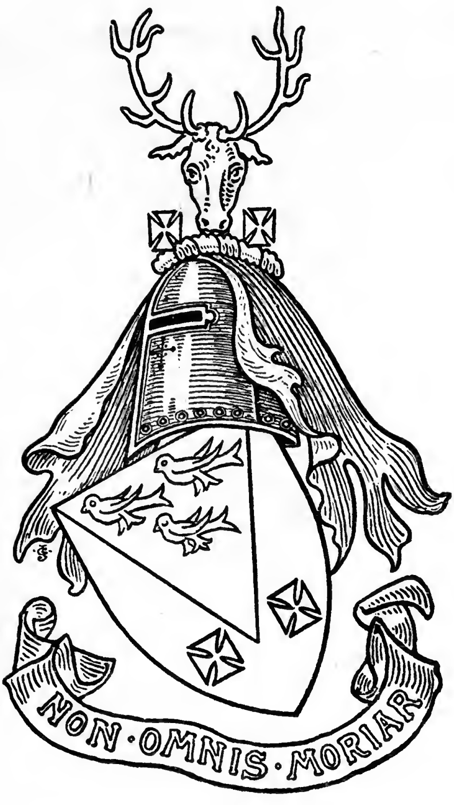
THE ORIGIN AND ANTIQUITY OF MAN

FREDERICK WRIGHT


NON·OMNIS·MORIAR

DUBLIN REVIEW—71 S.R.B.

DR G. FREDERICK WRIGHT, the well-known authority on the "Great Ice Age," has produced a very interesting, a very timely, and a very complete work in his book on the *Origin and Antiquity of Man* (Oberlin, Ohio, U.S.A. 1912. London. John Murray. Price 8s. net).

Opportune it certainly is, for certain recent discoveries of man have led to a flood of very

conclusions are drawn and that to the careful reader, who approaches the question without *parti pris*, he certainly seems to have made out his case. We cannot linger further over this very interesting, and, we may add, most readable book. The closing lines, however, may be quoted as summarising the author's final conclusions. "While the antiquity of man cannot be less than ten thousand, it need not be more than fifteen thousand years. Eight thousand years of prehistoric time is ample to account for all known facts relating to his development." And further: "The history of the human race as we actually know it gives no countenance to any doctrine of universal and general progress among the races of mankind, but sustains rather a doctrine of predominant natural tendencies to degeneration, which is only counteracted by contact with specially favoured nations and by voluntary acceptance of their most valuable ideas and practices." B. C. A. W.

ORIGIN AND ANTIQUITY OF MAN

Origin and Antiquity of Man

BY

G. FREDERICK WRIGHT
D.D., LL.D., F.G.S.A.

Author of "The Logic of Christian Evidences," "Scientific Aspects of Christian Evidences," "The Ice Age in North America," "Man and the Glacial Period," "Asiatic Russia," "Scientific Confirmations of Old Testament History," etc.

ILLUSTRATED

OBERLIN, OHIO, U. S. A.
BIBLIOTHECA SACRA COMPANY
1912

THE NEWS PRINTING CO., OBERLIN, OHIO

To

Professor Frederic Ward Putnam

Honorary Curator of Peabody Museum, Harvard University, in recognition of his invaluable service to American Archæology and of the great personal stimulus afforded by his encouragement even when not endorsing all the author's conclusions,

This volume is affectionately dedicated

PREFACE

I NEED make no apology for the space given in this volume to a fresh presentation of the facts of the Glacial epoch, for they continue to be the center about which the most important evidence of the antiquity of man gathers. Besides, as it has been the subject of my special study for forty years, new aspects of its bearing on the question at issue are constantly forcing themselves upon my attention.

While I cannot speak with equal authority upon the other lines of evidence along which we reach conclusions relating to prehistoric times, I think I have followed them sufficiently to reach conclusions that are probably correct, or, at any rate, so nearly so that they cannot be altogether ignored by those who think it worth while to make a comprehensive study of the subject.

Upon one point I would lay special emphasis, that is, the importance of giving just weight to the evidence presented of the occurrence of particular facts. Apparently, many experts in narrow lines of investigation are lamentably deficient in ability to appreciate the evidence with which ordinarily we have to be content in the establishment of particular facts. Many experts assume that when a discovery cannot be duplicated it is unworthy of attention, no matter how well it may be authenticated by evidence such as satisfies in all ordinary affairs. As instances we may adduce the discovery of the Nampa figurine detailed on pages 265 to 272, and of the Newcomerstown implement detailed on pages 226 and 228. The gentlemen endorsing these discoveries form a jury unexcelled in capacity for judging evidence, and in opportunity for deciding on the sufficiency of that on which their conclusions were based. Furthermore, the circumstantial evidence supporting their conclusions is ample and convincing. To ignore such testimony because others have not found similar things in the same place is not creditable to the pretentions to scientific knowledge made by those who do it. Again, we are bound to say plainly that the habit which many anthropologists have of ruling out all evidence which does not support some special theory of development is unworthy of scientific investigators. All the facts must be faced and be permitted to take their place in the theories which we promulgate.

Unfortunately there are some who will attribute to theological prepossessions the moderate estimates which we have made of the antiquity of man. With more reason we might attribute to "anti-theological" prepossessions, the extreme estimates of man's antiquity which are recklessly made by many with little regard to the facts in the case. We can only ask for a candid and careful consideration of the facts which are here presented in detail, and to the inferences drawn from them.

In conclusion I wish to acknowledge special indebt edness to Dr. Herbert W. Magoun for suggestions relating to the chapter on language, and to Dr. Melvin G. Kyle relating to the archæology of Egypt and Babylonia.

G. Frederick Wright.

Oberlin, Ohio, August, 1912.

CONTENTS

CHAPTER I

Methods of Scientific Approach 1

The solar system not eternal — Limitations to the possible existence of life on the earth — The moon not more than one hundred million years old — Life not possible on the earth fifty million years ago — Probably limited to twenty-four million years — Post-Tertiary time relatively very short — Lines of positive evidence — Written history — Archæological evidence — Ethnological evidence — High mental capacity of prehistoric man — Incorrect theory of uniformitarianism — Evolution includes catastrophes — Sundry geological catastrophes — The Glacial epoch a catastrophe — Destruction of species connected with it — No royal road to conclusions concerning man's antiquity.

CHAPTER II

The Historical Evidence 28

General considerations — Antiquity of Babylonian civilization — Of Egyptian civilization — Of civilization in Central Asia — Concluding remarks.

CHAPTER III

The Linguistic Argument 71

Language already well developed six or seven thousand years ago — The inflectional languages — The monosyllabic languages — The agglutinative languages — Antiquity of the Aryan languages — Possible rate of linguistic development.

CHAPTER IV

Origin of the Races of Europe 102

Historical evidence gives little help in untangling the problem — The stone age — The complexion of the races — The skulls — The Cro-Magnon race — The Basques — The Slavs — Mental and artistic ability of the neolithic race.

CHAPTER V

The Origin and Antiquity of the American Indian 128

No written records from which to reconstruct the history — Their language, culture, and customs — Their mode of reckoning blood relationship — Probable lines of migration from Asia, and in America — The Mound Builders — Antiquity of the Indian race.

CHAPTER VI

Significance of the Glacial Epoch 157

It establishes the antiquity of palæolithic man — Extent in Europe — Extent in America — Effect on drainage — Effect on land levels — Date — Rate of the withdrawal of the ice — The length of the epoch — The epoch in South America.

CHAPTER VII

Man in the Glacial Epoch 218

Gravel terraces of the Glacial epoch — Implements in the terrace at Trenton, New Jersey — Discoveries of Dr. Abbott and Mr. Volk confirmed — The Newcomerstown implement — Discoveries at Little Falls, Minnesota — Skeletons below the loess of Lansing, Kansas — Water action in the deposition of loess — Age of the Missouri loess — Human remains in the loess near Omaha, Nebraska — Primitive condition of glacial man in America — He probably succumbed amid the catastrophes which closed the epoch — Extent of these catastrophes — Probably an emigrant from Asia — Lines of migration from the western coast of America — Changes of land level accompanying the Glacial epoch — Extent of the floods connected with the close of the Glacial epoch — Glacial man in South America.

CHAPTER VIII

Man and the Lava Beds of the Pacific Coast 248

Extent of these lava beds — Period of their deposition — Influence upon the drainage — Formation of Table Mountain, California — Human remains discovered underneath it — Evidence collected by Professor Whitney — By Professor Wright — By Mr. George F. Becker — By Mr. J. F. Kemp — Final decision regarding the Calaveras skull — The Nampa figurine — Comparison with the Venus impudica from a prehistoric cavern in France — Details of the discovery — Extent and age of the lava flows in Idaho — Debacle connected with the bursting of Lake Bonneville — Ample explanation of the deposits at Nampa — Complicated problems of erosion in the mountains of Central California — Late date of the lava flows in that region — Stage of the development of prehistoric man on the Pacific Coast.

CHAPTER IX

Remains of Glacial Man in Europe 290

Evidence not so clear as in America — Remains in France — In England — In Germany — In Belgium — In Russia — In Siberia — In Switzerland — Erroneous interpretation by early investigators in the Somme — Enlargement of the land areas of Europe during the glacial elevation — Increased facilities for migration of man and animals — Local origin of the European gravels — Uncertainties of the rate of accumulation — Penck's error in estimating length of glacial episodes — Rapidity of changes in the Alaskan glaciers — Cave man in England — In Germany — In Belgium — In France —Character of the oldest skeletons — Classification of prehistoric races — Prehistoric man compared with modern races — Prehistoric art — Animals associated with prehistoric man in Europe.

CHAPTER X

Supposed Evidence of Tertiary Man 334

Importance of the question — Discoveries of Abbé Bourgeois at Thenay — Of M. Ribeiro in the Tagus Valley — Of Rames in Auvergne — Of Harrison and Prestwich in the valley of the Thames — Of Rutot in Belgium — Artificial character of eoliths disproved by Warren, Commont, and Boule — The existence of Tertiary man "not proven."

CHAPTER XI

Glacial Man in Central Asia 343

Distribution of species in the Northern Hemisphere — Former land connection between North America, Asia, and Europe — Geographical effects of Pliocene land elevation — Migration of Pliocene species — Most highly specialized animals originated in Southern Asia — Many lines of evidence pointing to Southern Asia as the place of man's origin — Evidence of language — Of ethnology —

Importance of the irrigated regions of Central Asia — Former glaciers in the mountains of Central Asia — Man and the mammoth in Northern Asia — The Extinction of the mammoth — Enlargement of the habitable areas of Central Asia during the Glacial epoch — Contraction of the area during the decline of the epoch — This correlated with the opening of Northern Europe and America during the withdrawal of glacial ice — Favorable climatic conditions in Central Asia during the Glacial epoch.

CHAPTER XII

The Physiological Argument 371

Unity of the human race now generally acknowledged — Possible rapidity of physiological changes effected by natural selection — Darwinism not a theory of inevitable upward progression — Man's mental powers predominant over physical conditions — Classification of man with the Quadrumana — Anatomical resemblances — Brain capacity of man and apes — Relative anatomical rank of man — Striking differences between man and the apes — No connecting link between man and apes yet found — *Pithecanthropus erectus* not a connecting link — Brain capacity of prehistoric skulls equal to that of some races and highly developed individuals of the present age — Rate at which physiological changes may take place under the operation of natural selection — Man's production must have been by a paroxysmal process — Man something more than a mere product of nature.

CHAPTER XIII

The Psychological Argument 406

Science cannot solve the mystery of man's origin

— The processes of evolution demand a Creator — A mechanical theory of the universe impossible — The theory of divine immanency incomplete — The Creator's supervision of nature — Divine intervention necessary to supplement the mechanical theory — Spontaneous generation inconceivable — The gap between plant life and animal life naturally impassable — Man's capacities compared with those of animals — Limitations of animal intelligence — Marvellous range of man's mental capacity — Man's mental and moral faculties divine gifts rather than natural products — Progressive capability of the lowest races — The progress of civilization largely due to the rise of leaders of great capacity — Theological difficulties similar to those of science.

CHAPTER XIV

The Biblical Scheme 437

Science cannot ignore the Biblical documents — But the language of the documents must be properly interpreted — Professor William Henry Green's discussion of Biblical chronology — The genealogical tables in Genesis not designed to teach chronology — Nothing in Biblical chronology to prevent any extension of prehistoric chronology of which there is proper evidence — The remarkable table of nations in Genesis x. — Influence of the Glacial epoch on the conditions of prehistoric man in Asia.

CHAPTER XV

Summary and Conclusion 477

Exaggerated estimates of geological time by Lyell and Darwin — Moderate estimates of George H. Darwin, Wallace, and Walcott — Small ratios of

Tertiary and Post-Tertiary time — Activity of present geological forces — Tendency of species to increase in geometrical ratio — Tremendous results of the Malthusian law in prehistoric times — Changes of land levels in the transition from Tertiary to Post-Tertiary time — Effect of the accumulation of ice on these changes — Present rate of changes in land levels — Present rate of glacial movements — Briefness of post-glacial time — History begins with a highly civilized condition of man — Tendency to degeneration — This counteracted only by acceptance of outside intervention — Man's origin inconceivable by purely naturalistic agencies.

Appendix 497

Implements Deemed to be of Great Age from Study of the Patinated Surfaces 524

Index 529

LIST OF ILLUSTRATIONS

Theatral area, Knossos 32
Map of Babylonia 38
Pre-Sargonic tablet (4500 B.C.) 41
Archaic arch of Nippur 43
Prehistoric mound in Turkestan 60
Prehistoric monoliths at Aksur, Abyssinia 124
Cahokia Mound 142
Fort Ancient 144
Mound at Miamisburg, Ohio 147
Serpent Mound, Adams County, Ohio 150
Serpent Mound, Warren County, Ohio 151
Southern face of the Temple of the Plumed Serpent, Xochicalco, Mexico 153
Section of Fort Ancient 156
Map showing glaciated areas in North America and Europe 161
Preglacial scenery in New York Harbor 169
Land areas at the close of the Tertiary period 173
Bird's-eye view of Muir Glacier in 1906, showing a recession of seven miles 203
Map showing stages in the recession of the North American ice sheet 209
Chipped implement from the Trenton gravels 221
Palæoliths from Newcomerstown and Amiens 227
The Nampa image 268
The Venus impudica, from a prehistoric cavern in France 269

Map of the Quaternary lakes, Bonneville and Lahontan 276
Map showing Pocatello, Nampa, and the valley of Snake River 277
Esker terrace on Miami River 294
Typical Chellean palæolith, called by Sollas "boucher" 295
Geography of Northwestern Europe in late Pleistocene age 302
Gravel pit at Mauer 307
Side view of jaw found at Mauer 310
Muir Glacier, Alaska 315
Man of Spy 322
Man of La Chapelle aux Saints 329
Mammoth and bison on walls of the grotto at Bernifal 331
Eolith from Puy Courny 336
Associated fragments of flints from the Thanet sands of Belle-Assize 339
Naturally formed flint flakes from the Thanet sands of Belle-Assize 341
Horse on walls of the grotto at Bernifal 342
Mammoth from Siberia, in the Museum at St. Petersburg 363
Comparative anatomy of the Primates 382
Pithecanthropus erectus, Dubois 394
Map of supposed post-glacial submergence in Asia 470
Kansas palæolith 527

ORIGIN AND ANTIQUITY OF MAN

Origin and Antiquity of Man

CHAPTER I.

THE METHODS OF SCIENTIFIC APPROACH

In the light of modern science it takes but a moment's reflection to see that the human race has had a limited period of existence in the world, and is destined to extinction sometime in the future. The earth may be compared to a transcontinental railroad train, and man a passenger boarding it at one interior station only to leave it at another far short of its ultimate destination.

According to the teachings of astronomy, the solar system consists of centers of matter and force which are slowly, but surely, parting with their heat, and tending to dead uniformity in their various modes of motion. The earth upon which we live is but one of these cooling planetary masses, and has become fit for the habitation of man only during recent geological ages. A few million years ago the heat upon the surface of the earth was so great that it would have been impossible for man with his present physical constitution to have endured it. A few million years hence, and the rigors of an arctic climate will have settled down over all; for, the sun is losing his pristine vigor, and finally, instead of being, as now, a source of life-giving power, will himself need to be warmed at the fireside of some longer lived and more fortunate luminary.

The limits set by astronomers and physicists to the conditions essential to the existence of man in the world are not very definite in either direction. From the rate at which the sun is at the present time parting with its heat, many modern astronomers are ready to assert that no forms of existing life could have been possible upon the world 20,000,000 years ago. They would compel us to bring not only the history of the human race, but all palæontology, within the limits of that period. Indeed, Sir George H. Darwin maintains, with the genius of his father, that it is not more than 50,000,000 or 100,000,000 years ago that the birth of the moon took place, coming verily out of the ribs of the earth (as, in Hebrew story, Eve is said to have come from man), having been thrown off from the rotating mass of the earth, as water is thrown from a grindstone, by accelerated centrifugal force. At first the earth and moon were in close proximity, and their period of united rotation did not exceed three hours. In short, the earth and its satellite long since passed through those stages of development which we are now permitted to witness at a distance in the systems of Jupiter and Saturn.

Of course at such a time organic life like that with which we are familiar was entirely out of the question. Everything was in an incandescent state. There was no solid earth, and there was no water either on the earth or above it; but everything was in a molten or gaseous condition. Gradually the heat was dissipated, and the volume of matter contracted, and the rotary motion of both the earth and the moon commenced to be reduced, until the present happy medium condition of affairs was reached which rendered organic life possible.

How life began upon the earth, it is not our province to ask. Whether, as some suppose, it was spontaneously generated in the effervescent turmoil of the cooling elements; or whether, as others have suggested, it was brought to the earth by the fortunate collision with some more fortunate planet; or whether it was brought into being by the creative fiat of the Almighty, are questions which we will leave for other times and opportunities of discussion. Here we will simply say that those who take the last alternative certainly cannot be charged with choosing the most difficult hypothesis. Every supposable hypothesis makes extravagant demands upon the reasoning powers of the human mind.

In the present condition of the moon we have an illustration of the ultimate condition of the earth itself, when it shall have parted with the most of its rotary motion, and, like the moon in its relation to the earth, shall continue its revolution about the sun in substantially the same period of time as at the present, but with a revolution upon its axis occupying fifty or sixty times as long a period as that now required. All this is shown by the mathematicians to follow through the influence of the tides, caused by the attraction of the moon. The moon, being the smaller body, and hence more amenable to retarding influence, has already gone through this phase of its experience; so that it now has a solar day equal to 28½ of our solar days. It is not difficult to see that, when the earth shall have made but a partial approach to that condition, human life — and indeed almost every other kind of life — will become impossible upon it. With the sun alternating a month above and a month below the horizon, or indeed a week below and a week above, everything would be scorched to death at noon and frozen solid before morning. But long ere this period arrives, the sun itself will have parted with so much of its heat that even, with the present rotary movement of the earth, the genial currents of life must cease to flow. Taking a long look into the future, we cannot shut our eyes to the fact that the solar system is running down, and the earth is moving to a condition of universal glaciation. In this vast secular movement, the post-glacial period is but a temporary episode.

Between these dim horizons it is evident that all forms of life upon the earth must have their limits, while human life is possible only in a still more transitory stage of the world's history. Beyond question, man has been one of the latest additions to the forms of life inhabiting the world; and, while able to survive the destruction of many of his companions among the higher members of the animal kingdom, he must also disappear long before the reign of eternal winter shall have set in. It is our present purpose to bring to bear upon the problem of man's origin and antiquity, so far as it is possible within moderate limits, all the light from all quarters that is now accessible. Leaving the future of the race upon the earth to the tender mercies of philosophers and theologians, we will set about the humbler task of endeavoring to interpret the footprints which man, in his progress thus far, has already left upon the sands of time. It will be profitable, however, at the outset, to take a brief survey of the field, and to consider the nature of the evidence upon which we must rely.

The astronomical evidence already presented distinctly limits our historical horizon, and brings the advent of the simplest forms of life down to a period, probably not more distant than 24,000,000 years; while that of the higher forms of life, and of man, must be indefinitely more recent.[1]

Another distinct approximation may be made by considering the general argument and evidence supporting the doctrine of man's evolution in connection with, if not from, the higher animals with which he is associated. There are two forms of evolution maintained by men of science. The one assumes a genetic connection between man and the original form of life in the world. According to this, man has slowly developed from an earlier form of life, and that, in turn, from one earlier still, and so on, until we see him emerging from the potencies involved in primordial life germs. But even on this theory, which may be either agnostic or theistic, man is the latest stage of that development, and the larger part of the 24,000,000 years allotted to the biologist for his forces of evolution to work out their results, must have been absorbed in the preliminary stages of development, which furnished the basis for its highest attainments in the marvellous mental and moral characteristics of man.

The bearing of the theory of evolution upon the date of man's appearance in the world will depend upon our conception of its gradualness. If in our scheme we adhere strictly to the arbitrary philosophical postulate, "Nature makes no leaps, but in everything moves by infinitesimal steps of progress," we might at once arrive at the conclusion that man's antiquity was immensely great; for the gap which separates him from his nearest allies in the animal kingdom is indeed a wide one. But on closer consideration, it will be seen that no system of evolution can be maintained which does not provide for a rate of progress rapid enough to cover the whole distance between protoplasm and the man of the nineteenth century in, probably, 24,000,000 years, and it would not seem possible to rule periods of paroxysmal progress entirely out of the question.

Even the most extravagant claims for the antiquity of man put him late in the geological development of the earth. The wildest enthusiasts would not place his advent earlier than the middle of the Tertiary period. But the continuance of the Tertiary and Post-Tertiary periods was not more than one-sixteenth of geological time; so that, if life began upon the earth 24,000,000 years ago, the Tertiary period could have been but little more than 1,500,000 years in duration. According to the estimates of Dana and Winchell, the ratios of Palæozoic, Mesozoic, and Cenozoic times are, respectively, 12, 3, and 1;[2] while Professor Henry S. Williams would estimate them as 15, 3, and 1.[3] If we take 24,000,000, on Dana's ratio we should have 18,000,000 for Palæozoic time; 4,500,000, Mesozoic; and 1,500,000, Cenozoic. Cenozoic time includes the whole period since the appearance of Mammalia, beginning with the Tertiary period. If man is limited, as we think he is, to Post-Tertiary time, considerable progress is made in our approximate calculations of antiquity; for, as plausibly estimated by Warren Upham, Post-Tertiary time is not more than one-fiftieth and perhaps not more than one one-hundredth of Tertiary time, which, on the present basis of 24,000,000, would make the limit 30,000 years. If geological time is extended to 48,000,000 years, the Glacial limit would be only 60,000; and if to 96,000,000 years, it would still be only 120,000. On the other hand, if it be taken as less than 24,000,000, Post-Tertiary time will be correspondingly diminished, as it would be on the second estimate of Upham.[4]

Those who do not believe in a physical bond of connection between man and the lower species are still accredited with believing that the Creator has pursued a line of ideal development in the creation of species, corresponding to the development of the physical conditions into which the species were from time to time to be ushered. According to this class of reasoners, also, the date of man's creation was late in the geological period. This they would infer, both from the nature of the geological development of the earth's surface, and from the character of the animals that were introduced in the various stages of its progress, — the animals and plants most nearly allied to man, and upon which he is most dependent, being clearly confined to the later stages of the earth's history.

So far, therefore, in our reasoning, the general considerations derived from both astronomy and geology will limit the possibility of the existence of the human race upon the earth to a period, at the very utmost, of a few hundred thousand, and probably less than 100,000, years in length. With this general limitation of the field, we will apply ourselves to the task of examining the more definite lines of evidence bearing upon the question in hand, dealing, first, with the specific evidence determining a minimum date of his arrival. In doing this we shall consider: (1) the evidence derived from ordinary historical documents; (2) the evidence derived from linguistic differences; and (3) the geological evidence. We shall then be in position to consider fairly what extension of time may be demanded by both the physiological and psychological evidence supposed to sustain the doctrine of man's development from some lower order of the animal creation. Here, however, it is important to pause a little to ascertain what we mean by some of the terms employed. Man himself needs definition. What is the specific element which differentiates man from the rest of the animal creation? With some, this is thought to be the power of self-consciousness and of carrying on sustained processes of inductive reasoning. With others, the specific character of the human race is thought to be the use of articulate speech. According to these, the first grammarian was the first man. But if these are indeed the determining elements of humanity, some more specific form of manifestation is required to provide the evidence needed to prove his past existence. For the rational mind can reveal itself only as its acts receive material embodiment. Such an embodiment is found most clearly in written language, whether inscribed on the rocks, stamped on clay tablets, or scrawled with perishable pigments upon equally perishable paper.

But the art of writing involves a still more fundamental material embodiment of thought, namely, the use of tools; for paper and ink and pen are material instruments requiring a high order of inventive genius. One of the simplest and most descriptive definitions of man, therefore, is " a tool-using animal." Without fear of fundamental error, we may say that the point at which the animal begins to make use of tools, and to combine with their use that of the more subtle instrument fire, marks his passage to manhood. Whether by evolution or creation, this step marks the real beginning of a human race with all its triumphs over nature. It is not strange, therefore, that the heathen philosophers of Greece and Rome looked upon the production and preservation of fire as a divine gift. But we find that primitive man everywhere produces it at will by friction. Even thus, however, it may well be regarded as a divine gift, since the ingenuity to produce it can scarcely be thought of as less than a direct inspiration from above. So also in the use of tools and clothing there is involved a power to dominate nature, of the very highest significance.

Fortunately for science in these later days, the primitive use of both tools and fire, has left indestructible marks of man's earliest occupation of the earth. In the caverns to which primeval man resorted for protection, both against the elements and against his enemies of various sorts, the fires he lighted changed the color of the soil upon which they were built, and left other indelible marks of man's presence. Rough stone implements seem at first sight indicative of a low order of intelligence, but it is fortunate for the historian of later times that early man was limited to the use of tools which rust could not corrupt. For it may be seriously questioned, whether the age of iron will leave any such permanent records as are furnished by the rough stone implements which primitive man used during the River Drift period in Europe and America, and which have been preserved in the original position in which they were lost in the growing gravel banks of the Glacial epoch.

Nor are we permitted to assign too low a stage of development to those primitive men who successfully prevailed over nature with implements more primitive than the bow and the arrow. For we must distinguish between the development of the individual and the development of the race. Division of labor is a necessary condition of the highest progress of the race considered as a whole; but this division dooms the larger part of the race to a one-sided and imperfect development both of body and of mind. Both the eyes and the ears of the civilized man are less acute than those of the savage; while it is only the favored few who can secure symmetrical physical development and broad mental training. The modern artisan, limited by his occupation to spending his days in making the fiftieth part of a shoe, has small chance to become a highly developed individual.

We shall certainly do primitive man a great injustice if we measure his individual advancement by comparing his tools with those which are turned out from a modern cutlery shop. For to make a palæolithic implement involves more individual skill than is required by the ordinary workman to make a watch. The chief difference in the product is that in the making of a watch we have the combined skill of successive generations of inventors. Successive generations had slowly learned to separate the iron from the ore, and to temper it and fashion it into the delicate hairspring and the complicated cogwheels of the modern timepiece. All this skill was a bequest to the modern workman. But the palæolithic implement was made by one man, and each chip struck off from the original core of flint was the embodiment of a far-seeing design. Nor did the production of the implement end the matter of individual development. To get one's living with such a tool would be beyond the power of a civilized man. Any of us would be slow to venture into the presence of a gigantic animal of the River Drift period without a more effective weapon of attack than was furnished by the stone hatchet of the River Drift man.

In endeavoring, as we shall be compelled to do, to arrive at conclusions concerning the antiquity of man by the use of circumstantial evidence, we shall at the outset meet a serious difficulty in fixing upon a standard of progress by which to measure the rate of the succession of events. Whether in geology, biology, or in history, we shall be confronted with the questions which separate both the men of science and the historians into three classes, according as they adopt a theory of uniformitarianism, catastrophism, or evolutionism. As the question of man's antiquity is partly historical, partly geological, and partly biological, it is essential at the outset, to form an opinion concerning the constancy and regularity of the causes at work to produce the changes which we see to be in progress.

In geology before the publication (in 1830) of Sir Charles Lyell's epoch-making " Principles of Geology," the accepted theory of progress had been that of catastrophism. It was supposed that all the great mountain systems of the world had been upheaved by sudden impulses in brief periods of time; that all mountain gorges had been formed by instantaneous displays of force, suddenly rending the mountains asunder, and that all the vast thicknesses of sediment which characterize geological periods had been deposited by floods and tidal waves with a rapidity defying all calculation. At every point this theory of changes was "prodigal of force and parsimonious of time." The words of Scripture were applied in a literal sense, and the mountains were made to skip like rams, and the little hills like lambs; and geological forces, like leviathan, were thought to have made the sea boil like a pot continually.

But with Lyell came in the spirit of quietism. The present was set up as the perfect standard of the past, and an effort was made to explain all geological phenomena by the action of forces of the same intensity with those which are known to be productive of existing geological changes. This hypothesis, as pushed by many of its advocates, was justly open to the taunt of being "prodigal of time and parsimonious of force," and was not inaptly dubbed "the Homeopathic theory of dynamics."

With our present survey of facts, however, the strict doctrine of uniformitarianism seems little less than absurd; for really there is no such thing as exact uniformity in nature. There is *continuity;* there is connection of cause and effect; but there is always progress and development; and, in justice to Sir Charles Lyell, it should be said, that his doctrine of uniformitarianism, by which he made the forces of the present a measure of the geological activities of the past, has been much misunderstood. Sir Charles Lyell's "present time" was not the present of to-day, nor of a single century, nor indeed of a millennium: his "present" comprehended a whole cycle of observation and inference. His work consisted not so much in diminishing our conception of the intensity of past geological forces, as of increasing our conception of the intensity of present geological agencies. His great book is largely a record of earthquakes and volcanic eruptions and of the known changes of level in continents and islands, joined with a vivid presentation of the vast effects finally produced by the cumulative action of slow causes operating through long periods of time.

The work of Lyell in checking crude theories of catastrophism has led to a more reasonable theory, comprehended in the single but very elastic word "evolution." The geologists of to-day are neither catastrophists nor uniformitarians, but evolutionists. When we say that they are evolutionists, however, we do not mean that they have adopted a materialistic theory of the universe, but that, in their study of the facts of nature, of the progress of natural events, and of the interaction of natural causes, they find that every combination of natural forces is subject to change; that, while there is continuity of development, there is never uniformity; that to-day is not as yesterday, and that they have no reason to expect that to-morrow will be exactly like to-day. Still, within narrow limits of time, they can, from a study of the present, forecast with reasonable probability a considerable portion of the future, and infer the condition of a considerable portion of the past. But they cannot fail to see that the slow moving causes which reveal themselves in the phenomena of to-day by no means disclose in those phenomena their full power. The wise evolutionist leaves the field open for catastrophes, both those which are calculable and those which are incalculable, both seen and unseen. For example, the strain of natural forces upon the crust of the earth is like the action of a force which bends a bow. Up to a certain limit, additional increments of force may be applied without the production of a catastrophe; but there comes a point when the limit of resistance is reached, and the bow must snap, and the strata of the earth must be ruptured, and in each a catastrophe is produced.

There is no end to illustrations which might be adduced to show that the course of nature never runs smoothly for any great length of time. The forces of nature are, indeed, evolving, but it is by a paroxysmal process. The elder Agassiz when he died was preparing for the press a series of articles in which he promised to show, first, that the geological record of America was more nearly perfect than that found anywhere else in the world; and, secondly, that it recorded a series of catastrophes which were so destructive of life as to necessitate as many creative interventions for the living species as there had been catastrophes. It is the general opinion of geologists that he exaggerated the suddenness of these catastrophes and the completeness of the destruction of life in connection with them. But the best informed geologists maintain with increasing confidence that the slow development of the geological conditions of the plains and mountains west of the Mississippi River has been marked by successive periods or epochs of rapid changes both in the geological conditions and in the forms of life dependent upon them.

In the words of Le Conte, when speaking of the transition from the Silurian to the Devonian formation, "it is impossible to overlook the *comparative* suddenness of the appearance of a new class (fishes) and a new department (Vertebrates) of the animal kingdom. Observe that at the horizon of appearance in the uppermost Silurian there is no apparent break in the strata, and therefore no evidence of lost record; and yet the advance is immense. It is impossible to account for this, unless we admit paroxysms of more rapid movement of evolution — unless we admit that when conditions are favorable and the time is ripe for a particular change, it takes place with exceptional rapidity, perhaps in a few generations." Again, the Permian formation represents a period of transition between the Palæozoic and the Mesozoic system of rocks. The greatest change of organisms in the whole history of the earth apparently took place in the midst of the conformable strata of this period. From this he reasons, as before, that the transition must have been comparatively rapid. Again, between the Mesozoic era, or age of reptiles, and the Cenozoic, or age of mammals, there is a great break in the life system, and in Europe, in the rock system, — the strata there being universally unconformable, — whereas in America "*the record seems* *to be continuous,"* — "conformable rocks connecting the two eras. . . This it seems impossible to explain on the theory of evolution, unless we admit periods of rapid evolution."[5]

Some of the headlines in Dana's "Geology" serve to emphasize this point. The formation of the mountains bordering the eastern part of the United States he refers to as the "Appalachian revolution." For a long period the whole Mississippi basin, extending to the eastern limit of the Appalachian range, was an area of subsidence. Slowly and regularly the bottom of the shallow sea which covered it sank, keeping pace with the accumulation of sediment and of vegetable material which when hardened into rock constitute the vast Coal Measures of the United States. But at a well-defined point of time the reverse process began. These beds were lifted above sea level, and the eastern portions of them wrinkled up into the folds of the Appalachian Mountains, carrying the coal beds to their very summits. At the same time, this movement was connected with profound changes in the animal and vegetable life of the continent.

Indeed, this is the story which is told in all the fields where are displayed the facts pertaining to the most recent epochs of geological history. The great mountain-building eras of the world's history have been few and far between. The earliest mountains have long since virtually disappeared from the world through the ever-active agencies of denudation. If asked why the Andes, and the Rocky Mountains, and the Alps, and the Himalayas are so lofty, it would be correct to answer, Because they are so young. The last great mountain-building era of the world's history is, geologically speaking, very close to us. The mountains all along the western portion of North America have been raised to their present lofty elevations mainly in late Tertiary and Post-Tertiary times. Middle Tertiary strata crown the summit of the Alps 13,000 feet above sea level, and there is equally conclusive evidence that the Himalaya Mountains have been raised even to a greater elevation since the middle portion of the Tertiary period.

In the Glacial epoch we have another illustration of the cumulative effect of slowly acting causes, leading at length to the production of catastrophes upon the grandest scale. During the long stretches of time which marked the different portions of the Tertiary period, nothing could have seemed more unlikely than what subsequently occurred in the great Ice Age; for, during the greater part of the Tertiary period a genial, subtropical climate prevailed without interruption over the northern part of British America, Greenland, Iceland, Spitzbergen, and Nova Zembla. Meanwhile the great plains of America west of the Mississippi River were covered with vast lakes into which were pouring sluggish streams of fresh water from almost every side, entombing in their sediment vast herds of animals like the camel, the elephant, and the hippopotamus, which are adapted to a warm temperate climate.

But this genial condition of things was brought to a close by the changes which introduced the Glacial epoch. Gradually the northern part both of Europe and America was elevated to a height that in connection with other causes brought on the rigors of what we now call an arctic climate. But if we had lived before the Glacial epoch the word "arctic" would have had a very different meaning from that which it now possesses; for the arctic zone was then temperate. At the same time the axis of the Rocky Mountains was elevated some thousands of feet, so as to tilt the plains upon the east and empty out the water from the great Tertiary lakes, and prepare them for the habitation of man, — a drainage enterprise of Nature in comparison with which all human schemes seem insignificant.

