rainfall is fair and the evaporation low, so that the region is much more promising than that to the north. The ridges are about 50 ft. high, and tend to run parallel to the dominant winds. In the centre they are controlled by the south-east trade winds. It seems possible that these dunes consist of the finer material of the extensive desert sandstone



FIG. 83. The Western Tableland regions. The arid and desert divisions are stippled. (The Lake Eyre lowlands are also arid.) On the north the arid boundary is about 15 in. of rain. The desert areas are based on soil character also.

formation of Eastern Australia, which has been blown to the west by the trade winds and piled up into ridges, of which four or five occur in each mile. While the western country will support travelling stock in favourable seasons, Talbot considers that it is never likely to be permanently occupied by pastoralists. However, the rainfall is sufficient to supply native wells and shallow soakage wells in most seasons. Thus Canning has opened up the stock route from Hall's Creek (Kimberley) to Wiluna (W.A.) by a series of wells, some of which give a supply of 1,000 gallons an hour. Very little if any use of it has been made in the last ten years.

In much the same way as we may use the inner (arid) border of the wheat belt to determine the boundary of agriculture, so we may use the inner border of the sheep (ss) and cattle (cc) belts to determine the limits of settlement in the arid regions. These are shown very roughly in the map (Fig. 72). In the north and west cattle encroach closest on the desert; in the south sheep are the most important stock, although here also cattle occupy the roughest regions.¹

It must be clearly understood that this country of sparse pastoral occupation will never support much human occupation. The largest stations, comprising thousands of square miles, rarely contain more than a score of white settlers, and of late years I believe the tendency is to work them with even fewer than before.

Thus we may rule out all the region on Fig. 72 marked 'No settlement' or 'Sparse stock' from the point of view of noteworthy human settlement. It must be clearly understood that I believe that sheep and cattle will be much more densely distributed in the future in most of this cattle and sheep country. It is largely a matter of adequate wells and bores. But this by no means implies a dense population of human beings. Mining towns may of course spring up for a decade or two, but they do not materially affect the question.

The most promising data of future progress are demonstrated by such settlements as the great Mutooroo station, near Broken Hill. Here, with a rainfall of 7 in. and no natural waters, an expenditure of £100,000 on dams and water-supply has resulted in the grazing of thirty-three sheep to the square mile. But this is obviously not a practical proposition for the class of settler who is going to add millions to the population of Australia.

Future Communications.

Intimately bound up with the possibilities of settlement are problems concerning future dominant railways, both across the states and across the continent. The state railways are for

¹ Recent stock maps (where, however, the distribution is shown by *dots*, a less accurate form than by *isopleths*) by Thomas are helpful here (*Roy. Soc. Vic.*, 1922).

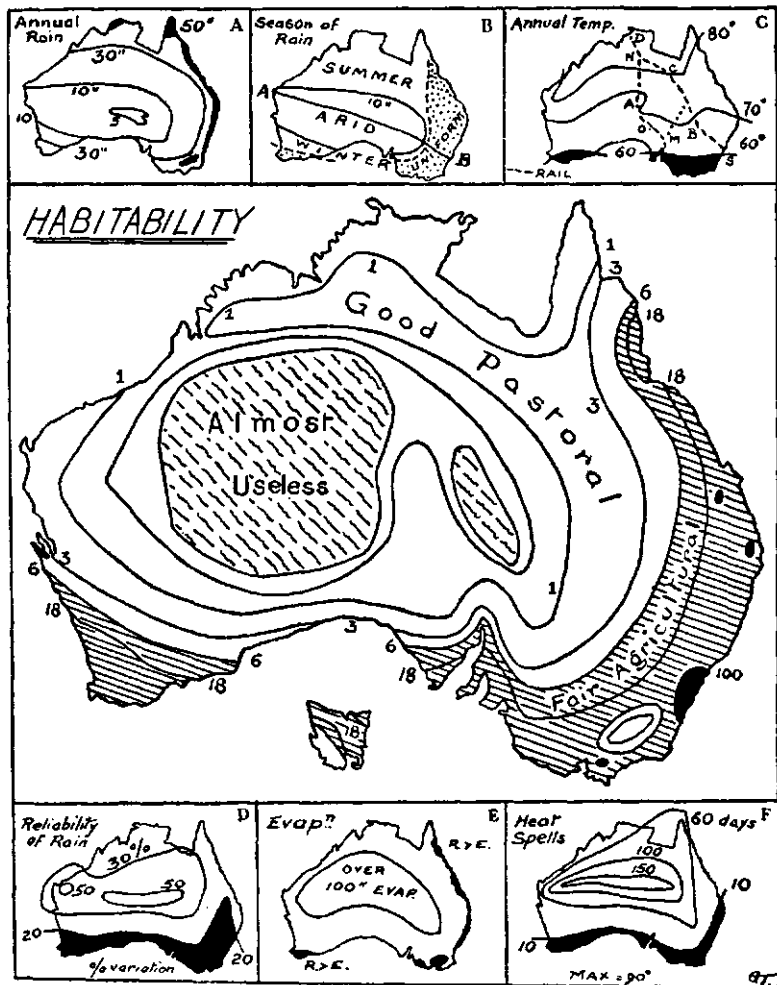


FIG. 84. Future settlement of Australia, showing approximate lines of equal population (per square mile). Small maps: A, Annual rainfall. B, Seasonal rains (the line *AB* separates summer from winter rains. C, Temperature (the suggested railway routes are indicated, *A* = Alice Springs, *B* = Bourke, *C* = Camooweal, *D* = Darwin, *M* = Marree, *N* = Newcastle Waters, *O* = Oodnadatta). D, Rain reliability, black being best. E, Evaporation; black is where rainfall exceeds evaporation. F, Heat spells, i.e. number of consecutive days when the maximum temperature exceeds 90° .

The agricultural lands in the east and south of Australia will of course support many more millions than they do at present, as may be seen by comparing the above central map with that in Fig. 69. This is considered in Chapters xxviii and xxix.

the most part advancing in a logical and economical fashion by radial and link lines spreading from the existing network. The transcontinental lines are another matter, and are often built with no hope of their being paying propositions for many decades.

Australia has already built the East-West line, and has been seriously considering a North-South line (to Darwin) during the last year or two. Since this latter line involves the spending of some twelve millions sterling, it is worth while to dwell on the geographic controls which should decide the route. There are, of course, three or more schemes, each strongly supported. The first is the shortest, and is to run from Darwin to Adelaide via Alice Springs (A in Fig. 84 C). This follows the course of the overland telegraph. The second passes fairly directly from Darwin, through Camooweal (c in Fig. 84 C) to Bourke (B), and thence to Sydney or Melbourne. The third is a compromise, and links Darwin to Adelaide via Central Queensland and Marree (M in Fig. 84 C). It is an attempt to avoid the central unreliable and arid region, and yet to keep the letter of the agreement to link Darwin and Adelaide fairly directly.

I have recently returned from a survey of a considerable section of the proposed *eastern* or Queensland route from Darwin to the south. A few years ago I made a similar survey of a portion of the rival *central* or Alice Springs route. As a result, my previous conclusions have only been strengthened, but the chief result of my journey is one that may surprise some readers. It is this: I feel sure that a much better guide to the relative merits of the rival routes is to be found in carefully charted climatic and economic maps than in any number of inspections of the routes concerned. Furthermore, with the best will in the world to give accurate evidence, a South Australian is inevitably biased in favour of his own state, and a Queenslander in favour of the eastern route.

Probably the chief value of such maps as I refer to is that they eliminate the results of the variable conditions which are characteristic of inland Australia. The visit of a commission must be greatly affected by the particular kind of season through which the country has recently passed. As I show

by means of the small map in Fig. 84 D, the whole of the region in question from Oodnadatta to Newcastle Waters (the middle half of the complete central route) is subject to the greatest variation of rainfall in Australia. The rival route through Camooweal, though somewhat better (compare Fig. 84 C and D), is handicapped by the same factor. This makes casual visits of inspection of less value here than in almost any part of Australia. It may be justly urged that the same objection holds as regards my own short visits, but I have never laid much stress on this method of appraising the relative value of the two routes.

It seems to me that a simple way of setting forth the advantages or disadvantages of the central route or of the Queensland route is to use the idea of the 'optimum belt', which is being used more and more in such large geographical problems as the present. I find that few people realize that though we cannot define at all exactly the 'outer limits' of the belt for any particular crop, yet we can be more certain of its 'optimum' region. And, furthermore, we can be reasonably sure, now that we know fairly definitely the immutable physical controls, that the bulk of that particular crop will for many years be grown near the optimum zone. Any extension of the margins of a crop will not make any very notable difference to the aggregate.

We have seen that the optimum for wheat in New South Wales (see Fig. 72) runs approximately from Corowa to Tamworth. Although the western limit is slowly moving westward, the percentage (of the whole crop) grown on the arid fringe is extremely small. These wheat data would seem to have little bearing on the railway problem, were it not that some optimists think it quite likely that wheat may yet be grown in noteworthy amounts near Alice Springs (A on Fig. 84 C) or on the Barkly uplands near Camooweal (c). A moment's consideration will show that, as the farmer moves farther and farther away from the optimum belt, one or other of the major physical controls must be getting worse and worse. If he finds it a difficult matter to grow wheat at Cobar, it will be increasingly difficult at White Cliffs and practically impossible at Alice Springs with its low and very unreliable rainfall.

The chief application of the optimum-belt method, however, is found when we consider the two great pastoral industries. There has not been a notable change in the distribution of cattle and sheep during the last forty years in the region under review. Whatever publicists may say to the contrary, there is not much chance of any really good pastoral country being left permanently unoccupied in the year of grace 1922. For instance, nearly a thousand would-be settlers applied for a single small block of

land which was thrown open recently in New England. Similarly, I was told in Longreach of seven hundred applicants for a small subdivision block in the vicinity. People from all over Australia balloted for this block, and obviously 699 were left landless. (Probably a number of these applicants, however, were speculators.)

Another point of view not often considered apparently by those in authority is that of the prospective passengers who may land at Darwin. Unless conditions change very materially, nine-tenths of them will desire to reach Brisbane, Sydney, and Melbourne, and not Adelaide. They will infinitely prefer the Queensland route. The same remarks will apply in a greater degree to the destination of merchandise or mails. These will be consigned to the great manufacturing centres of Newcastle, Sydney, Melbourne, &c., rather than to Adelaide.

There is a mistaken idea, based, I fancy, on the experience of the Canadian Pacific Railway, that one has only to build a railway and rapid settlement will follow. This is true if the rainfall, temperature, and soil-conditions are favourable, as they are, generally speaking, along the greater part of the C.P.R. But this is unfortunately not the case along either of the rival routes under consideration. For instance, I came across a resumption for a single family near Camooweal, which comprised 100 square miles. As far as I can learn, much larger blocks would be necessary along the central railway route.

I need not dwell further on the relative merits of the two routes. Total rainfall, season of rain, reliability of rain, evaporation, heat spells, artesian water, pastoral and agricultural possibilities are almost all charted in Fig. 84 herewith. In every case the Queensland route has the advantage.

It remains to say a word on the legal aspect. It is admitted that the original agreement involved a more or less direct connexion between Darwin and Adelaide. It was made in absolute defiance of economic and geographic controls, and, as usual, this entails a penalty. There is no doubt the Commonwealth must give some *quid pro quo* if South Australia relinquishes her legal claim to the railway she desires. But one would imagine that this matter can be arranged amicably by a round-table conference. South Australia has so many more suitable

investments, such as her afforestation schemes, her Murray port project and railways connected therewith, her Millicent drainage, her irrigation settlements, that all patriotic Australians will hope to see her use the public moneys on these rather than that it should be spent on the proposed Oodnadatta-Katherine Railway scheme.

Recently the report of the Commonwealth Railway Commission has been presented to the House. I learn that they have reported against the central (Alice Springs) route, and they have adopted as the best plan the idea of a compromise with South Australia, whereby the Queensland (or eastern) line shall ultimately be built. So far so good. But they also recommend the building of a light line from Oodnadatta¹ to Alice Springs, at a cost of one and a half millions sterling. The annual loss is estimated to be £182,000.

We have seen how little chance of further settlement there is in this region, with a rainfall of from 4 in. to 10 in. No through traffic is obviously expected, so that this huge sum is admittedly to be spent for the benefit of the people around the Macdonnell Ranges. How many are there who are likely to be affected? We may include every person from Tennant's Creek to Charlotte Waters, a distance of 200 miles each side of Alice Springs (see Fig. 84 C).

	<i>Men.</i>	<i>Women.</i>
Vicinity of Alice Springs	119	112
Vicinity of Arltunga	56	29
Vicinity of Finke River	63	30
Vicinity of Frew River	34	10

So that this 300-mile railway is to be constructed, as far as I can see, for the benefit of some five hundred people.

Railway development is essentially bound up with rainfall, and the following table will perhaps be of interest, as showing how the two are correlated in the newer lands of the United States of America. (I omit the older industrial states to the east of the line joining Galveston to Buffalo.) The table is based on a graph drawn up from data in the *Statesman's Year-book*.

RAINFALL AND RAILWAYS IN THE UNITED STATES OF AMERICA.

Rainfall in inches	10	15	20	25	30	35	40	45
Railways per 1,000 sq. miles (Miles of railway)	25	50	75	100	125	150	200	250

¹ One train a fortnight is still sufficient for the Oodnadatta line, more than thirty years after it has been completed (1891). Marree near Lake Eyre was reached by the railway in 1884.

Future Settlement in Australia.

Some years ago I made a lengthy study of the resources of tropical Australia with a view to determining the isopleths of future population. To these I gave the name *isoiketes* (Greek *οικητος*, habitable). In the present section I propose to extend my survey to include the remainder of Australia (9).