Considered in themselves the changes introducing the Glacial epoch would have seemed to proceed slowly. If man had been living at that time, it is not probable that in any single generation he would have been able to perceive and mark the change. Nevertheless, geologically speaking, it was so rapid as to constitute a series of catastrophes. The physical conditions, which for hundreds of thousands of years had been comparatively uniform, now underwent a change so rapid as to lead to the extinction of a large number of the species of plants and animals which then existed. The plants and animals of the present day are, indeed, without doubt, descendants of the plants and animals of the Tertiary period. But they are descendants that have adopted habits and forms peculiar to themselves. They are survivals from the extreme variations of that period. Most of the genera to which modern species belong, existed in the latter part of the Tertiary period; but the species are different. There were, indeed, then in North America vast herds of camels, horses, elephants, rhinoceroses, hippopotamuses, tapirs, and various other animals resembling modern types. But none of these survived in America, the only remnants of the genera being preserved in portions of the Eastern continent. Relatively, therefore, to the tenacity of life in species, the change introducing the Glacial epoch was so rapid as to merit the name of a catastrophe.

In the natural development of things, the closing scenes of the Glacial epoch involved catastrophes of a still more striking character. The gradualness with which the refrigeration culminating in the Glacial epoch proceeded, is witnessed to by the gradual displacement of warm-water species of shells by arctic species over the area of sea bottom which was eventually covered by ice. On the eastern shore of England, for instance, the gradation from subtropical species of shell-fish to arctic species is complete in the beds of Cromer.[6] But as the events connected with the breaking up of winter are much more striking than those connected with its beginnings, so the final breaking up of glacial conditions was a series of catastrophes. All the lines of drainage leading outward from the vast mass of the accumulated ice became periodically gorged with floods and choked with floating ice upon an enormous scale. At the same time the morainic débris, brought in many instances from distant regions, and which had been held in an icy grasp, was set at liberty, to become the prey of the swollen floods, and to combine with the loose fragments of ice still further to choke the water courses and partially obstruct the lines of drainage. Thus with great rapidity there were built up those vast lines of gravel deposits which mark the course of all the streams which flow outward from the glaciated region in North America. The terraces along these streams at the present time represent simply what is left from that period by the streams which are slowly reoccupying and reëroding the valleys which were choked up by the débris during the floods of the Glacial epoch. As we shall see later, it is in deposits connected with these closing catastrophes of the Glacial epoch that we chiefly find the earliest relics of the human race.

In estimating the antiquity of such relics, we shall have to be on our guard both against extending unduly the analogies of the present time and against exaggerated views of the briefness of time occupied by such a series of geological catastrophes as were evidently connected with the close of the Glacial epoch. For, as we can see, such catastrophes as are connected with the annual breaking up of the ice upon our northern rivers every spring, and which are limited to a few days, would in the movements of the Glacial epoch be represented by many centuries.

From this brief discussion of the conditions contributing to, and attending, the physical changes which have taken place in the geological history of the world, it will be seen that estimates of geological time cannot safely be made offhand. The significance of finding the evidence of man's antiquity connected with that of important geological changes is not so great as at first sight it might appear to be, for there is abroad a mistaken impression that whatever is geological is also ancient; whereas geological forces are now at work with a considerable degree of intensity, and geological changes of great importance may be very recent as well as very ancient. The determination of the length of time required to account for the geological changes which have taken place since man left the indications of his presence in the world will require a definite study of each instance and of all attending circumstances.

So, also, there is no royal road anywhere to the knowledge of man's antiquity. Especially will it be necessary to bear this caution in mind when considering the argument for antiquity drawn from the physiological changes which have taken place since man's original appearance in the world, and from his diversification into the various races which are now scattered over the surface of the earth. For the present stability of races may be, and probably is, correlated to the stability of the physical conditions now existing; while the paroxysmal changes through which the race may have been called to pass in the early stages of its history may have resulted in a correspondingly more rapid rate of change in man himself while becoming adapted to new conditions.

Most of all shall we find these cautions necessary in drawing inferences concerning the time required for the development of the various stages of civilization. Necessity is the mother of invention, and a prolonged subjection of the race to conditions in which mental development is of special advantage will be sure to quicken the pace of that development; so that here, also, we shall not find any ready-made rule by which to gauge the rise of the culture of antiquity and to estimate our distance in time from it.

Finally, a glance at the vicissitudes through which animals and man have been called to pass in their struggle to maintain existence will make it easy for us to believe that there has been a divinity shaping the ends of life, and determining the course of its tortuous development. The maintenance of organic life in continuity of development, especially of the higher forms of life, is dependent upon so many delicate adjustments that we are not at liberty to believe that it has been secured without design. Especially is the argument from design convincing when we see coming into existence man, the supreme and most exquisite flower of the course of nature.

CHAPTER II

THE HISTORICAL EVIDENCE

GENERAL CONSIDERATIONS

PROPERLY enough, we attempt to distinguish between history and natural history, but it must be confessed that it is somewhat difficult to draw the dividing line. By some, history is limited to inquiries concerning the origin and life of nations, thus relegating to natural history the whole period previous to that of written records; for it is scarcely possible to conceive of any extensive development of national life without the aid to organization furnished by written language.

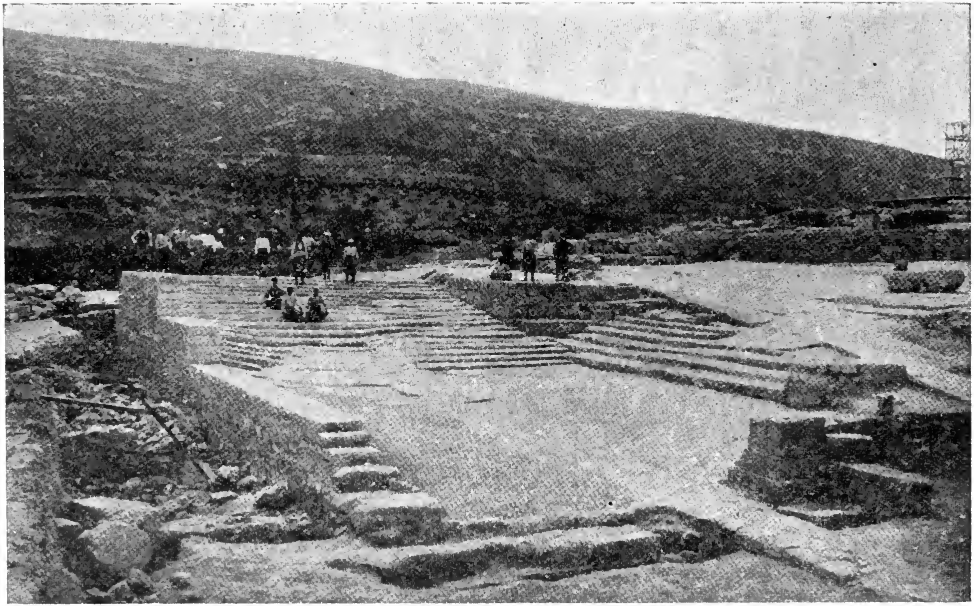
It might be thought that a code of laws could be transmitted by memory, as the Rig-Veda is transmitted even at the present time and as the Talmud was transmitted for about five centuries; but, although this may have been done to some extent, the natural perversity of human nature is such that it fails to remember what is not to its advantage, and a fixed code would be rendered impossible by conflicting interests. In the case of the sacred writings mentioned above, superstition was a powerful ally in maintaining the purity of the text. Men did not dare to change it. A code of laws would have no such backing, and only a written or inscribed text would be able to furnish a positive and unchanging basis of procedure, since a ruler's memory would dominate the situation otherwise and the code would change to suit his fancy at the moment. A favorite might thus warp the laws, and anarchy would soon follow.

Written records are found not only in books, but on monuments and coins, and furnish us the most copious and important information concerning the past; but their value depends in great degree upon the proximity of the historian to the facts he purports to record. Tradition loses its value after three or four generations. Still, with the present length of human life, a pretty correct account of leading events can be preserved by tradition for a period of 130 or 140 years. A person who is seventy-five years old can easily transmit from memory some very definite facts related to him by those whose memory goes back to events which occurred 130 years before. Perhaps in earlier times, before the art of writing was generally practised, tradition may have preserved a credible account of the events for a much longer period, but the tendency to the conversion of story into legend through the increments of subjective speculation is probably so nearly irresistible at all times as to make tradition valueless for historical purposes after the third or fourth generation, except where it has been held in check by written documents, by inscriptions, or by national or social observances. According to Sir W. Muir, out of 600,000 traditions current 200 years after the death of Mahomet, not more than 2,000 could be deemed to have the slightest claim to be regarded as authentic.

Bearing these considerations in mind, we shall find that written history conducts us but a small portion of the distance back into the vistas of time during which man has existed upon the earth; while many of the most important earliest records either will present difficulties of interpretation or will be of doubtful authenticity. For instance, the Chinese records carry back the authentic history of the empire only to the founding of the dynasty of Yaho, in the year 2357 B.C., from which time regular historical records have been preserved. Previous to that time the accounts are too evidently mythical to be of any value.

The classical literature of Greece carries us back only a short distance into the early history of the human race. It is not until the fifth century before the Christian era that systematic historians like Herodotus and Thucydides arose, and evidently their opinion upon the remote antiquities of the nation is of slight value. The poems of Homer had been reduced to writing perhaps four hundred years before Herodotus made his memorable contribution to the history of the world, that is, at about the year 850 B.C.; and the Trojan War, which they commemorate, occurred only three or four hundred years earlier, or possibly about 1200 B.C. Beyond this period we are left to inference from very uncertain data for the construction of Grecian history; while Roman history begins nearly five hundred years later than that of Greece.

A new chapter in Grecian history, however, has been opened by the explorations of Evans, Murray, Burrows, and others in the Island of Crete,[1] where, at Knossos, there has been uncovered the Labyrinth which Daedalus is reputed to have built for Minos, who is no longer considered a mere fabulous monster. In this remarkable palace evidence is brought to light of a pre-Grecian civilization connecting itself with the Sixth Dynasty of Egypt between 3000 and 4000 years before Christ. Here have been found numerous statues, paintings, and architectural designs, rivalling in excellence the products of the classic period of Grecian art, but antedating them by three



Theatral area, Knossos. (Restored.)

millenniums. Indeed, the ruin which overwhelmed the capital of the Sea Kings of Crete occurred as early as 1400 B.C., coeval with the Dynasty of Amenhotep III, at the time when luxury was undermining Egyptian civilization, and two hundred years before the siege of Troy. Furthermore, beneath the foundations of the palace, twenty-five or thirty feet of débris were excavated, containing relics of the stone age, such as are found extensively all over Europe. But the data for estimating the rate of the accumulation of this débris are so uncertain that one is not warranted in allowing for it more than a few centuries, or at most one or two thousand years.

It is only when we turn to the valleys of the Nile and the Euphrates that we get back any appreciable distance towards the origin of the human race through written records. It is the more important to get clearly before our minds the trustworthy teaching of the earliest records of these nations, since it is from their histories as a starting point that we set out upon the more difficult problem of tracing the progress of human events in earlier times by the vague and obscure data afforded by geology, by the science of language, and by natural history. The main problem immediately before us will, therefore, be to give a reasonable account of man as we find him in the stage of civilization to which he had arrived according to the records on the earliest Egyptian and Babylonian monuments.

From the evidence found in the literature and the monuments of these early empires in the valleys of the Nile and the Euphrates of the progress already attained by the human race in art and science and literature, and from the indications of the extent to which the peculiarities of race and language had then already become fixed, we may get a standard of some value with which to measure the preceding ages. Indeed, if we might assume that the progress of the human race had been in all times uniform, it would seem to be an easy matter to determine the date of its origin by a simple rule of three. Given, for example, the amount of physical change which has taken place in the races of the world since the beginning of Egyptian history, and, given the progress which has been made in the mental and moral development of man in that time, the question would be, How far would the line of progress have to extend to reach the point where mankind first emerged from the lowest level of his primitive condition? But unfortunately, as we have already seen, the problem is not so simple as this would make it appear.

The doctrine of uniformity in the progress of events, either in nature or in human history, is by no means established, and is not involved in any rational doctrine of evolution. As already stated, there are frequent paroxysms in nature, when slowly accumulating forces display themselves suddenly, and reveal effects for which previous observation could have done little to prepare us. The geologist has learned to recognize catastrophes in nature as well as the infinitesimal steps which mark the more quiescent stages of progress.

But especially are we compelled to recognize these paroxysmal stages of progress in human history. It is indeed true that a great leader is dependent for success upon his environment, or, in other words, upon the preparation for his work which he finds around him. Luther could have accomplished nothing without the German people; but, on the other hand, the German people would have accomplished little in the way of reform without their Luther. Alexander and Caesar are worthy of all the honor bestowed upon them for their military and political accomplishments; even though it be true that, without the peculiar material and moral conditions surrounding them they would have made little mark in the world. In all such movements there are the leaders and the led. When the preparation is made and the requisite moral and physical forces are in existence, a genius can change the face of history in a single decade. But without the timely appearance of the genius all these accumulated forces would be dissipated.

We cannot, therefore, reasonably escape the conclusion that history is naturally divided into epochs which are marked by rapid stages in their development. No one, for example, can deny that the appearance of Jesus Christ introduced transforming agencies which rapidly changed the whole course of human events. Mohammedanism, too, arose suddenly through the influence of Mohammed's remarkable personality. So, also, the discovery of America would not have been accomplished without the agency of a personality like that of Columbus. For thousands of years Europe and Asia had waited for it. But when it came, a new order in the world's history rapidly developed. And so through the discovery of steam and electricity, the whole world has been transformed, superficially, in a single century. Indeed, more progress has been made in the forms of material civilization during the past century than was made in the preceding four thousand years. In America a new order of political development was made possible by the exalted personality of Washington. It is use-less to say that the American Revolution was inevitable from slow working causes. Without such a leader as Washington the whole movement would have been futile. With incapacity and personal ambition in command the ship of state would have been beached on the surrounding shoals or broken to pieces on the hidden rocks of a tempestuous sea. The same is true concerning the outcome of the civil war in the United States when slavery was abolished. It was the unique personality of Abraham Lincoln which held the forces of the North together and made them effective. So it has always been. Without exception the turning points in the world's history have been marked by the appearance of great leaders whose personal characteristics are not accounted for by any known law of natural causes. Geniuses do not spring spontaneously out of the ground.

With these cautions in mind, we will turn to the immediate task in hand, and attempt to follow back the thread of history as brought to light by the literature, the inscriptions, and the monuments preserved in the ruins of Babylonia and Egypt.

ANTIQUITY OF BABYLONIAN CIVILIZATION

Inscriptions in the Euphrates Valley easily carry us back to about 3000 B.C., and probably to a con-

Map of Babylonia.

siderably earlier date. Some time during that indefinite period, Semitic bands apparently from the plateaus of Eastern Arabia entered the valley of the Euphrates, and took possession of various cities of an indigenous race (the Sumerians) that had already acquired a written language and attained a high degree of civilization. Among these cities, beginning at the south, were Eridu, Ur (Mugheir), Lagash (Telloh), Larsa (Senkereh), Nippur (Nuffar), Uruk (Warka), Babylon, Sippar (Abu Hobba), Ninevah, and Haran. Ur of the Chaldees, spoken of in Biblical history as the birthplace of Abraham, still exists in the ruins of Mugheir.

But strange changes have passed over the region since that early time. When Terah and Abraham left their native land (Gen. xi. 31), Ur was a maritime city, with harbor and docks. The Euphrates and the Tigris then entered the sea by separate outlets, and Ur was not far from the mouth of the Euphrates. But the ever-present sediment of these mighty rivers has long since silted up the upper part of the Persian Gulf until now these ruins are 150 miles from the mouth of the river. Ur was then the seat of an active intellectual life. The other cities mentioned contained numerous public buildings and libraries, which show that the cuneiform system of writing had already attained its full development. Irrigation was practised so as to develop the resources of the country to their fullest extent; while religious differences appeared which indicate a long previous history. Ur was the center of the worship of the moon-god, Larsa of the sun, Uruk of Ishtar, and Nippur of Bêl.

At a still earlier date we have the records of Sargon and Narâm-Sin, his son, the former of whom styles himself "king of Agade, (Accad)" a city forty or fifty miles north of Babylon. Sargon was a great warrior, extending his conquests to the shores of the Mediterranean, a distance of a thousand miles. The following inscription is the account he gives of his own deeds: "For forty-five years I have ruled the kingdom. The Accadian race I have governed. In multitudes of bronze chariots I rode over rugged lands. I governed the upper countries. Three times to the coasts of the sea I advanced." Sargon's date (about 3800 B.C.) is now pretty definitely settled, through an inscribed cylinder of Nabonidus, the last king of Babylon (550 B.C.), who, speaking of repairs which he made upon one of the temples, says, that beneath the foundations, or as we should say in the cornerstone, he found an inscription, deposited by the great Sargon's son, "which for thrice thousand and twice hundred years none of the kings that had lived before him had seen."[2] This would give, as stated above, to Narâm-Sin, Sargon's son, the date of 3750 B.C., and to his father 3800 B.C. Other independent documents corroborate this statement on the cylinder of Nabonidus.

Pre-Sargonic Tablet (4500 B.C.). (Courtesy of the S. S. Times Co.)

By another route we are brought to an equally early date in the history of the same region. The Assyrian king Assurbanipal was the founder of a great library at Nineveh. For a long time he was at war with the Elamites, in the lower part of the valley, and at length captured its capital, Shushan (or Susa). This was in 645 B.C. In the inscriptions he records that he found in the temple at Susa the statue of a Chaldean goddess which had been carried away from the city of Warka by the king of Elam 1635 years before. The Assyrian king says that he restored this statue to its own sanctuary in Warka. Adding together the dates above given, we are carried back to the year 2280 B.C. The condition of civilization implied by this Elamite conquest in 2280 indicates, according to ordinary experience, a long preliminary stage, which would very probably coincide with the date already given for the founding of Accad.[3]

Efforts have been made to discredit this inference of Nabonidus but at most Sargon's date is only brought down a thousand years, to 2800 B.C. There is, however, probably no good reason for disputing the higher estimate. But even if it should be reduced, the argument for the great antiquity of the human race in the Euphrates Valley is by no means discredited; for there is abundant evidence of a long period of civilization in Babylonia preceding the days of Sargon and Narâm-Sin.

In the excavations by the Philadelphia Expedition at Nippur, Mr. Haynes found thirty feet of débris below the pavement of Narâm-Sin. This débris represents the slow accumulation which takes place in Eastern cities built of sun-dried bricks, where

Archaic arch of Nippur (about 4000 B.C.). (Courtesy of the S. S. Times Co.)

the street slowly rises above the level of the house floors until the easiest way to remedy the growing inconvenience is to fill up the houses and start on a new level. It is thus that the mound marking the site of Nippur in the Euphrates Valley reached such an elevation that still in ruins it averages sixty feet above the plain, and at one point, where the temple tower originally stood, a height of ninety feet.

While there is no certain means of telling the rate at which this accumulation proceeded at all times, it is significant that the sculpture and the inscriptions discovered in these lower strata, below the pavement of Narâm-Sin, are of such a high order that they indicate a long lapse of time to account for the progress which had already been made in arts and civilization. Twelve feet below Sargon's pavement there was found a vaulted arch of burnt bricks, built in a wall to protect pipes which passed beneath; indicating a high state of progress in mechanical skill.

Among the other objects of special significance discovered in this thirty feet of débris below Narâm-Sin's pavement are fragments of a white stalagmite vase, bearing inscriptions of a dynasty which preceded Sargon by several centuries. These inscriptions show a well-established language and a high degree of skill in the formation of the letters.

Moreover, the French explorers at Telloh, a neighboring city, clearly established a line of rulers belonging to this period, extending far into the past. Among the art treasures discovered by them were two votive slabs covered with cuneiform inscriptions and figures of men and animals, showing remarkable skill in giving lifelike appearance to living forms.

Again, the character of the writing in this pre-Sargonic period shows an advanced stage in the art, since the letters have already lost to a large extent their original hieroglyphic or pictorial outlines. Indeed, the language of this pre-Sargonic period is nearly the same as that which was still in use in Babylonia four thousand years later, and was already differentiated from the other Semitic tongues.

This high state of art and culture, it is agreed, could not have been attained in a short time. Of the seal cylinders of this age the work is so delicate as to call forth admiration from all competent judges. In the words of Professor Clay, "The lapidist must have possessed delicate saws, drills and other tools. The fact is that the skill manifested in their execution was never equaled in subsequent Babylonian history, and can scarcely be surpassed in the present day with all our modern improvements." [4]

The same facts are expatiated upon by Winckler, who writes: "The numerous monuments of this period evince technical skill of the highest order. . . . The inscriptions of Sargon and Narâm-Sin are distinguished by a beautiful script, and so excellent is the technical execution of Gudea's statues that archæologists once thought it necessary to assume a Greek influence.

". . . Owing to the statements of classical writers the invention of the arch has hitherto been attributed to the Etruscans, but the Babylonians made use of it in their most ancient buildings in Lagash, or Telloh. Their technical skill rested on scientific principles no less unattainable in modern architecture than the Grecian idea of beauty in the plastic art. The buildings which they constructed with brick must have been built according to rules and laws unknown to modern architecture, which views many of these ancient works with the same astonishment as is evoked by the Pyramids of Egypt." [5]

We may also note again the significance of the fact that the development of writing, justly regarded as the greatest of all intellectual feats, was made thus early in Babylonian history. It is worthy of note, also, that in astronomy and mathematics we still pay tribute to the Babylonians of that remote period. From their astronomical observations we have borrowed our calendar. We continue to use their month and week, to name our days after theirs and to divide them, as they did, into twelve double hours, as the faces of our clocks and watches would remind us.

ANTIQUITY OF EGYPTIAN CIVILIZATION

The valley of the Nile vies with that of the Euphrates in the antiquity of its records, but in Egypt the difficulties of obtaining exact chronological data are even greater than in Mesopotamia. The chief reliance for dates in Egyptian history anterior to the eighth century before the Christian era are the lists of Manetho, an Egyptian priest, who lived during the third century before the Christian era, during the reign of Ptolemy Philadelphus, and wrote a history of Egypt in Greek. This history itself has been lost, but the lists were copied by Josephus,[6] and are preserved in two or three other works written early during the Christian era.[7] Still by the aid of the monuments we can go back with reasonable certainty to an antiquity of three thousand or four thousand years before the Christian era; and the revelations made concerning the advancement of the nation in arts, science, and literature in those early periods are the significant facts upon which we need to fix our attention in the present inquiries.

Among the dates pretty definitely fixed is that of the Exodus of the children of Israel from Egypt after the death of Rameses II. (about 1300 B.C.), a little before the Trojan War. Four hundred and thirty years before this, which is the generally accepted time for their sojourn in Egypt, would carry us back to the year 1730 B.C., when Joseph became prime minister under the Pharaohs. It was something more than 250 years before this that Abraham in his wanderings from Ur of the Chaldees was compelled by famine to share the hospitality of Egypt. But at this early period he found there a highly developed civilization considerably in advance even of what he had left behind him in the fertile plains of Shinar. The pyramids were even then monuments of great antiquity. In Napoleon's address to his soldiers in Egypt, his ignorance of Egyptian chronology weakened the force of his celebrated reference to these ancient structures. Instead of "forty centuries," he would probably have been within the truth if he had said, The shadow of sixty centuries look down upon you from these lofty piles of stone. For even according to the more moderate calculations, the great pyramids were constructed thirty-seven hundred years before Christ. More probably, however, they were built some centuries earlier than 4000 B.C.

We shall do well to consider what the existence of such monuments at that early date implies. The largest of the three pyramids of Gizeh covered an area of more than thirteen acres, having a base of seven hundred and sixty-four feet upon each side. Its height was a little over four hundred and eighty feet, — six feet higher than the dome of St. Peter's at Rome, and two hundred feet higher than the Capitol at Washington. The weight of its mass was 7,000,000 tons. Some of the basement stones of this huge edifice are thirty feet long by about five feet in their other dimensions, and would weigh from fifty to sixty tons. In general, the blocks upon the outside of the pyramids are larger than modern builders venture to handle. The interior blocks were quarried from limestone ledges near at hand, but the surface was covered with huge blocks of syenite, brought from a quarry in the vicinity of Assouan, near the first cataract, five hundred miles distant. This granite, sprinkled with black and red, harder than iron, and shining beautifully when polished, was quarried in enormous quantities, and brought down to Lower Egypt for building and monumental purposes. The labor of quarrying so hard a stone was not only immense, but required a high degree of skill. "The traces of this labor and severe work are still left visible from those ancient times. Here are seen the sharp stroke of chisel; there the mining hole may be clearly distinguished; here we meet with the outline of a colossal statue, like a form in a mould; there the whole length of a fourth side of an obelisk still hangs in the rock, as if it had grown there and was waiting for the master to loosen it from its bed." [8]

Nor are the marks of Khufu's energy limited to Egypt. Rock tablets in the wadies of the Sinaitic desert bear testimony to his victorious sway in that region, where doubtless he was attracted by the mines, which were so early worked for their hidden treasures. And all this, four thousand years before the Christian era, and three thousand years before the earliest gleams of Grecian history glance to us from the poems of Homer. A modern silver-tongued orator found abundant opportunities to expatiate upon the lost arts when contemplating the enormous works undertaken and carried through in Egypt in those dim ages of the world's history.

Astronomical data also furnish us important evidences of Egyptian antiquity. The Egyptians did not observe leap-year. Hence in every 1460 years there occurred a complete shift of the nominal months. But the actual progress of the seasons always conformed to the progress of the sun in the ecliptic. The inundation of the Nile began with the visible rising of the dog-star (Sirius). The name of this star in Egypt was Sothis. The revolution of the nominal year, which, as we have seen, occurred once in 1,460 natural years, was called the Sothic period or the Sothic year. One of these periods we know began 139 A.D. This enables us to reckon back to the recorded beginning of a Sothic period in the reign of Merenptah and through others to earlier dynasties. From these astronomical data, Petrie fixes the commencement of the first dynasty at 4777 B.C., the fourth dynasty at 3998, the sixth at 3410, the eleventh at 2985, the twelfth at 2778, the thirteenth at 2565, the eighteenth at 1587, the nineteenth at 1327.[9]

Nor was it alone in the arts of material civilization that Egypt excelled in those early days. In 1847 a papyrus was discovered in Thebes, and presented to the National Library in Paris by Monsieur Prisse; hence known as the Prisse Papyrus. On examination, this proved to contain a treatise on Manners, written by Kakimna in the reign of Senoferu, the last king of the Third Dynasty, and a treatise on Morals, by Ptah-Hotep, of the Fifth Dynasty. According to the best authorities, therefore, the first of these would date back to 4450 B.C., and the second to 3950 B.C. All unite in calling this the oldest book in the world, written according to the most trustworthy of these estimates more than six thousand years ago, and having for ages profoundly influenced the noble people in the valley of the Nile who offered a refuge to all the world in times of distress and trouble. We may profitably examine these documents for the sake of getting some adequate impression of the stage of development to which a portion of the human race had at that time attained.

In Kakimna's treatise on manners [10] we find cautions against gluttony which remind us of the proverbs of Solomon, some of which may indeed be the source from which the latter were drawn. This, for example: "If thou sittest down to eat with a glutton, to keep up with him in eating will lead afar." "If thou sittest down to eat with a number, despise the dishes which thou lovest. It is but a short time to restrain thyself; and voracity is something degrading, for there is bestiality in it." "He who is drawn away by his stomach when he is not on the watch is a worthless man. With such people the stomach is master."

Among these maxims, also, we find this in commendation of good manners: "As for a man lacking good manners . . . who wears a surly face towards the advances of a gracious heart, he is an affliction to his mother and his relatives." The interest of Kakimna in the instruction of children is worthy of special note: "Do not," he says, "harden the hearts of thy children. Instruct those who will be in thy place. . . . Let the chief talk to his children after he has gained experience. They will gain honor for themselves by increasing in well-doing, starting from that which he has told them."

Most instructive of all in this most ancient relic of human literature is the noble conception of the Deity appearing in it. God is referred to in the singular number, as bringing to pass events which cannot be foreknown by man.

In like manner the larger collection of precepts made by Ptah-Hotep in the Fifth Dynasty reveal a highly cultivated, gentle, generous, and virtuous man enforcing on the court of Pharaoh the precepts which he himself practised, and this nearly three thousand years before the beginning of Grecian history. From this single treatise, the translation of which would occupy about twenty pages of a duodecimo volume, one is led to form a very high estimate both of the progress in civilization already attained and of the standard of public morals which was cherished and inculcated. We do indeed learn that then, as now, "there are people who take all sides when they speak, so that, by not replying, they may not grieve the one who has made a statement." But this is not the course of conduct commended, for elsewhere he says, "When thou speakest, know what objections may be made to thee. . . . To speak in counsel is an art, and speech is criticised more than all other work; it is contradiction which puts it to the proof."

Of the desirability of controlling one's temper Ptah-Hotep speaks as follows: "If thou hast to do with a disputer while he is in his heat, and if he is superior to thee in ability, lower the hands, bend the back, do not get into a passion with him. As he will not permit thee to spoil his speech, it is very wrong to interrupt him; that shows thou art not able to be quiet when thou art contradicted. If then thou hast to do with a disputer while he is in his heat, act as one not to be moved. Thou hast the advantage over him, if only in keeping silent when his speech is bad. . . . If thou hast to do with a disputer while he is in his heat, do not treat him with contempt because thou art not of the same opinion. Do not be provoked with him when he is wrong. . . . He is fighting against his very self; do not ask him to flatter thy views. Do not amuse thyself with the spectacle which thou hast before thee; this is odious, small, and of a contemptible spirit." And yet again, "If thou aimest at having polished manners, do not question him whom thou meetest. Converse with him alone so as not to annoy him. Do not dispute with him until thou hast allowed him time to impregnate his mind with the subject of the conversation. If he displays his ignorance, and if he gives thee an opportunity to put him to shame, rather than that, treat him with consideration; do not keep pushing him on, do not reply in a crushing manner; do not finish him; do not worry his life out, for fear that he for his part will not recover, and that men will leave thee to the benefit of thy conversation."

Especially interesting are the instructions given concerning the proper treatment of one's wife and of his neighbors. "Do not," he says, "give way to thy temper on account of what occurs around thee; do not scold except about thine affairs. Do not be in a bad temper towards thy neighbors; a compliment to him who gives offense is better than rudeness. It is wrong for a man to get in a passion with neighbors, so that he knows not how to manage his words. Where there is only a little difficulty, he creates an affliction for himself at a time when he should be cool."

"If thou art wise, take care of thy house, love thy wife purely. Fill her stomach, clothe her back; these are the cares to her body. Caress her, fulfill her desire during the time of thine existence; it is a kindness which honors its master. Be not brutal; consideration will lead her better than force. . . . This establishes her in thine house; if thou repellest her, it is an abyss. Open thine arms to her for her arms; call her, show her thy love. . . . If thou takest a wife, may she be more content than any other of her fellow-citizens. She will be doubly bound if the chain is sweet to her. Do not repulse her; grant that which pleases her; it is when contented that she will value thy guidance."

All this, and much more equally good and interesting, was written by a wise man living under the dynasties that built the pyramids, — probably not far from two thousand years before Abraham went down to Egypt to share the hospitality of its rulers during a time of famine. But even then this was ancient wisdom; and Ptah-Hotep commends it as such, "which if his readers heed, their wisdom will be ever increasing."

ANTIQUITY OF CIVILIZATION IN CENTRAL ASIA

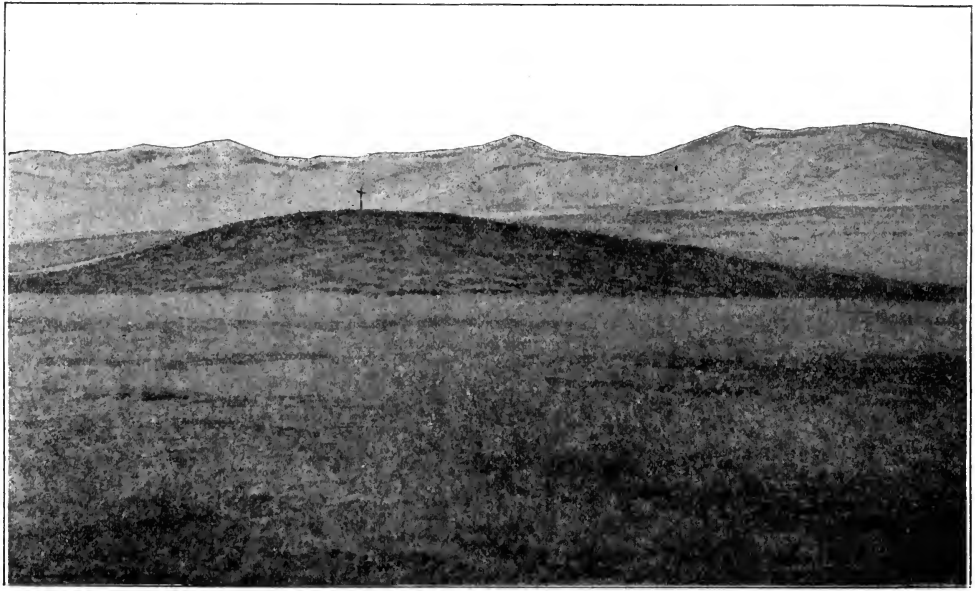
Though written records are absent we have such indications of the rise of civilization in Turkestan even earlier than that in Babylonia and Egypt, that this is the best place to pause and consider it. Indeed, here, in the great landlocked basin of the Aral and Caspian seas would seem to be the center from which there have radiated to all parts of the world most of the arts and practices which are fundamental to civilization. Fully to appreciate the evidence, however, the general physiographic features of the region must be kept in mind.

The Aral-Caspian depression occupies an area in Western Asia about as large as the United States, receiving the drainage of the Volga River from the plains of Central Russia and of the ancient Oxus and the Jaxartes which come down from the Pamir — the roof of the world in Central Asia. Upon the south it is bounded for more than three thousand miles by the highest mountain ranges of the world over which passes are few and difficult to traverse. The northern face of these mountain ranges presents a steep slope to plains which extend without important elevations to the Arctic Ocean more than two thousand miles distant. Mt. Demavend in the Ararat range is 18,600 feet above the sea; while the bottom of the Caspian Sea only one hundred miles distant is 2,300 feet below ocean level, making a descent of 21,000 feet in two hundred miles. The rainfall over this area is so slight and the evaporation so rapid that there is no surplus water to flow from it into the ocean. Large areas east of the Caspian Sea are now deserts almost entirely devoid of life; but, extending out for a considerable distance north from the base of the southern mountains, there is a fertile belt of soil which only needs a bountiful supply of water to make it extremely productive, and a partial supply of water is furnished by the innumerable streams large and small which descend from the snowclad mountains on the south.

From the earliest times this belt of irrigated land which forms the southern border of Turkestan has been densely populated by man, and has been the habitat of a greater variety of plants and animals than can be found in any other single section of the world. In this area was the ancient city of Merv, reputed to have had 1,000,000 inhabitants in the time of the Greco-Bactrian Kingdom in the third century before Christ. Here was Maracanda (the modern Samarkand), of equal size, which was the limit of Alexander's conquests in that section; and Balk, another city of equal size, containing the tomb of Zoroaster and reputed to be the center where the Parsee religion originated. In later times the hordes of Genghis Khan moved from Eastern Asia through this irrigated belt to their conquest of the larger part of the western world; while under Timur the Tartar Samarkand arose with a splendor of architecture and a wealth of learning that still dazzle the historian and the traveller.

Throughout its entire length this arable border between the mountains and the desert is dotted with mounds which cover the ruins of prehistoric cities and villages. But until recently none of these has been excavated with any reasonable care or thoroughness.

In 1903 and 1904, however, Professor Raphael Pumpelly with an ample corps of expert assistants was commissioned by the Carnegie Institute at Washington to excavate one of the most conspicuous groups of mounds and to throw upon the results what light he could from a general study of the geological, physiographical, and biological facts connected with them. The mounds, or "Kurgans," investigated were two, near the recently abandoned city of Anau not far from the city of Askabad, about three hundred miles east of the Caspian Sea. Anau owed its existence to a fertile oasis watered by a perennial stream which descends from the heights of the Kopet-Dagh not many miles to the south. Owing to the shifting course of the irrigating stream, the center of the oasis has migrated some distance to the westward, so



Prehistoric Mound in Turkestan. (Photo by F. B. Wright.)

that the city, which in its turn was deserted by the stream about the middle of the nineteenth century, is a mile or more distant from the two prehistoric Kurgans which were investigated.

The city of Anau was founded about 370 A.D. when glazed pottery was first introduced into the region. The mound which represented the site of the ancient city is an accumulation of soil and débris arising from the disintegration of the sun-dried brick, out of which all the houses of that region have been built from time immemorial. The summit of the mound is thirty-eight feet above the original base but only about twenty feet above the present level of the plain, which has been built up by the sediment of the irrigating stream and the dust brought in by the winds, until the base is now buried to a depth of from fifteen to twenty feet. But the beginning of the accumulations which formed the mound of the recently deserted city dates only from the time of the abandonment of the later of the two older Kurgans referred to, each of which now rises about forty feet above the plain and seventy above its original base.

By elaborate and careful estimation of the rate at which these accumulations, both artificial and natural, occur, the conclusion is reached that the older Kurgan was first occupied by man about eight thousand years before Christ. Examination of the successive superincumbent strata of accumulation sheds interesting light upon the character of the successive civilizations that prevailed and upon the date of the various inventions and discoveries which have spread from this center, and which, in all later times, have formed the principal basis of human comfort and progress.

In the lowest strata, the bones of wild animals only were found, which it would seem had been hunted without the assistance of even stone implements. A little higher up, there begin to appear the bones of the domesticated ox and pig which accompanied civilized man over the whole Northern Hemisphere throughout all the succeeding centuries. In still higher strata there appear the bones of domesticated sheep and an occasional object of copper and lead, and soon after the bones of short-horned cattle, of the dog, the camel, and of the hornless sheep and goat. All these indications occur in the older of the Kurgans, representing the accumulations of about 3,000 years when it was abandoned and the foundations of the south Kurgan were laid about a quarter of a mile distant. The beginning of this accumulation is estimated to be fifty-two hundred years before Christ, but it is not until forty feet of accumulation had taken place and fifteen hundred years had elapsed that stone arrow points appeared in the débris and various implements indicating progress in agriculture.

According to Pumpelly's [11] summary of results, during the growth of the north Kurgan extending, as he estimates, from 8000 B.C. to 5000 B.C. the inhabitants cultivated wheat and barley, made use of numerous implements of bone, used straightedged flakes of flint, and stones for grinding meal, had hand-made painted pottery with only geometrical designs, and had succeeded in domesticating the long-horned ox, the pig, and horse, and two breeds of sheep, while they practised the burial of children in a contracted position beneath the floor of their dwellings. But they were not familiar with the dog, the camel, or the goat, and they made no use of spear points, either of stone or metal, until near the close of the period.

In the south Kurgan arrow points of stone and obsidian appear, together with pivoted door stones, and weapons and implements of copper. The pottery indicates the use of the potter's wheel and furnace. There were also found terra cotta figurines of a goddess and cow, but there was no iron or burnt brick or bronze. The terra cotta figurines indicate a religious cult like that which prevailed later in Babylonia and among the Phœnicians.

Between this era characterized by the use of copper, closing about two thousand years before Christ, and the age of iron introduced shortly before the Christian era, there intervenes a mysterious gap in the evidence, during which the Kurgan was evidently unoccupied.

Everything seems to indicate an independent origin for the arts and usages of domestic life in this locality, and the spread of domesticated plants and animals from this center westward throughout Europe during the neolithic period; while the diminution of the domestic animals in size and the introduction of the camel would seem to indicate the general desiccation of the region, of which there is abundant other evidence from geological indications.

CONCLUDING REMARKS

But here we may well pause in the presentation of the direct historical evidence. The facts presented are certainly most surprising and significant. At the first dawn of history, and earlier by thousands of years, than the classic era of Greece, we find in Crete, Egypt, Babylonia, and Central Asia military, political, and social organizations worthy of the highest regard and in many respects fit to be an example to all subsequent ages. We shall be fortunate if we succeed in restoring the irrigating systems in operation six thousand or seven thousand years ago in the valleys of the Murgab, the Euphrates, and the Nile. We find in Egypt at that early period a conception of the Deity nobler than that to which Plato and Aristotle attained, an appreciation of the family scarcely less commendable than that of modern times, and in all these centers a progress in the arts only lacking inventions of steam and electricity to make it equal to that of the present time.

The questions, pertinent to our present discussion, arising in connection with these facts, are, How came this civilization to appear so early in the history of the race? Why has there been so little progress since? In the natural course of events, how long a time would be required for man to attain the point in civilization reached in these countries six thousand or seven thousand years ago? A brief answer to these inquiries will suffice. First, there is no evidence, but on the contrary it is against all evidence, that the road to this earliest attainment of high civilization was that of an extremely slow and gradual evolution. It is true, for example, that the way had been prepared, by the increase of population and the cultivation of numerous social virtues in Egypt, for the rapid progress which began with the establishment at

Thenis of the First Dynasty. But the real secret of the progress beginning with Menes is, that Menes was a great man: he had the necessary wisdom and foresight and organizing ability to make the cultivation of the arts of civilization among his subjects a matter of advantage to them. In the realm of politics and social order he did for Egypt what Peter the Great did for Russia, and Watt and Stevenson for the industrial systems of the nineteenth century. The wonder is that the wisdom of Egypt did not speedily fill the world. The same may be affirmed of the unknown promoters of the earliest civilization in Babylonia and Turkestan.

This leads us to an answer to the second question, namely, that there is no invariable law of progress in human history. The various elements at work in society tend in all directions. As a matter of fact, degeneration and disintegration seem as likely to take place as real progress and advancement. Among the common people in Egypt there has been no progress for six thousand years, and the same is true respecting most ancient centers of civilization. Neither in the valley of the Euphrates nor in China has there been any progress since the very dawn of history. As Dr. Brugsch has observed, the Fellahin of Lower Egypt "preserve to this day those distinctive features of physiognomy, and those peculiarities of manners and customs, which have been handed down to us by the united testimony of the monuments and the accounts of the ancient classical writers as the hereditary characteristics of this people." [12] It would require a prophet's vision to tell, whether, in the natural course of events if things were left to themselves, there would be any more progress in that region in the next six thousand years.

Evidently the progress of the human race has not been by spontaneous and uniform evolution. The civilization of Europe and America lighted its torch from the altars of the decaying civilization of Greece and Rome, and they, in turn, lighted theirs from altars of Babylonian and Egyptian wisdom. But whence did Egypt and Babylonia derive the fire with which to kindle the flame upon their altars? This mystery is so great that we are forbidden to speak with derision of those who insist that the wisdom of Egypt was given by direct inspiration from heaven or was handed down from a prior original direct revelation. We prefer, however, to say that its mystery is that which surrounds all the great geniuses whose careers have swayed and blessed or cursed the world. As already remarked, a candid study of history will compel one more and more to recognize the dependence of the race upon a few great leaders in thought and action. It is often said, as already intimated, that if there had not been an Alexander to lead the forces of Greece against the Persian borders, a man of some other name would have led them into corresponding victories. But for this assumption there is no just ground. When Alexander died, his kingdom went to pieces. The Egyptian sovereigns were a long line of illustrious men. It is easier to account for the continued propagation of their plans and purposes than it is to explain either their origin or their final decadence and transportation to other lands.

3 — To the third question, How long a time would be required for a primitive race to rise to the height of progress existing, for example, in Egypt at the beginning of the first dynasty? it must be answered that there is no known law of progress sufficiently uniform in its operation to afford a basis for calculation. The being that has capacity to invent the use of fire, that is able to make flint implements (and what is more to make a living with them alone) and that has created an elaborate language for the communication of ideas, is not far separated from the men who can build pyramids, convey their thoughts by hieroglyphs, and organize their companions for home de-

fense and foreign conquest. It requires but the accident of their possessing among their number a genius, to determine whether the higher civilization shall be within their reach. An impressive fact respecting the early civilization of Egypt and Babylonia is that it already had been preceded by the discovery of a method for the smelting and hardening of iron, which is probably the most far-reaching and important invention ever made by man. Among the earliest enterprises in which the monarchs of the first Egyptian dynasty engaged was that of conducting expeditions into the wadies of the Mount Sinai district for the purpose of working in the mines of that now desolate region.

The civilization of Egypt and Babylonia may possibly have been preceded by many thousand years of uneventful human history, or, on the other hand, if we are left to judge simply from the record of human progress directly within our knowledge, it may have been preceded only by one or two thousand years of man's more primitive state. For it is quite possible, as a simple calculation in geometrical progression will show, for the race, starting from a single pair, to have so multiplied and covered the earth in a thousand years as to furnish all the population of which the written record of Egypt gives any indication in the time of the First Dynasty. There may, indeed, have been many thousands of years of weary preparation for the incoming civilization of the Pharaohs; but the study of history furnishes us no trustworthy data for such an inference. The inference cannot rationally be based upon a few high-sounding phrases such as the "doctrine of evolution," "the law of progress," and "the principles of development." Ours is the more difficult, but at the same time more pleasing and satisfactory, duty of investigating the evidence buried in the geological strata in which man's earliest remains have been found, and of considering the inferences drawn from the facts which ally man in his physical and mental development with that of the rest of the animal kingdom. But before venturing upon these inquiries, we must pause, to consider the evidence concerning man's origin and antiquity which may be derived from the diversity of languages which has characterized the human race since the very dawn of history.

CHAPTER III

THE LINGUISTIC ARGUMENT

In the preceding chapter, our study of the earliest historical records has carried us back to a point of time four or five thousand years before Christ, or from six to seven thousand years ago. At that time we found a highly developed civilization in the valleys of the Nile and the Euphrates. In these countries the art of writing was already in use, and the language had entered upon that stage of systematic and orderly development which is secured by the conservative influence of literature.

In the valley of the Euphrates a branch of the Semitic language appears in full development in the earliest monumental records. Just what relation there is between the cuneiform inscriptions upon the tablets and monuments of Babylonia and the rich literature that appeared at a later date in Palestine, we cannot now determine; but though the form of the letters is different the grammatical structure of the inscriptions upon the monuments is closely related to that of the Hebrew language. Many of their root words are identical, and their mode of inflection is similar; so that there is no greater difficulty in supposing them to be descendants from the same mother tongue, than there is in crediting the well-known historical fact that Italian, Spanish, and French are variations of the Latin.

To the Phœnicians upon the shore of the Mediterranean we have generally given the credit of the invention of the modern alphabet, and they in turn are supposed to have been largely indebted to Egypt. Whether Abraham brought with him from Mesopotamia the Hebrew letters as well as the Hebrew language has not yet been determined. The more probable theory is that he found both the dialect and the rudiments of the literature, already developed among the cultured Canaanites that had so long inhabited the land, and who had been in close contact with the adventurous and enterprising people inhabiting the cities of Tyre and Sidon.[1] There are also other reasons for reaching the same conclusion. The Elamite king Kudur-Mabug calls himself *Adda Martu*, or "Prince of the Land of Amurru" (Palestine and Syria), and an inscription of Lugal-zaggisi, about 4000 B.C., shows that he conquered the land from the Persian Gulf to the Mediterranean. The inscription is in the Museum of the University of Pennsylvania, in Philadelphia. Such intimate contact for two thousand years as this implies, could hardly fail to involve knowledge of the dialect and literature of the dominant country, and the Tel-el-Amarna tablets seem to indicate clearly that that was the case.

The affinities of the language found upon the early monuments of Egypt cannot be wholly made out; but it is evident that they had at least a remote relationship to the Semitic languages of Palestine and Babylonia; for, though the words are mostly different and formed upon a different plan, the inflections are somewhat similar. At any rate, they are much closer in their analogy to the Semitic than they are to any other group of languages, except it be to some of the more obscure tongues of Africa.[2] The language was long preserved in the Coptic, which has become extinct only within the last two or three hundred years, and which produced considerable literature in the early part of the Christian era.

The divergence between the language of Egypt and that of Babylonia, found to exist at the earliest dawn of history, is very significant in its bearing upon the subject of our present discussion. For, these languages probably are not lineally descended the one from the other, but are both variants from some earlier form of speech that had been lost from the face of the earth for a longer time than that which separates us from the period when Latin was a living tongue. The relation between the Egyptian and Semitic languages may more properly be compared to that between the English and the Greek, where the divergence is so great that it points to a mother tongue far back in the vistas of time. We shall therefore be able to draw some inferences concerning the antiquity of man from the extent of this divergence of language which appears on comparing the cuneiform inscriptions of Assyria and Babylonia with the hieroglyphics which abound on Egyptian monuments and in Egyptian tombs of the earliest date. If these monuments are six thousand years old, how much earlier must have been the dawn of that civilization which led two nations so far apart in their forms of expression as we find the Babylonians and Egyptians already to be four thousand years before the Christian era. This is the problem.

THE INFLECTIONAL LANGUAGES

But we are able to get upon a still higher mount of vision, and look across a still wider chasm separating the Semitic languages from that branch of the human speech which the principal civilized nations now employ to convey their thoughts. The Greek, the Latin, the German, the Russian, and the English languages (together with some others in Europe, such as the Gaelic and the Scandinavian), the Sanscrit (the dead classic language of India, rich in an ancient literature), and the Persian, constitute what are called the Aryan or Indo-European tongues. In one respect the Aryan languages and the Semitic are similar; and, in the great threefold division into which the languages of the world have sometimes been classified, they are capable of being joined together. Both are what are called "inflectional" languages. The ideas of person, number, and tense, are conveyed by slight changes in the form of the word itself, and by affixes and suffixes which are made integral parts of the words to which they are joined. But the mode of inflectional development is so different in the Semitic tongues from that in the Aryan, and the root words themselves are so distinct, and formed on such a separate principle, that they seem as far apart as the poles.

For example, in the Semitic languages the verb can always be traced back to a root, containing three consonants, which conveys the essential, abstract idea of the action or state. The vowels which are introduced constitute the inflection, and determine the relations of the actions to the various persons or things concerned. For instance, the familiar word upon which Hebrew students commonly begin their study of the language is one signifying "to kill," *qatal.* The consonants are q-t-l. *Qatala* means "he killed"; *qutila,* "he was killed"; *qutilu,* "they were killed"; *uqtul,* the imperative, "kill"; *iqtal,* "cause to kill"; etc., the three consonants appearing in every form and the change in the vowels indicating the relational aspects of the verbal idea. So important are these consonantal elements of Hebrew words, that the whole idea can be expressed to the eye without vowels; and for ages the Hebrew writing was composed entirely of consonants, — the vowel points in our Hebrew Scriptures having been added far down in the Christian centuries. In consequence of these characteristics of the Semitic languages, they present a uniformity of structure quite different from the inflectional languages derived from the Aryan which now prevail in Europe. The all-prevailing triliteral Semitic roots doubtless have a history, and represent a long previous development, but that development occurred so far back in the past as completely to baffle the efforts of philologists to trace its course or arrive at its significance. In itself it is an evidence of an antiquity far higher than that of the oldest monuments in the valley of the Euphrates.

In other portions of its structure, also, the verbs of these two classes of language differ greatly. In Semitic the verbs in the second and third persons indicate by their forms distinctions of gender, while the indications of time are confined to an imperfect intimation of the differences between the completed and the uncompleted action, and each tense is employed to represent action past, present, or future. Of what we call mode the Semitic languages know little, while of conjugations they are exceedingly prodigal. They have a form of the verb to express the simple transitive tense, as "he killed"; another form to indicate that "he killed with violence"; another, that "he tried to kill"; another, that "he caused to kill"; and another, that "he killed himself," these all being expressed by special conjugations of one root. In the Arabic there are twelve or more such conjugations of the verb.

In these, also, as well as in some other respects the Semitic languages differ so radically from the Aryan that if they had a common origin, all signs of it have been so completely lost that it has seemed to most people hopeless to search any further for the mother tongue.[3]

In contrast with the simplicity of Hebrew words, it is interesting to notice a single case illustrating the capability of an Aryan language to accumulate ideas by prefixes and suffixes. Our word inapplicabilities is built up around the simple root "plic," which appears in its simpler form in the word "plicate," meaning to fold. But "inapplicabilities" contains two prefixes and three suffixes, while in other words this root itself forms a suffix, as in "triple," meaning threefold, etc.

But, passing from the divergencies between the different branches of the inflectional tongues, we find a still more radical division of language in the so-called monosyllabic and agglutinative forms of speech, of the first of which the Chinese is a typical example, and of the second the language of the American Indians.

THE MONOSYLLABIC LANGUAGES

In many respects the Chinese language corresponds more closely than any other to what one would naturally suppose to be the original form of human speech, but it is now the representative of merely a class of languages limited to the southeastern portion of Asia. So sharply defined is the boundary of this class of languages that it is difficult to resist the conclusion, not only that they are of common origin, but that they have been kept together by local historical influences, while contrary to ordinary experience, they have remained practically without change from the earliest period of our knowledge of them. Like the Chinese themselves, their literature and their language have long been in a fossilized condition. The words of these languages have no inflections, and the same word may be used for almost any part of speech, — which part it is, having to be gathered from the connection.

We have in English a few such words. For instance, "love" may be either a verb, a noun, or an adjective; while the word "better" may be an adjective, an adverb, a noun or a verb. But such instances are exceptional in the Aryan languages, while in the Chinese they are the rule. Schleicher[4] represents a Chinese sentence in English as follows: "King speak: Sage! not far thousand mile and come; also will have use gain me realm, hey?" which, being translated, means, "The king spoke: 'O sage! since thou dost not count a thousand miles far to come, wilt thou not, too, have brought something for the weal of my realm?'" This sentence in itself shows the advantage in clearness of the Aryan system of inflections which brings out clearly the relation to each other of the words used. To us the Chinese language sounds like baby talk, and so does what is called "Pidgin English" (pidgin being a Chinese corruption of "business") which we instinctively use in talking to a Chinese.

But the Chinese language existed in substantially its present form two thousand years before the Christian era, from which time some of the odes in the Chinese book of songs claim to date. Their annals and traditions carry the history of the nation several centuries farther back; and certainly the great difference between this language and the languages of the Aryan and Semitic races would imply a very high antiquity. The separation between the nations must have taken place long before the earliest historic records which are found upon the monuments of Egypt or Babylonia; for, the language of the Egyptians and Babylonians was already inflected, and was composed of roots which have only the slightest similarity to the Chinese. If a long period is required to account for the separation between the Aryan and Semitic tongues, it would seem that a far longer period must be allowed to account for the rise and development of the whole inflected class of languages. It should be remarked, however, in passing, that the original language in Babylonia was probably not a Semitic but an agglutinative tongue. The Semitic invaders seem to have adopted both the letters and the civilization of the Sumerians, who were the original inhabitants of Babylonia, while retaining their own inflected language.

THE AGGLUTINATIVE LANGUAGES

Midway between the monosyllabic and the inflected languages stand the agglutinative. This is by far the most numerous class and apparently the one most subject to variation. To this class belong most of the languages of Africa, America, and the Islands of the Pacific Ocean, to which may be added that of the Japanese, the Coreans, the Dravidians (in the southern part of India), the Tartars, the Finns, the Turks, the Basques, and some others. In these languages, some of which have a few inflected forms, the subsidiary elements of the sentence, or concept, are gathered about the central idea without that close articulation with it that is found in the inflected languages. The words are *segregations* rather than *organizations*. As Whitney [5] remarks, "Everything [in the American languages] tends to verbal expression: nouns, and adjectives, and even adverbs and prepositions, are regularly conjugated; nouns are to a great extent verbal forms." For example, according to the representation of Rev. S. G. Wright, a venerable missionary among the Ojibway Indians, the word "father" is not used by itself in the simple form, but is conjugated in all the moods and tenses, and is compounded with the possessive pronoun. Every father must be the father of somebody, — of him, you, or me. The root word seems to be *os,* but ordinarily it occurs in a verbal compound; *nĭn-do-yo-si,* "I have a father"; *ki-do-yo-si,* "thou hast a father"; *o-yo-si,* "he has a father." In the subjunctive we have *kic-pĭn-o-yo-si-yan,* "if I have a father," etc. In the optative mood it becomes *kĭc-pĭn-ge-o-yo-si-wă-nen.* There is even a double and twisted optative, as *kĭc-pĭn-ge-o-yo-si-wăm-ba-nen,* "if I shall should have a father, as I shall should have" — conditioned on something, such as that the truth has been told.

The number of words which can be formed from a single root is almost unlimited, and the length of some of the compounds is astonishing. Rev. Mr. Hurlbut estimates that in Algonquin 17,000,000 verbal forms may be made from a single root. Mr. Trumbull informs us that in Eliot's Massachusetts Bible the phrase "kneeling down to him" had to be translated by a single word of eleven syllables, *wut-appes-ituqussun-nooweht-unk-quoh,* which when drawn out in full means, "He came to a state of rest upon the bended knees, doing reverence unto him."[6] Corresponding illustrations may be drawn from the

Basque language of Southwestern France, where "the lower field of the high hill of Azpicuelta" is expressed in the one word *Azpilcuelagaraycosaroyarenberecolarrea,* and from the Eskimo, who express the sentence "he goes hastily away and exerts himself to write" by the word *Aglekkigiartorasuarnipok,* and from the Sanskrit, in which the word bhā*nd*apūr*n*akumbhakārama*nd*apikaikadeçe means, "in one corner of a little-shop of a jar-maker (which was) filled with earthen-pots." [7] All the American languages are constructed essentially on this agglutinative, or, what has been called by some polysynthetic plan; but they differ greatly in their roots, and are subject to rapid changes. To such an extent is this true, according to Whitney, that "there are groups of kindred tribes whose separation is known to be of not very long standing, but in whose speech the correspondences are almost overwhelmed and hidden from sight by the discordances which have sprung up. In more than one tongue it has been remarked that books of instruction prepared by missionaries have become antiquated and almost unintelligible in three or four generations." [8]

The multiplicity of linguistic stocks in America is especially noticeable on the Pacific coast, particularly in those portions where subsistence is most easily obtained, and isolation of tribes most readily secured. Mr. Horatio Hale[9] when he made the first ethnological survey of Oregon, found no less than twelve linguistic stocks in that limited area; while Mr. Stephen Powers, of the United States Ethnological Bureau, found sixteen additional linguistic stocks in California, making, with others that have been added, no less than thirty distinct stocks of language among the American Indians in a territory no larger than France.

In a subsequent chapter evidence of an independent character will be adduced to show that the Indian races of America and the Tamils of Southern India branched off from a common parent stock, which had already come to differ largely in their social customs from the Aryan and Semitic races. But here it is worth while to note that in the community of structure evident in the languages of these people, we have additional evidence of a common origin of these races, and that their separation dated back to a time subsequent to the beginning of that linguistic development which reveals itself in the three great classes of language, the monosyllabic, the agglutinative, and the inflectional. The agglutinative tendency, which finally became the main characteristic of many languages, may indeed have served as a stepping-stone, or a transitional stage, from the monosyllabic to the inflectional tongues so that it may yet be proven that the Semitic and Aryan languages are in a sense sisters of the agglutinative; but at any rate the distribution of people speaking the agglutinative languages is such as to indicate an antiquity far exceeding the earliest historical records of the human race.

ANTIQUITY OF THE ARYAN LANGUAGES

From the words common to the various branches of the Aryan language it is possible for us to get a pretty clear conception of the advancement already made by the race before the diversification of the primitive Aryan speech had proceeded far. By comparing its various branches we learn that the tribes who spoke the mother tongue had made much progress in many things, and had really laid the foundation of the civilization already attained by their remote descendants. As a common heritage from this mother tongue, various early but widely separated descendants received the same words to express the idea of settled habitations and fortified places, and of various things connected with the possession and rearing of cattle and of cultivating the earth. All of these descendants used variations of the same root word in naming the horse, the ox, the sheep, the goat, the swine, the dog, the bear, the wolf, the mouse, the dove, and probably the goose. They all had a common name for night and winter, and for wheat, barley, wool, and flax (probably also for hemp), clothing and the art of weaving. Their language shows that their common ancestors used the short sword, or heavy dagger, the spear, the bow, and probably the shield, and that they manufactured boats to be moved by oars. They all had a fixed mode of designating blood relationships to the third degree. They also had a common word for hundred, and the language shows that their common ancestors already had a name for the moon and one for the stars, and that they worshipped the powers of nature probably without the intervention of a priesthood.

It is important to note in passing, that beyond reasonable doubt, the original center of the Aryan languages is to be found in the irrigated belt bounding the southern limit of the Aral-Caspian depression from which have come, through Mr. Pumpelly's investigations, the early indications of civilization described in the preceding chapter. The civilization of Anau is that of the early Aryans.

POSSIBLE RÁTE OF LINGUISTIC DEVELOPMENT

In reasoning upon the data thus presented, so as to draw safe conclusions from them concerning the antiquity of man, the problem is to obtain a rate of development which may serve for a divisor. In the changes already evident in linguistic development at the earliest dawn of historic evidence, we have our dividend. Supposing the human race to have set out from a common center to distribute themselves over the surface of the earth with the simplest form of speech, the question is, How long would it take them to attain that linguistic divergence and development which we find to exist already at an indefinite period preceding the earliest historical records in the valleys of the Nile and the Euphrates? How long would it take wandering tribes to make the progress indicated by the language of the original Aryan-speaking people?

In order to get the rate of progress we naturally turn to the changes of language which have taken place within the historical period and more especially in modern times. That changes are continually going on in language is evident upon slight reflection. Even with all the conservative influence of literature such as has been in the possession of the European nations since their conversion to Christianity, a certain class of changes has proceeded with considerable rapidity. It is with difficulty that the ordinary English student of the present time reads the writings of

Spenser and Chaucer. Even the standard English version of the Bible contains so many archaisms that a new translation has been demanded.

But the most familiar example of modern linguistic changes is to be found in the varieties of the Latin language now spoken in different parts of Europe, and in the colonies that have carried these dialects with them to the New World. The Latin of the classical period died of formalism and propriety. The main currents of national life flowed outside of the literary channels. The men who spoke the homely dialects of the provinces, and of the busy marts of trade and common life, conquered by sheer force of numbers; so that now, instead of one form of speech, we have the Latin and eight or nine other tongues closely allied in form and structure to the language of Rome in her palmy days, yet differing so much from one another that each has to be learned as a separate language; viz., Portuguese, Spanish, French, Provençal, Italian, Wallachian, Rheto-Romanic, and Roumanian.

The most natural theory concerning the origin of these languages is that they are the modifications of the Latin which became prevalent in these various localities during the long reign of the Roman Empire. While the presence of the Roman legions, and of the Roman colonists of various kinds, disseminated and made popular the language of the capital, the numerical predominance of the native populations led to such modifications of it as spoken in the various localities that when the Roman legions were withdrawn, and there was no literary standard left, there was great freedom for development, which has shown itself in the so-called Romance languages of Europe, — each having a literature of its own, and each having a character naturally impressed upon it by the national peculiarities and the national language which it had supplanted. All this seems to have been the work of the first two or three centuries after the fall of the Roman Empire. If we knew the history better, however, we should doubtless find that it had been going on in the speech of the common people during all the preceding centuries of Roman occupation.

But it is difficult to obtain a quantitative measure from any observations devoted to languages with a living literature. There is, first, the retarding effect of the literature itself, which it is impossible fully to measure; and, secondly, there is the fact that all the linguistic changes known to have taken place within historic times fall short of affecting the essential structure of the language itself. No language has ever been observed in historical times to pass from one of the great classes enumerated above into any other. The monosyllabic languages have satisfied the people speaking them; the agglutinative tongues have offered the widest range for variation, but the people using them have never ventured out of the agglutinative fold; while the inflectional languages have constantly tended to variation, but always within the limits of their class.

Probably, however, we shall have to acknowledge that the rate of progress in the established order of things may be very different from that in the inchoate condition of the human race. Uniformity may not be the word which expresses the truth with respect to the development of language any more than it is in physiology and geology. Paroxysmal evolution may be the law of language, as doubtless it has been the law of the development of species. Certainly the stationary physical condition of the adult individual is no measure of the development in childhood and youth, and we may be as far from the truth in endeavoring to reach the primitive state of man by projecting the nearly parallel lines of linguistic development open to our study, as we should be in reasoning in a similar manner from the condition of the adult to the condition of the embryo before its birth into the outward world.

It has been ingeniously suggested by Mr. Horatio Hale that our safest analogies from which to reason concerning the origin of the various forms of human speech, may be drawn from the linguistic developments of those children, who, from one cause or another, have for a time isolated themselves from the rest of the world, and have independently framed a language of their own through which to communicate with one another. In several recorded cases this isolation has taken place voluntarily, not by compulsion; and the study of such instances affords a clue to what might take place, either in the infancy of the race, or at any time when a family of small children should by accident have become isolated amid conditions where life could be supported without parental care.

Man has been properly defined as "an animal that speaks." Articulate language is a necessity of his nature, and he makes use of the organs for producing it as instinctively as the bird does of his wings. Probably, every one is cognizant of families of children who have framed a language of their own, the full meaning of which was known only to themselves, — inventing names of their own for the various utensils of the house and the various tools used in the household. Such experiences will give the greater force to several detailed reports which have been made concerning the progress in language-making, where children have been permitted to proceed to considerable lengths. Of course this is not a field in which we can freely experiment; for, principles of humanity forbid any extended experiments in this direction. Valuable as is such truth, it is not of so much worth that we could stand by and permit experiments which would sacrifice the future development of any of our fellow men by shutting them off from the ordinary approaches to the full storehouses of the world's knowledge and wisdom afforded by established forms of speech.

The following instances seem to be the most instructive that have yet been made public. The first is an account published, in 1878, by Miss E. H. Watson,[10] of Boston, telling of the progress made by two children, some years before, in the construction of a language of their own. These children were twins, born in the suburbs of Boston in 1860. Their mother was of German descent, and, though able to speak the language of her father, never did so in her own household. The children looked so much alike that it was impossible at first for any one but their parents to tell them apart. Being constantly together they developed, as such children frequently do, an intense and exclusive interest in each other, and at the usual age when children commence to talk they began to manufacture a language of their own, and could not be persuaded to use any other. Their older sister could not induce them to utter a syllable of English. Not even the words " papa " and " mamma " could be extorted from their unwilling lips. They had a name for their mother, but it was one of their own devising. While playing and talking together in their own speech, they exhibited all the liveliness and volubility of common children. They had regular words for various objects which the family came to distinguish, but which, unfortunately, had for the most part been forgotten before Miss Watson wrote her account. Of these the word for " carriage " seems to be the only one that has been rescued. It was *nī-si-boo-a*, which they would cry out when hearing the carriage pass in the street, and then run to the window.

A more systematic series of observations was made by Dr. E. R. Hun,[11] of Albany, N. Y., upon a language invented by two children in that city. In this case the two children were a boy and a girl, the one being eighteen months older than the other. The older one of the children began to use words of her own invention soon after she was two years old, and these words were adopted by the younger one as he came to feel the need of language, and were used by him in preference to those which his parents endeavored to teach him. The parents were cultivated people, using only the English language, and the domestics employed spoke only English. But the children continued to talk with great rapidity and fluency to each other in an unknown tongue. Some of their words evidently imitated the sounds of the objects designated, that is, were onomatopoetic; but others showed no traces of the working of that principle. The word *mea* which closely resembled the mewing of the cat, was made to represent both cat and fur. But some of their words were evidently formed from the mere love of jingle, which is prominent in both children and poets. *Migno-migno* signified indifferently "water," "wash," "bath." *Go-go* signified "sugar," "candy," and other delicacies. *Waia-waiar* signified "black," "darkness," or a "negro." *Gummigar* was a generalized concept of all the substantial dishes of the table and at the same time was applied to the cook. Of miscellaneous words *gar* meant "horse"; *deer,* "money" of all kinds; *beer,* "literature," "books," or "school"; *peer,* "ball"; *bau,* "soldier," or "music"; *odo,* "to send for," "to go out," and "take away"; *pa-ma,* "to go to sleep," "pillow," or "bed." Of compounds we have from *odo* (which means, as we have said, "to send for," "to go out," or "to take away") *ma odo,* meaning "I want to go out"; *gar odo,* "send for a horse"; *too odo,* "all gone." *Gaän* signified "God," and we are told that when it rained the children would often run to the window and call out, *Gaän odo migno-migno, feu odo,* meaning, "God take way the rain and send the sun"; — *odo* before the object meaning "to take away" while after the object it meant "to send for." While the word for soldier was *bau* they applied it also to the bishop when they saw him in his miter and vestments, and while, also, *gar odo* meant "send for the horse," it was also used for a noun to designate the pencil and paper used in making a written order for the horse.

In these illustrations we have brought to light the fact that language is so much a necessity to the social nature of man, and his organs of speech and his instincts are such, that persons with a strongly linguistic bent can make a language almost as easily, in case of need, as they can learn one; so that there is no great mystery about the origin of language, when once we have man. It appears to be the most natural thing in the world for him to designate objects and actions by some vocal sound, and any two children who have a well-developed linguistic faculty and have not been previously taught a language would soon begin to communicate with each other by vocal utterances, and would speedily come to an agreement upon the names of the things about them, and upon expressions indicating the relations of things to one another. A language with all its essential elements might thus be formed, in some instances, in the same time that children now learn one from their parents and teachers. Indeed, it is a question if it would not be as easy for some peculiarly gifted children to make up their own language as to adopt that of their elders, except for the greater convenience which they find in the use of the existing language in interchanging ideas with the larger circle of their fellows.

With these facts in mind it is easy to see how diverse languages might arise in a short period of time if only we can imagine children to be isolated at an early age; and this is not difficult to conceive when we take into account the various vicissitudes of human life, and the facilities which certain regions afford for the sustenance of life with little forethought and exertion upon the part of the individuals. It is in such favored portions of the earth's surface that we are naturally led to suppose the human race had its origin and early development, where the climate was mild and equable and where food was accessible during all portions of the year. The ability to cope with the hardships of winter and with prolonged droughts of the summer months, we might suppose to have been acquired at a later stage of human development. As to the ability of early races to develop along these lines, we have no direct evidence; but Palæolithic skulls show, as we shall see, a remarkable brain capacity, equaling in some cases that of the greatest of modern scholars and savants, and it therefore seems likely that they possessed in a high degree this linguistic faculty.

As Mr. Hale has observed, it is a significant fact that the regions where languages are most numerous are those where conditions favor the isolation of families of children, such as we have supposed. In America it is in Oregon and California, on the Pacific coast, where we find the greatest number of languages; — there being, as already said, no less than thirty in that single region, and each one of the languages is spoken by a comparatively small number of persons. The significant fact in this connection is that here we find the conditions most favorable for the preservation of a helpless family. In the lowlands of California snow and ice are rarely formed; more than half of the days are cloudless; roses bloom throughout the year; "strawberries, blackberries, currants, raspberries, and salmon-berries are indigenous and abundant. Large fruits and edible nuts" are within easy reach. The horse-chestnut also provides abundant fruit, much used by the Indians. Wild cherries and plums abound, and there are various kinds of nutritious roots, maturing at different seasons, while fish crowd the streams, and earthworms are ever within reach of the starving; and, as already intimated, the climate is such that clothing is scarcely necessary, and shelter is well-nigh superfluous. In these Edenic conditions it is easy to see how it is possible, in the vicissitudes of savage life, for a family of small children whose father and mother have perished, to grow up in isolation, and be compelled to develop a language for themselves; or as Mr. Hale suggests, if only one of the parents had perished, the remaining one might find it easier to adopt the linguistic inventions of the children than to impose all of his own upon them, when, however, it would be likely that the structure of the parent's language would remain, even though new words had been devised and adopted. On this view of the origin of various isolated American languages, we can readily account for the striking resemblances which still characterize some that are in general far apart; as, for example, the common word for "foot" (*si* or *sit*) found in the Algonquin, Iroquois and Dakota, — a sound, says Mr. Hale, so simple that even a young child who had once heard it might be expected to retain it in designating the object to which it was originally applied.