The data have already been discussed in considerable detail, but in Fig. 84 I show the chief physical controls in a series of small maps. The first map, A, shows the total rainfall; and the very small area receiving 50 in. of rain is to be noted. In the second map, B, the line AB is the chief climatic boundary in Australia, separating the summer rains from the winter rains; but all the east (shown dotted) has eight months each receiving 1 in. of rain or more, and this region I have termed 'uniform'. At Dubbo (on the line AB) the rainfall is almost exactly the same in each month, but this condition is departed from as we move north or south.

The first of the lower maps, D, shows the variability of the rains. The black area has rains which rarely depart from the average, while in the centre of Australia the rains may be expected to differ from the average by 50 per cent. We note that the Barkly Tableland and the west coast have very unreliable rains. The middle lower map, E (after H. A. Hunt), shows the evaporation. The area of great evaporation naturally occurs in the tropics. Much of inland Australia receives less than 9 in. of rain, and experiences over 9 ft. of evaporation in the year. The areas where the rainfall is greater than the evaporation are almost negligible; they are indicated by the black patches on the coast.

The upper map, C, shows the average annual temperature. Wyndham (84.6° F.) is the hottest place in Australia, and has almost the hottest recorded annual temperature in the world. In the lower corner is an interesting map, F (taken from *Climate and Weather*), which shows where long 'heat spells' occur (23). The isopleths give the number of *successive* days which have a maximum temperature of 90° F. or more.¹ Much

¹ See foot-note on page 274.

of Central Australia has had five continuous months with the temperature reaching 90° on every day. These isopleths, of course, agree closely with those for evaporation, and they explain the barren character of so much of northern inland Australia.

Making use of these maps, and of the vegetation and pastoral maps which result from them, it is possible to gauge fairly closely how the zones of similar country will run (Fig. 84). The next step is to see how much population the same sort of country will support in other longer-established regions of the world. I have compared settlement elsewhere primarily in India, Africa, and the United States of America, and I have ventured to add figures representing *persons per square mile* at some not very remote future date. It is not suggested that the figures are more than relatively correct; but in the United States the 20-in. isohyet has determined the 18 isoikete (eighteen persons per square mile). Similarly, the outer edge of the good pastoral zone may reasonably determine the isoikete 1.

The four black areas represent the four chief coalfields of Newcastle, Morwell, Ipswich, and Baralaba. They merely indicate where manufacturing will be most largely developed within the next century, in my opinion.

A map of this nature should be the chief guide to the statesman who wishes to know where to spend the public money most wisely. Whether his aim be to benefit the greatest number to the greatest extent, or—what is much the same—to induce close settlement with the least possible waste of time and money, there seems to me no doubt that both desiderata will be most scientifically arrived at by allotting the available moneys in some such proportion as the isoiketes indicate.

I have now traversed the main problems in which I believe that the geographer can help the statesmen. It will be admitted, I trust, that our national policy must be *based very directly upon environment*—more so than in older countries. A detailed study of our environment is therefore one of the most necessary branches of Australian research; the more so that our arid and tropical conditions are less understood than are the environments of older communities.

The reader may be inclined to think that undue stress has

been laid on the less attractive regions of Australia, and that little has been said about our fertile east and south. The geographer, however, is interested in a continent as a whole. He wishes to know why the spaces are empty. If he sees that nearly one-half of the region is steppe or desert country, then his research must largely be concerned with problems connected with such an environment.

The development of the fertile regions and of the irrigation settler is occupying the entirely adequate attention of those public servants who have spent their lives in such service. But it has hitherto, perhaps, been no one's function to study the inclement regions of Australia as a whole. The geographer has, and will, come under much abuse in this connexion. He is accustomed to such terms as 'Doctor Dismal' and 'Modern Jeremiah', to mention no worse! But he would point out that abuse (usually based on false patriotism) is no answer to scientific deductions. He may be permitted to quote Lord Hugh Cecil, who writes of a similar controversy, that such false 'patriotism has become the convenient cudgel of the scoundrel to batter critics dumb' (26).

We have a fine heritage in Australia even if it appears to be restricted to one-half of the continent. We have a fine future for our people even if we cannot hope to rival greater centres of white settlement in America.¹ But all the evidence seems to show that the days of great expansion, which were so marked a feature of the latter half of the nineteenth century in America (and to a less degree in Australia), have gone, never to return. We have, in fact, practically reached the period of *resumption and subdivision*. It is by this means much more than by new irrigation schemes (which in our environment have a very limited distribution) that Australia will support the ten millions of the not-far-distant future.

I have shown elsewhere (1) that 42 per cent. of Australia is arid (though half of this is fair pastoral country in good seasons); another 34 per cent. is good pastoral country; about 3 per cent. (in Queensland) is well suited for tropical agri-

¹ As Huntington points out, 'Just because Australia is still below its maximum supporting capacity, its people are extremely fortunate and prosperous.'

culture ; finally, some 21 per cent. has a climate suitable for *close* white settlement. Unfortunately this includes a very large area of rugged mountain country.¹ It seems to me that actual experience justifies these figures, which are based directly upon climatic data. We see the population dwindling or stagnant almost everywhere except in the regions specified above as suitable for close settlement. The pastoral resources of Australia have greatly developed, but growth has occurred essentially in the wetter regions suited also for agriculture. In the arid regions the numbers of stock have remained almost the same for a score of years. Under present conditions these dry areas are fairly fully stocked, and large outlay for water-supply, &c., will be necessary before much improvement can be expected.

I have shown that no arid or tropical regions resembling our empty spaces have been settled by any noteworthy white population. I fail to see why Australians should be expected to settle them. There seem to be no crops under present conditions which could be grown economically in our northern coast lands. Anything that can be done there can be done better along the East Queensland coast. Moreover, as far back as 1915 the Administrator of the Territory reported that an agricultural labourer who had anything to do with farm machinery expected £4 per week. He adds, 'I know of practically no soil (save very rich soils close to great centres of population) which at any rent or no rent will enable agriculture to be conducted in such circumstances'.

We are accustomed to hear the problem of railway development argued under one of two headings : ' Shall the railway precede the settlers ? ' or ' Shall the settlers precede the railway ? ' Lord Bryce has pointed out that governments such as ours are not leasing land, but *rainfall*, to the settlers. So also I would say that the new trunk railways should develop in accord with the rainfall map. I venture to think that due consideration of this aspect of the case will prevent the waste of one and a half million pounds on the proposed railway to Alice Springs.

As regards future settlement (as I have written elsewhere)

¹ In New South Wales, of the humid region (receiving over 25 inches of rain) some 30 per cent. (or 23,000 sq. m.) is so rugged that there is practically no settlement.

it has long seemed to me that a frank avowal of our difficulties and of the low economic value of so much of our continent would be the best answer to foreign critics. We do not settle our empty spaces because they are not suited to the type of immigrant who has come to us in the past, and who will come to us in large numbers when conditions are more settled (27).

We must break up the large alienated holdings; and the small holdings too, if they are not utilized for the common good. Let us leave the empty spaces to the pastoralist for whom nature meant them. Their development will proceed on different lines from those leading to close settlement. In Australia, as everywhere else, it is the farmer and manufacturer who determine the dense population. My counsel to those who ponder these urgent problems in the present times of financial stress is that we should tackle the tropics and arid lands later—much later—and leave the desert to its loneliness.

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3. 'Broken Hill Region (New South Wales)'. *Sydney Morning Herald* (2 articles), October-November 1923.
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IV

THE FUTURE¹

THE CONTROL OF THE POTENTIAL WHITE SETTLEMENT OF THE WORLD BY ENVIRONMENT

¹ This part of the book follows closely my paper published in the *Geographical Review*, entitled 'Future White Settlement', July 1922.

XXVI

THE PROBLEM STATED, AND METHODS OF RESEARCH

THE story of the evolution of our own race, and of its wanderings over the face of the globe, and of the paramount control exercised by environment, is truly interesting. But it is even more interesting and, if one can do it with any accuracy, even more important to forecast the future migrations and history of the White Races. While the following chapters do not pretend to give an accurate forecast, it is hoped that they will indicate the physical controls which must play a very large part in future white settlement. In so far as we plan with due regard to these controls, we shall be facing the future in a scientific spirit, and such an attitude must make for the good of the nation concerned.

It is usual to be met at the outset of any such attempt with two criticisms. First, that this problem as to the future is too difficult owing to the complexity of the factors; and second, that there is little need for anxiety for the morrow, for science will always be able to cope readily with any problem of supply. The first argument is merely a challenge to the enthusiastic student, who does not expect complete success but only desires to help human progress in some small degree. The second argument assumes that because science has done wonders in the last century, that similar wonders can be done indefinitely. I know of no writer who expresses the very special environment which controls the food supply of the world *to-day* so sanely as E. M. East of Harvard. I quote extensively from a recent article of his, entitled 'Population in Relation to Agriculture'.¹

'The world is not as big as it used to be. It has shrunk tremendously in the past few years. It is difficult to realize the change that has taken place in our outlook on many economic problems, due to this globe-girdling with easy means for commercial transactions and for personal migrations.

¹ See his chapter in *Eugenics in Race and State*, 1923, Baltimore.

... Squatters have already camped on the choice spots of the earth's surface, and those who come after will have to take the by-ways and hedges and the stony ground.'

'The human race has had a history of at least 10,000 years since it developed enough mentality to leave written records, yet in all this time the natural increase was so slow that in the year of our Lord 1800 there were only some 850 million people. Since that time, in a hundred years, the population has doubled.' [In 1924 it was stated to be 1,841 millions.]

'The world has had a continuous natural increase annually for the past century of about 0.7 per cent., and the increase at present is greater than at any time in the past. My own estimate of this current annual increase is 15 million. In 1800 not a single country had reached a point where the population was pressing heavily upon subsistence in present-day terms. . . . To-day the story is different: China is full to overflowing; India and Japan have passed the saturation point according to Western standards of living. The Australians living on the rim of a barren desert-bowl [*sic*] are increasing at the rate of about 18 per thousand, a rate which their agricultural possibilities cannot stand for long. Our own United States have reached the point where there are diminishing returns in crop production.'

'A careful study of available statistics shows that it takes about 2.5 acres to support each individual. It is therefore necessary to cultivate some 37 million acres more land each year than was ever so treated before. . . . Take out the mountains, deserts, the undrainable swamps, in short, the areas not available for agriculture, and there is left 13,000 million acres (out of 33,000 million acres of land). Of this potential world-farm, some 5,000 million acres are now being cared for by the hand of man. . . . The total available of 13,000 million acres will support a little over 5,000 million people.'

This is less than three times the present population of the world.

Dr. East next considers the optimism of certain agriculturalists who pin their faith to scientific research. He writes: 'Useful variation in the domestic plants and animals is very rare. The real point of attack is through hybridization, yet even here it is doubtful whether a betterment greater than from 10 to 20 per cent. can ever occur. The true increase in production by more efficient methods of farming . . . may be as high as 50 per cent. But it is offset and masked by the bringing into cultivation of poorer new lands. I cannot see in this prospect anything but temporary expediency. *In any permanent system of agriculture the soil and the climate are the true arbiters of production.*'

In the United States Dr. East considers that three-quarters of a billion acres must for ever be withheld from agriculture. There is left 300 million acres (roughly equal to 35 per cent. of the present farm lands), which may in the future be incorporated with the farms. The same state of affairs is more or less present all over the world, for the first time in history.

We are nearly using all nature's resources to feed the present population. Thus Dr. East agrees with other economists that the food-problem will be very difficult in the near future.

Dr. Baker is somewhat more optimistic, and sums up the problem as regards the whole world in the following important table. We see that only 4.2 million square miles, out of 52.0 millions, remain to be exploited by future generations.

ARABLE LANDS OF THE EARTH

(From O. E. Baker, *Geographic Review*, 1923.)

<i>Lands.</i>	<i>Tropical and subtropical.</i>	<i>Temperate.</i>
	Million sq. m.	Million sq. m.
Too arid for crops	8.0	7.6
Too cold for crops	—	6.4
Not arable	10.0	10.0
Pasture, but arable	0.6	1.5
Cultivated	1.2	2.5
Potential arable	3.2	1.0
Total land area	23.0	29.0

I. *General Method used in the Present Research.*

With the passing of many purely artificial military and political boundaries we may look with more certainty to a time when the unrestrained economic resources of a region shall be the controlling factors in determining its prosperity and the density of its population.

For the past ten years the writer has been engaged on economic physiographic research in regard to the continent where such problems are presented in their simplest form. In Australia we are free from the race problem, while our climatic controls are relatively simple and are not confused by great topographic variation. At the same time a large range of climates from the hottest tropical in the north-west to the cool temperate of Tasmania is involved in such physiographic research.

In papers recently published ¹ I have determined for Australia

¹ 'Control of Settlement by Temperature', &c., *Meteorological Bulletin*, No. 14, Melbourne, 1916.

the temperature (and humidity) controls governing white settlement, and the temperature and rainfall controls which determine the economic limits of the main industries. In 1918 I published a map showing how the future settlement of tropical Australia might reasonably be expected to be distributed.¹

The present discussion is an attempt to carry out a similar investigation for the world as a whole. I have confined my study to the so-called white (European) race—because data as to its climatic controls are available. This is not the case so far as I am aware with regard to the Mongolian or Negro races. It is unnecessary to add that the Mongolian peoples will continue to spread beyond Asia, but this aspect is not discussed.

It is obvious that the European races have no opportunity or wish to supplant the yellow or black races in the regions of the Old World extending from Liberia to Japan. This limitation is, I trust, sufficiently indicated by the boundaries in the resulting map of future populations (Fig. 90). I have, however, thought it of interest to carry my investigation into these debarred regions—though here the results are outside the realm of practical geography.