The same tendency to extreme variations in language observable in California is also said to exist in tropical Brazil, where also the conditions are most favorable for the preservation of families of children that might happen to become isolated. Baron von Tschudi estimates that there are hundreds of such languages in South America.[12]

In striking contrast to the multiplicity of languages in California and Brazil is the uniformity of language in Australia, where the conditions are such as to insure the destruction of any family of young children that should become separated from their natural protectors. Here, though the climate is warm, the drought of summer interposes as serious an obstacle to the spontaneous existence of the human race as the cold of winter does in the higher latitudes.

As every consideration would point to a country blest with a mild climate and with abundant spontaneous fruits of the field, as the natural habitation for primitive man, we can readily see that the diversification of languages may have been the work of a comparatively short time. In those conditions, isolation of families was the most likely to occur. With the present preoccupation of the whole earth and the general spread of civilizing agencies, however, it is almost impossible for isolation to take place. As with the criminal in the palmy days of the Roman Empire, there is now no opportunity for flight. Wherever the culprit went he was still in the Roman Empire, for Rome was the world; so now wherever a family of children should become isolated, the isolation could remain but the briefest period before the all-pervading influences of the swarming nations would close in around them and absorb them in the great mass.

It is thus easily evident that present rates of linguistic development are no measure at all of the rates that may have prevailed in primitive times. There is an old age to the race as well as to the individual. After certain stages of progress, the conservative influences of society into which we are born and in which we are reared, become so predominant, that changes in language must be very slow, and must proceed in well-defined lines. We cannot, therefore, in this case draw long conclusions backward from the point at which history first rises from the misty depths of the past. The evidence of an extremely great antiquity of the human race drawn from the diversity of language at the dawn of history is far from conclusive. It does not, indeed, forbid the supposition of great antiquity, but it does not carry the positive weight of evidence which has often been claimed for it. It is peculiarly one of those realms of inquiry where the present is not a measure of the past.[13]

CHAPTER IV

ORIGIN OF THE RACES OF EUROPE

HISTORICAL evidence gives little help in untangling the problems presented by the conglomerated populations of Europe. While, for thousands of years the light of civilization was brightly burning in Northeastern Africa and in Western Asia, a dense night of barbarism rested over all the principal centers of modern culture. Rome's earliest legends reach back only a few hundred years before the Christian era. Adventurous Phœnician navigators had, at a somewhat earlier period, ventured beyond the pillars of Hercules, and extended their traffic to the shores of Britain. But they left no permanent influence upon the tribes with which they interchanged commodities. There are also a few other signs of extended lines of traffic between the earlier centers of civilization and the plains of Northern Europe during their long seclusion in the night of primeval barbarism. I was much impressed a few years ago, while crossing the Alps, to encounter a party of excavators under direction of the Italian government, who had just uncovered near the summit of the St. Bernard Pass the foundations of an ancient temple which had been laid long before the walls of Rome were built. Here votive offerings were found whose date could fairly be assigned to a period as early as 800 B.C., showing that, from very early times, the lines of traffic across the Alps had been the same as they now are.

It is evident that a civilization of a high order developed in Northern Italy about one thousand years before Christ, and became the foundation of the later civilization of Rome. The relics of Etruscan art which have come down to us reveal a skill that was scarcely excelled in any later time in Italy. But even this civilization was not indigenous. It had come from the East, either from the Mediterranean shore where the first rudiments of Grecian culture flourished, or from the valley of the Danube which had received cultured immigrants from the more distant parts of the world.

Archæologists are now inclined to trace important elements of the Etruscan civilization to one whose center was at Hallstatt, a little Alpine village in upper Austria near the border of Salzburg, where discoveries have been made marking an epoch in archæological research. Here, a long distance from any present great center of population, a prehistoric cemetery was found where were excavated more than three thousand graves containing a great variety of weapons, implements, and ornaments, none of which were Greek or Roman. Both bronze and iron appear at Hallstatt, indicating the advent of influences from an advanced stage of Eastern civilization. The date is certainly as early as that of the Trojan era celebrated by Homeric song, and its influence can be traced over a large part of Central and Southern Europe, being specially marked in that of the Etruscan era and through them in the later Roman. Great artistic skill is shown at Hallstatt in ornamental work in bronze. Large numbers of *situlæ,* or metallic pails, have been found, ornamented with figures worked in *repoussé.* The figures both of men and animals in these designs are wrought with a skill worthy of the classical age of Greek art.[1]

But preceding the period when bronze and iron were in use in Europe, there stretches out into the dim recesses of the past an age when stone was the only material from which implements, weapons, and ornaments were made. This period is subdivided into the palæolithic (ancient stone) and the neolithic (newer stone) eras — the palæolithic, as the word indicates being the older. Moreover the palæolithic implements are all worked into shape by chipping, and so are often referred to as rough stone implements, while the later neolithic implements are fashioned by rubbing and so are appropriately called smooth stone implements. In Europe geological evidence shows that the palæolithic age long antedates that of the neolithic. We will, therefore, first detail the essential facts concerning neolithic man in Europe.

Prominent among the relics of neolithic man in Europe are the kitchen middens, or shell heaps, of Denmark and Sweden — places where successive generations of primitive men have thrown the refuse of their favorite camping places. In these refuse heaps are to be found the shells and bones of the animals which served for their food, intermingled with various implements that had been either broken or lost. These implements consist of flint hatchets and other utensils made of stone, horn, wood, and bone, together with coarse pottery, while charcoal and cinders abound. The stone implements have usually been polished and sharpened by rubbing; this justifying their assignment to the "smooth stone age."

The mounds formed by these kitchen refuse heaps are sometimes as much as ten feet high, and stretch along the shore for a thousand feet, and extend back one hundred and fifty or two hundred feet. Usually they are within a few feet of the level of the sea, and in all cases were originally upon the shore of the sea or upon some inlet. In some instances, however, through the silting up of the inlet, the refuse heaps are now several miles from the shore.

But extensive as are some of these refuse shell heaps, we are not compelled to assign to them extreme antiquity. The animal remains here associated with the neolithic implements are all of existing species, showing that there has not been any great change in the physical conditions since their deposition. The shell-fish are sometimes larger than those now existing in the same region, which is owing probably to the greater saltness of the Baltic at that time, due perhaps to a freer influx of ocean water, which has subsequently been prevented by the silting up of some of the passages between the many islands of Denmark.

The evidence from a succession of forests is more suggestive of great age, and yet by no means conclusive. As far back as history or tradition can carry us, Denmark has been covered with beech forests, and they continue to flourish there at the present time with great luxuriance. Eighteen centuries have passed without sensibly modifying the character of the forests. How long before this the beech was enabled to displace the oak, we have no means of telling. Yet during the continuance of the bronze age, oak was the prevailing forest; while in the stone age, which is that of the kitchen middens, the pine forests had not been displaced by deciduous trees. The age of stone was the age of the pine and fir. Something of a clue is given to the date of these older forests by the growth of peat, which is found to overlie both prostrate trunks of the pine and scattered implements of the stone age. Steenstrup, one of the most careful observers, estimates that we are carried back by these calculations at least two thousand years before the Christian era.

In the lake dwellings of Switzerland we meet with another class of relics of the smooth stone, or neolithic, age.[2] These are dwellings built upon piles extending out into the shallow portions of the various lakes, where it was easy to obtain protection both from the incursions of wild beasts and the sudden attack of human enemies. Such dwellings in actual occupation had come to the notice of Herodotus as late as the sixth century before Christ, in some of the mountain lakes of what is now modern Roumelia. From recent explorations much has been learned about the conditions of life among the lake dwellers. Sometimes these settlements were large enough to contain a population of a thousand, and a single village is believed to have been found which had three hundred houses in it. Forty thousand piles are estimated to have been necessary for the construction of some of these villages. The villages existed in great numbers throughout the lake region of Switzerland, and belonged to different periods, — some to the bronze and some to the stone age. Naturally the larger and best preserved were those belonging to the bronze period. In one of those of stone age, near Berne, the flint employed must have come from outside the bounds of Switzerland, but the chippings were so numerous as to suggest that the place was fixed upon as a manufactory. Implements of jade also were found, — a material which probably had to be brought from the shores of the Baltic or from Central Asia. Thus in the early part of the neolithic age an extensive commerce among the tribes of Europe is indicated; while in the bronze age of the lake dwellers the indications of an extensive commerce are still more numerous. In the lake dwellings of the stone age, grains of carbonized wheat and barley, and round cakes of bread, have been found, besides bones of the dog, the ox, the sheep, and the goat.

Like the animal remains of the Danish refuse heaps, those of the Swiss lake dwellings are all of species that have survived to the historical era. A change in the predominant animals is noticeable, however, in passing from the lake dwellings of the stone age to those of the bronze age. In the early age the remains of the stag and roe are more abundant than those of domestic cattle and sheep, and those of the wild boar more frequent than those of the tame pig, and those of the goat than those of the sheep; while in the later dwellings the proportions were reversed. The bones of the fox are very common in the lake dwellings of the stone age, but give place in the bronze age to those of the hunting dog. But the ox, the sheep, the goat, and the dog existed during the earliest period of the lake dwellers. The domestication of animals proceeded throughout the period with considerable regularity, and they gradually took the place of wild animals for food. The existence of domestic animals in the earliest sites of lake dwellers would seem to indicate that the first occupation of this kind of dwellings was later than the period represented by the refuse heaps of Denmark, where the remains of domestic animals have not been found with the exception of the dog, and where there are no remains of cultivated cereals. But all archæologists now admit that the development of the races of Northern Europe lagged far behind that in Central and Southern Europe.

The most elaborate attempt to determine the age of any of the lake dwellings was made by Morlot through calculations drawn from the details of the Tinière, which flows into Lake Geneva near its upper end. Morlot's calculations would make the remains of the stone age from five to seven thousand years old. But these calculations were based upon assumptions respecting both the amount and rate of deposit which are uncertain. Dr. Andrews, after going carefully over the ground, concluded that the earliest human remains found in the delta of the Tinière were probably not more than three thousand years old.[3]

Thus it appears that no geological facts carry neolithic man farther back in Europe than to the period in which historical evidence reveals a high state of civilization in the valleys of the Nile and Euphrates. Some further light, however, may be shed upon both the date of neolithic man's entrance into Europe and the stage of his culture, by attending to the more general ethnological problems which recent investigations are attempting to solve.

At first sight it would seem impossible to untangle the ethnological problem that is presented by the coexistence of so many varieties of the human race as exist in Europe and adjoining regions. In color the blond type prevails in the north and the brunet in the south. Light hair and blue eyes prevail almost universally in Scandinavia and Northern Germany, and among the Slavs of Russia. On the other hand black hair and eyes and dark skin prevail increasingly as we go south in Europe and into Northern Africa, with intermediate types over Central Europe. But it is to be noted that while the color of the hair varies through all extremes from blond to brunet, the form and texture of the hair of all the European races is the same. There are in Europe no races with the crisp and curly hair of the African Negro, nor any with the stiff, wiry, straight hair of the Asiatic and the American aborigines. It is worthy also of note that this latter peculiarity in the structure of the hair prevails in Hindustan where the Sanskrit branch of the Aryan languages had spread.

The curly hair of the Negro has a "flattened ribbon-like form in cross section, as examined microscopically; while cut squarely across, the straight hair more often inclines to a fairly rounded or cylindrical shape."[4] On the basis of texture of the hair, the European races would be classed as intermediate between the African and the Asiatic races. Whatever be the color of the hair of a European race, it is fine in texture and inclines to be wavy, rather than curly or stiff.

These peculiarities in the color of the skin and in the structure of the hair of the European races would seem to indicate either that they are crosses of the other two varieties, or that color and peculiarities of hair structure are more variable elements than some others in the determination of race.

But of the more permanent racial characteristics the form of the skull seems to be the most important. On this basis races are divided into broad-headed and long-headed varieties, or in technical terms brachycephalic and dolichocephalic. In the brachycephalic, or broad-headed, varieties the breadth of the skull above the ears is more than eighty per cent of its length from forehead to back. When the breadth falls below seventy per cent of the length it is called dolichocephalic, or long-headed. In Europe there is a curious intermingling of long-headed and broad-headed races. Scandinavia, Northern Germany, Great Britain, Iceland, Spain, and Southern Italy are occupied by long-headed races, as are Africa, Arabia, Hindustan, and Australia. But broad-headed races are thrust in between them, occupying the Alpine regions and the regions bordering the Adriatic Sea on the east and eastward through Russia, and Central and Northern Asia.

An important fact bearing on our subject is that the remains so far discovered of prehistoric man in

Europe show that he was of a remarkably long-headed variety. This appears from the measurement of all available skulls which have come down to us from the stone age. It seems, therefore, to be well established that Europe was originally occupied by a long-headed race resembling in that respect both the present inhabitants of the Mediterranean area and those of Great Britain and Scandinavia.

But, as already said, Central Europe is now principally occupied by broad-headed races, — this being specially true of the Alpine region. "In the high Alps of northwestern Italy are communes with an average index of 89, an extreme of roundheadedness not equalled anywhere else in the world, save in the Balkan Peninsula and in Asia Minor. This type of head prevails all through the Alps, quite irrespective of political frontiers." [5]

Formerly it was supposed that the original European race was of the broad-headed variety so characteristic of the Asiatic Continent. But more careful analysis of the facts leads to the conclusion that the broad-headed races were invaders who partially, and only partially, crowded out the original long-headed race which had preoccupied the whole area. Coming in, apparently, with a higher civilization the broad-headed people penetrated to all the more attractive portions of the country and dispossessed the long-headed stone age people of the best of their lands. But time wrought its accustomed revenges. Primitive man of Europe in due time learned the arts of his more civilized conquerors, and possessed himself of his heritage, and in turn drove his conquerors to the wall, crowding them to the more inaccessible regions of the mountainous districts where they have maintained themselves ever since in comparative purity. That the prehistoric culture of Europe was not indigenous, but was derived from the East, is ably argued by Professor Sophus Müller [6] of Copenhagen, who shows that the stone axes, the pottery with its peculiar ornamentation, the species of cereals, the dwellings, the graves, and the habits of agriculture of prehistoric Europe came into the region from the East and the South where we find the earliest seats of ancient civilization. An interesting confirmation of this theory of Mr. Ripley [1] (to whom we are indebted for many of the facts in this chapter) is found in the present existence of a long-headed race in Southwestern France in the vicinity of Périgueux and Limoges.

The continued existence of this long-headed race in the midst of broad-headed races receives special significance from the fact that it is just here that we find positive evidence that the prehistoric man of

France was of an extremely long-headed variety. For it is here that the numerous skeletons of the so-called Cro-Magnon race, of neolithic age, have been found. In 1858 workmen in the valley of the Vézère unearthed six complete skeletons, three of men, two of women, and one of a child. This was near the little village of Les Eyziès, and the excavation was that of the celebrated Cro-Magnon Cave, from which the name of the race has been derived. Later, similar discoveries were made near Saint-Gaudens in the valley of the Garonne, in the cave of Aurignac; at Laugerie Basse in the Vézère Valley and in the cave of Baumes-Chaudes in Lozère. Altogether, according to Ripley, nearly one hundred skeletons were found in the caves of this vicinity, while others of similar character were found in several localities more or less distant.

"The prehistoric antiquity of the Cro-Magnon type in this region is attested in two distinct ways. In the first place, the original people possessed no knowledge of the metals; they were in the same stage of culture as, perhaps even lower than, the American aborigines at the coming of Columbus. Their implements were fashioned of stone or bone, although often cunningly chipped and even polished. They were ignorant of the arts, either of agriculture or the domestication of animals, in both of which they were far below the culture of the native tribes of Africa at the present day. Additional proof of their antiquity was offered by the animal remains found intermingled with the human bones. The climate must have been very different from that of the present; for many of the fauna then living in the region, such as the reindeer, are now confined to the cold regions of northern Europe. To be sure, the great mammals, such as the mammoth, mastodon, the cave bear, and hyena, had already become extinct. They were contemporaneous with the still more ancient and uncultured type of man, whose remains occur in a lower geological stratum. This Cro-Magnon race is not of glacial antiquity, yet the distribution of mammals was markedly different from that of to-day. Thus of nineteen species found in the Cro-Magnon cave, ten no longer existed in southern Europe. They had migrated with the change of climate towards the north. The men alone seem to have remained in or near their early settlements, through all the changes of time and the vicissitudes of history. It is perhaps the most striking instance known of a persistency of population unchanged through thousands of years." [7]

It should be added that the Engis skull of Belgium, so fully described by Huxley, was of this type, as have been several others from caves in widely separated regions in Central and Western Europe and bordering regions. But from nearly all other regions it had apparently disappeared.

Closely adjoining the region occupied by the Cro-Magnon race is that of the Basques, who by their language would seem to be related to the oldest races of the world. The Basques occupy a small area in Southwestern France and Northwestern Spain, on both sides of the Pyrenees, yet they speak a language entirely different from the Aryan languages everywhere surrounding them now in Europe. To find their linguistic affinities we have to go to the Finns of Northern Europe or to the Hungarians who are known to be immigrants from Asia. The Basque language is agglutinative like that of the Tartars of Asia and the Indians of America. Their words express concrete conceptions rather than abstract ideas. There is no regular inflection, but rather an agglutination of concepts in one word, instances of which are given in a preceding chapter. In language, therefore, the Basques would seem to belong to the most primitive stock of the human race.

But when considered from the point of view of skull measurements the problem is more perplexing; for the Basques are partly long-headed and partly broad-headed. Those living south of the Pyrenees in Spain are long-headed; while those living north of the mountains in France are mostly broad-headed. Apparently the linguistic and the anatomical evidence contradict each other. Careful attention to all the facts, however, bring them into harmony. The Basques of Spain are probably the original unvaried stock, and those on the north of the mountains a mixed stock, which has been produced by contact with the broad-headed Alpine race that penetrated to that part of the mountainous region. But though intermarrying with the broad-headed race the Basques have preserved their language, and at the same time greatly modified the physical features of their mixed descendants. For the French Basques do not have the round face of the Tartar, but the pointed chin and narrow face of the Spanish Basque.

It seems therefore probable that in this curious relic of people speaking an agglutinative language in these isolated parts of France and Spain, and living close to the former home of the Cro-Magnon race, we have additional evidence that a long-headed people originally occupied Europe, and that the Aryan-speaking peoples are Asiatic invaders, who brought with them the higher civilization which they had developed in Central Asia. But, having conquered the country, they eventually yielded to the superior force of the native population, when it had become possessed of their arts of war and domestic culture. The Basques are like the silent letters in archaic words. Their anomalous character gives irresistible force to their testimony.

To the theory that the original inhabitants of Europe were a long-headed, dark-skinned race, affiliated with the Negroes, additional likelihood is given by careful study of the existing races in Russia and Scandinavia. Recent investigations show that the Slavs are a broad-headed race — the cephalic index rising progressively as we go southwest from Moscow to the Adriatic Sea, where the extreme of broad-headedness is reached in Bosnia. But the Baltic Sea is bordered by long-headed races upon both sides, — the Swedes and Norwegians being the best types of a robust, fair-haired, long-headed race. Measurements of the skeletons found in the barrows and tumuli which are frequent in Denmark, Sweden, and Russia, show that the prehistoric people who erected them belonged also to a long-headed race.

Another interesting confirmation of the possibility of determining past movements of population from its present distribution is to be found in Great Britain in the distribution of dark-haired communities speaking the Celtic language. These are to be found in Western and Southern Wales, where there is a large proportion of brunets among the people and the Kymric Celtic is generally spoken. This is also true in Inverness and Argyle, Scotland, and all over the west and south of Ireland, where there is the same proportion of brunets and the Gaelic Celtic is spoken. Now though nearly all the races in Great Britain belong to the long-headed variety, there is little doubt that a dark-haired, Celtic-speaking people were the original occupants of the Islands. Their present isolation on the western sides of the Islands show that they were crowded out by invaders from the east. Scandinavian and German varieties of the long-headed race took possession as we know of the more accessible portions of the country, and left these peculiarly isolated groups of Celts in the extremities and more inaccessible portions of the land.

According to Ripley, "The anthropological history of northeastern Europe is now clear. Leaving aside the question of the original centre of dispersion of the Slavic languages, generally placed somewhere along the upper Dnieper, it would seem that the Slavs as a physical type penetrated Russia from the southwest, where they were physically an offshoot from the great Alpine race of central Europe. In so doing they forced a way in over a people primitive in culture, language, and physical type. This aboriginal substratum is represented to-day by the Finns, now scarcely to be found in purity, pushed aside into the nooks and corners by an intrusive people, possessed of a higher culture acquired in central Europe. Yet the Finn has not become extinct. His blood still flows in Russian veins, most notably in the Great and White Russian tribes. The former, in colonizing the great plain, has also been obliged to contend with the Asiatic barbarians pressing in from the east. Yet the impress of the Mongol-Tartar upon the physical type of the Great Russian, which constitutes the major part of the nation, has been relatively slight; for instead of amalgamation or absorption as with the Finn, elimination, or what Leroy-Beaulieu calls 'secretion,' has taken place in case of the Mongol hordes. They still remain intact in the steppes about the Caspian; the Tartars are banished to the eastern governments as well, save for those in the Crimea. The Asiatic influence has been perhaps more powerful in determining the Great Russian character than the physical type. A struggle for mastery of eastern Europe with the barbarians has made the Great Russian more aggressive; vigour has to some degree developed at the expense of refinement. The result has been to generate a type well fitted to perform the arduous task of protecting the marches of Europe against barbarian onslaught, and at the same time capable of forcefully extending European culture over the aborigines of Asia." [8]

The mental capacity of neolithic man has been too much underestimated. Until recently it was supposed that his development was very meager. But recent discoveries have shown that there was an indigenous culture of no mean order among the neolithic inhabitants of Western Europe. Among the conspicuous evidences of the civic organization and mechanical skill of neolithic man the dolmens and other prehistoric stone monuments of great size abounding in Western Europe are worthy of prominent mention.

Dolmens in their simplest form consist of from three to five upright stones of large size, five or six feet high, set up on end, and covered by a capstone of still larger size. The dolmen at Kit's Cotty House, between Rochester and Maidstone in England, has a capstone measuring eleven by eight feet. The mechanical problem of balancing such a capstone, weighing many tons, upon three upright stone pillars is an extremely difficult one, and has greatly puzzled students of these remarkable structures. Probably, however, it was accomplished by first piling a mound of earth around the pillars, and then moving the capstone along the inclined plane thus formed until it was properly centered and afterwards removing the earth so as to leave the covering in its present poised position. All this is easily enough said, but not so easily done. Its accomplishment implies keen foresight and strong mechanical imagination, combined with a considerable power in organizing and utilizing the work of his fellow men.

For the most part these dolmens evidently belong to the neolithic period, and so are evidence of the advancement of man in Western Europe during that prehistoric epoch. They abound in Northern Africa, Western Europe (especially in Brittany and in Great Britain) and in Northern Germany, Denmark, Southern Sweden, Southern Russia, and the Crimea, and thence on through Central Asia into India where they are widely distributed. In India and Africa these singular structures have been erected in comparatively recent times, but in Europe they are evidently remnants of prehistoric human effort and accomplishment. It is noticeable that these dolmens follow lines of Aryan emigration and Aryan race location, for the most part. They do so in India and on the way thither. Northern Africa is the only possible exception, and it is easily accounted for by

Prehistoric Monoliths at Aksur, Abyssinia. (Courtesy of Records of the Past.)

lateness of the usage there. It may be a borrowed art obtained from Aryan centers of culture or it may have been carried there by late Aryan immigrants, who followed traditional fashions in these monuments.

Even more remarkable are some of the monoliths which have been erected in many places by prehistoric man in Western Europe. Two of large size rising fifteen or twenty feet above the ground may be seen near the road running from York, England, to Aldborough, the ancient capital. These must have been brought several miles across broken country; for they are not the rock of the immediate vicinity. At Carnac in Brittany, France, a monolith of prehistoric age is sixty-three feet high and fourteen feet in diameter and is estimated to weigh two hundred and sixty tons.

Nor was neolithic man wholly devoid of artistic capacity. The stone implements fashioned by him are often symmetrical and beautiful and very difficult of manufacture. In the Scandinavian kitchen middens are found chipped flint daggers of exquisite form, ministering to a high sense of beauty as well as to direct utility. The smooth stone implements are often of even greater beauty and difficulty of manufacture. To fashion a hard diorite mass into a symmetrical axe with a hole bored in the middle for a handle, requires a very high degree of skill. Yet implements of this sort are the rule and not the exception in the shell heaps of Denmark and Scandinavia.

Carvings upon ivory and bone are also by no means infrequent in the abandoned dwelling places of neolithic man. Several described by Bertrand and Reinach from the grotto of Mas d'Azil, in the extreme southwestern corner of Europe, give evidence that man in those primitive conditions had there domesticated the reindeer, the horse, and the ox; while, as already remarked, in the lake dwellings of Switzerland there is revealed in the relics found, a knowledge of agriculture, of the manufacture of pottery, and of the domestication of animals, long before the inhabitants of the region had any contact with the higher civilization which developed in the East. A carving on bone from Thayngen, reproduced by Heim, represents a reindeer, with an artistic skill that would do credit to a modern craftsman.

The lake dwellings of Switzerland give abundant evidence, however, that the broad-headed race did not at the outset bring with them into Europe the culture of the bronze age. For the skulls of the lake dwelers were as broad as those of the inhabitants of the Alpine region at the present time; while the culture revealed in the lowest strata of the pile dwellers' refuse is only that of the stone age. The use of bronze and iron came in gradually as well as that of domestic animals.

The final conclusion concerning these questions is well stated by Ripley as follows:

"The nearly contemporaneous appearance of the Alpine race and the first knowledge of metals, indicative of Oriental cultural influences in western Europe, is more or less a coincidence. The first civilized peoples of the Hallstatt period seem to have been closely allied, both in physical type and culture, with the Greeks and other peoples of the classic East. Among them, perhaps over them, swept the representatives of our broad-headed Alpine type who came from the direction of Asia. These invaders may have been the Scythians, although the matter is incapable of proof. Pressure from this direction set both culture and population in motion toward the west, in much the same way that the fall of Constantinople in the fifteenth century induced the Renaissance in Italy." [9]

CHAPTER V

THE ORIGIN AND ANTIQUITY OF THE AMERICAN INDIAN

America has no written records previous to its discovery by Columbus in 1492. In reconstructing the history, therefore, we must be content with such light as is thrown upon the subject by various natural sciences, especially philology, comparative anatomy, geology, sociology, and archæology.

At the outset, however, it is important to note that the Red Indian of America is sharply separated in many ways from the Eskimo of the Arctic region. So that, for the present, we will confine our attention to the Red Indian who at the time of the discovery of America by Columbus, was spread over the continent from sea to sea and from Alaska to Patagonia. Notwithstanding their diversities in dialect and civilization, their resemblances are so many and so striking as to separate them from the other races of the world, and to gather them into a unity by themselves. The best informed students of the subject affirm that physiologically, linguistically, and politically the races of North and South America betray a common origin with only such diversities as the conditions of life and the lapse of time might naturally produce.

1. The language of the native races of America is what has already been described as agglutinative or "polysynthetic," abounding in combinations and refinements of grammar which throw into shade even the language of classic Greece. Thus, while differing in many minor particulars, the grammatical structure of all the Indian languages is so much alike as to indicate a common origin at some time in the distant past. Old words have dropped out and new ones have come in, but the structure of the language remains essentially the same. In the Ojibway language, for example, one can but be impressed with the discriminations which appear in the inflection of the verb. An instance appears in the first person plural which has a form expressing a "we," meaning *you and I*, and a "we," meaning *they and I*. Among moods they have not only a form to express the simple subjunctive, as, *If I see him;* but one to express the additional idea, *If I see him, as I probably do.* With two words they express the idea, *If I understand you, as I probably do, we will finish what we wished to do.* Kic-pim-ne-si-to-nin-o-ni-mo-gul-o-gwen ki-ga-gi-dji-to-min-wa-i-dji-tci-ge-yung.

2. Again, there was, at the time of its discovery

by Columbus, from the Arctic Sea to Patagonia, a remarkable similarity in the arts and customs of all the inhabitants of America. The Indians had nowhere advanced, except perhaps to a limited extent in Peru, beyond the culture possible in an age of stone implements. The copper implements found in North America are insignificant, and were merely hammered, cold, from the native metal. The arts of making pottery, of weaving, and of tanning skins, were at a pretty uniform stage of development all over the continent.

3. With wonderful patience of research, and with a great wealth of illustration, Mr. Lewis H. Morgan[1] has shown that the domestic, social, political and military customs of the village Indians of New Mexico, and probably of the Indians of Mexico and Central America in their highest state of development, are substantially one with those of the Iroquois of New York and of the purely roving tribes farther north. According to Mr. Morgan, it is the vivid imagination of the Spanish historian which applied the title "king" or "emperor" to Montezuma. The Mexico subdued by Cortez was not a despotic power under the control of hereditary rulers, but was merely a remarkable confederacy of Indian tribes, like that of the Six Nations in New York. The won-

derful palaces of Mexico described by the Spanish historians are likewise declared by Mr. Morgan to be largely the product of their imagination. These historians transferred the conceptions of European architecture to the communal houses of the Aztecs in Mexico, which were but improvements upon the pueblos in New Mexico and Arizona, which also are, in turn, but modifications of the "long bark houses of the Iroquois, designed for twenty families." The social organization and mode of government pervading all America at the time of its discovery, was a military "democracy, based upon communism in living." The Indian, nowhere, ever had a title in fee simple to a solitary foot of land.

All this arises from the mode of reckoning blood relationship among the Indians of America, which is so characteristic, so complicated, and so uniform that it could not have arisen by accident, but must have had its origin in community of descent. Furthermore, these peculiarities of reckoning affinity, show that the ancestors of the American Indians must have been one with the ancestors of various nations in Asia speaking the Turanian language, prominent among which are the Tamils of India, classified as Dravidians. Still further the facts seem to prove that the ancestors of the American Indians and of the Turanian race of Asia had separated from the common stock previous to the spread of the so-called Aryan civilization over India and Europe.

Mr. Morgan's researches upon this point are so interesting and instructive that we may profitably devote a few paragraphs to them.

European nations inherit from the earliest times a *descriptive* mode of expressing consanguinity. This mode is specially adapted to a state of society in which individual rights to property are recognized and where estates are to be distributed. In this plan it is important to recognize the degree in which blood relations are separated from each other. If an estate is to be distributed among all the descendants of its original possessor, it is important for the surviving relatives to know how large a number there may be to claim a portion. Our third cousin, for example, is the great-grandchild of our great-great uncle. With our mode of calculation, blood relationship is made to appear so slight that at a few degrees removed it ceases to be of any account. The number of fourteenth cousins which every person ought to have, is, according to Blackstone's computation, not less than sixty-seven millions. The number of a person's ancestors, as we recede in time, likewise increases with striking rapidity. Each one of us has four grandparents, eight great-grandparents, and so on. If there had been no intermarriage of relatives for twenty generations back, each person would find himself the possessor of more than a million ancestors, living at the time of the Crusades.

With our system of classification we attempt to describe the exact degree of relationship, as in the terms grandfather, great-grandfather, grandson, great-grandson, uncle, great-uncle, nephew, great-nephew, and cousins to any required degree. But the mode of reckoning relationship common to the Indian tribes and the Turanian races of Asia is based on an entirely different conception. The Indian, in common with the Tamil, did not recognize the relationship of cousin, but he reckons the children of his brothers as his own sons and daughters, and as brothers and sisters of his own children, who are all classed in one family. The children of his sister, who is likely to have married out of his tribe, are indeed nephews and nieces. But all the others whom we would call our cousins would be reckoned as the grandsons of our father, and as our own sons and daughters. Thus we at once see in this mode of reckoning relationships a partial similarity to that used by the Jews, which has led to so much misunderstanding in efforts to obtain chronology from the Biblical records.

In view of the suggestions just made as to the Asiatic origin of the American Indian, it will be profitable to dwell upon the facilities afforded even in present geographical conditions for a migration from Eastern Asia to Western North America. Behring Strait being less than fifty miles wide, and having an island half way across, affords abundant opportunity for the migration of Asiatic tribes to the milder climate of Alaska. The Eskimo now frequently cross in their small boats. The Aleutian Islands, several hundred miles farther south, afford frequent and regular landing places, inviting emigration by easy stages from Kamchatka to the southern part of Alaska. Such, also, is the course of the ocean currents in the Pacific as to favor a line of migration pretty well to the south, and the wrecks of Japanese ships are frequently cast upon the American coast even in the vicinity of Puget Sound. Mr. C. W. Brooks, of San Francisco, gives forty-one instances of such wrecks occurring during the past century, twenty-nine of which contained a portion of the crew alive. These facts show that there was more than one feasible route for emigration from Asia to North America, and that there is no insuperable difficulty in the way of supposing such an emigration at a very early period of human history.

To Mr. Morgan, also, we are indebted for the clearest presentation of the considerations which give supreme importance to the country about the mouth of the Columbia River as a center for the dispersion of Indian tribes. In the islands of Puget Sound and in the lower valleys of the Fraser and Columbia rivers we find the most perfect paradise in the world for savage tribes. Here are forests for their protection and fish in boundless quantities for their sustenance. The crowds of salmon which press up the Columbia River during the two or three summer months are beyond all calculation. During the spawning season these powerful and noble fish ever head up stream, leaping waterfalls many feet in height, and urging their way onward to the fastnesses of the Rocky Mountains. In such numbers do they come that oftentimes those crowding behind push great quantities of their fellows out upon the dry land, and at every rapid and waterfall they can be caught in the most primitive manner with the greatest ease.

With salmon as the basis of their diet the aborigines were also supplied in this region with much small game and with two or three most valuable esculent roots, the most important of which is the kamash, which is found in great quantities, and which after being baked makes a palatable and nutritious flour.

There is also an edible moss growing upon pine trees, which may serve an important purpose as vegetable food. Nuts and berries also abound, while oysters and clams were ever within reach. No place probably in the world furnishes equal facilities with this for the maintenance of life among savage tribes. This would naturally make of the region a breeding place where population would increase until an overflow was necessary; and so we find that from the first discovery of this region there was in it, for savage tribes, an unusual density of population, and it becomes of interest to study the natural lines leading out from this region to the other portions of the continent.

Following the fish up Fraser River and the main branch of the Columbia, the advance guard of the immigration would be brought in close proximity to the headwaters of the Saskatchewan and Missouri rivers, along whose courses they would eventually be brought to the central portion of the continent and to the occupation of the whole region covered by the basin of the Great Lakes and the Mississippi Valley. Most significant, however, would have been the line of migration extending up the south fork of the Columbia, or what is now called Snake River. This course would bring the migratory tribes into close proximity to the headwaters of the streams which flow to the south and lead into the region where some of the important discoveries of domestic plants have been made.

Of these that of Indian corn, or maize, is perhaps the most important. This was found by the whites almost as widely dispersed as were the aborigines themselves upon this continent. Yet it could not have originated in New England or the Mississippi Valley on account of the difficulty of keeping the seed from one year to another. Everything points to the more temperate and arid regions in New Mexico or Arizona as the place where the conditions were favorable for the spontaneous development of this most useful plant. Here doubtless it was that Indian corn was discovered and utilized by man. In the same region and farther south other most important plants capable of domestication were also encountered. Among the most important of these were species of beans and squash.

But agriculture was never carried to a high degree by any of the tribes of America. Their corn fields were little more than garden patches. Indeed, with their stage of development it could not be otherwise, since they were confined to the use of implements made of wood and stone with which to cultivate the soil. Nor could they with these implements clear the country of forests, but must be limited for the most part to such areas near the streams as were free from timber.

Considering these lines of migration in their order, it is thought that they can be traced in the results as they appeared upon the first exploration of America by the whites. First, there were the Algonquin tribes which occupied the region north of the Great Lakes and had pressed southward into the Mississippi Valley to Tennessee and along the Atlantic seaboard to the Carolinas. These had naturally passed from the Fraser and Columbia rivers into the Saskatchewan, and so to the Red River of the North and the regions east and south. The whole disposition of the tribes implies such a center of distribution.

Second, there were the tribes most closely affiliated with the present Sioux, or Dakotah, Indians, including the Assiniboines, the Winnebagoes, the Mandans, and the Iroquois. From their distribution they would seem to have penetrated the Mississippi Valley through the Platte River and to have spread north and south from its mouth.

Third, the Pawnees can with considerable certainty be traced up the Arkansas River to the same center and they are distributed from the mouth of the Arkansas as though that had been their line of movement.

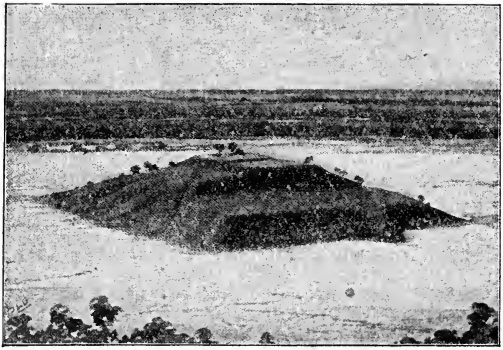
Fourth, the Shoshone migration, which is still in progress, is from the same center southeastward by the Arkansas into Texas and southwestward into Lower California.

The persistency with which these migrations followed the lines of the rivers is not surprising when we consider the disabilities under which savage races maintain their existence. Originally the Indians were without horses, and so could with difficulty contend with the buffalo of the plains. Indeed, the wide prairies and plains would seem to present insuperable barriers to savage migration. Savages need the protection of the forests. They need also its game, and exist with difficulty when out of the reach of fish. It is only after the advent of the horse that the savage could even partially contend against the difficulties of existence upon the prairies.

So far we have spoken only of Roving Indians. In some respects a more significant migration, naturally traced to the same source, is that of the Village Indians, who, by some happy accident, on reaching the warmer climate of New Mexico and Arizona, discovered and began to utilize the domestic plants to which we have already referred, namely, Indian corn, beans, and squash, to which may be added cotton and tobacco, and at a later time the potato. With regard to these Village Indians Mr. Morgan has clearly shown that their organization is not essentially different from that of the roving tribes, and that their advancement in the arts is extremely limited, while their form of government is such that none of them were ever consolidated into a strong nation. From the necessities of the case the areas of land cultivated by them were small and from the comparative isolation of their villages and the feeble bond of their political alliances they were constantly subject to incursions from the north. Of this there was even traditional evidence existing at the time of the conquest of Mexico by the Spaniards. The Aztecs were from the north, and their advent into Mexico had been so recent that the particulars of it were retained in considerable detail, and it is pretty certain that they had not been in possession of the country more than three or four hundred years.

Of the population of South America we can speak with less confidence, though there can be little doubt that they entered the continent from the north. This we should infer from the extreme difficulty, if not impossibility, of reaching South America from any of the islands of Oceanica, with only the savage's means of navigation. They would be more likely to reach it from Africa, but the Indians of South America do not belong to the same race with the Polynesians or the Negroes of Africa. There are, indeed, reports of some isolated communities of Negroes which may thus have reached the continent. But, for the most part, the aborigines of South America are so nearly of the same race with those in North America, as to justify the inference that they had at a very early period been pushed across the Isthmus of Darien by the constant pressure of the roving tribes behind, which, from time to time, had emerged from the valley of the Columbia. Following down the Andes upon either side these spread over the continent, penetrating on one hand to the wilds of Patagonia and on the other hand to the more congenial islands of the Caribbean Sea.

This part of the subject is not complete without a word concerning the Mound Builders [2] in the valley of the Mississippi and the Ohio. On the earliest exploration of this interior region the attention of the explorers was attracted by vast earthworks which seemed to be the remnants of an earlier civilization that had wholly disappeared. These earthworks consisted of mounds, truncated pyramids, vast circular enclosures, and fortifications. The size of some of these is very impressive. One of the mounds near Wheeling is seventy feet in height and one thousand

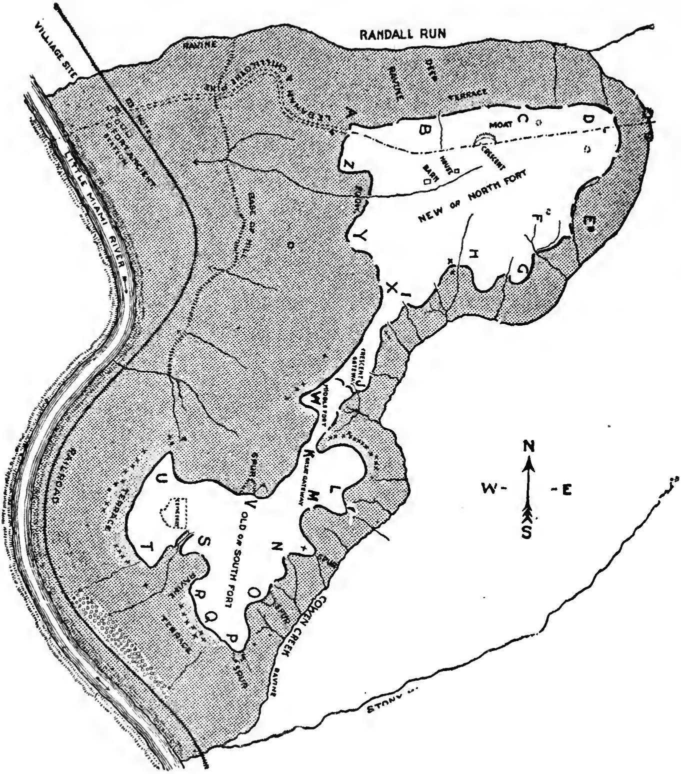


Cahokia Mound restored.

feet in circumference at the base. The Cahokia Mound in Illinois, just east of St. Louis, covers a space of twelve acres, and rises by four terraces to a height of ninety feet. The cubical contents of it may be estimated at 600,000 cubic yards, and its construction would occupy a thousand Indians for a period of eight years. In the same vicinity were also sixty other mounds, several of which are from thirty to sixty feet in height.

In other places there are elaborate systems of fortifications as at Marietta, Ohio, on the banks of the Ohio, where there were two enclosures of forty and twenty acres respectively, surrounded by embankments five or six feet in height by twenty at the base. In the vicinity of Newark, Ohio, there originally existed a network of embankments measuring all together many miles in length, and there still remain a circular enclosure of thirty acres, a square enclosure of twenty, and an octagonal one of fifty acres. The embankments of the circular enclosure are no less than fifteen feet high, and near the entrance they are fully thirty feet in height, while on the inside there is a continuous ditch five or six feet in depth. Of the fortifications, the one in Highland County called Fort Hill consists of an embankment around the summit of one of the highest eminences. It encloses thirty-five acres, is more than a mile and a half in length and contains upwards of 50,000 cubic yards of material. Upon the Little Miami River, about thirty miles above its mouth, there is found the largest of all these fortifications known as Fort Ancient, where a position of great natural strength is surrounded by an embankment four miles in extent, rising to a height of eighteen to twenty feet above the surface. The total amount of earth contained in the protective wall is estimated to be 172,000,000 cubic feet.

Near Chillicothe in the Scioto Valley, and in the valley of the Little Miami below Fort Ancient there are remarkable clusters of mounds and earthworks of



Plan of Fort Ancient. (Courtesy of the Ohio Archæological and Historical Society.)

which it is possible, for want of room, to speak only of two or three groups, and of these only to mention the witness which their contents bear to the wide commerce of the period. From a single mound in the Hopewell group near Chillicothe, Ohio, Professor Moorehead reports that 8,185 flint disks, each one weighing on an average one pound, were taken. These had been brought from the southern part of Indiana, or Illinois, and were only roughly trimmed, evidently having been "cached" to await a convenient opportunity to make the material up into perfect implements. In other mounds of the group there was a large number of obsidian arrowheads and spearheads. The material from which these implements were made is not found nearer than the Rocky Mountains, two thousand miles distant to the west. Many copper implements and ornaments were also found here. These had all been hammered, the material being the native copper of the Lake Superior region, several hundred miles to the north. On the other hand there occurred large quantities of mica, some of it in sheets from fifteen to twenty inches in diameter, which must have come from the east as far away as North Carolina. Shells from the Gulf of Mexico also were found side by side with the other material from such far-separated regions, indicating a commerce almost as wide as the continent.

In a neighboring group of mounds (the Baum) Professor W. C. Mills, Curator of the Ohio Archæological and Historical Society, has found, in addition to many objects similar to those discovered by Professor Moorehead, interesting indications of the Mound Builders' love of ornaments and their ingenuity in gratifying their taste. In one mound there was found a great number of carefully selected pearls, which had evidently been fastened together upon a string. Upon showing these to one of the most prominent experts in estimating the value of precious stones and gems, he was assured that if these pearls had been fresh they would have a market value at the present time of ten thousand dollars, and that it would probably require several generations of Indians to collect them. Another discovery alongside of this revealed the fact that the supply of pearls was not equal to the demand. Therefore the Indians had resorted to making artificial pearls. Clay was molded into the shape of pearls and hardened in the fire, when they were skillfully covered with a malleable mica, whose luster closely resembled that of a genuine pearl.

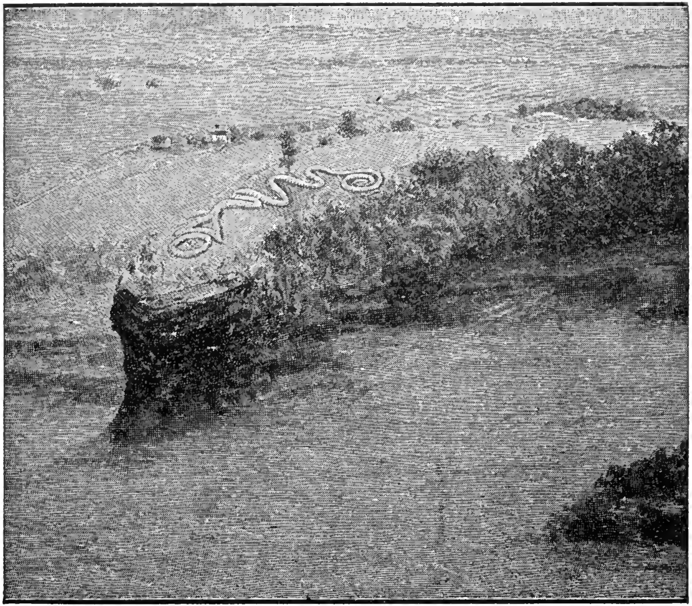
From the Turner group of mounds, in the Little

Mound at Miamisburg, Ohio, 68 feet high, 852 feet in circumference.
(Courtesy of Mr. Albert Kern.)

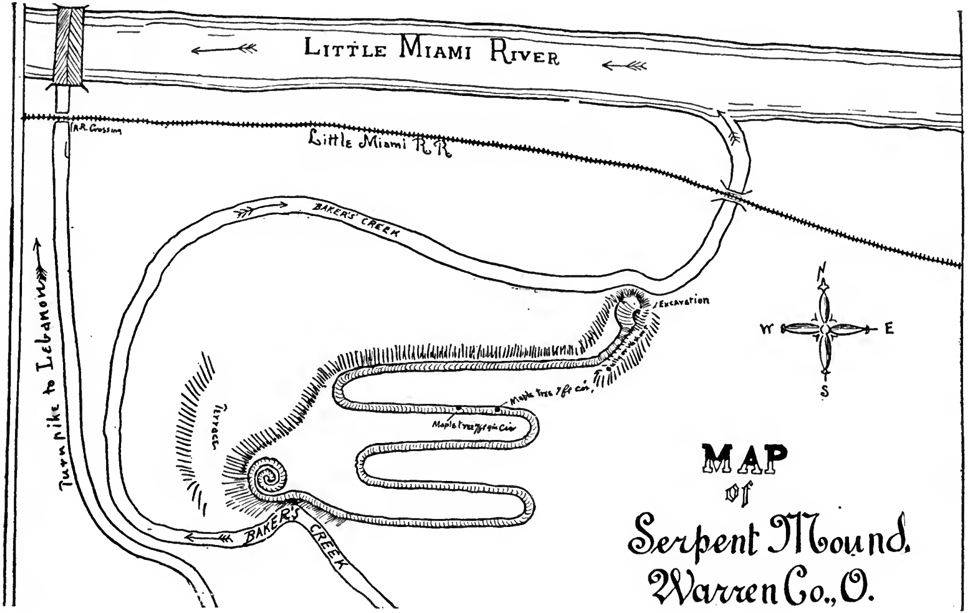
Miami Valley, a few miles below Fort Ancient, articles were found from an equally great range of localities, mica, obsidian, copper, and what has been found in no others, meteoric iron, and small quantities of gold.

In Wisconsin were numerous mounds imitating the shape of various animals, among others the elephant; while in Ohio these animal forms were fewer, but equally remarkable. At Granville, Ohio, there is a mound in the shape of an alligator, and in Adams and Warren counties mounds in the shape of a serpent, the total length of whose body is in each case more than a thousand feet. These serpent mounds are both in conspicuous situations, suitable for the performance of religious ceremonies in the presence of a vast concourse of people. That they were constructed for religious purposes cannot reasonably be doubted. They are near the most thickly settled areas occupied by the Mound Builders, yet evidently they were not located for any utilitarian purpose. The serpent, however, has been almost universally employed as a religious symbol from the earlier times, appearing on the monuments of Egypt, China, India, Mexico, and Central America. The serpent also enters largely into the mythology of the Greeks, and is not absent from early Bible history. In view of these facts it is difficult to reject the conclusion that the religious regard for the serpent indicated in these symbolic mounds is an inheritance from the Old World, and points with so many other things to an Asiatic origin of the aborigines of America.

In speculating upon the history of the race that constructed these mounds and earthworks we have but a few data to go upon, yet they are of considerable value. In the first place, the tribes of Indians occupying the region when first explored by the whites made no use of them and were ignorant of their origin. In the next place, from the growth of single trees in the forests over the embankments it seems evident that they had been disused for several hundred years. Thirdly, there is in many respects a close analogy between these various collections of earthworks and the pueblos of New Mexico, Arizona, and the regions farther south, that is, they seem to have been the work of Village Indians who lived by agriculture and chose their places of residence on the river banks where there was much fertile soil easily tilled. The existence of fortifications would indicate, without much doubt, that they were compelled to maintain an attitude of defense, and indeed it was shown by Colonel Whittlesey long ago that over a large part of Southern Ohio, what



Serpent Mound, Adams County, Ohio.



MAP
of
Serpent Mound.
Warren Co., O.

seem to be signal mounds, were erected in such situations that communication and warnings of danger might be almost instantaneously spread from point to point.

The whole appearance of the system of mounds is that they are the work of Village Indians, who had spread northward from the region of New Mexico and brought with them what few arts they possessed to the Ohio Valley, and endeavored to transfer to that region the modes of life which had developed in the more favorable conditions of a dryer and warmer climate. Whether they finally retreated because of the incursions of the roving tribes from the north, or quietly withdrew because of the unsuitability of the conditions to their mode of life, we may never know. But at any rate we have no grounds for attributing an extreme antiquity to them. Their arts, as shown by the ornaments and utensils found in the mounds, were not much in advance of those of the roving tribes. They were essentially in the stone age, but to them probably the roving tribes are indebted to the lasting and priceless heritage of Indian corn and the art of preserving and cultivating it.

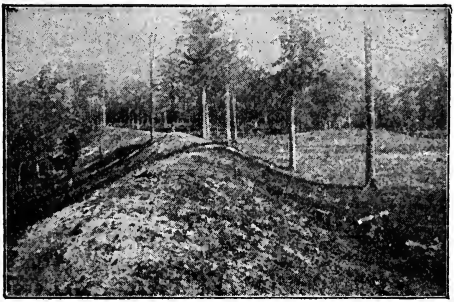
Leaving for the present the Eskimo out of consideration, a few remarks may properly be made upon the bearing of the facts already presented upon the

Southern face of the Temple of the Plumed Serpent, Xochicalco, Mexico.
(Courtesy of Records of the Past.)

antiquity of the Indian occupancy of America. An antiquity of some thousands of years would seem to be indicated by the very fact that every nook and corner of the continent was occupied. It must have been a slow process by which the waves of emigration succeeded each other, and, passing through the constricted channel of Darien, spread to the farthermost end of Patagonia. The diversities of language, and of habits of life, indicate also a long lapse of time between their first occupancy of the country and their discovery by the whites. Or, if one should take the other alternative, and regard the Indians not as having descended from a single stock, but as having arrived upon the continent by different lines of emigration and consisting originally of different races, as would then necessarily be the case, an enormous lapse of time must have occurred before they could have so commingled as to secure the present degree of similarity. But this supposition verges so nearly upon the incredible that we cannot be expected to give it much place in our thought.

Another indication of the great antiquity of the Indian race is that already referred to as derived from the methods of expressing degrees of consanguinity. From this we saw that the separation of the Indian races from the parent stock of mankind was previous to the rise of the Aryan civilization. This would throw the origin of these races on the Eastern continent far back of the oldest historical monuments of Egypt and Babylonia. It would not, however, determine the time of their entrance into America. But it should be remarked that the descendants of the first immigrants would dominate and determine the character of all the subsequent racial developments, for in a short time the increase of numbers from the first migration would be such that all subsequent migration would be insignificant in its relative amount. This we see to be the case even at the present time. The descendants of those who came to America in the early part of the seventeenth century are still forming the national character, notwithstanding the enormous emigration made possible by present modes of travel. Amid the conditions of prehistoric times this result would have been still more apparent and necessary.

So far we have considered only the races and their progenitors who are in the present occupancy of the continent. But recent investigations have brought to light the remains of what we may well believe to be an earlier race that became widely spread over the continent before the Glacial epoch closed, and it will be necessary, therefore, for us to discuss at considerable length the facts connected with the changes accompanying that, in order to form some intelligent opinion on the question whether glacial man in America became extinct in connection with the catastrophe, or whether his descendants may still survive in the American Indians or in the Eskimo.



Section of Fort Ancient.

CHAPTER VI

SIGNIFICANCE OF THE GLACIAL EPOCH

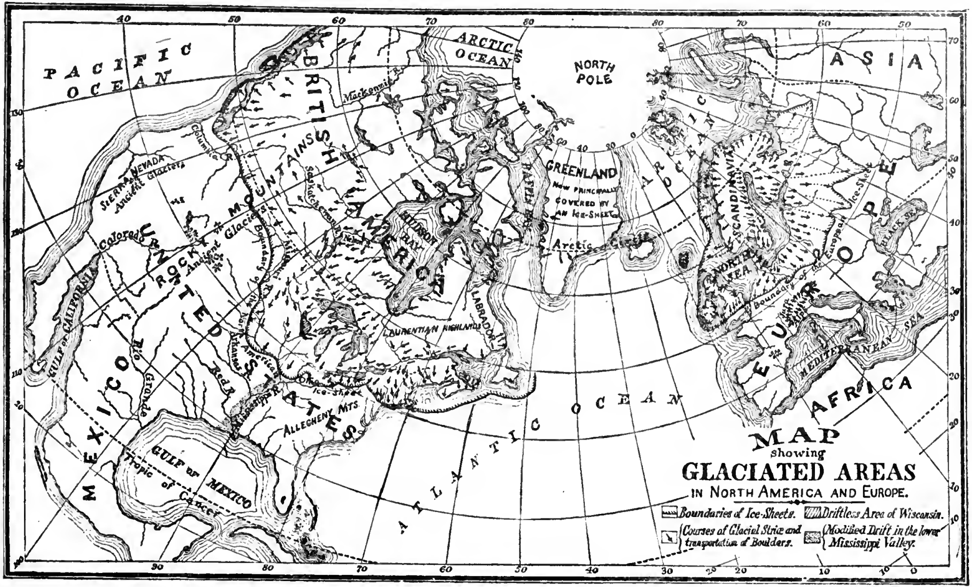
WHILE the facts concerning the neolithic age, combined with those of an anthropological character, carry us no farther back in Europe than two or three thousand years before Christ, those concerning palæolithic man indicate a much earlier antiquity. For evidently he was an inhabitant of Europe amidst physical conditions far different from those which prevailed during neolithic time. At this point geology assumes the rôle of the principal witness; for when once the existence of man during the Glacial epoch was established, his antiquity became a geological question. More light, therefore, seems likely to be shed upon the primitive chronology of the human race from glacial geology than from any other source of evidence. In fact, no studies bearing upon Post-Tertiary geology can now be reckoned as foreign to our subject. The student must be prepared, therefore, for extensive excursions into the geological field.

Apparently the palæolithic age is separated from the neolithic by a wide geological chasm representing great physical changes both in Europe and America. Our reliance in determining the age of palæolithic implements is not so much upon their rudeness, as upon the conditions of life in the midst of which the fabricators spent their days. We must content ourselves with the briefest possible statement of the data upon which trustworthy conclusions can be based.

To get the evidence clearly before our minds it is necessary briefly to outline the facts concerning the Glacial epoch. Evidence of the most startling character continues to accumulate, proving that at a comparatively recent date arctic conditions of climate extended far down into Central Europe and into the valley of the Mississippi in America. The glaciers which now are confined to the Alps, the Scandinavian highlands, Greenland, and Alaska formerly extended until all the higher latitudes in Europe and America were enveloped in glacial ice as Greenland is at the present time. The evidences of this are indubitable. Scandinavian bowlders, such as can be carried only by glacial ice, are found around the arc of a circle whose radius is seven or eight hundred miles. From Scandinavia as a center the ice moved eastward beyond Novgorod, southeastward beyond Kiev in Russia, and southward over Northern Germany, and Saxony to the base of the Erzgebirge. Northern Holland was covered by the ice sheet, as was Great Britain as far south as the Thames. Scandinavian bowlders are frequent all along the eastern shore of England from Hull southward, and inland to the vicinity of Cambridge.

Some of the bowlders transported by this movement are truly enormous. A mass of chalk near Malmö in Southern Sweden has been described by Dr. Holst[1] that is three miles long, one thousand feet wide, and one or two hundred feet thick. This has glacial deposits both below and above it, showing that it is a true glacial bowlder. Its limits have been determined by efforts to quarry its valuable contents for commercial purposes. Masses of chalk of nearly equal size, which have been transported a considerable distance, are found in Eastern England. In one case a village was found to have been built upon such a bowlder. The depth of the glacial deposits over Northwestern Russia and Northern Germany are estimated to be 135 feet, while the ice itself, where it met the Harz Mountains, was fully fourteen hundred feet thick; for northern glacial débris is deposited on their flanks up to that height. In Sweden and Norway the thickness of the ice is estimated to have been at least seven thousand feet.

The ice sheet was not continuous over Central Europe. There were, however, centers from which it spread long distances towards the northern field, but failed to meet it. The most important of these was that upon the Alps, where glaciers of considerable size are still found above the five thousand foot line. During the Glacial epoch, however, they extended down the valley of the Rhone as far as Lyons, and of the Rhine 150 miles to Thiengen, and of the Danube to Ulm. Upon the south side the glaciers extended 120 miles to the vicinity of the river Po, at Turin, and Ivrea. At Ivrea the moraine hills are fifteen hundred feet thick. A bowlder near Soleure, which must have been transported 115 miles, would weigh 4,100 tons. One near Neuchatel, which must have been carried clear across the valley of Switzerland from the Alps to the Jura Mountains, measures fifty by forty by twenty feet; while another near Monthei contains 60,840 cubic feet. The depth of the ice, over the central part of Switzerland, must have been more than three thousand feet; and the valley filled is fifty miles wide. From the Pyrenees, also, glaciers of considerable extent came down into France throughout nearly their whole extent, that into the upper valley of the Garonne attaining a length of forty-five miles. Altogether the ice fields


MAP
showing
GLACIATED AREAS
IN NORTH AMERICA AND EUROPE.
Boundaries of Ice-Sheets.
Driftless Area of Wisconsin.
Courses of Glacial Striæ and transportation of Boulders.
Modified Drift in the lower Mississippi Valley.
PACIFIC OCEAN
ARCTIC OCEAN
NORTH POLE
ASIA
BRITISH AMERICA
UNITED STATES
MEXICO
ROCKY MOUNTAINS
SIERRA NEVADA
Ancient Glaciers
GULF of CALIFORNIA
GULF OF MEXICO
Tropic of Cancer
HUDSON BAY
LABRADOR
LAURENTIAN HIGHLANDS
ALLEGHENY MTS.
GREENLAND
Now principally covered by an Ice-Sheet
Arctic Circle
ATLANTIC OCEAN
SCANDINAVIA
NORTH SEA
EUROPE
Boundary of the European Ice-Sheet
BLACK SEA
MEDITERRANEAN SEA
AFRICA
Mackenzie R.
Columbia R.
Saskatchewan
Rio Grande
Red R.
Mississippi R.
Ice-Sheet

of Europe during the Glacial epoch covered an area of two million square miles, and must have had an average depth of fully one mile. This represents so much water abstracted from the ocean and locked up over an elevated area, to be let loose in tremendous floods when the climatic conditions changed.

In America during this epoch the area covered by ice was fully twice that in Europe, amounting to about four million square miles, while its depth is variously estimated to have been from one to three miles. The ice certainly was more than one mile deep over New England, for marks of the movement are found on the summit of Mt. Washington, which is more than six thousand feet high. The centers of dispersion east of the Rocky Mountains were from Keewatin west of Hudson Bay, and from Labrador. West of the Rocky Mountains there was a separate center about half way between Alaska and British Columbia. It is estimated by Professor Chamberlin [2] that there was an actual movement transporting material fully fifteen hundred miles from west of Hudson Bay to Southern Illinois. Certainly there is an immense amount of transported material near the Ohio River at Cincinnati, which must have been brought from Canada a distance of seven or eight hundred miles.[3] In places in Southern Ohio the glacial débris is hundreds of feet thick. A Canadian bowlder seven hundred miles from its source rests upon the highest land near Lebanon, Ohio, which measures twenty, by twelve, by eight feet out of ground. Many others of nearly equal size are to be found in other parts of the state.

The southern boundary of this glaciated area in North America runs along the southern shore of New England, through Long Island, the northern part of New Jersey and Pennsylvania, Southeastern Ohio, the southern portion of Indiana and Illinois, and Central Missouri to Northeastern Kansas, where it turns north near Topeka and keeps, for two or three hundred miles, nearly parallel with the Missouri River, and about one hundred miles west of it. Finally it turns west again and follows an irregular course to the Pacific Ocean, in the northern part of the state of Washington.

Contrary to former suppositions, it was found that Northern Alaska and the larger part of Siberia were not covered by glacial ice. The soil in these regions is, however, even yet frozen to a great depth. At Irkutsk the frost penetrates the soil six hundred feet below the surface.[4] In Northeastern Siberia above the sixtieth degree of latitude there are indeed evidences of extended glaciation, but not in the central portion, which borders on the Arctic Ocean. The vast mountain systems of Central Asia still support great glaciers in their higher elevations. But though they are in the latitude of the Alps, they never sent glaciers down to the plains at their base as did the mountains of Europe. Still the former glaciers in the Asiatic mountains were far larger than the present ones. In the Tian Shan Mountains, which separate Eastern Turkestan from Siberia and Western Turkestan, it is found that glaciers formerly extended down to the level of seven thousand feet, but no farther. The mountains, however, are much higher and larger than the Alps. Some of the peaks run up to twenty-three thousand feet, and several to seventeen thousand. The Glacial epoch in this region may have had, as we shall see, a most important part in influencing the early development and distribution of the human race.

The anomalous facts of the Glacial epoch and the extent of the disturbances which it introduced into the history of species cannot be fully appreciated without going somewhat further into details concerning its influence upon changes of land levels, upon drainage systems, and upon the survival and migration of plants and animals. Both in its inception and in its close the Glacial epoch was a catastrophe of the most impressive order. Throughout, its conditions were abnormal. No reasoning from present conditions can apply to the Glacial epoch without great reservation.

It requires but a glance at the map of the glaciated region to see that effects were produced upon the drainage systems of both continents which baffle the imagination. All the northerly flowing streams both of Europe and America were obstructed at their mouths and their currents reversed, while the southerly flowing streams, whose headwaters were in the glaciated region, had their volumes indefinitely increased by the augmented precipitation characterizing the epoch in general, and by the enormous amount of water set free by the melting of the ice during the closing stages. This result is more readily seen in America than in the Old World, for there the valleys are better defined and are on a much larger scale than in Europe. The obstruction of the St. Lawrence by the advancing ice turned immense floods of water through the Champlain and Hudson valleys; then, a little later, over the passes from the Great Lakes into the valley of the Mississippi. The outlets to these great floods of glacial water are clearly traceable through the pass at Fort Wayne, Indiana, leading from the drainage basin of the Maumee River to that of the Wabash, and so on into the Ohio and Mississippi; also through the line of the Chicago Drainage Canal into the Illinois River, the elevations above the sea being respectively eight hundred and six hundred feet. In both these cases the abandoned channels are as distinct as though they had been occupied but yesterday, and in both cases are as broad and deep as the channel of Niagara where it leaves Lake Erie.

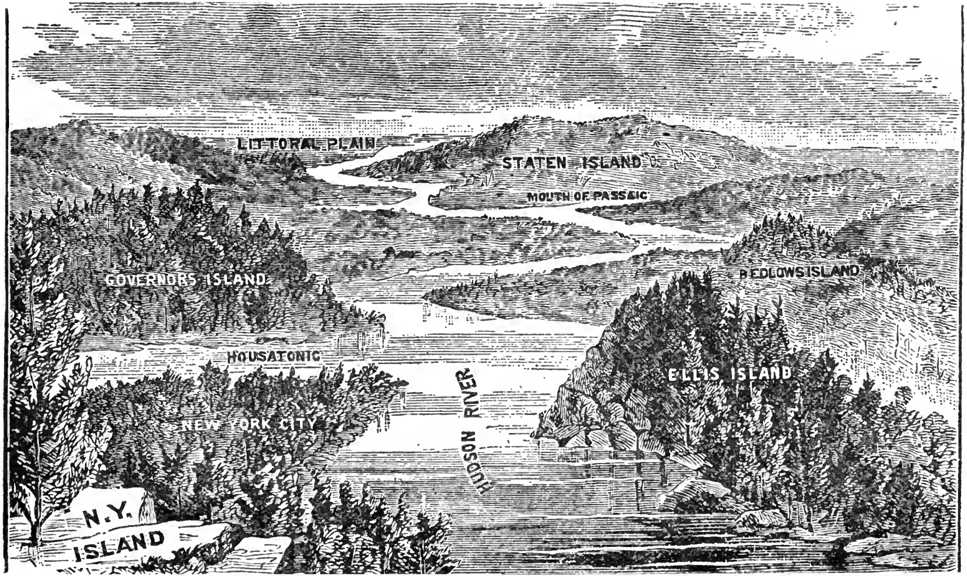
At a still later stage, when the ice had filled the basin of the Great Lakes the increased volume of water flowed directly into the northern tributaries of the Ohio, and through the higher passes leading from Central New York into the Susquehanna, while six thousand square miles of the upper basin of the Delaware River was deeply buried in ice to augment its floods during the seasons of rapid melting.

Most astonishing results were also produced farther north in the valley of the Red River, in Canada. Here the floods which now pour into Hudson Bay were confined in a vast enclosed basin forming a lake covering an area of more than one hundred thousand square miles and held up to the level of the pass leading into the Minnesota River at Brown's Valley, and thence into the Mississippi at St. Paul. Of course these channels were opened and occupied in reverse order upon the melting of the ice during the closing stages of the period. As a result of these floods all these south flowing streams are bordered by gravel terraces from fifty to one hundred and fifty feet above the present high-water mark. These terraces are composed largely of pebbles of the hard Canadian rocks, which were first brought over the watershed by the glacial ice, and then distributed by the streams which flowed over and in front of the retreating mass. The extent of the floods is almost incomprehensible. In the Missouri Valley [5] the annual rise of the river during a considerable portion of the closing stages of the period was fully two hundred feet during the latter part of the summer. In the Ohio, at Cincinnati, they were probably twice that height, though, perhaps, they were augmented by a glacial dam, or by ice gorges which obstructed the flow.[6]

According to an estimate based on several seasons' study of Alaskan glaciers by Professors R. S. Tarr and O. D. von Engeln,[7] the water supplied to the Mississippi River by the melting of the glacial ice sheet during the closing stages of the ice age was annually sixty times that carried off by the present flow. My estimate for the Missouri was only twentyfold.

The epoch was also characterized by abnormal changes of land levels, both in its inauguration and in its closing stages. The Tertiary period closed with a great elevation of land over all the northern part of the Northern Hemisphere. There is indubitable evidence that the northern part of the Mississippi Valley, the Atlantic coast from Chesapeake Bay upwards, and the Pacific coast in corresponding latitudes, were elevated at the beginning of the Glacial epoch fully two thousand feet above the present level. This evidence is found in the deeply buried or drowned preglacial channels which have been brought to light all over the areas mentioned. For example, a drowned channel, or rather cañon, reaching to a final depth of two thousand feet can be traced out from New York Harbor across the shallow submerged shelf which borders the continent to the deep water one hundred miles from the present shore. This could only have been formed when the land stood two thousand feet higher than now, and when the shore was at the present border of the deep water of the Atlantic.

Interesting confirmation of this fact has recently been brought to light in the construction of an aqueduct under the Hudson River above West Point to convey water to New York City from the region of



Preglacial scenery in New York Harbor. (Newberry.)

the Catskills. For security it was necessary to go down to the rock bottom of the river for a foundation to support the conduit. On doing this it was found that at that point this was 800 feet below the present bed of the stream. In preglacial times, therefore, the present striking scenery of the Hudson would have been augmented by cliffs rising half a thousand feet higher than those which now give such grandeur to it. Channels buried in a similar manner by glacial débris are abundant in Central New York, Ohio, Indiana, and Illinois. Other drowned cañons like that projecting out from New York Harbor can be traced from the shore all along both the Atlantic and the Pacific coasts of America. Such are specially marked for hundreds of miles from the mouth of the St. Lawrence across the Banks of Newfoundland, and opposite the Columbia River and Puget Sound on the Pacific coast. The deep fiords of Southeastern Alaska are probably depressed valleys of streams eroded during the elevated period preceding the Glacial epoch.