The problem falls into three divisions. First, it is necessary to decide on the major controls which determine white settlement. Secondly, we must assign relative values to these several controls. Thirdly, we must classify the many diverse regions of the world, so that each unit shall be capable of quantitative consideration in terms of the controls determined upon.

My method has, therefore, been as follows: I have subdivided the continents into seventy-four economic regions.² These are much the same as Herbertson's natural regions in the temperate zones—but my studies of tropical Australia have led me to distinguish other types in the torrid zone. The units are, therefore, much more numerous than in Herbertson's map. Each of these regions is tabulated in terms of what seem in the writer's opinion to be the four dominant controls (temperature, rainfall, location, and coal reserves). A quadrangular graph—the *econograph*—is constructed for each region. The area of

¹ *Settlement of Tropical Australia*, Roy. Geog. Soc. of Brisbane, 1918.

² These are shown approximately on Fig. 89.

this graph is found to represent approximately the habitability of the region concerned.

Lines of equal habitability (*isoioketes*) are drawn on a map of the world. Using the present European populations as a criterion, it is shown that these *isoioketes* may be translated into isopleths of future population.

The map indicates that white settlements will tend to congregate around five world centres, or clusters of cities of a type which Geddes has named *Conurbations*. These are near London, Chicago, Sydney, Durban, and Buenos Ayres. Of these the United States' centre will probably be the largest.

II. *Economic Regions.*

In an investigation which contains so many variable factors the 'personal equation' of the writer is bound to enter to some extent. The only way to counteract this is to classify the regions involved carefully, and then to allot their economic values according to a fixed scale.

The economic areas which I have used are shown in Fig. 89, and the areas in square miles are given in the table on p. 322. I have inserted the boundary between Europe and Asia in Herbertson's map (Fig. 1, *Senior Geography*). The European plain varies so greatly in its economic resources that I have divided it into three units, approximately depending on the temperature. In Asia the Siberian belt is also separated into a western lowland and an eastern highland portion. The north and south halves of China differ greatly in resources and are subdivided.

It is in the monsoon lands that I have modified Herbertson's regions most largely, both in Asia, Africa, and Australia. Diverse topographies and differences in the rainfall types determined the subdivisions. The Sahara and Australian Arid Regions are divided in accord with the line separating the summer- from the winter-rain regions. This is, however, not of great economic importance. In America the alterations are not marked. I have extended the Tundra region to the south, and separated the Utah region from Alberta.

The areas of these regions are given in the first column of the large table which appears on p. 322. They were determined by

planimeter and are approximate only. I have named the region in accord with the chief country or province included, but the economic and political boundaries rarely agree.

III. *Temperature Control.*

A glance at an ethnographic map of the world will show that temperature is the primary control in determining the distribution of the white race; but the optimum temperature and the upper and lower limits require considerable investigation. In a former paper (1916) I give reasons why 50° wet bulb and 75 per cent. relative humidity are near the optimum for the white race. Unfortunately few countries publish wet bulb data, but the usual dry-bulb reading under these conditions is close to 53° F.

Huntington (in *Civilization and Climate*) by an entirely different method arrived at 60° F. as the best temperature for strenuous physical work, and 40° as the best for mental work.¹

As regards the upper limit of temperature suited for fairly close white settlement, the chief regions where such conditions obtain are in Brazil and in North Queensland. An average annual temperature of a little over 70° F. seems to characterize the outer fringe of fairly close white settlement. But even an average temperature of 68° involves several trying months for settlers in Australia of mid-European race.

With regard to the lower limit—the chief control is economic rather than hygienic. The polar boundary of agriculture is not far from the annual isotherm of 30° F. We may, therefore, adopt these temperatures (30°, 53°, and 70°) as critical values in our investigation.

Any world-wide study of temperature is greatly handicapped by the fact that all published maps (so far as I am aware) show isotherms *reduced to sea-level*. This may be essential for forecasting, but it makes the map almost useless for the economic geographer. Obviously it is not much use to know that Tibet would have a temperature of 70° if it were at sea-level, when actually the thermometer is usually below freezing!

In Fig. 85 I give an approximation to the *actual* average

¹ In a private letter Huntington writes that this means 40° *outside* temperature. Brain-workers then receive the maximum stimulus from the differences between indoors and outdoors.

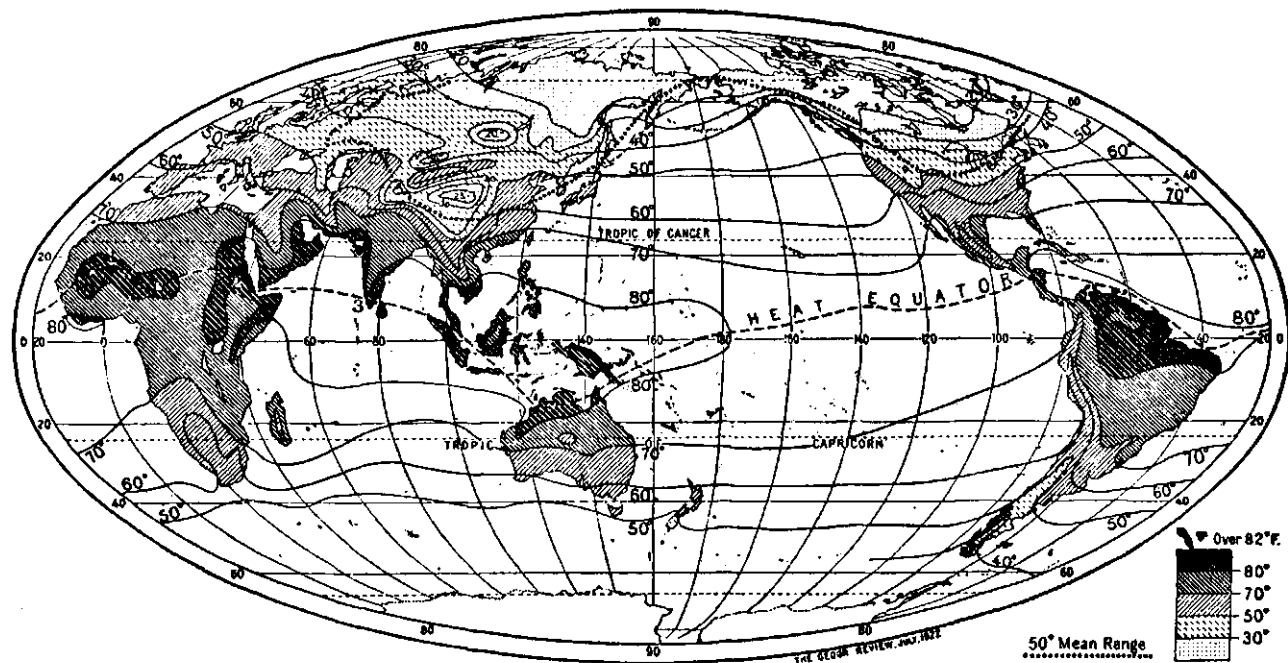


FIG. 85. Actual average annual temperature (i. e. not reduced to sea-level). The region of great annual range of temperature (over 50°) is enclosed within the dotted line. The heavy broken line shows the heat equator passing through the four hottest recorded regions of the world: 1, Timbuktu; 2, Massowah; 3, Tinneveli; 4, Wyndham.

annual temperature chart of the world. It is based on Buchan's map in Bartholomew's *Meteorological Atlas*, but is modified in accord with data in Hann's *Klimatologie*, and elsewhere. The factor of 10° F. decrease with each 3,000 ft. elevation has been used in calculating the temperatures. Little alteration is necessary in Europe and Australia, but Africa and especially Asia show striking convolutions in the isotherms.

The usual maps tend to give a wrong impression of inland Asia. We see that vast areas are too cold to have any value as areas of close settlement. On the other hand, there is a corresponding improvement in Africa, especially in the Rhodesian region, where a cool loop runs north nearly to the equator. The same feature is shown in the west of South America.

An interesting feature is the course of the thermal equator. It runs through Wyndham in West Australia, for this is one of the four hottest regions in the world, and is far hotter than anything to the north or south of it.

In the following table the areas in the various continents experiencing specified temperatures are given.

APPROXIMATE LAND AREAS WITHIN GIVEN TEMPERATURE BELTS

(Unit, 1,000 square miles.)

Values.	VIII	VI	IV	II	I	III	V	VII	Total.
Temperature in degrees F.	Under 20	20-30	30-40	40-50	50-60	60-70	70-80	80+	
Europe	0	160	800	1,790	760	320	—	—	3,830
Percentage	—	4.0	21.0	47.0	20.0	8.0	—	—	
Asia	2,500	2,180	2,780	1,840	2,440	2,020	2,160	1,820	17,740
Percentage	14.0	12.2	15.6	10.4	13.8	11.5	12.0	10.0	
Africa	—	—	—	—	830	1,460	6,880	1,910	11,080
Percentage	—	—	—	—	7.5	13.0	62.0	17.0	
N. and Central America	2,400	1,360	1,200	1,360	1,140	1,500	320	70	9,350
Percentage	25.1	14.6	13.4	14.6	12.2	16.0	3.4	1.0	
S. America	—	—	170	340	470	1,460	3,300	1,420	7,160
Percentage	—	—	2.4	4.8	6.6	20.0	46.0	20.0	
Australia	—	—	—	40	240	1,180	1,140	360	2,960
Percentage	—	—	—	1.0	8.0	40.0	39.0	12.0	
Greenland	510	—	—	—	—	—	—	—	510
Antarctica	3,670	—	—	—	—	—	—	—	3,670
Total	9,080	3,700	4,950	5,370	5,880	7,940	13,800	5,580	56,300
Percentage	16.0	6.6	8.8	9.5	10.4	14.1	24.5	9.9	

The total areas by continents in the two most favourable temperature belts (40° – 60°) are as follows :

1. Asia	4,280,000 square miles
2. Europe	2,550,000 " "
3. North America	2,500,000 " "
4. Africa	830,000 " "
5. South America	810,000 " "
6. Australia	280,000 " "
7. Antarctica	nil

The dominant position taken by Asia in Fig. 85 and in the above order is to some extent paralleled in Huntington's world map (1915) of ' Human energy on the Basis of Climate '. But however energetic a race may be it has not much chance in the struggle for existence if natural resources are wanting. When agricultural and mineral resources are also considered it is seen (see Fig. 90) that the greater part of Asia has a poor future.

Now that we have obtained a fairly accurate idea of the distribution of the temperature belts, it is necessary to estimate their effect on the density of white settlement. This can only be obtained empirically from data relating to the sole region where European settlement is fairly dense, i. e. in Europe itself.

The densest populations in Europe are distributed along the coal belt from Swansea to Silesia. Here temperature is obviously not the main factor. Another obvious control (tending to prevent settlement) is elevation—though here temperature is concerned as well as absence of good soils and difficulty of communications. Hence we shall find that the temperature effect is least complicated by other factors in the *lowland regions where no coal is present*.

In Fig. 86 I have charted the temperatures and densities of almost all the plains in Europe, from the south of Sweden and Central Russia (with an average temperature of 42° F.) to Andalusia and Algeria (which is also settled by European peoples) with a temperature of 63° F. These seventeen regions with one notable exception (Western France) lie fairly close to a cusped curve. It is to be noted that the rainfall (from

20 to 30 in.) is much the same in all these localities except in Ireland and Portugal.

There are, of course, considerable differences in some of the minor controls. For instance, the scale of living, the facilities for communication, and the *annual range* of temperature are variable as well as the temperature itself. This, of course, complicates the problem. No doubt the high position of Italy is partly due to her low scale of living, while the low position of West France is perhaps partly due to her poor soil and notable lack of harbours. But, all things considered, I believe a large enough number of examples has been investigated to establish the general truth of the following conclusions.

The curves in Fig. 86 support the view that a temperature of 53° F. is near the optimum for close European settlement, while 45° and 62° are nearly on a level, as are 40° and 68°.

This graph—with some slight modification due to the distribution of settlement in Australia—is the basis of the temperature scale (Fig. 89) which I use in later portions of this discussion.

On the North American coast a similar optimum occurs, though here the density of population is naturally different. The American graph is shown at the base of Fig. 86, and has much the same limits and optimum. In this region the rainfall factor is nearly constant from north to south.

The average annual temperature is a fair criterion, except in the case of the interior of Asia and of North America. Here the mean monthly range during the year exceeds 50° (see Fig. 85), and the summer growing season is much more favourable than the annual average would indicate. The summer is equal to that of many countries with an annual temperature 5° higher. I have, therefore, taken this into consideration, as is noted later.

A direct control of settlement—depending on pastoral and agricultural pursuits—may also be graphed in terms of temperature. I have found the data given in Finch and Baker's *Geography* of great assistance in drawing up the graphs given in Fig. 86.

The temperature controls for the main European and U.S.A. food crops are somewhat as follows :

Barley grows in regions with an average annual temperature as low as

30° F. Oats, wheat (in Canada), and potatoes are also possible in such countries if they have a relatively hot (continental) summer. The optima for barley and Canadian wheat are near 40°; for oats and potatoes near 45°; for U.S.A. maize near 49°; and for European wheat 51°.

These crops have little relative importance in regions above 60°, except the Indian wheats. It is worth noting that Central Queensland, East Brazil, Yucatan, and Rhodesia are all regions where the climate would seem to be suitable for this winter wheat crop.