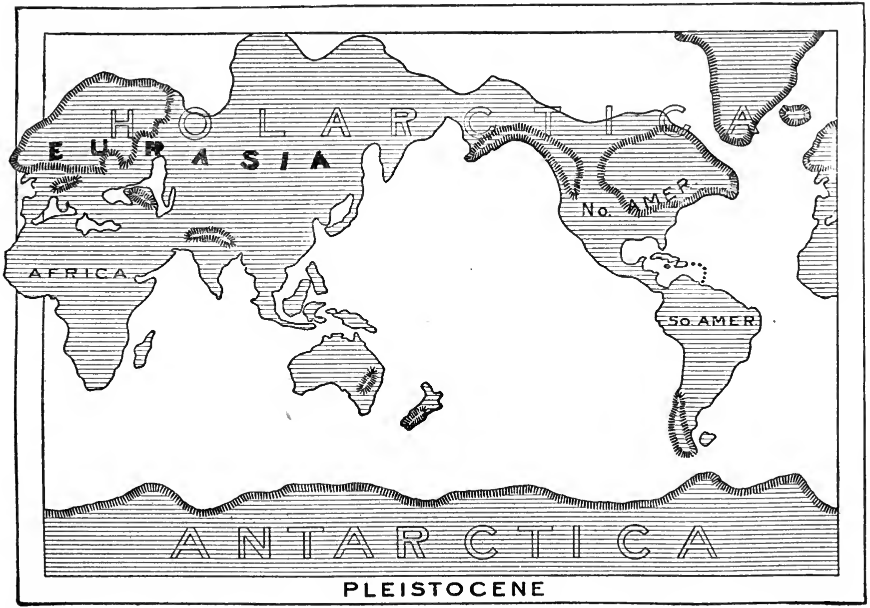
Similar evidence of a great elevation of land in late Tertiary time, just preceding the Glacial epoch, is found in Northern Europe and along the Atlantic border of Western Europe. Professor Hull [8] has traced from the Admiralty surveys of the waters surrounding Great Britain and along the western coast of France and Portugal drowned channels similar to that just described south of New York Harbor.

The fiords of Norway are also important evidences of the former elevation of the land surface of that region. They bear every mark of being drowned river gorges, like those referred to in Alaska. They were mainly eroded by water action during a period of elevation in Tertiary times. But in the Glacial epoch they were filled with moving ice which enlarged and deepened them and deposited morainic material a short distance out at sea, rendering the water shallower there than it is in the fiords themselves where the ice prevented solid material from accumulating.

It is evident, therefore, that at the close of the Tertiary period the coast lines both of Europe and America were considerably outside of the present ones. On both continents the present coast is bordered by a shelf of shallow water not over five or six hundred feet deep, which is terminated by a plunge into water which is several thousand feet deep.

This preglacial elevation of the land of the Northern Hemisphere has great significance with reference to the problem of the distribution of plants and animals, including man. An elevation of a few hundred feet would establish land connection between Asia and America and lay bare the whole bed of Behring Sea, together with a wide strip all along the west coast of North America as far down as Mexico. In Europe it would make dry land of the whole German Ocean, unite the British Isles to the continent and add a wide margin to the whole western coast of Europe. It would also cut off connection between the Mediterranean Sea and the Ocean, and very likely make of it an interior basin like that of the Caspian Sea at the present time. It requires but slight inspection of the map to see that during this period of elevation man and many animals could go back and forth from Asia to America and could reach the islands in the neighborhood of Europe, and at the same time find ample space for obtaining sustenance even while the ice of the Glacial epoch prevailed to its greatest extent over the interior. Ready connection would also be established from Europe to Africa, not only across the Strait of Gibraltar, but through Sicily and the shallow bed of the sea extending southward from that island.

While it is clear that there was an extensive elevation of land all over the glaciated area and over the adjoining areas of the Northern Hemisphere during the Tertiary period, it is equally evident that a widespread depression of these areas accompanied and



PLEISTOCENE

Land areas at the close of the Tertiary period.
(Courtesy of The Macmillan Company.)

followed the accumulation of glacial ice. In America this glacial depression amounted to six hundred feet below the present level at Montreal, and to one thousand feet farther north. In Europe the shore lines of this depression run from near sea level in the south of Sweden to a thousand feet in the northern part of the country. On the shore of the Black Sea at Trebizond clear evidence exists that there was a post-glacial depression of the land in that region to the extent of 750 feet.

Such is the close correlation of these changes of level with the waxing and waning of the Glacial epoch, that it is difficult not to believe that there is in it a relation of cause and effect. The preglacial elevation of land would seem sufficient to produce the epoch, while the accumulation of ice would seem equally sufficient by its own weight to depress the land and thereby partially restore the original conditions which preceded the advent of the arctic climate.

At this point we can profitably consider the question of the date of the Glacial epoch. So astonishing are the events of the period, and so prodigious are the forces set in motion that we are likely to make an exaggerated estimate of the time necessary for their production. Under the influence of Croll's astronomical theory of the cause of the epoch it was formerly confidently stated that it began with a period of high eccentricity of the earth's orbit around the sun, 240,000 years ago, and closed with the beginning of the present period of small eccentricity, 80,000 years ago. But subsequent investigations have led geologists to give less heed to astronomical theories and more to the terrestrial facts which directly bear upon the subject. Among these are prominent (1) the recession of post-glacial waterfalls; (2) the enlargement of post-glacial river valleys; (3) the filling up of post-glacial lakes and ponds; (4) the oxidation of glacial deposits; and (5) the subaërial erosion of glaciated rock surfaces.

(1) It is an interesting fact that nearly all the waterfalls in the world are post-glacial, and that with few striking exceptions there are no waterfalls in the unglaciated regions. The reason of this is that in the unglaciated regions the eroding agencies have been at work so long that they have worn back the gorges to the headwaters of the streams; while in the glaciated region the old gorges are generally filled up with glacial débris, and new drainage lines have been established which are hence so young that the recession of their waterfalls has been slight. Post-glacial gorges are short because they are young.

One of the most instructive and convenient of glacial chronometers is the gorge below the Falls of Niagara. That this is post-glacial is evident from the fact that there is a buried preglacial channel leading from Lake Erie to Lake Ontario, some distance west of the present river. Preglacial time had been so long that the stream connecting the lakes had worn a channel completely through from one lake to the other at the level of the lower lake. This was afterwards so filled up by glacial deposits that, on the recession of the ice, the drainage was turned to the present course, and a new gorge began to be cut. The time at which this renewed activity of the stream began, however, was not at the end of the Glacial epoch, but a long time before, namely, when the ice first melted off from the valley of the Mohawk River between the Adirondack and the Catskill mountains. At that time only could the eastward drainage of the Great Lakes have been resumed, after the long period of reversal caused by the obstruction of the continental glacier. For some time after the recession of Niagara Falls, therefore, all the lower valley of the St. Lawrence was enveloped in glacial ice.

The gorge worn by the recession of the Falls of Niagara is, in round numbers, only seven miles long, extending to the abrupt escarpment of rocks at Queenston, more than three hundred feet high, which borders the southwestern part of the valley of Lake Ontario. The rocks through which the gorge is worn are very uniform in their character. At the surface throughout the whole district there is a solid stratum of compact Niagara limestone, seventy or eighty feet thick at the Falls, but thinning out to fifteen or twenty at the mouth of the gorge. Underneath the Niagara limestone is a deposit of shale about seventy feet thick, which is easily eroded by the backlash of the cataract, preserving thus the perpendicular face of the fall. Underneath the Niagara shale is a compact stratum of Clinton limestone, from twenty to thirty feet thick, which, again, is underlaid by shaly deposits sixty or seventy feet thick. Underneath this is a deposit of Medina sandstone, thirty or forty feet thick, and underneath that an indefinite thickness of Medina shale, reaching below the water's edge at the mouth of the gorge. These strata, resting upon each other like the layers in a layer cake, dip gently to the south, so that, combined with the gradient of the river, all, except the Niagara limestone and shale, are made to disappear at the cataract. No geological conditions could be more uniform and calculated to yield more definite results to careful study.

Taking this gorge as the dividend, we search for a divisor in the annual rate at which the Falls are receding. When Sir Charles Lyell visited them in 1842, he made a random guess that the recession could not be more than one foot a year, and probably not more than one foot in three years. This would make the minimum age of the gorge 35,000 years, and the maximum 100,000 or more. Unfortunately this random estimate has been extensively published as the mature opinion of a most distinguished authority in geology. But Lyell himself did not so regard it. On the contrary, he urged Dr. John Hall of the New York Geological Survey to make an accurate trigonometrical survey of the Falls, so that there would be a basis of comparison for future surveys which should give definite and positive results. Several such surveys have been made, the last after sixty-five years, in 1907, which shows that the average rate of recession of the Horseshoe Falls during this period has been a little over five feet a year; so that, if the same forces had been at work continuously in the past that are operative at the present, Niagara River would have eroded the whole gorge in seven thousand years.

With great confidence we can locate the position of the Falls at different past historical epochs. For example, at the time of the Crusades the cataract was about one-third of the way down to the head of the rapids. At the time of the birth of Christ it was two-thirds of the way down to the rapids. When the Falls had receded to the head of the rapids, Rome was being founded and Greece was just entering upon her classical career. When the Falls were at the whirlpool, Israel was just entering Egypt, while the beginning of the Falls at Queenston occurred only a short time before the building of the great pyramids, and the expedition of Sargon from Babylonia to the shores of the Mediterranean about 3800 B.C.

This amount of space has been given to Niagara Falls, not because it is the only, or indeed, the most important chronometer of the period, but largely because it is the most spectacular timekeeper, and the one with which the public is most familiar. The Falls of St. Anthony, at Minneapolis, Minnesota, are equally important and interesting. Here, too, under the prolonged and careful study of Professor N. H. Winchell, similar results have been attained. The post-glacial gorge below the Falls of St. Anthony requires only seven thousand years for its erosion by the forces which are known to have been in action during the past two hundred years. Numerous other post-glacial waterfalls might be cited from which approximately the same results are obtainable.

(2) Calculations from the enlargement of post-glacial river valleys yield similar results. In thousands of places over the glaciated areas streams are flowing in channels wholly composed of unconsolidated glacial débris. In all these cases the streams are enlarging their valleys by methods that are open to observation. At first their channels were no wider than the current of the streams. But as time went on the sides were undermined and made to fall down, when the material was carried away by the current and so the trough was enlarged and a flood plain formed. This enlargement of the trough and increase of the flood plain have gone on from the inception of the stream to the present time. If only we can get a reliable estimate of the rate at which the enlargement proceeds, it will be easy to get an equally reliable estimate of the time required to produce the enlargement now apparent.

Professor Hicks,[9] of Granville, Ohio, made some most valuable and instructive calculations based on observations on the post-glacial valley of Raccoon Creek, Licking County, Ohio, near the glacial border. Estimates from that latitude, three or four degrees further south than Niagara, would of course carry us back to a much earlier time than the beginning of the Niagara epoch. The glacial terraces of gravel which border this small stream are fifty feet in height and the width of the trough eroded since their deposition is easily obtainable, so that the number of cubic yards of gravel which have been removed by the stream along a definite length can be accurately determined. But it was not so easy to obtain a rate of removal.

It has been found, however, from the observations of Humphreys and Abbott that every 2,610 cubic feet of flowing water in the Mississippi River, transports to the Gulf of Mexico, one cubic foot of silt. Knowing the size of the drainage basin of Raccoon Creek, and the amount of rainfall, and making the proper reduction for the evaporation, we can readily get the amount of water which annually flows off through the bed of the creek. Estimating the silt at the rate found in the Mississippi and making that the divisor, it was found that even at that rate of erosion Raccoon Creek could not have been at work enlarging its trough for more than fifteen thousand years. The probability, however, is that the rate at which Raccoon Creek has been at work is much more rapid than that of the Mississippi; for the gradient of the great river is only a few inches per mile, while that of the creek is several feet per mile, making its current immensely more effective as an eroding agent.

About the same time I made estimates from data derived in a similar manner from the post-glacial valley of Plum Creek, a small stream running through the village of Oberlin, in Northern Ohio, and with similar results.[10] During the last few years, however, there has been offered a much more reliable opportunity for calculations upon the valley of this stream through the turning of its course incident to the construction of a reservoir in the village. This has permitted definite estimates of the rate of erosion in the cut-off during twelve years. As the result of these observations and measurements it appears that from the new channel, five hundred feet long, the stream has removed 8,450 feet of solid material annually; while measurements of a section of the trough a little below, where there has been no interference by artificial means, show that through a length of five thousand feet, the total amount removed by the stream since it began to flow, upon the retreat of the ice, is 34,000,000 cubic feet. The length of the bank through this section exposed at the present time to the direct impact of the current of the stream as it meanders from one side of the flood plain to the other, is sixteen hundred feet. Throughout this length the action of the stream is essentially under the same conditions as in the cut-off. As in the cut-off there is one thousand feet of bank exposed, the exposure in the section of the main trough under consideration is sixteen-tenths as great, hence at the same rate the stream is removing from this section 13,568 cubic feet annually. At this rate the present stream would produce the trough in 2,505 years.

But, doubtless the present rate is excessive on account of the removal by civilization of certain well-known retarding influences, the chief of which is the former existence of a dense covering of forest. This retarding element, however, can scarcely have been sufficient to increase the time more than tenfold; for the obstructions to the current by fallen timber were only temporary, and even they would set in motion eddies and counter currents that would be effective in considerable degree, and after a few decades the fallen timbers would decay, so that if a period of a few hundred years is taken into view the movement of the stream would be closely analogous to that at the present time. It would seem impossible, therefore, for any one conversant with the conditions to assign more than 25,000 years to the period (which implies a rate only one-tenth that of the present), even at the present proportion of the exposure of the bank to the direct action of the stream. But, when the creek first began its work there was no forest to retard its activity, and it was then at work on both sides of the trough as in the cut-off now. The average proportion of the bank exposed to the direct action of the stream would therefore be twice what it is now. The result, therefore, is that our first quotient must be divided by two, which gives 12,500 years as the extreme limit, and that to be considerably reduced by the increased activity at the outset owing to the freshly uncovered surface of the country, and to the increased precipitation while the front of the retreating ice was in the vicinity. The fact is that a period of twelve thousand years is more than can be reasonably allowed for the post-glacial erosion of Plum Creek. Even ten thousand years is a severe strain upon the credulity of any one who is familiar with the facts. But the date of the withdrawal of the ice from Northern Ohio is considerably earlier than that of its withdrawal from Central New York, which marked the beginning of the erosion of the Niagara gorge.

At this point, it will be profitable to consider the evidence bearing on the rate at which the ice withdrew upon its final retreat. For it is from some facts connected with this that attempts are made to prolong the time required for the production of the Niagara gorge.

It is well known that upon the melting of the ice from the valleys of the St. Lawrence and of the Red River of the North, the land over those areas was depressed below its present level, and that this depression increased in a northerly direction. In the Champlain Valley it was but three hundred or four hundred feet, while at Montreal it was six hundred feet, as evidenced by terraces, and the skeletons of whales and other aquatic animals, in the post-glacial deposits of the region. These facts are beyond question.

An irresistible inference from this is, that, for a time after the withdrawal of the ice from Canada, the drainage which now passes over Niagara Falls, was diverted into the Ottawa River. For, at North Bay, on the water parting between the Great Lakes and the Ottawa the elevation is less than one hundred feet above that of the head of Niagara River. While, therefore, the land to the north was depressed to that extent the water of the lakes would be diverted in that direction and little work would be done in the Niagara gorge. The date of that gorge, must, therefore, be extended to take in this period of diverted drainage.

But these facts have not been overlooked in our general calculations.[11] Indeed, as long ago as 1892, I was the first to discover and report definite evidence of this diversion of drainage across from Lake Huron at North Bay into and through the Mattawa River to the Ottawa at Mattawan. But from the condition of the immense delta formed at the junction of the streams, it was apparent that two or three thousand years was ample time to allow for the continuance of this drainage line, so that there is no occasion greatly to enlarge our estimate of the age of Niagara on this account.

Moreover, as the continuance of this diversion of the drainage was dependent upon the continuance of the northerly depression it would seem possible to obtain from this source evidence of the duration of the diversion of the water from Niagara to the Ottawa. The absolute amount of this post-glacial elevation has been, as already remarked, six hundred feet in the latitude of Montreal, and one thousand feet farther north and east. At the southern end of Hudson Bay it was several hundred feet. From the fact that the depression of land was evidently greatest towards the main centers where the glacial ice accumulated, it has been regarded as a reasonable supposition that the weight of the ice has had something to do with causing the depression, and its removal with effecting the reëlevation. If this were indeed a real cause, it would be natural that the elevation would proceed with greatest rapidity immediately after the ice had melted away from the depressed area.

Even now this reëlevation is going on at a slow rate. Mr. Gilbert,[12] of the United States Geological Survey estimates that the rate of elevation is about six inches a century faster at the head of Niagara River than at the head of the Chicago Drainage Canal, so that after 3,500 years the whole drainage will be diverted from Niagara and turned into the Mississippi basin, through the Illinois River. But Dr. Warren Upham, who for many years was engaged by the state of Minnesota, the United States Geological Survey, and that of Canada, in surveying the valley of the Red River of the North, has adduced most convincing evidence that upon the removal of the ice the rise of the land to the northward was much more rapid than this.

The Red River rises in Lake Traverse, in Minnesota, at an elevation of one thousand feet above the sea. After flowing north for several hundred miles it empties into Lake Winnipeg, whose waters find their way to Hudson Bay through Nelson River. As already noted the ice obstruction extending across this valley at the north produced a vast temporary lake, which was held up to the level of the lowest pass into the Mississippi Valley, which is through the head-waters of the Red River in Lake Traverse to a continuation of the trough in Big Stone Lake, the source of the Minnesota River, which joins the Mississippi between Minneapolis and St. Paul. The evidence of the existence of this outlet is as clear as day, the gravel terraces marking the height of the stream, eighty-five feet above the level of the lakes, being plainly marked at the present time. The temporary body of water held up by this ice obstruction and having its outlet through the channel described has been named Lake Agassiz, and during its largest extension, just before the ice barriers to the north broke away, covered an area of not less than 100,000 square miles. It is the sediment in this vast lake that furnishes the soil of the most important wheat-producing center of America, if not of the world.

It fell to the lot of Mr. Upham[13] to survey the shores of this great lake, which are marked by a line of gravel ridges a few feet high thrown up by the waves during its continuance. Near its south end there are also areas of dune sand which was blown outward from the high-water accumulations during storms and piled up into gentle knolls and ridges.

Furthermore, at various places streams of greater or less size pour into the valley from the higher land on either side, especially from the west. Among these are the Saskatchewan, the Assiniboine, the Qu'Appelle, the Souris, the Pembina, and the Sheyenne. Those streams now enter the Red River itself, but during the existence of Lake Agassiz they terminated at its shores and deposited deltas at those elevations. These remain as mute but irresistible witnesses to the brevity of the time during which the water remained at that level. The small extent of these deltas bears indubitable evidence to the fact that the conditions under which they were formed existed only a few centuries. The small size of the lines of beach gravel surrounding the basin also bears testimony in a general way to the same limitation of the continuance of the lake at that level.

But, more definite still, is the witness of the dunes near the south end of the enclosed body of water. For, these are analogous in their origin to those which border the south shore of Lake Michigan. In both cases we have a vast body of water practically closed at the south end, with corresponding erosion of the shores by the waves, and transportation of the débris to the head of the basin at the south end, and, through the action of the wind, the piling up of the sand in dunes. In the case of Lake Michigan the accumulation has been going on during the whole time since its southern end was freed from ice, which from various estimates can be shown to be not more than ten thousand years. Accepting that estimate, the dunes at the south end of Lake Agassiz would have been accumulated in one thousand years, for they are not more than one-tenth as great in amount as those south of Lake Michigan.

Now, these shore lines around Lake Agassiz rise as you go north, until finally they are three or four hundred feet higher than at the south end. All this differential elevation must have taken place during the latter part of the retreat of the ice from the Canadian border to Hudson Bay, therefore, in a period of about one thousand years.

This discovery makes it certain that the elevation of the col at North Bay, regulating the diversion of the water from Niagara, need not have occupied more than one thousand years to be in analogy with the rate of elevation in the region of the Red River. There is no ground, therefore, for any great modifications of the date assigned to the Niagara gorge from calculations made from the present rate of the recession of the cataract.

(3) A third line of evidence demonstrating the re-

cency of the Glacial epoch, is derived from the small extent to which post-glacial lakes, ponds, and kettle holes have been filled up and obliterated since their formation. All the lakes, both large and small, which are so numerous in the northern part of the United States and Canada, as well as throughout Ireland, Scotland, Norway, Sweden, Finland, and Northern Russia, are of glacial origin. Either they are in old river basins which have been dammed by abnormal glacial accumulations across their outlets, or they are in smaller basins which were formed when great masses of ice melted away and left hollows surrounded by glacial débris. Technically these are called kettle holes, from their resemblance in shape to the potash kettles that were in common use when the country districts of America were first settled, and until the forests had been removed.

The number and freshness of these bodies of water in the glaciated region have attracted the attention of glacialists from the beginning of observations upon them. It is evident at a glance that two powerful and ever-active forces are at work to obliterate these depressions. First, there are at work the agencies which tend to fill them with solid matter of various kinds. The rains wash down the soil from the sides of the basins and deposit it over the bottom; in the larger bodies of water, the waves erode the shores and distribute the material far and wide, — while streams bring in material gathered from the whole drainage basin and add it to the sediment that comes from nearer localities; and in the smaller basins, peat accumulates often with great rapidity and transforms the lakelet into morass or quagmire.

At the same time that this process of sedimentation is going on, the stream of water carrying off the surplus drainage is engaged in lowering the outlet and thus reducing the size of the enclosed body of water. It is impossible for any one who gives attention to these facts not to be impressed with the youth of the whole topography of these lake districts, both in Europe and America. The lakes exist because the country is young. Since their formation there has not been time enough for their outlets to drain them or for the winds and rains and waves to fill them with sediment, even with the aid of peat-forming vegetation. No one has been able to find a flaw in the calculations made in the early period of glacial investigations concerning the age of certain typical kettle holes in Andover, Massachusetts.[14]

Upon measuring one of these typical enclosed basins it was found that the enclosure was a rim of gravel, the highest part of which was seventy-seven feet above the bottom of the enclosure. The average height of the rim above the present bottom of the depression was fifty feet. The width of the basin at the upper rim was 372 feet. The slope of the sides was such that they would meet at seventeen feet below the present bottom. From the nature of the material, it is impossible for the sides ever to have met much deeper down. A calculation will show that the total amount deposited in the bottom of this kettle hole, by wind, water, and vegetable growth, is equal to only eight feet in thickness over the present bottom. If we bring the date of the formation of the basin down to 12,500 years, we allow 125 years for the accumulation of one inch of sediment, which is about as far as credulity can go. More recently (1908), Baron de Geer,[15] of Sweden, has reported observations on a post-glacial lake bed in Sweden, from which he reaches the conclusion that the ice did not retire from that region until about five thousand years ago.

(4) Another striking indication that the retreat of the ice from the main centers of accumulation occurred very recently, is found in the small amount of subaërial disintegration of glaciated rock surfaces, which has taken place since exposure upon the retreat of the ice. Everywhere this has been noticed on glaciated surfaces upon which bowlders are rest-

ing. In the places protected by the superincumbent bowlders the original glaciated surface is preserved, but in all the surrounding area the surface has been lowered by subaërial disintegration, so that the bowlders stand upon slight pedestals. These are everywhere so low, especially in limestone districts, that a maximum date of a few thousand years must be assigned to withdrawal of the glacial ice.

More striking still are the facts reported by Professor Geo. F. Becker, and the late Professor I. C. Russell, two of the most careful members of the United States Geological Survey. Mr. Becker says, "No one who has examined the glaciated regions of the Sierra [in California] can doubt that the great mass of the ice disappeared at a very recent period. The immense areas of polished surfaces fully exposed to the severe climate of say from 7,000 to 12,000 feet altitude, the insensible erosion of streams running over glaciated rocks, and the freshness of erratic bowlders are sufficient evidence of this." [16] In similar strain Professor Russell, speaking of the region farther north, in Nevada and Utah, remarks that "The smooth surfaces are all scored with fine, hair-like lines, and the eye fails to detect more than a trace of disintegration that has taken place since the surfaces received their polish and striation. . . . It seems reasonable to conclude that in a severe climate like that of the high Sierra, it (the polish) could not remain unimpaired for more than a few centuries at the most."[17] Sir William Logan and Dr. Robert Bell[18] of the Canadian Geological Survey report many similar instances.

The combined effect of all this evidence from so many different sources is irresistible. Large areas in Europe and North America which are now principal centers of civilization were buried under glacial ice thousands of feet thick, while the civilization of Babylonia was in its heyday. The glib manner in which many, not to say most, popular writers, as well as many observers of limited range, speak of the Glacial epoch as far distant in geological time, is due to ignorance of facts which would seem to be so clear that he who runs might read them.

In view of the fact that the human race had spread all over the Northern Hemisphere before the close of the Glacial epoch, it is important to consider the probable length of the whole period and the vicissitudes connected with it. For it would seem that both man and a number of extinct animal species must have passed from Asia to America during the continuance of land elevation connected with the accumulation of the continental ice sheets. It seems impossible to account for the spread of the mastodon and mammoth from Northern Asia into North America, except on the theory that it took place while there was an extensive land connection between the two continents over the area now occupied by the shallow water of Behring Sea. We shall find it profitable, therefore, to enter somewhat in detail into the general question of the time necessary to account for the entire accumulation of glacial ice, together with the various interglacial epochs that are supposed to have existed.

We are so profoundly ignorant of the causes which produced the Glacial epoch that great freedom of speculation is allowable, and at the same time speculative conclusions of any sort can have little weight in overcoming the witness of actual observations bearing upon glacial dates. If, as we are inclined, and have much evidence to believe, the Glacial epoch was brought on by the elevation of land known to have occurred during the latter part of the Tertiary period and by consequent changes in the course of the oceanic currents which do so much to distribute the excessive heat received from the sun over the tropics, the coming on of the Glacial epoch would naturally have been very gradual. But when the climax of the period approached, it is easily shown that forces of great relative activity would be set in motion. The rapidity with which the ice may have accumulated, and that also with which it may have been melted, can be inferred both theoretically and from actual observation.

The beginning of the Glacial epoch was not so far distant as is popularly supposed. The whole epoch was one in which forces were at work at an abnormal rate, while it is estimated that even now the ice floating away from Greenland as icebergs is sufficient, if accumulated on a land surface, to extend the borders of a continental glacier about 450 feet a year, or one mile in twelve years, one hundred miles in twelve hundred years, and seven hundred miles (about the limit of transportation of bowlders in America), in less than ten thousand years. It is not surprising, therefore, that so eminent an authority as Sir Joseph Prestwich[19] should conclude that 25,000 years is ample time to allow to the reign of the ice of the Glacial epoch. Certainly there is no need to enlarge this estimate more than two- or threefold.

This will be evident if one will reflect upon the enormous forces temporarily brought into play during the epoch.

The movements of the earth's crust are even now considerable in extent, amounting in many places to two or three feet a century. But at the culmination of the Glacial epoch several million cubic miles of ice had accumulated over the glaciated area in North America and Europe. This is probably sufficient greatly to disturb the equilibrium of forces which preserves the present land levels. With the weight of several million cubic miles of water removed from the ocean beds and the same amount set down in ice over a definite area of the Northern Hemisphere the land would naturally sink with a rapidity which is out of all analogy to present changes in level. When, later, this ice melted and returned to the ocean these forces would again be liberated to reverse the process and cause an elevation whose rate would naturally exceed anything which comes under present observation. Moreover, the floods consequent upon this rapid melting of the ice would hasten the work of stream erosion to a degree that is almost incomprehensible. With an annual rise of two hundred feet in the Missouri and Minnesota rivers, and perhaps of five hundred feet in the Ohio, the results both in erosion and in deposition may well beggar description.

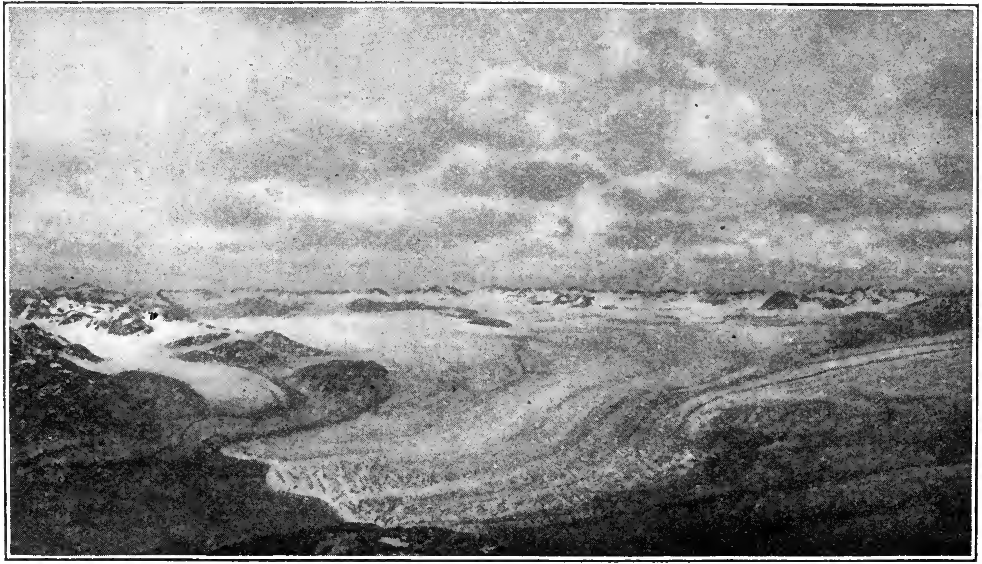
Theoretically it cannot be regarded as at all improbable that, when the Glacial epoch had fairly set in, ice began to accumulate over the center of the glaciated area at the rate of one foot a year. This need not necessitate an increase of precipitation to that amount, but merely that twelve or fourteen inches of the precipitation which had been in the form of rain was now in the form of snow. In Greenland it would seem now that the entire precipitation over the most of the interior is in the form of snow. At the same time it is well known that there is a considerable amount of direct condensation of frozen moisture upon the surface of the glacier. If now we suppose the accumulation of ice on the surface of the incipient continental glacier to have been at the rate of one foot a year, it would require, in round numbers, only five thousand years for it to reach a thickness of one mile. Supposing this to have been over an area of 500,000 square miles (about the present area of the Greenland ice field) the simple overflow of ice from this area would extend the border so that in another five thousand years 1,000,000 square miles would be covered, to say nothing of the snow that would accumulate directly over this added area. By the same process during another five thousand years the margin would be so extended that 2,000,000 miles would be covered with glacial ice. We have to conceive the process as continued only another five thousand years (amounting in all to twenty thousand years) to have the glaciers reach their full extent during the Glacial epoch in North America. Estimating the deflation of the ice and the retreat of the ice border to have gone on at a corresponding rate during the decline of the Glacial epoch, we should have 40,000 years as sufficient to cover the entire epoch. But as evidently there were various episodes of temporary advance and recession, this estimate of time must be considerably enlarged. If, however, we double each half of the epoch to allow for interglacial episodes, which would seem to be ample, this would extend the epoch only to 80,000 years.

That this estimate of the rapidity with which the forces causing both the accumulation and the disappearance of the ice of the Glacial epoch is not excessive is shown by a variety of observations upon existing ice fields and upon the permanent glacial deposits that were left behind.

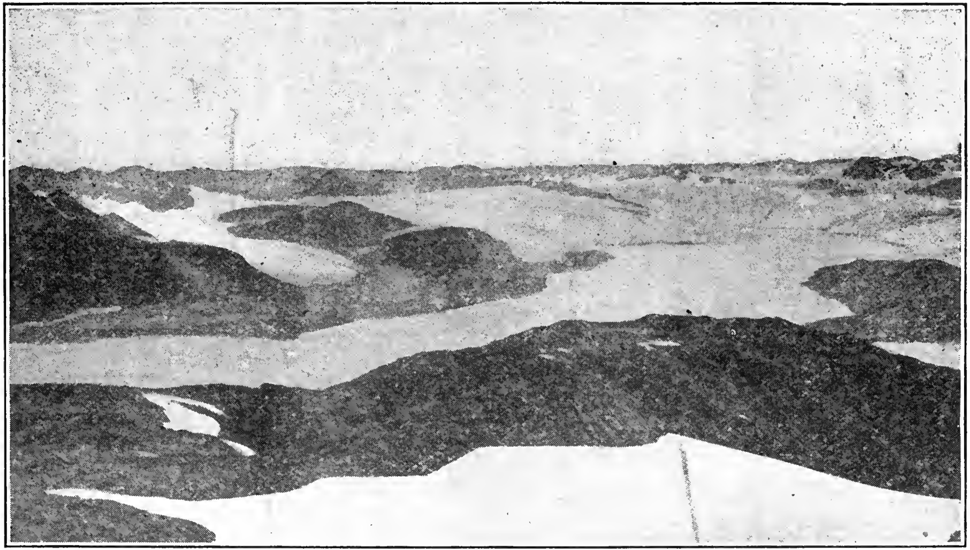
The icebergs which float down through Baffin's Bay and are dissolved on meeting the warm currents of the Atlantic Ocean represent the surplus ice of the great Greenland ice sheet, whose motion has been aptly compared by Helland to that of an inundation. From this great ice field there is a general movement from the central regions towards the sea. The movement concentrates in the ice fiords, through which individual glaciers are constantly pushing out to the deep sea, where their fronts are broken off and swept away by the southward flowing current.

These glaciers are of immense size, many of them two or three miles in width, and one, the great Humboldt Glacier, more than sixty miles; while their velocity has been found to average between thirty and fifty feet a day throughout the year. The great glacier near Upernavik moves at the rate of ninety-nine feet per day. Taking the average movement (determined by the Danish surveyors as from thirty to fifty feet), and estimating the proportion of glacier front to rock front on the coast of Greenland to be as one to twenty, it would appear that the ice carried off by these glaciers annually would amount to a fringe of one-eighth of a mile along the entire coast; that is to say, if it were not for the transportation of icebergs away from the front of the glaciers, the border of the Greenland ice field would extend itself one mile every eight years. At the same rate, were the continent unobstructed by Baffin's Bay, the ice would extend five hundred miles in four thousand years; or, if we suppose the ratio of ice front to rock front to be as one to thirty, the ice front would then extend itself five hundred miles in six thousand years.

In the case of Muir Glacier in Alaska, we have



Bird's-eye view of Muir Glacier in 1886.



Bird's-eye view of Muir Glacier in 1906, showing a recession of seven miles.

positive evidence of an actual rapidity in the retreat of a great glacier which is of the first importance. When I made my survey of the glacier in 1886 evidence was gathered proving that the front of the glacier had retreated fifteen or twenty miles during the last century.[20] Every observation since by other investigators has, from general considerations, confirmed this conclusion.[21] Since 1886, however, this rapid retreat of the ice front is positively known to have continued, until, in 1906 (after a lapse of twenty years), it was seven miles farther inland than it was in 1886. During that period the ice front has actually retreated, on the average, at a rate of one mile every three years.

A striking impression of the rapidity with which the ice disappears is seen also in the fact that upon the mountain slopes which border Muir Inlet, clearly defined and well preserved glacial striæ were discovered at an elevation of thirty-seven hundred feet, and running parallel with the axis of the inlet, while Willoughby Island, which rises ten or fifteen hundred feet above the level of Glacier Bay, retains the polish of glaciation so perfectly that it glistens in the sun like a mirror. There is no room for doubt that a hundred years ago the whole inlet and the upper part of Glacier Bay were filled with the glacier from two to four thousand feet in thickness and from one to five miles in width.

Evidence concerning the rapid retreat of the continental ice sheet in North America is also abundant, and has already been sufficiently presented in discussing the age of the Niagara gorge and the time occupied by the retreat of the ice front from the Canadian border to Hudson Bay, as estimated by Dr. Warren Upham. The ice did not withdraw from Central New York and the Province of Quebec until about seven thousand years ago. The entire time occupied by the retreat of the ice from the Canadian border to Hudson Bay, a distance of five hundred miles, did not exceed one or two thousand years at the utmost.

As many extravagant but vague estimates concerning the duration of the Glacial epoch have been made from the evidence of several interglacial periods, from the relative amount of erosion which has taken place in the older deposits near the border of the glaciated area, and from the extent of the oxidation of the material in the glacial deposits near the border, it is necessary here to consider the evidence in some detail.

There have been three, and perhaps four, glacial advances in the United States with interglacial periods between, marked by buried peat deposits and overwhelmed forests. These are (1) the Kansan (2) the Illinoisan, (3) the Wisconsin episodes, deriving their names from the localities where the deposits can be most easily traced.

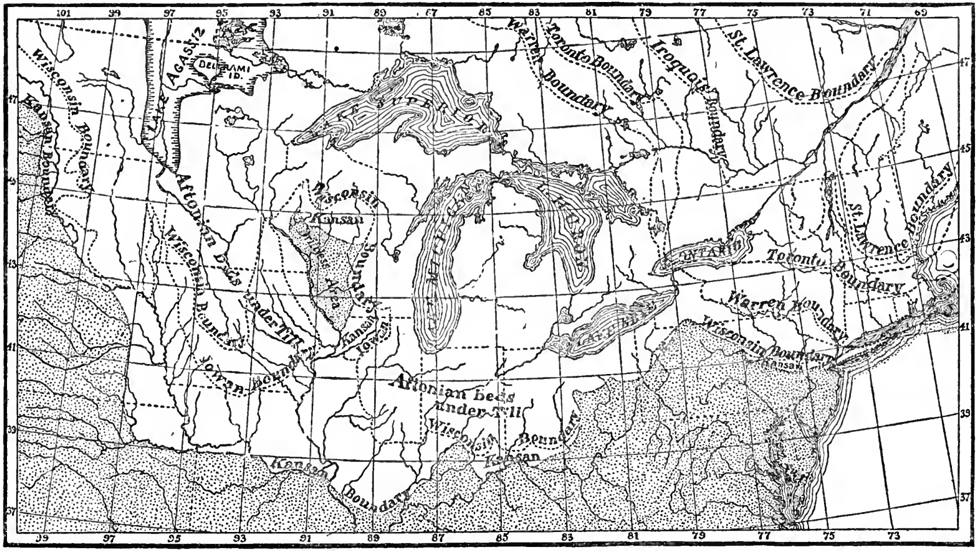
1. During the Kansan stage the ice everywhere attained its extreme southern extension, reaching Topeka, in Kansas, covering all of Missouri north of the Missouri River, extending to the southern part of Illinois and to the Ohio River at Cincinnati. Where the deposits of this age are exposed, they are very thoroughly oxidized, and are spread out over the country in a comparatively thin and uniform stratum, without the occurrence of moraines. The Kansan deposits, also, show the effects of erosion to an extent many times greater than that of those in the area at the north from which the ice last retreated. From these facts it has been inferred that the age of the Kansan deposits was very many times that of those of the Wisconsin stage.

But it should be observed that the oxidation of the deposits of Kansan age was probably effected, for the most part, in preglacial times. This was clearly brought to light many years ago in a paper by Professor Raphael Pumpelly [22] and has since been emphasized by Professor Ralph S. Tarr [23] and others. Previous to the Glacial epoch, during nearly the entire Tertiary period, a warm, moist climate characterized the Northern Hemisphere up to the Arctic Sea. The flora of North Carolina and Virginia and of Japan and Central Europe flourished at that time in Greenland and Spitzbergen. During the continuance of these conditions the rocks of the entire region must have been deeply penetrated by oxidizing agencies, so that the whole area was covered with a thick blanket of residual soil, such as exists at the present time outside of the glaciated areas, where, as in Virginia and the Carolinas, for example, the rocks are often decayed to a depth of one hundred feet, and in the Ozark Mountains of Missouri Professor Pumpelly reports that the limestone rocks have been dissolved to such an extent that, though the residuary products are less than ten per cent of the original volume, they now cover the country to a depth of from twenty to one hundred and twenty feet; while, in Nicaragua, Thomas Belt reported that the decay of the rocks had reached a depth of two hundred feet.

Now it is evident that the first grist of the Glacial epoch would consist of this already oxidized material which covered the region at the close of the Tertiary period. It was this material which was first picked up by the glacial movement and carried to the extreme limit of the continental ice field. The excessive oxidation of the material over the field covered by the Kansan ice is therefore no clear indication of the time which has elapsed since its transportation. It was already oxidized when it started.

Nor is the relative amount of erosion of the Kansan deposits a clear indication of their age. It is true that this erosion is many times in excess of that which has taken place since the Wisconsin stage, but it is also true that the forces in operation over the area were excessive. Every stream passing through the area of Kansan drift has been surcharged with water from the melting of the successive receding ice sheets, and it is well known that the eroding power of a stream of water is manyfold greater when the supply of water is superabundant than when it is at an ordinary stage. Moreover, the absence of moraines over the exposed Kansan area prevented the occurrence of those numerous obstructions to the drainage which exist over those portions of the glaciated area from which the ice receded last. This same line of argument also goes far to diminish the time estimates which have been made concerning the interglacial erosion in areas which have been subsequently covered by the readvancing ice.

2. The Illinoisan Stage. It is a fact whose significance is not fully understood that the center of



Map showing stages of recession of the North American ice-sheet. (Upham.)

dispersion of ice during the Kansan stage was different from that of the two subsequent stages. The center for the dispersion of Kansan ice was somewhere west of Hudson Bay; while during the Illinoisan stage the center of dispersion was from the vicinity of Labrador and southeast of Hudson Bay. During this stage bowlders were transported from the north of Lake Huron southwest as far as the southern part of Iowa, where they occur overlying the Kansan deposits north of Keokuk, Iowa.

The extent of the oxidation of the exposed Illinoisan drift sheet and the amount of erosion which has been effected in it since its deposition are both midway in amount between that of the Kansas deposits and that of the Wisconsin deposits. But this is what is to be expected, in view of the facts just presented with reference to the preglacial disintegration of the rocks over the centers from which the ice moved. The material accessible to the moving ice would necessarily be less and less oxidized as the surface soil was more completely removed.*

3. The Wisconsin Stage. The deposits of the

* The projection of the Illinoisan deposits beyond the Wisconsin are relatively so slight, that, to avoid confusion, they have been omitted on the accompanying map; while the Iowan border, which Mr. Leverett is now inclined to discard, is left for convenience of future reference.

Wisconsin episode consist of much fresher material than those of the earlier episodes, showing that they have been largely derived from the unoxidized strata which had been left exposed by the removal of the residual soil during the earlier stages of the glacial advance. But there is over the entire Wisconsin area an oxidized stratum extending several feet from the surface downwards. This stratum is characterized by a yellowish color, and rests upon a much thicker stratum of glacial deposits which is more compact, is unoxidized, and is of a bluish color. Whether this upper stratum has been oxidized since the deposit was made is a question of dispute among geologists. The more probable theory seems to be that the upper, oxidized, stratum consists of material which was incorporated into the moving ice and gradually accumulated upon the surface as the ice sheet melted and diminished in thickness, and became oxidized in considerable part during the exposure while in process of transportation.

The deposits of the Wisconsin ice overlie those both of the Illinoisan and of the Kansan stage, extending in the Ohio Valley very nearly to the border of the Kansan boundary, and sometimes beyond it. It was during this stage, also, that the great lines of moraines that are traced across the country were deposited. The estimates which have been made concerning the date of the Glacial epoch derived from the Niagara gorge and the other facts which have been already detailed refer wholly to this Wisconsin stage, and show clearly that the ice of that epoch did not disappear from the northern part of the United States until seven thousand years ago.

The question of the entire length of the Glacial epoch depends to a considerable extent upon the time which must be allowed for the interglacial epochs. That these were of considerable length appears from the fact that extensive forest beds and stores of peat are found between the deposits of these various stages spoken of and of various minor advances. Doubtless some centuries, and perhaps many centuries, must have elapsed between the recession of the ice during these episodes and its readvancement to cover the accumulations of vegetal material and the eroded surfaces that had been sculptured during the interglacial exposure. Whether these intervals are to be measured by hundreds of years, as in Alaska, or by thousands of years, is not capable in many cases of demonstration. But nowhere does it seem necessary to assume intervals expressed by a higher order of figures, namely tens of thousands.

The clearest evidence of a prolonged interglacial episode appears in the deposits carefully studied at Toronto by Professor A. P. Coleman. Here on the northern shore of Lake Ontario there are two series of glacial deposits, one overlying the other, separated by interglacial deposits representing both a flora and a fauna containing species that even now do not live in that latitude, but are found no nearer than the Mississippi Valley and the upper portion of the valley of the Ohio. There must therefore have been an interglacial period in the latitude of Toronto long enough and warm enough to permit the migration of shell-fish and of various trees and plants from the Mississippi Valley into Canada, where they had opportunity to flourish for a considerable period.

When, however, we attempt to estimate this time, we are confronted by various paradoxes of the Glacial epoch. In the first place, it is evident that, for the ice to have melted away as rapidly as it did, an unusually warm climate was necessary. So that it seems likely that extremes of climate met during a considerable time when the summers were very warm and the winters very cold. This supposition is supported not only from the nature of the case, which requires an excessive amount of warmth to melt the ice back as fast as we have shown that it did in the valley of the Red River of the North, but also by discoveries which Professor Holst,[18] of the Swedish Geological Survey, has made in the glacial deposits near Malmö. Here he has found, mingled in the same lake deposits, species both of plants and of animals which are ordinarily characteristic of widely separated latitudes. But during the close of the Glacial epoch in Southern Sweden there were climatic conditions such that all could flourish in the same locality. While it may not be permitted to suppose that elms, oaks, maples, and pawpaws flourished during an interglacial epoch at Toronto when the edge of the continental ice sheet was a few miles away, it is not at all beyond the realm of plausible supposition that the ice edge was not more than fifty or one hundred miles away, in which case two or three thousand years may be ample time for both the retreat and the readvance of the ice. Until we know more about the causes of the climatic changes which passed over the Northern Hemisphere, and indeed over the whole earth, during the Glacial epoch, it is impossible for us to form any very definite ideas concerning the rapidity with which the various episodes of the epoch followed each other.

The moderate estimates concerning the date of the earliest glacial episode are amply sustained, and we believe demonstrated to be correct, by the investigations of Professor E. H. Williams [24] on the attenuated border of the glaciated area of the state of Pennsylvania. This border extends on an average about twenty miles south of the moraine which was surveyed in 1880 by Lewis and Wright, and which is reckoned now as of Wisconsin age. On the other hand, the attenuated border, as noted on the accompanying map (p. 209), is reckoned as of Kansan age.

But Professor Williams found that the glaciated surface of the mammoth coal bed at the extreme southern edge of the border was remarkably fresh. Though covered with loose débris permitting free access of eroding acids it was not eaten into to any appreciable extent, whereas south of the border the coal was oxidized and made worthless to a depth of several feet. Again, the blanket of glacial material covering the attenuated border, though in general highly oxidized, contained wherever examined, and that was in hundreds of places, a small intermixture of rocky fragments which were almost unoxidized, though of a kind to be specially subject to oxidation. Evidently the age of the deposits is determined by this unoxidized material which had been picked up in the movement and brought along with a great mass of material which, as before said, had been already oxidized from the start. Furthermore, Mr.

Williams found numerous rounded pebbles which had been oxidized almost to the center, but leaving a core of unoxidized material. But some of these pebbles had been glaciated upon one side so as almost to expose the core without disturbing the deep bands of oxidation on the other side, thus demonstrating that the main oxidation of the pebbles had occurred before they were picked up in their original beds in the far north.

These facts certainly show that there must be some flaw in the calculations which give an extreme age, in some cases of many hundred thousand years, to the Kansan deposits. The conditions during the entire ice age were abnormal and we are led into serious error when we apply to them the measures of geological time drawn from the progress of events characterizing the more stable conditions of present or preglacial periods.

It was formerly maintained on Croll's astronomical theory that the glaciation of the Southern Hemisphere was not contemporaneous with that of the Northern, but that the glacial episodes of these two hemispheres followed each other in successive alternation, the Northern Hemisphere experiencing glacial conditions while the Southern Hemisphere was passing through a period of milder climate, and vice versa. But recent observations show that the glaciation of the two hemispheres was contemporaneous. According to Professor Isaiah Bowman,[25] who has extensively investigated the phenomena, all the valleys of the Andes reaching above 12,500 feet were even in the equatorial latitudes filled with glacial ice at a comparatively recent time. In some places the glaciers, as for example, between Ollantaytambo and Torontoy, descended to a level of 8,500 feet above the sea and deposited moraines four hundred feet in height. But the deposits of these South American glaciers are so fresh that they are probably to be correlated with those of the Wisconsin episodes in North America. It is in the deposits of one of these glaciers near Cuzco that Professor Hiram Bingham has found human remains, details of which will be given in a later chapter.

Thus, though we may not be able to extract any very definite chronology for human history from these glacial facts, they do enable us to set limits to speculation upon the time of man's entrance into the world, and they give us a vivid idea of the vicissitudes which the race encountered during the early centuries of its history.

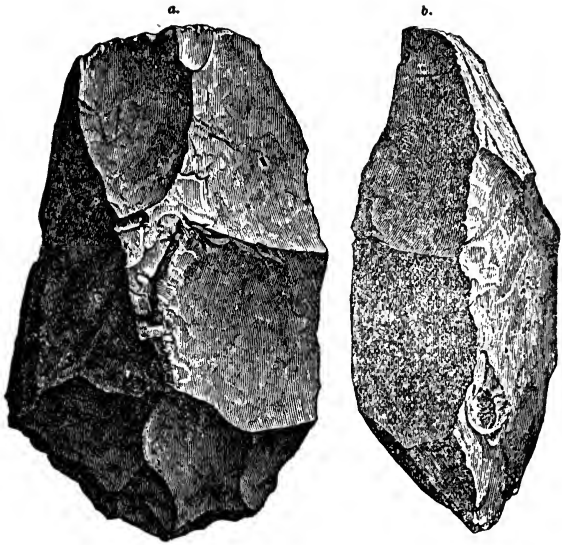
CHAPTER VII

MAN IN THE GLACIAL EPOCH

Up to the present time the direct evidence of man's existence during the Glacial epoch has been limited (with one or two doubtful exceptions) to the occurrence of implements and remains found in what is called modified drift, that is, deposits made by the streams of water which everywhere poured out in great volume from the margin of the ice fields during the decline of the period. In America, as already pointed out, the gravel terraces laid down by these glacial floods form bordering terraces to all the southerly flowing streams which rise in the glaciated region. So uniform and characteristic are these deposits that they have given the name to the well-known "Terrace epoch." The terraces marking this epoch are prominent features along the borders of the Connecticut, the Hudson, the Delaware, the Susquehanna, the Ohio with all its northern tributaries, the Mississippi, and the Missouri rivers. That they are connected with the closing stages of the Glacial epoch, when the ice was melting away with exceptional rapidity, giving rise to what we may appropriately call "the spring freshet" of the Glacial epoch, is capable, as already said, of being proved to a very high degree of certainty. These terraces are composed of material derived from the far north. In the Ohio River, for example, granitic pebbles form a large constituent of the material composing them. But the nearest native granite rocks lie far to the north of Lake Erie and Lake Ontario. In every case, also, the terraces can be traced from the south up to the glacial boundary, — the material increasing in coarseness as the boundary is approached, where the water deposits at last merge into the unstratified till, or bowlder clay.

The evidence of man's existence during this "Terrace epoch" in America is now ample, and, owing to the simplicity of the physical conditions of the continent, capable of very precise determination. The first discoveries were reported in 1875 by Dr. C. C. Abbott in Trenton, New Jersey. The geological situation is here very simple.[1] Trenton is at the head of Delaware Bay, where the Delaware River emerges from a rock gorge which it has followed for a long distance in its course through the highlands to the north. The city of Trenton is built upon a delta terrace of gravel, two or three miles in diameter, which was deposited at the head of the bay under conditions very different from those now existing.

Its general level is fifty feet above tide, and it is composed of irregular strata of coarse and fine gravel containing extensive strata of pebbles several inches in diameter, and an occasional bowlder two or three feet in diameter. The material of this terrace is all derived from the valley of the stream above; while everything bears witness to the fact that the deposit was made by tumultuous currents of water far beyond anything possible under present conditions. Upon following up the stream one finds remnants of the high-level gravel terraces everywhere bordering the trough, which also speak in no uncertain voice of a former tumultuous current far above the level reached by the present stream. Sixty-five miles above the mouth of the stream, at Belvidere, the explanation is found. Here we enter the glaciated region, where a veritable terminal moraine crosses the valley, and we learn that six thousand square miles of the upper part of the drainage basin of the river was deeply enveloped with ice during the Glacial epoch. This moraine furnished the material for the delta terrace at Trenton, and the melting of the glacial ice furnished the floods to transport it through the long gorge and deposit it at tide level. The facts are too plain to need any discussion. Seeing is believing. Nobody now questions them.



Chipped implement from the Trenton gravel. *a,* front view; *b,* edge view. The material being argillite, or metamorphosed slate, is incapable of being wrought into the delicate shapes possible with flint. (C. C. Abbott.)

Dr. Abbott's discoveries in this delta terrace consisted of roughly chipped implements, made, not of flint, which is rare in the region, but of argillite, or metamorphosed slate. A short distance above Trenton a series of well-known trap dikes cross the valley in a diagonal direction, bursting through extensive Archæan slate rocks. The heat of the trap has transformed the slate into an incoherent mass which has lost its stratification and can be chipped like flint, breaking with conchoidal fracture. But the texture is coarse, and the chipped implements made from it are very rude as compared with those from flint. Still, there can be no doubt of the artificial character of a great number which have been found at Trenton.[2]

The only ground of doubt which can be urged relates to the question whether the implements were really found in undisturbed gravel. For a long time this was questioned by many investigators. This was made possible by the fact that at first no one but Dr. Abbott found the implements in place in undisturbed strata. This, however, was not strange, since he was the only one who was on hand when they would naturally come to light. For several years the Pennsylvania Railroad was excavating gravel from this terrace near Dr. Abbott's house, so that he was in position to see the exposed banks daily. In more than sixty cases Dr. Abbott reported finding argillite implements in the undisturbed strata of this gravel, and in more than 250 cases found them in the talus at the foot of the bank, where it was altogether probable that they had fallen down from a considerable depth in the deposit. At the same time hundreds of the implements were found on the surface.

Without questioning the veracity of Dr. Abbott, various suggestions were made as to how error could arise. By some it was thought that it would not be possible always to distinguish between undisturbed strata of gravel and a talus which had fallen down and become hardened. But this could not account for all the cases, since some of them occurred in ditches freshly dug in the middle of the deposit. It was then suggested that the implements had fallen into holes which burrowing animals had made, or into cracks in the soil which occurred during extreme dry weather, or still again that they had followed down the holes left by the decaying taproots of trees.

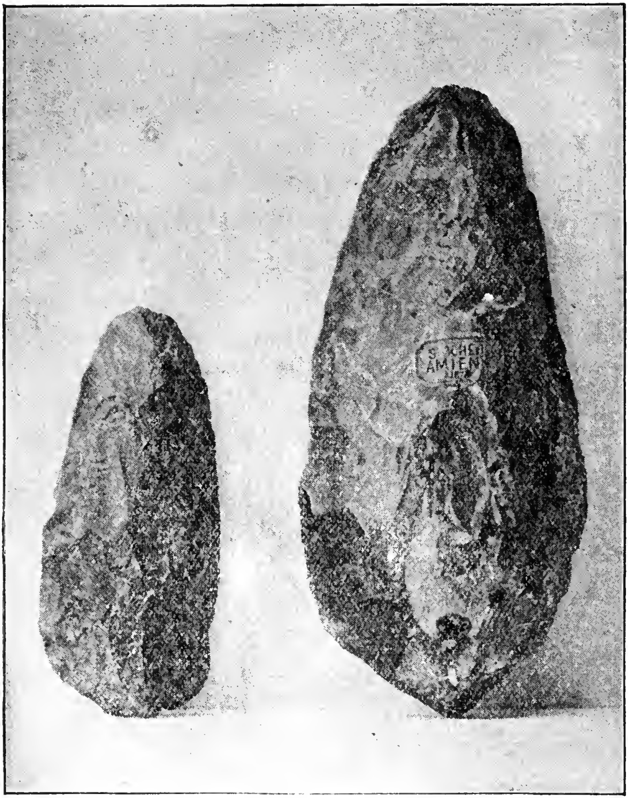
To settle these points committees at two different times visited the ground, and carried on some interesting experiments. Dr. Abbott had, from the outset of his discoveries, contended that argillite implements were practically the only ones found in the glacial gravel. But on the surface thousands of flint and jasper implements, such as are used by the modern Indian, are found, together with pottery. To settle this point the committees were told by Mr. Ernest Volk, who for several years was employed to carry on excavations for Professor F. W. Putnam, curator of the Peabody Museum, that they might select any area on the surface, and he would foretell that they would find numerous flint and jasper implements and some fragments of pottery in the upper layer of ten inches, but that below that depth they would find nothing of that character, but would find an occasional argillite flake or implement. In both cases the committees found the facts as Mr. Volk predicted. The absence of flint and of pottery below the first foot of soil was complete, and from the next two or three feet argillite flakes and implements were occasionally obtained.

The drawback to these investigations was that the committee penetrated only three or four feet from the surface, so that it could be objected that they had not reached the real glacial gravel. But the deposits penetrated were just such as cover all flood plains, where finer material always settles upon the surface, being laid down by the gentler overflows which spread over the flood plain at its highest level. Still the fact remained, as Dr. Abbott had contended from the outset, that flint was not found below the surface, and argillite was. As argillite is lighter than flint, it would seem that if the material had worked into place by falling into cracks, or holes made by animals, or by the decay of taproots of trees, it would have been the flint and not the argillite that occupied the lower position.[3]

But still there were doubters. A quietus was only attained in December 1, 1899, when Mr. Volk discovered and photographed before removal, a fragment of a human femur in the cross-bedded green sand lying below a mass of unassorted gravel, which is unquestionably of glacial age. Upon presentation of this evidence to the society of Americanists, in October, 1902, all doubts were silenced, and the existence of man during the close of the Glacial epoch in New Jersey has become an accepted fact.[4]

A word, however, should be said about the way these implements became associated with the gravel at Trenton. We are not to suppose, as many seem to do, that the implements were dropped from boats with which primitive man was moving over the surface of the swollen waters. The process probably was much simpler. The flooded condition of glacial streams exists only during the warm part of the year. In August and September they would be at their height. But in winter, and early spring, there would be little water in the stream, and the delta terrace at tide level would be a broad expanse of dry gravel over which primeval man could roam at will. Here he would occasionally lose his implements, to be covered by a fresh stratum of gravel during the ensuing flooded season.

One of the most interesting and important of similar discoveries elsewhere was that of a perfectly formed implement of the palæolithic type discovered by Professor W. C. Mills,[5] the present accomplished curator of the museum of the Ohio State Archæological and Historical Society. The discovery was made in October, 1889. The gravel pit in which it occurred is at Newcomerstown on Buckhorn Creek, a small tributary of the Tuscarawas River. The headwaters of this river are in the glaciated region about twenty miles to the north. All the way below the glacial boundary the trough of the stream is bordered by extensive high-level terraces of glacial gravel. The terrace on the north side extends back about a quarter of a mile into the recess formed by the junction of Buckhorn Creek, and is there twenty-five feet above the present flood plain of the river. In a fresh section of this terrace, where the railroad was excavating



The Newcomerstown implement side by side with one from Amiens, France, (face view), reduced one half in diameter. (From Wright's Man and the Glacial Period.) (By courtesy of D. Appleton and Co.)

gravel, Dr. Mills discovered the implement projecting from the freshly exposed perpendicular face, sixteen feet below the surface. It is made of a peculiar dark flint with white specks arising from the occurrence of small shells characteristic of the Lower Mercer limestone found in the near vicinity. In form it is a perfect replica of an implement in my possession, which came from Sir John Evans' collection from Amiens, France, showing perhaps that in palæolithic times the fashions originated in Paris, as they continue to do at the present time.

Other implements in corresponding situations in glacial terraces in the United States are two found in 1885 by Dr. C. L. Metz, a specially capable coadjutor of Professor Putnam in his investigations in the Little Miami Valley, near Cincinnati. One of the implements occurred in the coarse gravel at Loveland, Ohio, thirty feet below the surface, the other at Madisonville, several miles nearer the junction of the Little Miami with the Ohio.[6]

Another important locality where implements have been found in glacial gravels in America is Little Falls, on the Mississippi River, a short distance above Minneapolis. As early as 1877 Professor N. H. Winchell called attention to some chipped quartz implements found in the terrace of the river at that point, and near an outcrop of extensive quartz veins. Afterwards, Miss Franc E. Babbitt found a large number, which attracted much attention at the time, and led to considerable controversy. But subsequent investigations by Professor Winchell and Dr. Warren Upham have settled beyond reasonable doubt that these quartz quarries were resorted to by primitive man while the ice of the Glacial epoch lingered over the northern part of the State; and that he roamed over the bare exposures of gravel terraces during the portions of the seasons when the water was low, as we have supposed him to have done at Trenton. Here the implements lost in the dry season were covered by the torrents which came down during the summer months and covered the whole flood plain, a mile or more in width. This, of course, was later than the time of the formations in New Jersey and Ohio, by the length of time required for the glacier to melt back a distance of several hundred miles. But, according to Dr. Upham's calculations as to the rate of melting, it was not over two thousand years before the final melting of the ice from Hudson Bay, and perhaps not more than three or four thousand years later than the formation of the terraces at Trenton, Newcomerstown, and Madisonville.[7]

So far, in America, the evidence of glacial man had been limited to the occurrence of his implements and of a single human bone in terraces of glacial gravel. But in 1902 great interest was excited by the reported discovery of a human skeleton underneath the loess of the Missouri River at Lansing, Kansas, a little below Leavenworth. The skeleton was found on the farm of Mr. Martin Concannon, by him and his sons while tunnelling in the loess to make a vegetable cellar. At the time of the discovery they had penetrated seventy feet from the entrance of the tunnel and were twenty-three feet below the natural surface. The skull and the bones were first brought to public notice by Mr. M. C. Lane of Kansas City, Missouri. But an artificial chert chip and some remains of other human skeletons were found in the undisturbed portions of the tunnel by a number of other scientific men who investigated the place, so that there is no doubt of the occurrence of human remains in the place indicated by the Messrs. Concannon. The discussion which ensued related wholly to the question of the age of the deposit in which the remains were found. To arrive at a proper understanding of the merits of the case, it will be necessary to give an outline of the facts about the loess of the Missouri Valley.[5]

For several hundred miles the trough of the Missouri River, to a height of one hundred feet or more, is bordered by an accumulation of loam, the particles of which are midway in size between clay and very fine sand. It is identical in structure and behavior with the "loess" of Southern Russia, of the Rhine Valley, and of China and Central Asia. It is so porous that springs are found only at the bottom. It everywhere has the peculiar property of fracturing vertically, so that it presents perpendicular cliffs, in some cases hundreds of feet in height, which do not crumble under the action of the elements much more than does the hardest rock. Still it is so soft that it can be crushed in the hands, and can be cultivated with the greatest ease. Indeed, the areas covered with loess are the most fertile portions of the earth's surface, constituting the better portions of China, Central Asia, and Southern Russia, as well as of large portions of the Missouri and Mississippi valleys.

But there has been much discussion as to whether loess has been distributed by wind or water. Since the report of Baron Richthofen upon the loess of China a number of geologists of the highest eminence have maintained the wind hypothesis. In this opinion they are sustained by the fact that the animal remains found in it are exclusively of snails and other land species. Moreover the prevailing winds of Asia are from such a direction that they would bring the material constituting the loess from the Desert of Gobi, and they are known to be loaded with dust swept off from the plains of Central Asia. The absence of aquatic shells from the formation is certainly significant.[9]

But on the other hand it is evident that whatever part the wind may have had in bringing the loess material into the regions where it is found, water must be invoked to account for much of its peculiar distribution. In the Missouri Valley it is found in about equal proportions on both the west and the east side of the trough, though the prevailing winds are westerly. Moreover, in many places, as at Leavenworth, near Lansing, the loess runs back from the brink of the river in a distinctly formed terrace, marking a temporary water level; while level-topped areas frequently occur at considerable distance from the main valley.

Concerning the snail shells found in the loess, it is to be remarked that while the snail is not an aquatic animal, its most natural habitat is on the flood plains of streams which are periodically overflowed, and purely aquatic shell-fish are never found on the flood plain, but in the bed of the stream.

It is not to be denied that wind may in many instances distribute the loess over higher points than that reached by the overflowing water after the manner of the formation of dunes. I have myself insisted upon the necessity of relying on the wind for the accumulation of the loess in the mountainous part of Eastern Mongolia.[10] But it is equally clear that as the great rivers of China are now tearing down these accumulations in the mountains and redistributing the material over their plains near the seacoast, there was doubtless an analogous distribution of loess in glacial times by the greater floods which coursed down the river valleys of North America.

The loess of the Missouri Valley is now known to have a definite relation to the glacial ice cap at a particular stage of its recession. The material itself is found to be of mechanical origin, and is believed to be for the most part the finest grist of the continental glacier. The time of its deposition is correlated on abundance of the best of evidence, with what some have called the Iowan stage of the glacial recession, intermediate between the Illinoisan and the Wisconsin. The southern portion of Iowa and the northern portion of Missouri are more or less covered with this deposit of loess, while the northern part of Iowa is free from it, except in the case of some of the river valleys along its margin. But below the middle portion of Iowa, all the southerly flowing streams are bordered with heavy deposits of the material, which is accumulated in special quantities where these streams join or approach the Missouri on the one side and the Mississippi on the other. When the ice was melting off most rapidly from the upper basin of the Missouri and the Mississippi rivers it is no extravagant supposition that there were annual floods in these streams rising to a height of two hundred feet. At the same time there is abundant reason for believing that there was at that time a northerly differential depression on the continent which greatly diminished the gradient of the stream flowing south, thus rendering these immense floods the more credible.[11]

The date of this Iowan stage of the Glacial epoch is considerably earlier than that of the stage at which Niagara began its work, which is elsewhere discussed at considerable length. But it is one of the later stages of the epoch, and there is no demonstrable reason for assigning it a date more than three to five thousand years earlier than that of the Wisconsin period, during which the Niagara recession began.

A question has been raised, however, as to whether the deposit of loess at Lansing was original or secondary. Professor T. C. Chamberlin maintained that the evidence was doubtful, and that it might be a secondary redeposition of the material, of great age, indeed, but much younger than the main body of loess in the valley. But Professor N. H. Winchell and Dr. Warren Upham (both very high authorities upon such subjects) after repeated visits adduce overwhelming evidence that the deposit is original, and that the skeleton was buried by the loess at the time of its deposition during the Iowan stage of glacial recession.[12]

Reason for doubting that remains of man had been found in the original deposit of Iowan loess at Lansing would seem, however, to be dissipated by the discovery of human bones by Mr. Robert F. Gilder, in the bluff of loess near Omaha in Nebraska. The ground was thoroughly studied and reported upon by Professor E. H. Barbour of the Nebraska State University. The human bones, including a skull, were shown to be in undisturbed loess from six to twelve feet below the surface, with modern remains in the stratum above them. Evidently, also, they were somewhat waterworn, showing that moving water had been instrumental in transporting them to their present position.[13]

The principal objection urged against the glacial age of the Lansing skull is that it is not much different from that of a modern American Indian. This question, however, must be remitted to the chapter on the physiological evidence of man's antiquity. But it is in place to remark here that those who reason most confidently from these data seem to have a much exaggerated estimate of the antiquity of the Glacial epoch. If the age of the Lansing man be, as we have surmised on plausible evidence, only ten or twelve thousand years, that is not much farther back than we find civilized men possessing exceedingly well developed skulls in Babylonia and Egypt.

In contemplating the remains of glacial man in Eastern North America, we are naturally led to ask, Who were his ancestors, and has he any descendants? The conditions of life at that time, and the animal remains found in the vicinity of Trenton, New Jersey, and in Southern Ohio, suggest to some the likelihood that the Eskimos may be his descendants. For, as the Eskimo skirts the borders of existing ice fields and seems to delight in its weird conditions, so palæolithic man in Eastern America seems to have eked out a precarious existence along, perhaps, both the advancing and the retreating ice front. But upon the whole there seems no satisfactory evidence of any connection between palæolithic man and the Eskimo. Stone implements are but little used by the Eskimos, and the skulls of palæolithic man, so far as they have been observed, are not of the Eskimo type. Furthermore, the Eskimos are found upon both sides of Behring Strait, and are much more likely to have emigrated from west to east than in the contrary direction, since the attractions are greater upon the eastern side of Behring Strait than upon the western. Nor is there the diversity of dialects among the Eskimos which would have arisen in a long lapse of time.

The better founded opinion of ethnologists now is that the Eskimos represent the latest wave of prehistoric emigration from Asia to North America, and that a tribe having become inured to the winters of Northeastern Siberia, bettered its condition by crossing to the northern shores of America, and thence secure from attack, under the protection of their uninviting conditions of life, spread to the islands and shores of Eastern America, occupying the whole habitable portion of Greenland and the whole eastern shore of the continent as far south as Labrador.

The evidences of glacial man in America all indicate an extremely primitive social condition. They are the remains of men not only in the stone age, but in the earliest stages of that age, before smoothed stone implements had come into use. It is worth while also to recall the animals which accompanied him on this continent at that early period. They include the camel, the hippopotamus, the rhinoceros, the tapir, the mammoth, the mastodon, and the horse, all of which were abundant in the central latitudes of North America during the milder climate which preceded the culmination of the period. As the ice pressed southward another class of animals were forced down to the same region to struggle with the original occupants of the constricted area, amid the rapidly changing conditions of life. Of this latter class we may mention the walrus, the Greenland reindeer, the caribou, the bison, the moose, and the musk ox, all of whose remains, as already noted, are found in the superficial gravel deposits of Southern New Jersey and the vicinity.[14]

It is by no means an altogether improbable supposition regarding the fate of palæolithic man in Eastern North America that with many of the species associated with him, he succumbed to the adverse conditions of life and became extinct. A little reflection will impress one with the widespread disturbance which the advancing ice of the Glacial epoch must have produced, not only in the area actually glaciated, but throughout the whole continent. Before the Glacial epoch the plants and animals which now flourish in Europe and in the central portions of the Atlantic States of North America, flourished well up towards the north pole in Greenland and in the northern part of British America and in Iceland and Spitzbergen. All these became fugitives before the advancing rigors of the glacial climate, migrating slowly southward to keep pace with the movement of their natural climatic conditions. It is easy to see, however, that the problem of their survival was not merely one of keeping pace with their climatic conditions, but was largely one of success in the sharp competitive struggle forced upon the individuals of their species by the contracting area of the continent. What species should survive this struggle would depend upon a very complicated set of causes. A number of species we know succumbed to the adverse influences and became extinct in North America. For, before the Glacial epoch there were, as already said, two species of lion, four species of Canis, six species of horse, two of bison, one of camel, two of elephant, two of mastodon, living in America, which had become extinct previous to its discovery by the whites; and in late Tertiary times the continent fairly swarmed with species of horse, rhinoceros, camel, and various other animals, which became extinct before the close of the Glacial epoch. It would be natural, also, to suppose that man found it impossible to cope successfully with the difficulties of the situation and so was unable to survive the changes of that destructive period. Whether he really did so we have no certain evidence, but much of what we have points to his extinction upon this continent.[15]

Before pausing to dwell upon the direct evidence bearing upon this point, it will be profitable to say something further upon the variety of adverse forces which were crowding in to constrict the habitable area of North America during the progress and culmination of the great Ice Age. Not only did the ice wall slowly close in upon it from the north to limit the area, but the depression to which we have referred, upon the Atlantic coast and in the Mississippi Valley, still further constricted the habitable area, devastating the fairest portions of the land. At the same time there were occurring upon the Pacific slope and upon the plains of the great West a series of some of the most enormous volcanic eruptions which have ever been witnessed in the history of the world. The gold-bearing gravels of California are doubtless partly of glacial origin. The sudden melting of vast masses of glacial ice by outflowing streams of lava seems to have given a unique character to the destructive agencies of the period. Immense tracts in this region are covered by vast lava deposits, in some places many hundreds of feet in thickness and extending over hundreds of thousands of square miles. These lava outflows occurred not from volcanic cones, as in typical craters of the present day, but from immense fissures where the earth seemed to crack open for long distances to permit the escape of the molten flood. Such Quaternary lava masses form the walls of the Columbia River for scores of miles, and constitute an important portion of the Yellowstone Park. Over considerable portions of Northeastern Nebraska, interstratified with deposits of glacial origin, is an extensive stratum of volcanic ash which must have been belched out during that time from craters hundreds of miles away, and been transported by the wind.[16]

With considerable plausibility Professor Alexander Winchell connects these vast Quaternary outflows of lava with the direct effect of the pressure upon the earth's crust exerted by the ice which was piled up over the glaciated area. This pressure upon one part of the crust would cause the fluid portion of the interior to exude through cracks in the weaker portions just as pressure upon one part of an orange causes the juice to exude through other portions of the rind. It is easy to see, also, that these great lava flows among the Sierra Nevada and Rocky Mountains by melting the snow and ice upon their summits and the glaciers in their valleys, have produced local floods of incredible dimensions. Thus we have man and his companions in the animal world huddled together in the gradually contracting area of the southern part of the United States — beset with a wall of ice upon the north, with advancing waves of the Atlantic upon the east and with the extension of the Gulf of Mexico far up the Mississippi Valley, while the great plains of the West, and the mountain slopes of the Pacific coast were made uninhabitable both by fire and by flood. It would be strange if, amid it all, man as well as the horse, the camel, the elephant, and the mastodon should not have become extinct upon this continent.