It is obvious that the temperature belt from 35° to 60° is that most favour-

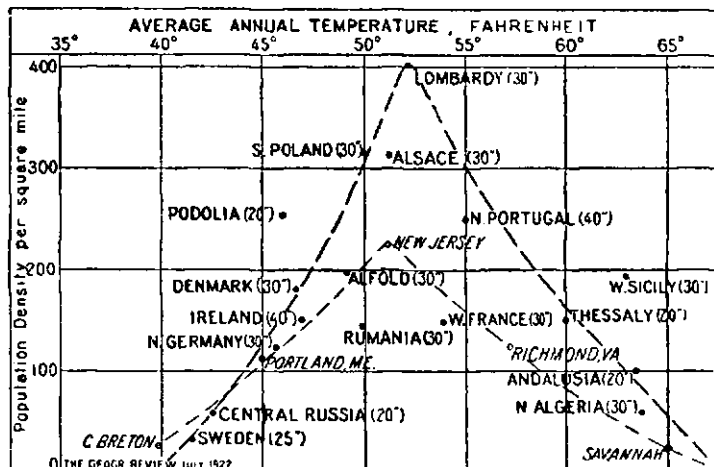


FIG. 86. Graph showing the relation between temperature and density of white population. The heavier line shows values for the European plains, coal-producing regions being omitted; the lighter line for the eastern coast of North America. The rainfall is shown in brackets.

able to grain crops, proceeding from barley through Canadian wheat and oats to maize and European wheat. However, the closest white agricultural settlement does not occur in these open prairie lands, but in the mixed farming country, where the optimum temperature is distinctly higher.

The lower limit for stock is also about 30° F. where sheep occur. Cattle are not much in evidence below 35°, while pigs and goats begin about 40°. The optima are somewhat as follows (according to Finch and Baker's charts): pigs at 45°, cattle about 50°, goats at 56°, and sheep at 65°. The cattle (excluding dairy cattle) range importantly through the tropics, but the other stock are not of much importance above 70° F.

IV. Rainfall Control.

If temperature is the most important control, rainfall is easily the next most important, and if one were ignoring the

race aspect it would rise to the chief place among the physical controls of settlement.

The lower limit of important settlement can be placed about 15 or 20 in. of rainfall per annum. In certain favoured regions, where the rainy season is very reliable and where the rain falls just at the right time, it is possible to grow wheat successfully with a rainfall as low as 11 or 12 in. This is the case in a narrow strip of country in West Australia, South Australia, and in the Mallee of Victoria. As regards the optimum rainfall for European settlement, there is not much to choose anywhere from 40 to 50 in. The lower rainfall is adequate in cooler regions, the higher is not too much in regions where the evaporation is very rapid, unless it is somewhat concentrated in the summer months when the wet-bulb readings are too high for comfort (as in Brisbane).

In south-eastern Australia near latitude 34° S. there is a very uniform decrease in rainfall from 50 in. at the coast to 8 in. near Broken Hill. Dairy cattle are densest on the coast with the maximum rainfall, while cattle are unimportant in the region below 12 in. Sheep are a maximum about 32 in., but range from 42 in. downwards. Wheat is grown between 12 and 28 in., with a maximum at 22 in. (The data for North American sheep and for spring and winter wheat are also indicated in the original paper on 'Future White Settlement' (q.v.).)

It is important to note that the great cattle and sheep regions are not those semi-arid districts usually so designated in Australia, but that by far the greater number are reared in the wetter regions, where their importance is apt to be lost sight of among the many other occupations of the settlers. As regards the vast arid expanses of Australia with a rainfall below 10 in., only a very small percentage (i. e. about 2 or 3 per cent.) is grazed there, and it will never bulk importantly among the pastoral regions of the world. Similar conditions obtain in the other arid regions of the world.

Few countries receive more than 60 in. In Australia this heavy precipitation is of little advantage either in Queensland or in Tasmania. In most countries it is a disadvantage, and so I have classed it in the scale shown in Fig. 89 as less valuable than a rainfall of 50 in.

XXVII

FUTURE SETTLEMENT AS CONTROLLED BY AGRICULTURE AND COAL SUPPLY

World Agriculture. From the point of view of white settlement there are four types of land surface which are quite unsuitable. These are the *tundras* of the polar regions which are too cold for abundant animal life, and also usually too dry.¹ Secondly, and most important, the *desert* regions of the world which are too dry for agriculture, though a certain amount of stock can live therein. Thirdly, the rugged *mountainous* regions and cold plateaux. (In tropical regions the plateaux are much more favourable for settlement, but unfortunately they are not very extensive. Huntington, however, points out that these tropical plateaux suffer from the excessive monotony of their climate. The healthy *variety* of temperate regions is absent.) Fourthly, there are the *hot wet regions* of the tropics whose natural resources are abundant, but whose climate is quite unsuited for close white settlement, or indeed for any white settlement requiring constant manual labour.

In Fig. 87 these four types are given in a generalized form. Here the regions left blank are those suited for European settlement of some sort. Almost the whole of Europe and North America is available, and about half of Asia and Australia and relatively small proportions of Africa and South America. It is the purpose of the later sections to give a quantitative estimate of the value of these regions.

In the moderately watered tropical regions a considerable population of *pastoral* whites will probably develop. In my opinion there is no prospect of a large agricultural settlement there. In temperate regions I have inserted the zones where the most important crops thrive. In the northern hemisphere the zones, like the chief mountain ranges, run for the most part from east to west. These zones are broken by the arid and mountainous regions.

¹ Sparse pastoral occupation, based upon reindeer, is possible, as Stefansson has pointed out in several recent books.

In the southern hemisphere the trend lines of the continents run north and south. The crop belts more or less agree with this direction. In no case does the crop region extend to the desert areas, but a belt of stock country always occupies the marches of the desert.

The optimum of the wheat crop is near the optimum of white settlement in northern lands. In southern lands the present wheat optimum (in easily tilled prairies) is on the arid side of the optimum of white settlement.

Isopleths for rye, wheat, maize, cotton, tea, sugar, and Indian wheat are inserted in Fig. 87 in a somewhat generalized fashion. They are in part derived from Finch and Baker's fine series of maps.

Coal Control.

Coal has been described as the 'mother of industry'. There is no doubt that the great industrial settlements will remain where power is cheap for many generations. Hydro-electric power—the *blanche houille* of the French—is not likely to be a serious rival of coal, except for certain specialized industries, for very many years.

In 1911 the Geological Congress at Ottawa arranged for a survey of the world's reserves of coal. I have used the ensuing invaluable volumes very freely in this section of the discussion. In Fig. 88 a condensed statement of the results is charted.

The most striking feature of the map is the way in which all the major coal reserves are clustered along or near the 50° isotherm. A teleologist would be inclined to believe that Providence had arranged the world's coal supplies with an eye to the dominance of the White Race! Probably this coincidence indicates that the climates during past ages have on the whole not varied very largely,¹ and that the coal-forming vegetations grew under warm temperate conditions. Probably our present world temperatures are rather lower than usual—for we are living in the later stages of the Pleistocene Ice Age.

The total coal reserve—so far as is known at present—is approximately $7,937 \times 10^9$ tons.

¹ Incidentally, this apparent permanence of climatic regions is in opposition to Wegener's theory of drifting continents.

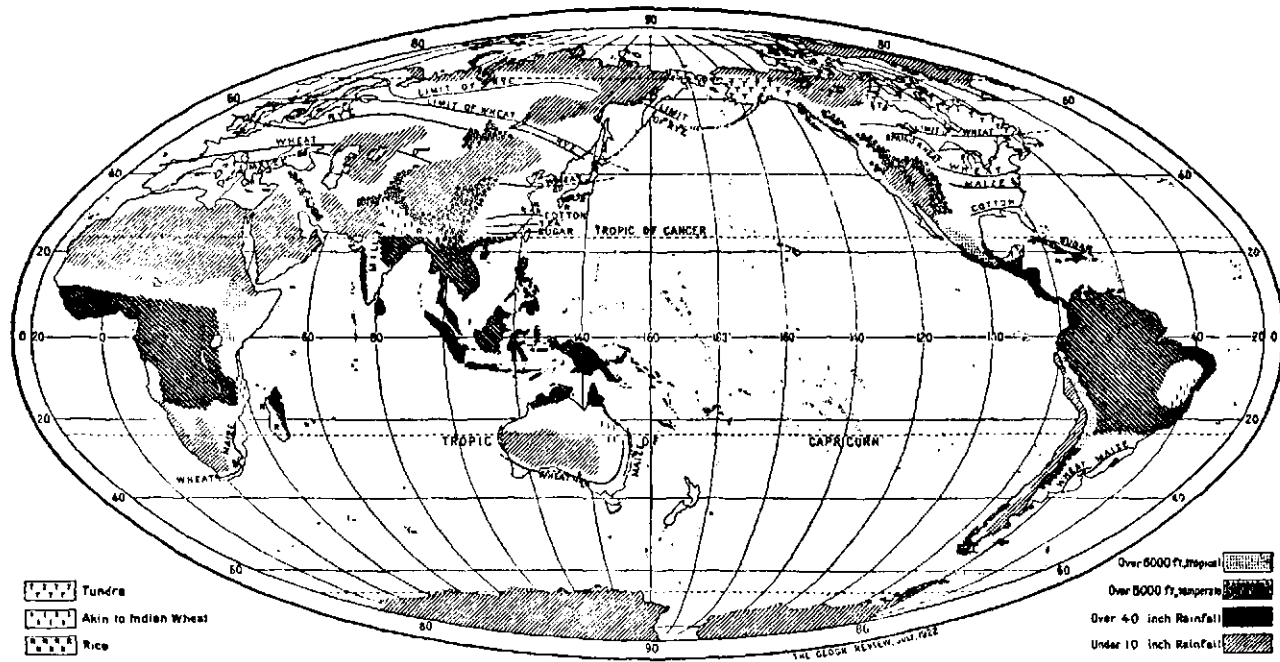


FIG. 87. Map showing in generalized form regions suitable for white settlement and crop zones of the temperate lands. Shaded areas (ruled or circles) are largely unsuitable for white settlement.

Of this colossal amount almost 90 per cent. occurs in the seven countries given below :

United States	$3,838 \times 10^9$ tons
Canada	$1,234 \times 10^9$ „
China	995×10^9 „
Germany	423×10^9 „
United Kingdom	189×10^9 „
Siberia	173×10^9 „
Australia	165×10^9 „
	$7,017 \times 10^9$ „

The more one studies the resources of the world the more astounding is the position of the United States. They excel in temperature, in rainfall, in coal—so that the centre of the world's industry and of the white population will inevitably move across the Atlantic from Europe to North America.



FIG. 88. Estimated coal reserves of the world arranged in order of abundance.

In the *Fortnightly Review* of February 1918, 'Politics' discusses the effect

of the Coal Factor somewhat as follows :

Coal production and the birth-rate are closely related, for only where there is cheap power can the densest civilized populations obtain remunerative wages in the many factories dependent on the coal. Hence the so-called 'decay of the French nation' is almost entirely due to her poverty in coal and iron, which largely depended on German aggression in 1871. Almost all the growth of German population has occurred in the coal and iron towns, whose expansion has only been exceeded by the western towns of U.S.A. On the other hand, the German rural population was less in 1910 than in 1871.

Similar results are to be expected in the other coal regions of the world, which makes the following table of vital interest in the question under discussion. In this table I have discussed separately the several well-defined coal-fields which occur in some of the countries listed.

CHIEF COAL RESERVES OF THE WORLD

(Based on the Reports of the Geological Congress of 1913.)

No.	Locality.	Tons estimated × 10 ⁶ .	Kind of coal.	Remarks.
1	United States Northern Plains	1,175,000	Largely lignite	Black Hills and Colorado are bituminous
2	Canada, Alberta	1,000,000	Lignite or soft coal	Bituminous in centre; anthracite along west
3	United States, Rockies	1,000,000	{ Bituminous Anthracite	In Montana
4	China, Shansi	714,340		Anthracite	In Utah, &c. Possibly best field in the world
5	United States, Eastern	500,000	Anthracite	Chiefly Pennsylvania, Ohio, and W. Virginia
6	United States, Central	500,000	Anthracite	Chiefly Illinois and Mis- souri
7	Germany, Westphalia	212,000	Bituminous	
8	Germany, Silesia ¹	166,000	Bituminous	
9	China, Yunnan, &c.	140,000	Anthracite and bitu- minous	Also Hunan and Szech- wan
10	England (total)	125,000	Bituminous	Carboniferous
11	New South Wales	115,000	Bituminous	Permo-Carboniferous
12	Canada, British Columbia	70,000	Chiefly bituminous	Crow's Nest
13	Canada, Saskatche- wan	57,400	Lignite largely	Cretaceous, &c.
14	Transvaal	56,200	Chiefly bituminous	
15	Russia, Donetz	55,000	Chiefly anthracite	
16	India, Raniganj	53,000	Bituminous	
17	Wales	40,000	Bituminous-anthracite	
18	Bohemia	40,000	Bituminous-anthracite	Pilsen and Prague
19	Victoria, Morwell	30,000	Brown coal	Tertiary
20	Colombia	27,000	Bituminous	
21	India, Hyderabad	23,000	Bituminous	
22	Scotland	22,000	Bituminous	
23	United States, Texas	21,000	Lignite	
24	Indo-China	20,000	—	
25	Germany, Saar ¹	16,000	—	
26	Siberia, Irkutsk	15,000 ?	—	Total reserves in Siberia said to be 173 × 10 ⁶
27	Siberia, Kuznetz	12,500	Chiefly brown coal	
28	Belgium	11,000	Bituminous	
29	France ¹	11,000	Chiefly bituminous	
30	Spitsbergen	8,750	Bituminous	
31	Spain	8,750	—	

¹ Changed since the war.

It may be objected that we have no accurate knowledge of the geological formations through large areas of the world. This is no doubt true of much of the tropical forest country in Brazil and Africa, but here, as we have seen, white settlement is not likely to take place owing to climatic disabilities.

Much of the tropical deserts and grass-lands has been prospected—at any rate to such an extent that the chances of a coal-field rivalling the seven important regions is not probable. For instance, in Australia—though half the area hardly contains an inhabitant—it is safe to say that there is no likelihood of a large coal-field anywhere—though some seams may be found in the north-west. When one thinks of the ubiquitous prospector for precious minerals—and of late for oil—it seems improbable that the above table will be materially altered.

I have not thought it necessary to consider other mineral deposits in this world-wide survey. Iron ore is generally carried to the coal-fields. Gold and other deposits do not lead to settlement to the same extent that coal does. In Australia it has been estimated that only about 120,000 people dwell in gold-fields which are remote from agricultural districts.

It is true that the gold discoveries of 1851 led to a large influx of emigrants, as has often been pointed out. But very few of these emigrants ultimately engaged in gold-mining—they turned to farming, &c. In other words, the gold merely accelerated a settlement which would inevitably have occurred without this attraction, though at a much later date.

Location Factor.

We have considered the three major factors determining close European settlement. Of the remaining, soil and communications are perhaps the chief. Both of these depend largely on the elevation—for almost all the largest areas of good soil and of easy communication (i. e. the Chernoziom of Russia, the Ganges and Chinese regions) are plains below 2,000 ft. elevation. It will be useful to consider the chief elevated regions with a considerable population.

In Europe the largest areas of heavy population occur in the

Rhine and Po valleys below 600 ft., and along the slopes of the Bohemian Highlands, &c., at about 1,500 ft. Only in Spain and Bulgaria are there many inhabitants above 3,000 ft.

In Asia the regions of close settlement in India are below 1,500 ft. and in China below 3,000 ft. In Mysore, Western Persia, Yunnan, and Southern Tibet there are elevated regions with moderate settlements.

In Africa parts of Abyssinia and Uganda are over 6,000 ft., and have moderate settlements. Much more important are the regions over 3,000 ft. in Uganda, Transvaal, Rhodesia, &c.

In America the chief population is below 1,500 ft., but Mexico, Colorado, and the Andean Plateaux offer notable examples of high-level populations. Speaking generally, elevation is a disadvantage, for it always implies heavy transport difficulties. Tropical plateaux are an improvement on tropical lowlands for white settlers inasmuch as they come nearer to the optimum temperature; but this is expressed by the temperature scale in our estimate of the value of the region under consideration. Good soils, generally due to extensive deposits of river silt, are, as stated previously, almost invariably found in the lowlands. We can, therefore, use a *location scale* ranging upwards from an optimum at *sea-level*—and trust to the temperature control to express the healthier conditions of tropical plateaux.

It will be found that almost all the factors influencing human settlement are based on the four now considered. *Health* is controlled primarily by temperature and humidity—of which the latter is closely related to rainfall. *Agriculture* is concerned with rainfall and temperature. A rich *soil* is not vital, for in the Australian Mallee and other regions of an extremely sandy nature an addition of superphosphate gives a payable wheat yield. In the future, artificial manures will be of increasing importance, but the natural controls of temperature and rainfall can never be altered.

Irrigated regions are perforce not properly represented in this scheme. Except for Egypt and Mesopotamia they are not likely to build up vast populations in desert countries. In Australia, for instance, the irrigated lands form only one part in ten thousand of those which require more rainfall, and this small proportion will never be sufficiently increased to be of much importance.

The *Pastoral industries* are determined almost wholly by rainfall and not by temperature, for some varieties or other of cattle, sheep, or allied

animals range throughout the continents, excluding only the permanent ice-caps and the dense tropical forests. *Industrial settlement*, the great feature of modern life, is dependent essentially on temperature and coal. We have noted that there are practically no coal-fields in arid regions.

It is impossible to discuss every factor. *Fisheries* are ignored, and they lead to some fairly important populations. Our *oil* supply is a vital factor, but nearly all of it (90 per cent.) comes from U.S.A. and Baku, so that it is by no means likely to lead to many new industrial regions.

The psychical factor, for instance the influence of religion and of education, in determining man's environment and status is obviously an aspect which does not lend itself to quantitative representation.

XXVIII

FUTURE WHITE SETTLEMENT DEDUCED GRAPHICALLY BY THE 'ECONOGRAPH' METHOD

THE most difficult feature in this research was to compare the values of the four major factors with regard to each other. What is the order of importance as a control of European settlement among the factors, temperature, rainfall, coal, and location? I was only able to arrive at what seems a fairly satisfactory conclusion by a method of trial and error.

I have shown that temperature is the most important factor. No matter what the variations in rainfall or location, there are no important white regions with annual temperatures below 80° or above 70°. After trying the effect of giving the *same* 'weights' to temperature and rainfall, and then a ratio of 3 to 2, I found that 2 to 1 gave results as concordant as could be expected; i. e. the resultant economic graphs for certain fully developed regions agreed fairly with their respective populations. Hence I was led finally to giving temperature double the value of rainfall as a determining factor.

Location, on the other hand, was of much less importance. As long as the regions were on the average below 1,500 ft. or so this factor was not vital. Above that elevation a handicap was introduced. I assigned to the location scale one-half the importance of rainfall, and one-quarter the value of temperature.

With regard to coal, it was only possible to see how this factor influenced the population of a country by comparing it with an adjoining country not blessed with this asset.

DENSITY OF POPULATIONS

<i>Country rich in coal.</i>	<i>Small or no coal supply.</i>	<i>Ratio.</i>
Bohemia 315	Hungary 160	1·9
Germany 324	France 191	1·7
Poland 193	West Russia ¹ 94	2·0
Britain 460	Ireland 140	3·2

¹ Four adjacent provinces equal in area to Poland.

The above comparisons are by no means exhaustive, and some striking exceptions (such as Italy) can be found ; but they serve to show that, under *present* conditions in Europe, the presence of coal and the resulting industries have about doubled the population in the countries so favoured.

Since the density of population depends directly on the variable temperature and rainfall, the theory of variation tells us that we may use the product *temperature* \times *rainfall* to represent the density. This can be expressed as an area—and this area (the triangle A B O in Fig. 89) forms the basis of the empirical graph which I use to compare the seventy-four regions of the world.

The econograph is a rectangular figure formed on four axes which represent, respectively, the average annual temperature, the average annual rainfall, the average elevation, and the (estimated) total coal reserve of the region.

Usually the econograph is a triangle—but if there be important coal reserves it becomes a quadrilateral shaped more or less like a kite.

The ideal region would have an econograph like that shown enlarged (inset in Fig. 89). The temperature would be 55° F. ; the rainfall 50 in. ; the region would be at sea-level and the coal supply 200×10^4 tons per square mile. It will be seen that the temperature and rainfall give the triangle A B O (in Fig. 89) —while the presence of a large coal supply doubles this, by adding the triangle A O D. The location effect is shown by the small area below the line B D. It is not of much importance save that if a region be mountainous this area almost disappears.

In the scale used the area of the ideal econograph occupied exactly 1,000 units. All the seventy-four regions were below this ideal, though Britain and North China each totalled 770 units. It is my purpose to show that the area of the econograph represents the habitability of the region as closely as one can expect to assess it in the present state of our knowledge.

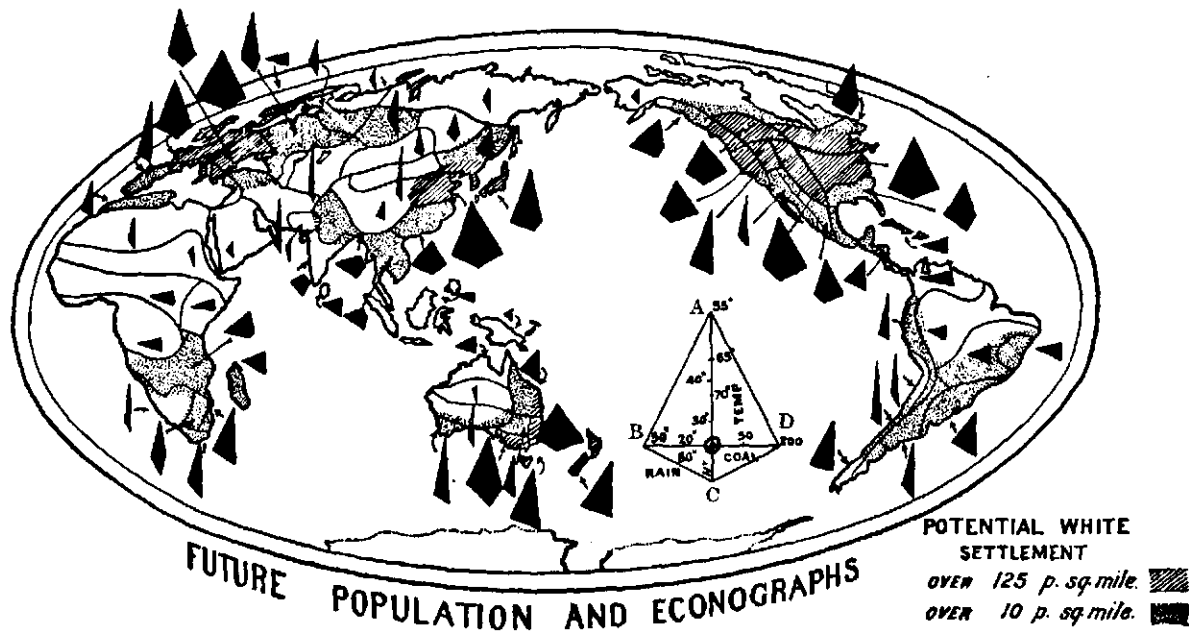


FIG. 89. Econographs for the seventy-four regions. The larger the econograph the greater the habitability. The large inset graph shows the arrangement of the four axes.

ECONOMIC FACTORS OF THE REGIONS

<i>Region</i> (see Fig. 89).	<i>Area</i> (square miles × 10 ³).	<i>Average</i> <i>annual</i> <i>temp.</i> (°F.).	<i>Annual</i> <i>rainfall</i> (inches).	<i>Average</i> <i>eleva-</i> <i>tion</i> (feet).	<i>Total</i> <i>coal</i> <i>reserve</i> (tons × 10 ³).	<i>Coal per</i> <i>sq. mile</i> (tons × 10 ³).	<i>Area of</i> <i>econo-</i> <i>graph</i> (1,000 units = max.).
		A	B	C		D	
<i>Europe.</i>							
British Isles . . .	120	50	40	600	190	160	770
Franco-Prussia . .	422	50	30	600	250	60	620
Poland (with S. W. Russia, &c.) . . .	400	50	28	600	200	50	565
Central Russia . .	1,200	45*	20	600	55	4	245
Mediterranean . .	545	60	20	1,500	—	—	210
Northern Russia .	461	38	15	600	—	—	65
Norway	125	28	38	3,000	—	—	60
Tundra	600	29*	9	600	—	—	12
<i>Asia.</i>							
Northern China . .	360	55*	30	1,500	714	200	770
Japan	300	55	40	2,000	—	—	484
Southern China . .	588	68	65	2,000	140	24	288
Mediterranean . .	158	60	18	3,000	—	—	180
Siam	750	75	60	1,000	20	3	136
Manchuria	940	30*	20	1,500	—	—	120
Western Siberia . .	768	35*	15	600	13	2	120
Ceylon	25	80	30	1,500	—	—	78
Deccan	588	75	20	1,200	—	—	72
Persia	1,000	55	10	3,000	—	—	66
Eastern Siberia . .	740	30*	12	2,000	15	2	45
East Indies	800	80	80	2,000	—	—	43
Aral	1,100	50*	6	600	—	—	40
Altai	820	30*	15	4,600	—	—	35
Tibet	2,100	30*	12	12,000	—	—	30
Tundra	3,220	20*	10	600	—	—	27
Arabia	1,372	75	10	1,500	—	—	20
Tarim	750	55*	6	3,000	—	—	20
Thar	263	80	5	600	—	—	13
Northern India . .	870	75	40	1,000	76	9	140
<i>Australasia.</i>							
Victoria	172	55	30	1,000	30	18	575
Eastern Coast . . .	98	65	40	2,000	115	110	574
New Zealand . . .	104	50	50	2,000	—	—	430
Tasmania	28	50	40	1,200	—	—	400
Swanland	172	60	20	1,000	—	—	225
Queensland	282	73	25	1,000	—	—	143
Lachlan	245	65	15	500	—	—	119
Northern Coast . .	578	80	25	800	—	—	70
Southern arid . . .	835	65	7	1,200	—	—	40
New Guinea	343	77	100	2,000	—	—	21
Northern arid . . .	565	75	9	1,000	—	—	16

* Temperate region with hot (continental) summer; 5° F. added on econograph axis.

ECONOMIC FACTORS OF THE REGIONS (continued)

Region (see Fig. 89).	Area (square miles × 10 ⁴).	Average annual temp. (°F.).	Annual rainfall (inches).	Average eleva- tion (feet).	Total coal reserve (tons × 10 ⁶).	Coal per sq. mile (tons × 10 ⁴).	Area of econo- graph (1,000 units = max.).
		A	B	C		D	
<i>Africa.</i>							
Natal	140	60	30	3,000	—	—	300
Transvaal	264	62	20	3,000	56	21	273
Cape	128	59	20	1,500	—	—	225
Rhodesia	1,250	72	40	3,000	—	—	180
Madagascar	227	72	40	1,500	—	—	136
Algeria	390	68	20	2,000	—	—	125
Congo	1,587	78	70	1,000	—	—	76
Uganda	770	75	30	3,000	—	—	68
Sudan	2,080	79	35	1,500	—	—	65
Kalahari	500	63	8	3,000	—	—	48
Northern Sahara	2,466	68	1	1,000	—	—	16
Southern Sahara	1,338	78	5	1,000	—	—	10
<i>North America.</i>							
North-eastern							
States	747	50	35	1,000	1,000	135	755
Inland plains	592	60	20	2,300	1,175	200	675
Alberta	630	40*	15	2,500	1,000	170	420
Utah	250	45	10	5,000	500	200	345
South-eastern							
States	486	65	40	1,000	21	4	326
Eastern Canada	960	40*	27	1,000	—	—	315
Oregon	246	55	25	3,000	—	—	315
Southern Rockies	510	65	12	5,000	500	100	300
British Columbia	345	38	40	2,500	70	20	286
Central America	592	70	60	3,000	—	—	165
West Indies	100	78	50	1,000	—	—	120
Southern Cali- fornia	444	63	10	2,000	—	—	72
Tundra	1,910	15*	12	1,000	—	—	15
<i>South America.</i>							
Uruguay	750	65	35	1,000	—	—	315
Southern Chile	131	45	70	3,000	—	—	272
Western Argen- tine							
	525	60	20	800	—	—	210
Central Chile	78	55	15	3,000	—	—	184
Andean plateau	525	63	15	8,000	—	—	112
Colombia	945	78	40	1,000	27	3	95
Central Brazil	1,820	78	70	1,000	—	—	91
Eastern Brazil	328	75	25	1,000	—	—	78
Amazons	1,969	80	80	500	—	—	65
Northern Chile	210	60	3	5,000	—	—	60
Patagonia	78	45	10	1,200	—	—	45

* Temperate region with hot (continental) summer; 5° F. added on econograph axis.

In the lengthy table on pp. 322, 323 I have recorded the economic factors. The first column gives the area of the region. The columns A, B, C, and D are plotted to form the econograph according to the scales on the ideal graph (Fig. 89).

We may profitably study how the shape of the econograph varies, and the meaning of these variations (see Fig. 89). A symmetrical graph (like that of Britain) indicates that a region is well equipped for agricultural or industrial occupations. If only the left side is present, it is chiefly an agricultural or pastoral region (e.g. Central Russia). In a few cases the right side predominates (as in Utah) which means that the coal reserves are likely to be of greater value than the agricultural resources. Where the lower triangle (below the horizontal axis) is large the region possesses extensive lowlands, and is likely to have large areas suited for intense cultivation (e.g. South Russia). Where it is small the country is elevated and usually not well suited for agriculture (e.g. Norway).

Somewhat similar indications are given by the length of the diagonals (or axes) (see Fig. 89). If the upper axis be long, then the region will have a *comfortable climate* (e.g. Britain or South California); and if it be short, the converse is the case (e.g. Norway or most tropical regions). A short axis to the left is unfavourable for white farming, but is often suitable for a *pastoral* occupation. A wet mountainous region, where *hydro-electric* energy is usually plentiful, is shown by a short lower axis combined with a long axis to the left (e.g. South Chili). The *desert* regions have a characteristic elongated shape ranging from the moderately arid type, such as South California, to the almost entirely useless types of the Tundra or the Thar.

XXIX

POTENTIAL REGIONS OF CLOSE WHITE SETTLEMENT

World Isoiketes

It will be admitted, I trust, that the areas of these econographs—all drawn according to the same scale, and embodying the variations in the major factors determining settlement—express approximately the habitability of the region charted. If now we plot the numbers expressing these areas on a map of the world (as in Fig. 90), we can draw lines through the same numbers and form a sort of contour map. To such a line the name *isoikete* has been given (see p. 290).

POTENTIAL REGION OF CLOSE WHITE SETTLEMENT

Class.	Group.	Units of habitability. 1,000 = max.	Region as defined in Fig. 89.	Present settlement.
I	a 1	770	Britain	Closely settled
	a 2	620	Franco-Prussia	" "
	b 1	770	North China	Not available for whites
	c 1	756	N.E. of U.S.A.	Moderately settled
	c 2	675	Inland Plains	" "
II	a 3	565	Poland, Austria, &c.	Closely settled
	d 1	575	Victoria (Australia)	Moderately settled
	d 2	565	East coast "	" "
III	b 2	484	Japan	Not available for whites
	d 3	430	New Zealand (and Tasmania)	Sparsely settled
IV	c 3	420	Alberta	" "
	e 1	315	Uruguay, &c.	Moderate settlement
	f 1	300	Natal	(not wholly available)
	c 4	345	Utah, &c. (U.S.A.)	Dry—sparsely settled
	c 5	326	S.E. States of U.S.A.	Moderately settled
	c 6	315	East Canada	Sparsely settled
	c 7	315	Oregon	" "
	c 8	300	South Rockies	Dry—sparsely settled
V	c 9	286	British Columbia	Sparsely settled
	b 3	288	South China	Not available for whites
	e 2	250	South Chili	Sparse
	a 4	245	Russia (Central)	Fairly close settlement
	d 4	225	Swanland (Australia)	Sparsely settled
	f 2	213	Transvaal	" "
	e 3	210	West Argentine	" "
	a 5	210	Mediterranean	Closely settled

a-f refer to the six world-centres, b being China.

Fig. 90, drawn in this fashion, presents many points of interest. There are three first-class centres of (white) habitability, two of the second class, three of the third class, and two of the fourth class, besides many areas in North America around major centres. These are shown in the table on p. 325. (The group 'classes' refer to the six world-centres previously mentioned.)

The first eight regions in the above table are all endowed with a plentiful coal-supply. In the third class come two regions, Japan and New Zealand, with poor coal-supplies but excellent climatic controls. The enormous coal-supply of Alberta is balanced by its long winter, so that it appears rather low down amid the most attractive regions.

REGIONS OF POTENTIAL MODERATE WHITE SETTLEMENT

<i>Class.</i>	<i>Units of habitability.</i>	<i>Region.</i> (<i>Defined in Fig. 89.</i>)	<i>Remarks.</i>
VI	180	Rhodesia	Sparsely settled
	180	Anatolia (Asia)	Largely occupied
	168	Mid Chili	" "
	165	Central America	" "
	143	Central Queensland	Sparsely settled
	140	North India	Not available
	136	Siam	" "
	136	Madagascar	" "
	125	Algeria	Largely occupied
	120	West Siberia	Sparsely settled
	120	West Indies	Largely occupied
	120	Manchuria	Not available
	119	Lachlan-Darling Basin (Aus.)	Sparsely settled
	112	Andean Plateau	Largely occupied

In this class Rhodesia, Central Queensland, West Siberia, and the Darling Basin offer large areas for settlement, which may be used as ranches or (in places) for dry farming.

The remaining regions of the world comprise the tundras, deserts, and hot wet countries where even moderate white settlement is unlikely. A considerable development of the pastoral industry with sparse white settlement is of course probable in the more favourable areas.

Europe as a Criterion

The only large region where white settlement has taken place for centuries is of course the continent of Europe. From all the European countries emigration has removed the surplus

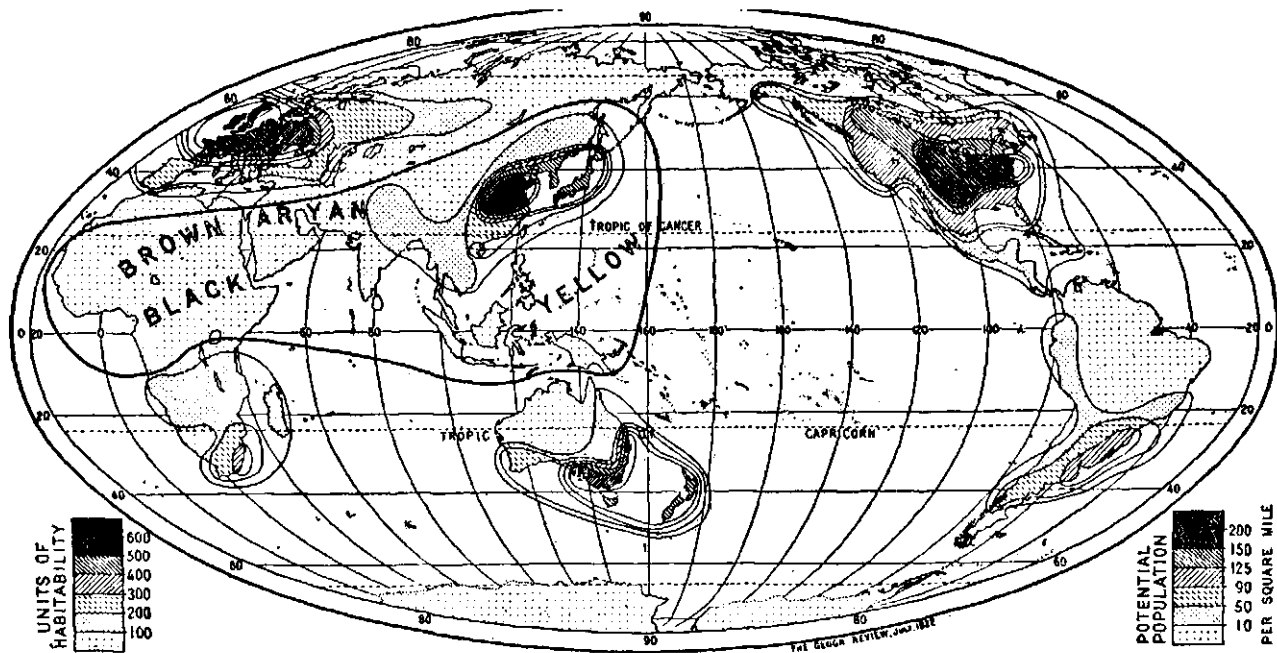


FIG. 90. The distribution of future white settlement according to the economic value of the world regions. The area within the heavy black line is not available for white settlement, but has been treated uniformly here. The facts of the distribution shown in this figure may be expressed by degrees of habitability, shown by 'isoketes' (see legend to left) where the optimum of habitability is 1,000, or by the corresponding potential population density (see legend to right.) The 'yellow' race will certainly expand beyond Asia, but this aspect is not here discussed.

populations, and though we cannot describe the Continent as 'saturated', it is the only one which approaches that condition.

In Fig. 91 the present distribution of population is given. It is based on Bartholomew's map in his most useful 'Advanced Atlas'. We see at once that there is a strong resemblance between the isoiketes and the population lines. Thus both the population lines and isoiketes centre about London. They both form concentric loops about an axis reaching from London to West Siberia. The 100 isoikete agrees quite closely with the 10 population line—if the latter be inserted between the 2 and 26 lines. In the same way the 200 isoikete agrees fairly with the 50 population line, if it be inserted. The 500 isoikete is near the 150 population line, and the 600 isoikete is not far from the 200 (except in Galicia).

Plotting on a graph the European density of population and its corresponding isoikete, we can interpolate for the regions of moderate habitability, which do not occur in Europe. We thus arrive at the following table :

APPROXIMATE DENSITY VALUES FOR ECONOGRAPH AREAS

<i>Econograph area.</i>	<i>Population density per square mile.</i>
600 units	200
500 "	150
400 "	125
300 "	90
200 "	50
100 "	10

Using these factors, we can arrive at a probable answer to the question: 'How will the white population¹ of the world be distributed when the empty continents are occupied to the extent that Europe is at present?'

Conclusions

(a) *Distribution of population.* Using the ratios indicated in Fig. 89, we may hazard an estimate of the populations which will cluster around the five world-centres of Central U.S.A., London, Sydney, Buenos Ayres, and Durban. When the surrounding regions shall have reached the condition of Western

¹ The probable expansion of the Asiatic races is beyond the scope of this discussion.

Europe (with a density exceeding 100 per sq. mile) we may expect populations of the following order :

POTENTIAL POPULATIONS

<i>Centre.</i>	<i>Region (Fig. 89).</i>	<i>Area in sq. miles.</i>	<i>Estimated density per sq. m.</i>	<i>Total population.</i>
I. North America	N.E. States	747×10^3	400	298
	Inland plains	592	200	118
	Alberta	630	100	63
	Utah	250	100	25
	S.E. States	486	100	48
	E. Canada	960	100	96
	Oregon	246	100	24
	Adjoining regions	—	below 100	30
				702
II. West Europe	Britain	120×10^3	500	60
	Franco-Prussia	422	300	126
	Poland, &c.	400	200	80
	Adjoining regions	—	below 100	120
				386
III. Argentine, &c.	Uruguay, &c.	750×10^3	100	75
	Adjoining regions	—	below 100	40
				115
IV. South Africa	Natal	140×10^3	100	14
	Rhodesia	$1,250 \times 10^3$	(40)	50
	Adjoining regions	—	below 100	18 *
				82
V. S.E. Australia	Victoria	172×10^3	180	29
	E. Coast	98×10^3	180	18
	Adjoining regions	—	below 100	15
				62

* 6 = foreign.

In the above list I have omitted those regions which are classed as tundra, deserts, &c., in this paper. Europe comes out about its present population, which indicates that the standards are as near as we can expect. An unexpected feature is the high value of Rhodesia and Angola. The temperature, though high, is much superior to that of most other countries of the same latitude, owing to its high elevation. The rainfall is almost wholly a summer one—which is a disadvantage. (A somewhat analogous region is to be found in the Atherton

Tableland (3,000 ft.) in Queensland, where settlement is going ahead rapidly.) 'It is owing to the elevation of this great upland that the white man can live and work in comfort in Rhodesia, and that his wife and children may flourish by his side: conditions such as are rarely possible in other regions which come under our survey in these pages' (*The Tropics*, by C. R. Enock, 1915).

If the estimates in the above table be accepted, the future white population of European ancestry will be distributed somewhat as follows:

FUTURE WHITE SETTLEMENT AND ITS POLITICAL CONTROL

	<i>British.</i>	<i>U.S.A.</i>	<i>Other States.</i>	<i>Total.</i>
	Millions.	Millions.	Millions.	Millions.
I. North American region 52 % of total	179	513	10	702
II. European region 29 % of total	60	—	326	386
III. Argentine region 8.5 % of total	—	—	115	115
IV. South African region 6 % of total	76	—	6	82
V. Australian region 4.5 % of total	62	—	—	62
Total	377	513	457	1,347
Percentage	28	39	33	100

(b) *Conurbations*. Assuming that an adequate food-supply is forthcoming, we may briefly consider how these vast populations will settle in the five areas specified in the above table.

Professor Geddes in his *Cities in Evolution* has pointed out that in the British industrial regions the cities at present merge into great 'disorderly conglomerations'. He looks forward to a time when orderly design shall control the growth of these clusters of cities or 'conurbations'. In England, for instance, there are already two great clusters, 'Greater London' and what he terms 'Lancaston'. The latter, extending from Liverpool to Leeds, is already 100 miles wide. He points out that five other conurbations are arising. These are the Scotch centre (Glasgow-Edinburgh), the Newcastle centre, the Sheffield centre, the Birmingham centre, and the South Wales centre.

Lille and Essen are two continental examples which in the near future will unite via Antwerp and Liège. Pittsburg in the

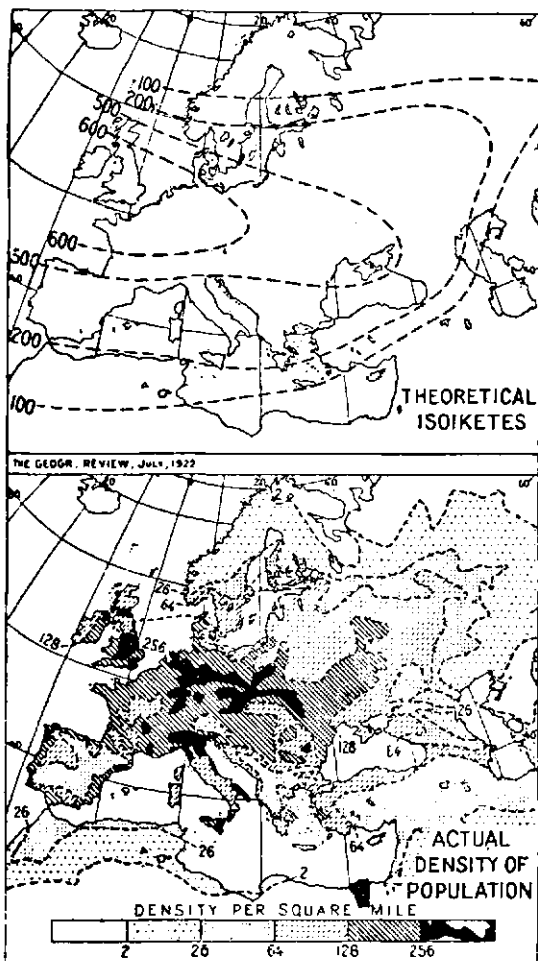


FIG. 91. The actual population density of Europe compared with the theoretical isoiketes (lines of 'habitability'), deduced from the econographs.

United States is a forecast of the intense settlement which will arise in the Eastern States. Even in Australia the rise of such towns as Cessnock (4,000) within the last few years points to

a conurbation around Newcastle. This will unite with Sydney and spread down the coast to the great Bulli coal-field.

(c) *Food-supply.* Where is the food coming from to feed these industrial centres? Most people know of the huge granaries of Russia, United States, India, &c., but fail to realize that already their huge populations permit of practically no export. Canada, Argentina, and Australia are exporting considerable percentages at present; but how long can this be maintained in the face of their own augmented populations?

CHIEF WHEAT-EXPORTING COUNTRIES, AVERAGE
PRODUCTION AND EXPORT, 1911-13* and 1923

(In millions of bushels.)

	Millions of population.		Production.		Export.	
	1911.	1921.	1911.	1923.	1911.	1923.
Russia	133 †	156 †	727	330	128	none
United States	91	106	705	785	116	208
Canada	6	9	229	474	111	358
Argentina	7	9	156	247	101	193
India	247 †	300	370	—	60	38
Rumania	7	17 †	88	101	54	?
Australia	4	6	89	125	52	80§

* G. B. Roorbach, 'The World's Food Supply', *Annals Amer. Acad. of Polit. and Soc. Sci.*, Philadelphia, vol. lxxiv, 1917, pp. 1-33. See also J. Russell Smith, *The World's Food Resources*, New York, 1919.

† With Poland and Ukraine.

‡ Including former Hungarian lands.

§ Including 20 per cent. as flour.

It has been estimated that before the war the United Kingdom and Belgium produced only 53 per cent. and 57 per cent. of their respective food requirements. To a less degree Germany and even France were dependent on outside sources. The closely settled regions of the East—India, China, and Japan—also are already anxious as to future food-supplies.

Professor Russell Smith makes the following remarks, which are well worth repeating :

'Belgium has passed the point where she can under present standards feed her people, but she has passed into the stage of buying raw material and selling manufactures and importing food with the proceeds. This nation has become like a city in its economic life.

'Japan until the recent sudden shift to commerce supported itself

almost entirely by agriculture with an average area of 2.6 acres per farm family. . . . They have entered on the ultimate stage of agriculture, namely, the garden-stage of hand labour and the non-flesh diet.'

(d) *The birth-rate.* From these brief quotations it will be seen that many of the closely settled regions of the world, e. g. West Europe, India, China, and Japan, are already anxious as to future food-supplies. This is a vital problem—and is of more immediate interest than most people realize.

Let us consider the North American region of settlement with its potential 700 millions. The population of the United States has been doubling itself approximately each thirty years during the last century. It was 25 millions in 1850, about 50 millions in 1880, and nearly 100 millions in 1910. If this rate of increase continue, it will have grown to the 700 millions mentioned in the table on p. 330 in less than 100 years! (See Fig. 92.)

The world as a whole, according to Knibbs, has doubled its population during the last ninety years. If the rate for North America drops to this figure, then it will take about 270 years to reach 700 millions.

If we consider the time which it will take the Australian population of 5 millions to grow to 62 millions (see Fig. 92), we find that it amounts to 100 years on the more rapid rate (which obtains at present), and to 320 years on the slower rate. These are much the same periods as deduced for the United States.

The Commonwealth Statistician (G. H. Knibbs) concludes his voluminous report on the 1911 census with the following very pertinent remarks (p. 455):

'The earth's population may be taken . . . as 1,500 millions and its land area (excluding Polar regions) at 33,000 million acres. If we could raise 22.8 bushels of food-corn per acre per annum, the total yield would only be 752,400 million bushels. The food consumption (per person) per annum is about equivalent to 5.7 bushels—which on the above computation would feed 132,000 million people.

'At the rate of increase of population of 0.01 per annum (somewhat less than the rate for all countries which have accurate statistics) it would require only 450 years to exhaust the food requirements mentioned. . . . The fundamental element in Malthus' contention is thus seen to be completely established.'

Future policy. I have shown, with some probability, I hope,

the distribution of the white peoples during the next two centuries. We may expect probably 600 millions more gradually to occupy North America ; 100 millions in South America, and over 50 millions in South-east Australia and also in South Africa.

I have not attempted to discuss the future of the Indian and coloured races in this paper. Already they amount to over 1,000 millions, so that one can hardly realize their increase in numbers in two centuries. For with the spread of sanitation, law, and order the birth-rate throughout Africa and Asia is not likely to diminish.

Yet a *general decline in the birth-rate*¹ would seem to be the only answer to the statistical argument which I have quoted. It is difficult to imagine a crop (at present unknown) more valuable than wheat and covering every acre of land surface. The general trend of this paper seems to foreshadow a vast world-struggle between higher civilizations with a low birth-rate and lower civilizations with a high birth-rate. This would seem to be inevitable within the next two centuries if the white race is to maintain its dominant position. The victory is to the thrifty and sober in any prolonged economic struggle.

This is not the place to discuss the White Australia policy. Indeed, few can object to it during the early and somewhat experimental stages of the Commonwealth. But Australia should beware of the effects of the absence of keen competition which such a policy may involve in the future. To quote an extreme case, this isolation to some extent accounts for the backward state of the Australian aboriginal.

It is worth while drawing attention to Professor Gulick's suggestion as to foreign immigration. He would admit foreigners—whether European or Mongolians—up to a fixed proportion (say 5 per cent.) of those of that race already living in the country. Thus there are about 33,000 Germans in Australia : he would admit 1,650 per annum. There are 21,000 Chinese : he would admit 1,050 a year. There are 3,474 Japanese : he would admit 173. All foreign races would be treated alike ; there would be no slur on any nation, and

¹ Such curves of declining birth-rate are given by Pearl in *Biology of Death*, 1922. His final population of 197 millions for U.S.A. seems much too low. Her unparalleled coal supplies will pay for food as long as any part of the world remains unsaturated.

since the natural increase of population has been about 100,000 a year, Australia would not be swamped by aliens.¹

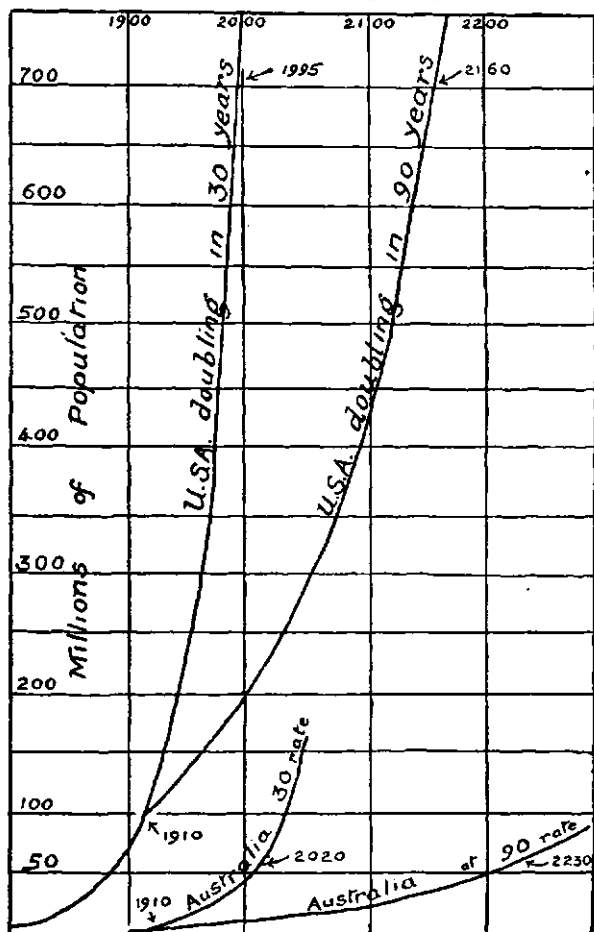


FIG. 92. Approximate graphs showing growth of population, assuming two hypothetical rates of increase. The decline in the birth-rate will of course flatten the curves.

Finally, from the point of view of national preservation, it would seem vital that the entente between America and Britain should be strengthened in every way possible. May we not hope that the allied victory of 1918 will obliterate the troubles resulting from the Great Schism of 1776!

¹ See foot-note, p. 339.

XXX

DEDUCTIONS AND SUGGESTIONS

MANY controversial problems have been raised in the preceding pages, and the solutions put forward will naturally be unpopular with various schools of thought and certain classes of people. I have come to the conclusion that the so-called Nordic races do not stand out as the most advanced type of man. This will not please a powerful section in American circles. I have shown that Australia is rather poorly endowed with natural resources. This statement has already antagonized an influential party, including most politicians in Australia. My deductions give Australia a rather low economic status among the nations of the world, while the United States take first place. I do not think that race is so important as environment in the coming economic struggles for supremacy, and this thesis contradicts the views of many eminent sociologists. Finally, it seems to me that the whole teaching of ethnology shows that peoples of mixed race are the rule and not the exception ; that they have founded and developed powerful states in the past ; and that what was true in the past will hold good in the future.

Let us briefly consider the Nordic question. If sociologists propose to contrast the Nordic with the Alpine and Mediterranean peoples, as is usual in certain American publications, they must not confuse nation with race. In France and Italy the three racial stocks are perhaps nearly equally divided ; in every country of Western Europe they are almost inextricably mixed. In the British Isles the people are possibly more largely Mediterranean than Nordic, but there is quite a strong mixture of Alpine blood.

For instance, Lothrop Stoddard in his interesting book, *The Revolt against Civilization*, gives a table (p. 66) in support of the alleged mental supremacy of the Nordics.

Out of every 100 in the 'Superior Intelligence' groups from Europe, there are said to be :

England	19·7	Ireland	4·1
Scotland	13·0	Turkey	3·4
Holland	10·7	Austria	3·4
Canada	10·5	Russia	2·7
Germany	8·3	Greece	2·1
Denmark	5·4	Italy	0·8
Sweden	4·3	Belgium	0·8
Norway	4·1	Poland	0·5

I would point out that it cannot be racial factors which place England and Holland so high, while the closely allied nations of Norway and Belgium are so low in mental capacity.¹ I have great respect for the Binet type of test, but I doubt the ethnological conclusions which Stoddard bases upon the table.

It may very pertinently be asked : If the Alpine-Mongolian peoples are even slightly 'higher' ethnic types than the Nordic or Mediterranean stocks, why have they not come to the front, like the British (and Americans) and other West Europeans? One could reply that there are important *Alpine* strains in the West Europeans which may have largely accounted for their achievements. But I think another line of argument, based on geographical controls, is more to the point.

Present material prosperity and the resulting supremacy depend to a large extent on two factors : (a) Command of the sea ; (b) Control of easily worked coal deposits. We have seen that racial evolution probably depended chiefly on greatly varying climatic stimuli. These were most pronounced in the *inland* regions of the Old World. When command of the sea became of importance, the outer rather primitive peoples had reached the seaboard, while the Alpine folk to a large extent were still inlanders. For instance, the latest Alpine immigrants into Europe, the Slavs, have only become a maritime people in one corner, i. e. Dalmatia, in the Adriatic (see Fig. 40).

As regards industrial supremacy, this is a growth of little over

¹ The so-called purer Nordic nations of Denmark, Sweden, and Norway make but a poor showing here !

a century. It is largely founded on the coal-fields of North-west and Central Europe, and of the Eastern United States. No one can doubt that China and Japan in another century will duplicate the material prosperity of the European or American manufacturers. One can only hope that they will manage to distribute the resulting wealth in a better fashion. The medieval nations of independent craftsmen had a happier environment than the congested, factory-ridden community of to-day. But it seems unlikely that China will show us the way to employ the valuable economic methods of mechanical production without also developing the slums (and millionaires) of our industrialism.

There are of course many other factors which account for the lagging behind of China and the central Asiatic nations. The character of the education in China, where the people were taught to look backward instead of forward, has, no doubt, greatly retarded their progress. This 'ancestor-worship' is not likely to affect them so much in the future. The fact that the environment of the remainder of 'Alpine' Asia has so deteriorated in recent times is a sufficient reason for the slow cultural advance of the *central* Asiatic peoples.

As regards racial mixture, no one desires more than the writer to see Australia free from those troubles which in the past have arisen when two races of very different cultures have amalgamated. But we should not assume that conditions may not be happier in the future. Any one who has seen how the educated Chinese have command of much of the East Indies must grant that they are at least our equals in culture and commercial sagacity.

There are, no doubt, many people who are willing to concede that the Mongolian and certain of the other coloured races are ethnically, mentally, and industrially our equals; but they believe it best for Australia to keep them at a distance. Their race-prejudice is based on two genuine fears, which relate to intermarriage and wage-cutting. I feel sure that the time has come to view both these aspects more dispassionately than hitherto.

Most educated Australians are acquainted with Anglo-Mon-

golian marriages which have been very successful, at any rate where the family lives in Australia. It is admitted that an Anglo-Saxon wife would have more than the usual trials of the pioneer and foreigner if she were to dwell in the Celestial Kingdom, where indeed the status of women is deplorably low. But my point is that this is not inevitably the result of a mixed marriage. The Australian women married to lower-class Chinese in *Australia* who have come under my notice are as happy as their neighbours. Indeed, in my opinion many Chinese husbands are unusually kind to their wives, while Dr. Harvey Sutton¹ informs me that their half-Chinese children are healthier and better cared for than the white children in the same environment with similar white mothers.

This very difficult problem should never be approached by people who cannot see any difference between the poorly educated negroes of the United States of America, who are only a few generations removed from the barbarous cannibals of Dahomey, and the cultured Mongolian or Indian of at least our own ethnic status. There is absolutely nothing in common in the two cases. Critics forget that in South America the experiment has been working for 200 years. In Chili, as Lord Bryce pointed out, the Mestizo (half Spanish, half Amerind) is at least as good a citizen as the Argentine peasant of practically pure Spanish descent. Here the rather low 'Iberian' blood of the Spaniard is mingled with the higher type (akin to Polynesian) to which many of the Amerinds belong. We should remember that the above Mestizo is very similar to a British-Chinese half-caste.

However, the economic argument is the crux of the whole problem. We fear the invasion by hordes of lower-paid, more industrious Asiatics. It is natural to prefer to keep our own country entirely to ourselves, just as the Chinese decided in the eighteenth century. But shall we not suffer greatly from it in the future? A small influx of Chinese (say, on Gulick's plan)² would greatly stimulate our tropical settlement. Domestic

¹ Chief Medical Officer to the Education Department of New South Wales.

² *American Japanese Problem*, p. 284, New York, 1914. (Cf. p. 334.)

labour and agriculture would benefit at once. There are many ways of ensuring that these immigrants shall never rival the natural native-born increase. A healthy competition would be developed which in similar cases has resulted in the benefit both of native and immigrant. One may instance the Huguenot migrations. Our Chinese carpenters and gardeners have not ousted white labour ; but I imagine they must certainly have shown the Caucasian that he must do thorough work if he is to hold his own in the industrial world of the future.

But, more important perhaps than all this, we should show China that we recognize her undoubted claim to racial equality. In the near future, when China is one of the greatest Powers on earth (and nothing is more certain, in my opinion), we shall reap the benefit of a far-seeing policy of the kind indicated briefly above.

The writer has closely studied this race problem for many years. The whole trend of racial history in the past points to an amalgamation of peoples in the next few centuries on a scale never before accomplished. I can see nothing which is likely to prevent the ultimate mingling of the European and Sino-Japanese types to produce a dominant racesomewhat resembling the Slavs and Western Asiatics around the Caspian Sea ; where indeed the same mixture has probably occurred through the ages.

It is surely wisest to look ahead and study possibilities. No folly can be greater than stifling scientific discussion of such problems.

As regards the *negro peoples*, theirs is a very different and very difficult problem. On every count they stand on a lower plane than white or Mongolian. Racial mixture with them may be a deterioration for the other races.¹ Yet here again the past shows, I think, what will happen. An ever-increasing proportion of half-castes will arise. These, while inferior to the lighter races, are more capable of holding their own than the negro, and the latter will ultimately disappear. The half-caste in time will then merge in the remainder of the world's population. Such is, to a considerable extent, what is happening with the Australian

¹ See *Menace of Colour* (Gregory) for a sympathetic review.

aborigines, as the following table indicates for the State of New South Wales (see *Kamilaroi and White*):

	<i>Full bloods.</i>	<i>Half-castes.</i>
1882	6,540	2,379
1892	4,458	3,015
1902	2,880	3,948
1912	1,917	5,117
1921	1,281	6,270

It is a very important fact, and one which is not realized by the public, that the birth-rate of the negro in the United States is rapidly falling off.¹ In the north in 1920 the proportion of negro children to women was only 68 per cent. of the similar proportion for white folks. Even in the south in 1920 it was 5 per cent. less than the proportion for white folk. W. F. Willcox¹ states that 'whereas the negroes were one-fifth of the community at the first census, by the end of this century they are likely to be not more than one-twentieth'.

Finally, as regards *racial exclusion*, it seems to the writer that this is the chief world-problem of to-day. Apart from the negroes, he can see no reason for saying that one race, in any important aspect, is better than another. Chinese, Japanese, British, Indian, 'Nordic', 'Alpine', and 'Mediterranean' have all made good in suitable environments. Hence he would say that eugenics rather than nationality is the best criterion for those responsible for racial exclusion. As regards the future, it seems clear that *environment* will be the most potent factor in moulding every race and nation.

The ideal towards which the most enlightened statesmen are working is surely a World at Peace. The chief obstacles in the way are *race prejudice* and *national jealousy*. The former in most cases is but another name for ethnological ignorance. The latter will tend to diminish as each nation realizes the place in the world's 'order of precedence' for which its racial, moral, and economic status equips it. The foregoing study is an attempt to investigate some of these ethnological and economic problems. If it helps, in however small a degree, to promote the brotherhood of man, the writer's main object will have been accomplished.

¹ *Eugenics in Race and State*, Baltimore, 1923, p. 174.

APPENDIX A

CYCLES IN THE GEOLOGICAL RECORD, CHIEFLY FOR NORTH TEMPERATE LANDS

(Quotations partly from Schuchert in *The Climatic Factor*)

	STAGE I Somewhat Zonal Climate Mountain Building Cool, but warmer than present	STAGE II Culmination Ice Ages and Interglacial Periods Mountain Building (Many genera die out) Colder than now, on whole	STAGE III Somewhat Zonal Climate at first Warm, drier	STAGE IV Uniform Climate Red Sands Salt Deposits Warmer, arid	STAGE V Culmination Uniform Climate Peneplains Warmer, moist	STAGE VI Uniform Climate Red Sands Salt Deposits Warm, arid
1st Cycle of 150 million years	RECENT	Interglacial age				
	PLEISTOCENE		Four ice ages			
	PLIOGENE		Man develops			
	MIOGENE	(Oaks in Spitsbergen)				
	Eocene	Early cold cycle San Juan, Colo.				
	CRETACEOUS	"In N Europe no warm seas" Mountains Sierra Nevada etc upraised				Red sands
	JURASSIC					"Cooler than Trias" Climatic zones begin
2nd Cycle of 150 million years	TRIASSIC			Plants scarce (Upper) Red sands, Salt deposits New marine fauna (Lower)	Subtropical U.S. to Spitsbergen. (Nearly uniform warm water everywhere)	
	UPPER PERMIAN		First land animals Appalachian folding ends	Vanishing swamps		
	LOWER PERMIAN		Great ice age Urals, Australia S. Africa, India, Brazil			
	UPPER CARBONIFEROUS	*Coolness and some glaciation (Barrell) Appalachian folds start				
	MIDDLE CARBONIFEROUS				Warm in Spitsbergen Coal at Cape Lisburne, Alaska	
	LOWER CARBONIFEROUS				Warm seas and corals U.S. to Alaska	
	UPPER DEVONIAN			Increased warmth Upper Devonian (Barrell) as compared with Lower Devonian	*Upper Devonian aridity* (Barrell)	Coal at Bear Island
	LOWER DEVONIAN		(Old Red Sandstone glacial evidence in England?) "Entire stocks blotted out." Sharks and other vertebrates start Mountains and volcanoes in New England & Canada			
	UPPER SILURIAN		5000 feet of glacial deposits in S. Africa harmonize with cold climate (Barrell) Chiefly apparent in Southern Hemisphere.			Arid Climate
	LOWER SILURIAN				Mild and uniform climate "Warmer than Upper Silurian"	
3rd Cycle of 150 million years	ORDOVICIAN			Mild and uniform climate Red sands (Schuchert) Reef corals in North		
	UPPER CAMBRIAN			"Markedly warmer than Lower Cambrian"	"Lime habit" came in dominantly suggestive of warm seas	
	LOWER CAMBRIAN		Some mountain building in E. America and W. Europe			
	UPPER PROTEROZOIC		Greatest ice age in the record Australia, China, Norway etc Great mountain building			
	MIDDLE PROTEROZOIC					Ice age of earlier cycle probable at Kadapha horizon, India, in Pretoria series, and Torridonian?
4th	LOWER PROTEROZOIC					possible at Huronian level?

APPENDIX B

EVOLUTION OF CULTURE AND LANGUAGE (TENTATIVE CORRELATION)

Group.	Migration zone and cephalic index.	Language type.	Typical customs, folklore, &c.	Africa, Europe.	Asia.	America (suggested only).	Australasia
I	Negro (70-72)	Jejune; often reduplicating; absence of gender; few numerals	Fetishism	Sudan and Guinea tribes Mbugu	—	—	Papuan
II	Mousterian (72-74)	Very complex prefixes and suffixes; much alliteration	Fetishism; matriarchy; group marriage; boomerang; totemism	Bantu	Nair, &c.	Boto-cudo?	Australian New Hebridean
III	Hamitic (74-75)	Polysynthesis common; and more regular synthesis	Couvade; totemism; serpent cult	Masai Fulah Basque	Dravidian	Eskimo Iroquois	Dentrecasteaux
	Semitic (75-76)	Trilliterals	Couvade; serpent cult	Coptic Tigrina	Arabic Hebrew (Kanarese)	(Algonquian)	South Solomon
IV	Early Aryan (76-78)	Highly synthetic (<i>ken-tum</i> in west of Eurasia)	Megaliths; Gaelic belt; tattooing; levirate	Gaelic) Latin) Greek) Teu-) ton)	Igorot Japanese Korean	Algonquian Arawak Athapascan	Malay S.E. Papuan Maori
	Late Aryan (78-80)	Highly synthetic to analytic (<i>sa-tem</i> in west of Eurasia)	Unforked kin words; levirate; shamans; swan-maiden myths	Slavonic	Persian Galcha	Carib Tlingit Haida	Louisiade E. Solomons
	Early Alpine (80-85)	Vowel harmony; clear suffixes to root; losing inflections	Forked kin words; head deformation; shamans	Magyar Serb Czech	Finn Tungus	Shoshone Aztec? Sioux?	Hawaiian Samoaan Tahitian
	Late Alpine and Mongolian (85-88)	Tending to positional; monosyllabic	Early triumph of art and social law	Albanian	Kirghiz	Quichua?	

The Groups I-IV are related to four migrations probably due to the Four Great Ice Ages.

From the earlier sections on language it is clear that culture boundaries rarely march with those of race. The above table merely suggests the line of evolution of languages and certain other criteria of culture.

The table gives in a tentative fashion the main conclusions (as regards culture) of my paper 'Evolution of Race, Culture, and Language' in the *American Geographical Review* for January

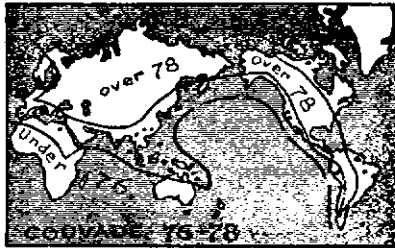


FIG. 93. Localities (dots) where couvade is practised, according to Ling Roth, correlated with the migration-zone of Iberian races (head index 76-78).

1921. The various 'customs', &c., are there plotted on eight maps of the world (see p. 79, Figs. A-H). Thus head deformation, kinwords, couvade, megaliths, snake and sun cults, tattooing, swan tales, levirate, and boomerangs are plotted. For instance, the couvade custom seems to mark a very persistent 'horizon' (to use a geological term) all over the world, wherever the Hamitic (or Iberian) folk (of head index near 76) wandered (see p. 84).

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