If now we again ask for the origin of that hardy race whose remains are found in the glacial terraces of the eastern and central parts of the United States, our attention is still turned westward to the witness borne by the relics of man, discussed in a later chapter, found in the auriferous gravels of California, and beneath the lava beds of the Pacific coast.

It is interesting to notice that these supposed earliest remains of man are from that very gateway through which we supposed the migrations of the red Indian to have penetrated the continent. So that we may well believe that glacial man entered by the same route which we have supposed the red Indian to have followed, viz., that leading up the Columbia and Snake rivers to the great continental divide from which the streams invite emigration into the valley of the Mississippi and the genial climates of the South and the Southwest. So that we seem here to see a primeval tide of emigration from Asia along the same lines which at a much later date were followed by the present so-called aborigines of America. But the real aborigines were the palæolithic men whom we have already given some reason to suppose became extinct through the fearful and trying climatic changes and extensive conflagrations and floods connected with the advance and close of the Glacial epoch.

Increasing evidence is accumulating of the existence of such floods. Especially does study of the glacial phenomena in America tend to give credence to those traditions of destructive floods which are so widespread among the nations of the world. Certainly, since man came upon this continent there have been changes of land level, and abnormal accumulations of water sufficient to submerge a large part of the inhabitable portions of the United States. As already stated, there was, at the close of the Glacial epoch, a depression of the eastern part of the continent amounting to two hundred feet along the coast of New Jersey, to three hundred feet in the Champlain Valley, six hundred feet at Montreal and one thousand feet farther north. In the Mississippi Valley it is difficult to account for the deposits of loess without supposing a depression of two or three hundred feet in the lower portion, and of increased extent in the upper portions.

But, more impressive still, are the indications of enormous floods in the river valleys flowing out from the glaciated areas during the melting of the ice. I was the first to call attention to the evidence of such floods in the upper Ohio basin. To account for them a glacial dam was invoked at Cincinnati, where there was clear evidence that at the climax of the epoch the ice crossed the Ohio River and pushed over several miles into Kentucky. The effect of this would be to produce a dam five hundred feet in height which would flood a wide margin on both sides of the river above, extending even into the tributaries of the Allegheny and the Monongahela above Pittsburgh, and submerging that city to a depth of three hundred feet. Nothing has been found to discredit this theory. The only alternative is that the floods themselves annually rose for some time during the summer to that unprecedented height. As has already been stated, floods of two hundred feet or more annually devastated the valley of the Missouri during the closing stages of the Glacial epoch, entombing in its débris the remains of man; while, as noted above, the late Professor Tarr, after his survey of the glaciers of Alaska, estimates that during the closing stages of the Glacial epoch, the Mississippi had to dispose annually of sixty times the amount of her present outflow.

Our attention has already been directed to the vast accumulations of water in front of the retreating ice where it obstructed northerly flowing streams, like the St. Lawrence and the Red River of the North. But still more striking are the immense accumulations in interior basins like that of Great Salt Lake in Utah, where during the Glacial epoch a body of water one thousand feet deep accumulated over an area of twenty thousand square miles. In a later chapter we shall give the evidence that when the upper 375 feet of this accumulation burst the barrier of dirt that temporarily held it in, it poured down into the inhabited Snake River Valley for twenty-five years in a torrent as large as Niagara.

It is important in this survey to keep in mind the influence, already indicated, upon land levels of the ice accumulations of the Glacial epoch. At the climax of the period sufficient water had been abstracted from the oceans and locked up in land ice over the Northern Hemisphere, to lower the whole ocean level two hundred and fifty, and some of the highest authorities say five hundred, feet. Not far from 6,000,000, and some of the highest authorities say 12,000,000, and possibly 18,000,000, cubic miles of water were thus locked up in ice over the glaciated area of the Northern Hemisphere. Such a transference of material from the ocean bed to the continental area was very likely in itself a cause sufficient to produce the depression of land known to have taken place during the period.[17] Indeed, it is now coming to be a pretty current belief among geologists that the weight of the ice, accompanied with what can now be demonstrated its very rapid melting, explains these widespread evidences of post-glacial submergence. Thus has history become joined to geology, and every student of the antiquity of the human race is compelled, at the outset, to reckon with the geologist, and especially with the glacialist.

From South America, also, remains of man are reported from glacial deposits in the vicinity of Cuzco, Peru.[18] The remains consist of a number of human bones representing different individuals, but not sufficiently preserved to determine much about the character of the individuals to which they belonged. Only small portions of the skull were preserved and the other bones agreed in all essential respects with "normal adult male Peruvians of the later Inca period."

The discovery was made by Mr. Hiram Bingham, Director of the Yale Peruvian Expedition in 1911. From the geological report of Professor I. Bowman, it appears that contemporaneously with the glaciation of the Northern Hemisphere there was a great lowering of the snow line in the equatorial regions of South America, when extensive glaciers descended from the lofty heights of the Andes, in some places to within 8,500 feet of sea level. In one instance a well-developed terminal moraine, four hundred feet high, was found at that elevation. In the vicinity of Cuzco, which is itself eleven thousand feet above the sea, glaciers extended down from the surrounding heights as far as the twelve thousand and fifty foot line. During this extension of the ice great quantities of gravel were washed down the valleys to build up the plain on which Cuzco is situated. In one of these tributary valleys two sets of glacial deposits are clearly exposed by the erosion of the modern stream. The lower portion consists of fine material, which from the description we should say was deposited by the more moderate streams which poured forth from the glacier during its advance over the higher portion of the drainage basin. The upper portion consists of beds of coarse gravel which may well have been washed down during the melting stages of the glacier. Altogether these deposits are three or four hundred feet in thickness. The bones were found beneath a deposition of from seventy-five to one hundred feet of gravel, through which a channel had been worn by the present stream since the departure of the glacial ice. The bones lay about midway in the coarser deposits. Associated with the human bones were those of the dog, and of what seem to be the bison, which before had not been known to range farther south than Northeastern Mexico.

While admitting that doubt rests on some points of the evidence, Professor Bowman is reasonably confident that the remains are as old as the deposition of the glacial deposits. Their age would, therefore, depend on the date of the Glacial epoch in South

America. This is now generally acceded to be contemporaneous with that in North America. It is interesting to notice that Professor Bowman could distinguish no great difference between the condition of the coarse and fine deposits mentioned, the lower portion being apparently as fresh as the upper portion, and he has no data by which to determine the rapidity with which such an accumulation would take place. From their appearance he would correlate them with those of the Wisconsin episode in the United States. From what we now know of the rate at which glaciers are melting away in Alaska, and of the enormous increment of water furnished by the melting ice to the streams which flow from the ice-covered drainage basin it is easy to see that there is nothing here to indicate an antiquity of more than ten or twelve thousand years, while there would be nothing surprising if the remains should prove much younger than that.

CHAPTER VIII.

MAN AND THE LAVA BEDS OF THE PACIFIC COAST

The Old World has scarcely yet ceased to be incredulous concerning the marvellous reports upon the geology of the western part of North America. When the traveller passes westward from Cheyenne into the Laramie Valley in Wyoming, he can scarcely believe that he is crossing the summit of the Rocky Mountains at an elevation of nearly nine thousand feet; for the only mountains visible are almost as distant as the eye can reach. So gradual is the ascent from the Missouri River to the base of the Rocky Mountains that it is absolutely imperceptible to the naked eye. The route lies over nearly level beds of Tertiary and Cretaceous rocks, which have been slightly tilted up by the elevation of the main axis of the Rocky Mountain range in recent geological times.[1]

The period of the deposition of these extensive beds was a most interesting one in the history both of America and of the world; for the shores of the lakes in which they were deposited were frequented by vast herds of animals as strange in form and habits as in the scientific names which have been bestowed upon them, though most of them are more or less related to existing species. Here were the ancestors of the hyena, the tiger, the wolf, and the panther; while fraternizing with them could have been found the rhinoceros, the mastodon, the elephant, three species of camel, and five of the horse, with a numerous array of other animals, whose scientific names would give the ordinary student no idea whatever.

The information from these beds which has created the greatest interest pertains to the horse, for America seems to have been the birthplace of this most useful species of the animal kingdom. It is here that the earliest ancestors of the horse branched off from some more generalized stock, and began that progress which has ended in the great number of varieties of his domesticated descendants. But though the horse was evolved in America, for some strange reason the land that gave him birth and early nurture proved unfriendly to his continuance, and the species disappeared from its original home; so that when Columbus discovered the continent it was destitute of horses, — those we now have being the descendants of importations since the beginning of the sixteenth century. A similar fate befell a number of other species which flourished abundantly in America during the Tertiary period, and which lingered even till after the advent of man upon the continent. In the preceding chapter we have described the vicissitudes of man's experience on this continent in connection with the advance and retreat of the great northern ice sheet. There is, if anything, a still more interesting history in connection with the vicissitudes occasioned by the volcanic eruptions which have characterized the later geological periods west of the Rocky Mountains.

Geologists whose studies of volcanoes had been chiefly confined to such phenomena in the Old World were for a long time incredulous of the facts reported from the western borders of the United States. Some of these eruptions date back to an early geological age. But the most of them belong to Tertiary and Post-Tertiary times, and they were on a most enormous scale. Literally, hundreds of thousands of square miles west of the Rocky Mountains are covered with fresh basaltic lava, and over large areas this is of great thickness. The areas where the basaltic capping is most pronounced, extend over Northern California, Oregon, Idaho, Washington, and adjoining regions. The Columbia River, where it cuts its way across the axis of the Cascade Mountains, is lined on either side by precipitous basaltic cliffs, through which it has been compelled to force a passage. Seventy miles south of the Cascades this great basaltic plain has been cut into by the Deschutes River for a distance of 140 miles to a depth of 1,000 to 2,000 feet without reaching the bottom of the lava. At Shoshone Falls in Idaho the Snake River is occupying a narrow, precipitous gorge from three hundred to seven hundred feet in depth, the sides of which are composed of the freshest looking lava. At the falls the river plunges down three hundred feet farther, and continues for a long distance between perpendicular walls of basalt, which are one thousand feet in height, and from whose edges almost anywhere a stone can be thrown with sufficient force to reach the water which courses along at the bottom of the cañon.

In many cases the lava has played a most singular and interesting part in its influence upon the drainage of the country. At one point in the great cañon of the Colorado River an eruption of lava ran into it from the north side, and formed an immense dam, obstructing the drainage for a time, and giving rise to an extensive temporary lake. But in the natural course of things the water has prevailed, and long since removed the obstacle. On the California coast, however, it is evident that many of the old water courses leading into the Pacific Ocean have been permanently obliterated by the extensive eruptions of lava which have taken place in the region. From near the summits of the Sierra Nevada, in the vicinity of the Yosemite Cañon, vast eruptions of lava have poured out and flowed down the river valleys for a distance of sixty or seventy miles. These eruptions have necessarily displaced the water from the ancient channels, and compelled it to seek exit by a new course, roughly parallel with the old, but occasionally crossing it. Such has been the history of the Stanislaus River. At a recent geological period an eruption of the lava occurred near its headwaters just below the summit of the Sierra which followed down its shallow channel for a distance of fifty or sixty miles, burying its gravel and completely obliterating its channel. But the Stanislaus, nothing daunted, has kept on its quiet work, and with its tributary and parallel streams, has worn new channels far below the deserted one, and has removed so much of the softer bedded rocks of the region that the basalt stream is left as a projecting flat-topped ridge, the width of the ancient valley, forming a marked feature in the landscape all down the flanks of the mountain. From the flat-topped appearance this is locally known as "Table Mountain."

From 1850 to 1860 great excitement was produced in California by the discovery that the old river gravels underneath the Table Mountain of the Stanislaus contained gold in considerable quantities, and an immense amount of enterprise and capital was expended in efforts to obtain the gold that had been thus securely sealed beneath these remarkable lava deposits. Tunnels were pushed in through the rim rock at the base of the lava, expecting to strike the old bed of the stream. In other places shafts were sunk from the surface of the mountain until they should accomplish the same object. In all it is estimated that not less than one million dollars were expended in the vicinity of Sonora in efforts to secure the gold under that part of Table Mountain.[2]

Naturally many things were found beside gold, among which were the bones of numerous extinct animals, which we elsewhere have learned to associate with the early history of man, and finally reports began to circulate that the remains of man himself had been found securely preserved beneath the lava cap of Table Mountain.

The evidence that human implements, and fragments of the human skeleton, have been found underneath Table Mountain seems to be abundantly sufficient; but, as the witnesses have been challenged, and as so much depends upon the truth of their report, it is best to give the evidence in some detail.

The first man to call special attention to such discoveries was Dr. Snell, a physician of high repute in Sonora, to whom, at various times from 1850 to 1860, there were given numerous human implements and a jaw, which were said by the miners to have been found under the lava of Table Mountain. One of the stone implements given him seems to have served as the handle of a bow, and there were one or two spearheads and "several scoops or ladles with well-shaped handles." These were not discovered by Dr. Snell in place, but there was no motive for the miners to deceive him, as they had nothing to gain by so doing. And this is a case where an ordinary man's testimony is as good as an expert's. It does not require an expert to tell whether he finds a thing in a cellar or in a garret. An object found in the ordinary course of driving a tunnel under Table Mountain is older than the mountain. Still, as if to remove all cavil, there was one object which the Doctor found himself. This was a stone implement for grinding, taken with his own hands from the dirt as it came out from a shaft under Table Mountain.

During this same decade, Hon. Paul K. Hubbs, a well-known citizen of Vallejo, California, and at one time state superintendent of public instruction, found a portion of a human skull in the mining sluice into which the dirt from one of the shafts under Table Mountain was being shoveled; and there was clinging to the specimen, when found, portions of the gold-bearing gravel. This fragment was given by Mr. Hubbs to Rev. C. F. Winslow, who divided it into two pieces, and sent one to the Boston Society of Natural History, the other to the Philadelphia Academy of Sciences; and an account of the discovery is given in the Proceedings of the Boston Society of Natural History for October, 1857. The point in the tunnel from which the bucketful of dirt containing this object came was 180 feet below the surface of Table Mountain. At about the same time, one of the owners found in this shaft, also, a large stone mortar, fifteen inches in diameter; but no pains were taken to preserve it and it has disappeared, as the fragment of the skull would have done except for the intelligent interest in it of Mr. Hubbs and Mr. Winslow. Important as was this discovery by Mr. Hubbs, and promptly as it was reported to two of the best known scientific societies of the country, it attracted no general notice until Professor Whitney's attention was turned to it, ten or twelve years later, when the ground was revisited, the original parties were questioned, and the facts as above stated were placed beyond reasonable doubt.

Upon making further inquiry, Professor Whitney found in the hands of the miners various other articles said to have come from under Sonora Table Mountain. Among these was a large white marble bead, about an inch and a half long and an inch and a quarter in diameter, with a perforation suitable for a string. This bead was taken in 1853, by Mr. Oliver W. Stevens, from a carload of gravel as it came out of the tunnel. The load was obtained 200 feet in, and 125 feet below the surface of the lava. Beside the bead there was found the tooth of a mastodon. Both objects bore evidence in themselves to the situation from which they came, being partially incrusted with sulphate of iron. Mr. Llewellyn Price also gave to Professor Whitney the particulars concerning a stone mortar, estimated to be about thirty inches in circumference, which he found in 1862 in what was known as the Boston tunnel, about 1,800 feet in from its mouth, and where the overlying lava was more than sixty feet deep.

It will be observed that these are all independent cases of evidence, dating from the time of greatest activity in pushing mines under this lava deposit. Unfortunately, the expense of reaching the gravel was so great that after a time the work was suspended in nearly all the mines. It is estimated that in their efforts to get the gold from under Table Mountain the miners spent a million dollars more than was ever actually returned to them. But from time to time later spasmodic efforts have been made to reach this gold, and the discoveries which have since been made will, in the opinion of many, add greatly to the force of the evidence here detailed as collected by Professor Whitney.

One of these subsequent discoveries is that of a mortar which came into my own possession in 1890, while on a visit to Sonora. This was six and a half inches in diameter, with a bowl about three and a half inches broad and three deep, made from a volcanic fragment of rock. It had been found by Mr. M. C. McTarnahan in the Empire mine, which was on the opposite side of Table Mountain from the Valentine shaft. The tunnel of the mine had been excavated 758 feet before reaching the gravel, and was there 175 feet in a horizontal line from the edge of the Table Mountain basalt, and one hundred feet below the surface. The mortar was brought out from the end of the tunnel by Mr. McTarnahan, so that there would seem to be no doubt of its genuineness. An account of this was given at the meeting of the Geological Society of America in January, 1891.

At the same meeting, Mr. George F. Becker, one of the most experienced members of the United States Geological Survey, reported having received from Mr. J. H. Neale, a well-known mining superintendent, a mortar about the same size of the one just described concerning which Mr. Neale made affidavit that he took it with his own hands from undisturbed gravel in the Montezuma tunnel under Table Mountain, near Sonora, fourteen hundred feet from the mouth of the tunnel, and between two and three hundred feet from the edge of the lava. Several obsidian spear heads were also found by him in close proximity to the mortar. Concerning this, Mr. Becker aptly remarked that the judgment of a mining engineer in a tunnel which he was himself excavating is the best that can be obtained, — far better than that of a chance geologist who makes a temporary visit. For, the engineer is acquainted with every foot of the excavation, and from the necessity of the case is constantly on the lookout for disturbances which would endanger the lives of the workmen.[3]

At the same meeting of the Geological Society, Mr. Becker presented a pestle, given to him by Mr. Clarence King, who made the celebrated geological exploration of the fortieth parallel across the continent from east of the Rocky Mountains to the Pacific coast, and who was the first director of the United

States Geological Survey. Mr. King said that he took this pestle with his own hands from the undisturbed gravel underneath Table Mountain, near Tuttletown, between Rawhide Gulch, where Mr. Neale's discoveries were made, and the Empire mine, where the McTarnahan mortar was found.

From the fact that placer mining has nearly ceased to be profitable on the Pacific coast, it is not, as already remarked, to be expected that numerous discoveries will be made at the present time. Still they are reported occasionally. The last one that has come to our notice was made in 1906 by Mr. J. F. Kemp of the United States Geological Survey, which was of two mortars found in the undisturbed gold-bearing gravels of Southern Oregon, which are certainly as old as those under Table Mountain.

So much has been written about the celebrated Calaveras skull that notwithstanding the partial discredit which has been thrown upon it, it will be in place to give the facts somewhat fully in this connection. These are as follows: In February, 1866, Mr. Mattison, a blacksmith, living at Altaville, between the two mining camps known as Murphy's and Angel's, near the line between Calaveras and Tuolumne counties, was employing his spare earnings in running a mining shaft under that portion of the

Sonora lava flow known as Bald Hill. He had penetrated the base of the hill with his tunnel until it was 150 feet below the surface, the intervening space being occupied by distinct strata of lava intercalated with thin beds of gravel, — the superincumbent lava being nearly one hundred feet thick. Here, in connection with some petrified wood, Mr. Mattison found, thickly encased in cemented gravel, an object which he first thought was the root of a tree. But what he mistook for a root proved to be the lower jaw attached to the skull above referred to. Having brought the shapeless mass to the surface, and finding it of no value to himself, Mr. Mattison gave it to Mr. Scribner, who was then acting as agent for an express company, and who was for thirty years later a prominent and highly respected business man in the neighborhood, living at Angel's. Mr. Scribner, on perceiving what it was, at once passed it into the hands of Dr. Jones, an intimate friend of his living a few miles away at Murphy's. Dr. Jones was for many years afterwards a resident of San Francisco, and, like Mr. Scribner, was a gentleman of the highest reputation. Not having a very definite idea of the situation in which the relic had been found, Dr. Jones laid it aside in his yard, and paid little attention to it until the following June, when Mr. Mattison chanced to come to his office for a medical prescription. Recalling Mr. Mattison's relation to the discovery, Dr. Jones questioned him as to the circumstances attending the discovery of the skull, and elicited the facts as above stated. Dr. Jones immediately communicated with Professor Whitney at San Francisco, and at his request forwarded the skull to him. As soon as was convenient Professor Whitney visited Altaville, and made a careful examination of the evidence, both as to the genuineness of the discovery and as to the geological conditions in which the skull was reported to have been found.

Not long after, Professor Whitney was permitted to take the skull with him, on his return home to Cambridge, Massachusetts, where, in connection with Dr. Jeffries Wyman, he subjected it to a very careful investigation, to see if the relic itself confirmed the story told by the discoverer. In their opinion it did so, to such a degree that the circumstantial evidence alone placed its genuineness beyond all reasonable question. According to this examination, the skull was in a fossilized condition, — that is, the phosphate of lime had been largely replaced by the carbonate of lime (as would not have been the case had it lain near the surface in loose gravel), — and evidently it had been exposed to considerable rough treatment while rolled along in the channel of the ancient stream.

We are bound to add, however, that the skull which Professor Whitney presented has been pretty thoroughly discredited by the recent investigations of Mr. William J. Sinclair,[4] who on reëxamining the material of the matrix in which it was embedded, found evidence that it was a comparatively modern skull from some one of the numerous neighboring caverns that were used as burial places. But in the opinion of Professor Putnam, in which on good evidence I concur, a skull of some sort was found as reported by Mr. Mattison and brought to Mr. Scribner; but in the interval of several months while it was lying with others neglected outside Dr. Jones' office the wrong one was sent to Professor Wyman. (See *Records of the Past,* vol. vii. p. 186.)

Moreover, Mr. Sinclair is not satisfied with challenging the genuineness of the Calaveras skull, but goes through the whole evidence connecting man with the auriferous gravels of California, and finds reasons satisfactory to himself for setting it all aside as inconclusive. While, however, he is able to show some possibility of error concerning each one in particular, the cumulation of evidence from so many quarters is such that it is impossible by this means greatly to diminish its force. Besides, Mr. Sinclair and those who side with his views, seem, in their conclusions, to be unduly swayed by certain untenable theories concerning the age of the auriferous gravels, and concerning the durability of species. They regard the deep gravels as of Eocene or early Miocene age. That man should have existed in this remote geologic age is justly thought by Mr. Sinclair to be "contrary to all precedent in the history of organisms, which teaches that mammalian species are short lived." But other, and we think, the best authorities, regard the mammalian remains associated with man in these gravels to be of late Pliocene or Post-Pliocene species. Lesquereux regarded the plants of the deep placers as decidedly Pliocene, and the animal remains are those with which we have been made familiar in our study of the glacial deposits, viz., the mastodon, the mammoth, the tapir, the rhinoceros, the hippopotamus, the camel, and the extinct horse. As to the relative age of these deposits it will be necessary to enter into a fuller discussion.

Before doing so, however, it will be in place to present somewhat fully the evidence of a remarkable discovery of a small figurine in Idaho, under conditions analogous to those surrounding the California discoveries. We refer to the so-called Nampa image. This is a skillfully formed miniature representation of the human body, made from clay, and slightly burned, which was brought to my notice in October, 1889, by Mr. Charles Francis Adams, its genuineness being certified to by evidence that was perfectly satisfactory to him. The figurine was found by Mr. M. A. Kurtz,[5] at Nampa, Idaho, while boring an artesian well at that place.

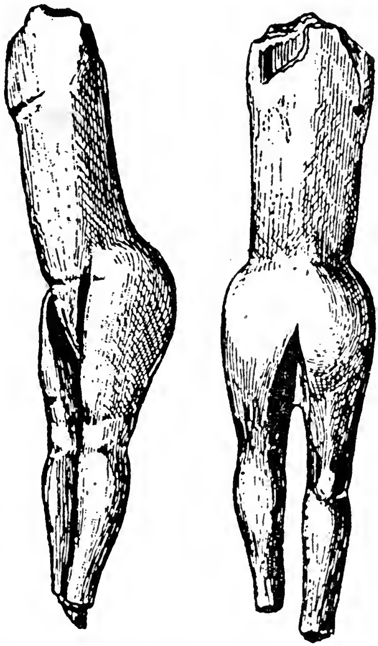
Nampa is at the junction of the branch railroad connecting the Union Pacific Road with Boisé City, the capital of Idaho, and is near the western border of the State about half way between Boisé River and Snake River. The record of the well shows that in reaching the stratum from which the image was brought up they had penetrated first about fifty feet of soil, then about fifteen feet of basalt, and afterwards passed through alternate beds of clay and quicksand, — the quicksand largely predominating, — down to a depth of about three hundred feet, when the sand pump began to bring up numerous clay balls, some of them more than two inches in diameter, densely coated with an iron oxide. In the lower portion of this stratum there were evidences of a buried land surface, over which there had been a slight accumulation of vegetable mould. It was from this point that the image in question was brought up at a depth of three hundred and twenty feet. A few feet farther down, sand rock was reached.

The image in question is made of the same material as that of the clay balls mentioned, and is about an inch and a half long; and remarkable for the perfection with which it represents the human form. It was not, however, a perfect product. The legs were broken off, the hands had never been put on, and the face was imperfectly finished. It was a female figure, and had the lifelike lineaments in the parts which were finished that would do credit to classic centers of art. Upon showing the object to Professor F. W. Putnam, he at once directed the attention to the character of the incrustations of iron upon the surface as indicative of a relic of considerable antiquity. There were patches of the anhydrous red oxide of iron in protected places upon it, such as could not have been formed upon any fraudulent object. In visiting the locality in 1890 I took special pains, while on the ground, to compare the discoloration of the oxide upon the image with that upon the clay balls still found among the débris which had come from the well, and ascertained it to be as nearly identical as it is possible to be. These confirmatory evidences, in connection with the very satisfactory character of the evidence furnished by the parties who made the discovery, and confirmed by Mr. G. M. Cumming, of Boston (at that time the superintendent of that division of the Oregon Short Line Railroad, and who knew all the parties, and was upon the ground a day or two after the discovery) placed the genuineness of the discovery beyond reasonable doubt. To this evidence is to be added, also, the general conformity of the object to the other relics of man which have been found beneath the lava deposits on the Pacific coast.

On comparing the figurine one cannot help being struck with its resemblance to numerous "Aurigna-

Nampa figurine. View from front, back, and side (natural size).

cian figurines" found in prehistoric caverns in France, Belgium, and Moravia. Especially is the resemblance striking to that of "The Venus impudica from Laugerie-Basse," reported by Breuil and figured in Sollas's "Ancient Hunters." [6]



The Venus impudica, from a pre-historic cavern in France. (From Sollas's "Ancient Hunters.")

During my visit to Nampa, special pains was taken to ascertain whether there was any possibility that the object should have been originally at a higher level and had by some means worked to the position from which it was brought up. To answer objections it will be well to give the facts more fully. The well was six inches in diameter and was tubed with heavy iron tubing, which was driven down from the top, and screwed together, section by section, as progress was made. Thus it was impossible for anything to work in from the sides. The drill was not used after penetrating the lava deposit near the surface, but the tube was driven down, and the included material brought out from time to time by use of a sand pump. The inside diameter of the tubing was about five inches. The sand pump consisted of a tube about eight feet long, with a valve, of three and a half inches aperture at the bottom, opening upwards. There was also a suction valve, which played inside of this tube, which was attached to what is called a jar, that is, a long iron loop which followed the piston down to the bottom of the pump, and upon the reversal of the machinery, after the pump had been let down to the bottom of the well, suddenly drew the valve to the top of the pump and filled it with water and sand and such other material as was accessible. Whereupon the whole was drawn to the surface, and the tube emptied. It will thus be seen that there was nothing at all impossible or improbable in bringing up an object of this sort from the depth mentioned, if only it should come within reach of the suction of the pump.

But at first it seems exceedingly improbable that in driving down six-inch tubing for a depth of three hundred and twenty feet one should at random strike so rare an object as this. In commenting, however, upon the subject, Professor Putnam has well said this is not the only well which has been bored in the world, but one of a great many thousand. So that we have not to overcome the probability against striking such an object at the first venture, but at the ten-thousandth venture. Furthermore, the improbability is greatly diminished by the fact that after the tube had penetrated the strata of clay, which were impervious to water, the quicksand worked into the space below in great abundance, being forced in by the hydraulic pressure around, so that an enormous quantity of the material was brought up from near the bottom, in excess of what would be in the direct line of the tubing. Indeed, it seems quite probable that in clearing the tube the sand pump may in its repeated journeys have sucked up the material over the bottom from many square yards. At any rate an immense pile of quicksand was formed by the process. Assuming, therefore, that the evidence of the genuineness is satisfactory, we will consider the facts bearing upon the age of the relic.

We have already alluded to the vast extent of the lava deposits west of the Rocky Mountains. To understand their bearing upon the chronology of the human relics found beneath them, we must go more minutely into details.

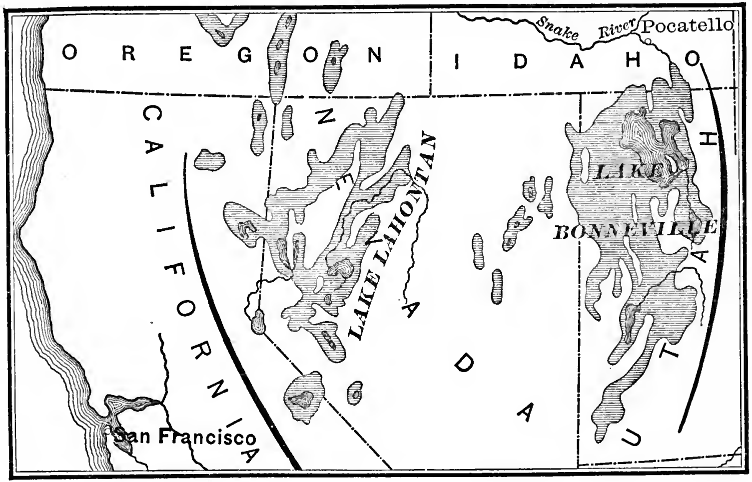
In crossing the continent upon the Union Pacific and Oregon Short Line Railroad, one first encounters lava fields near Soda Springs, in the Bear River Valley, in Southeastern Idaho. Here he finds extensive level areas of basalt, filling the whole space between the mountains like a solidified inundation, which it really is. Occasional small craters appear above the surface of the basalt plains, but they seem totally inadequate to have supplied the vast amount of lava which spread over the plain. These craters are probably but the last breathing holes of the volcanic fires which produced the total result. The fresh condition of the craters impresses one with the recentness of the eruptions. Several hundred square miles are here covered with lava to an unknown depth; certainly as much as one hundred feet. Bear River, which here turns an acute angle around an intervening mountain mass, was forced by the lava flow from the north to hug close to the mountain wall.

A much more impressive view of the lava plains is received on crossing the Port Neuf Mountains and coming down to the valley of Snake River, in the vicinity of the American Falls, where one looks out upon a basaltic valley extending forty or fifty miles in width, from the Blackfoot Mountains on the southeast to the Lost River Mountains on the northwest. From this barren waste of lava, much of it seemingly as fresh as though it had poured out of its vents but yesterday, several buttes rise like islands from the sea, and have long served as waymarks for weary travellers attempting to cross this trackless plain. Far in the east the Teton Mountains look down upon us from their serene heights on the axis of the Rocky Mountain chain. The length of this lava plain from northeast to southwest is about two hundred and forty miles, making its total area not far from twelve thousand square miles. The Snake River flows pretty close to the southern edge of this basaltic plain, having, like the Bear River, evidently been pushed aside from the center of the valley by the encroachments from the lava fields of the north. Pillar Butte is a crater of considerable size, but totally inadequate to have supplied a tithe of the lava that forms the prairie-like expansion about it. There can be but little question that this vast lava flow has poured out of fissures rather than from craters.[7]

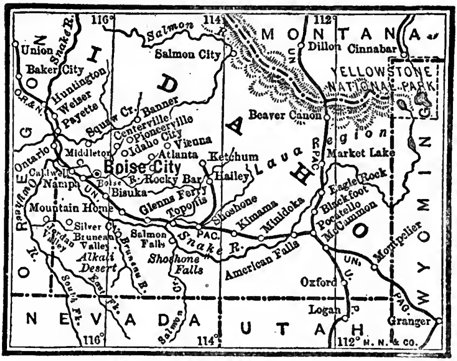
It is difficult to obtain any definite estimate of the age of this lava flow. Some of the craters were thought by Hayden to have been in eruption within the last few hundred years. Indeed, it is not improbable that the geysers of the National Park, which are at the head of this valley, are the last gasps of the waning volcanic force which has produced these vast results; but it is equally evident that when measured in years the date of the earlier flows must be placed a great many thousand years ago; for the erosion at Shoshone Falls is from twenty-five to thirty times as much as has been accomplished by the Niagara River since the close of the Glacial epoch. Yet it is evident that massive eruptions continued up to late Tertiary or Post-Tertiary times. For, the shells found beneath the lava at Glenn's Ferry (eighty-five miles east of Nampa in the Snake River Valley) are identified by Mr. Dall as belonging to one or other of these periods.

But we have not yet reached the center of interest concerning the deposits found at Nampa. For this we must go seventy-five miles farther down the valley, where we find it considerably narrower than the upper portion, and still filled with the basaltic lava, though separated to a considerable extent from the greater area to the east. In this narrowing portion of the valley, between the Boisé and the Snake River, about five hundred square miles was covered with lava. Nampa is almost upon the extreme western edge of the flow, the lava entirely disappearing four miles farther west. No basalt appears for seventy miles below this point in the valley of Snake River. The lava deposit upon the edge of which Nampa stands seems to have come from a center about twenty miles to the east, and to have pushed in like a wedge between the Boisé and the Snake River, thrusting them both against the mountains which are here closing in upon the valley. From some extensive cañons cut through the lava by the Boisé River nine miles above Boisé City, it would seem that a number of thousand years must have elapsed since a tongue of the lava there thrust up against the mountains and temporarily obstructed the drainage. The lower strata of the cañon, however, consist of gravel deposits which were overrun by the lava stream. In the same manner the Boisé River cuts across the western edge of the lava, where it has thinned out to a few feet near Caldwell, about four miles west of Nampa.

It will appear on further investigation that the age of the stratum from which the Nampa image was de-



Map showing the size of glacial lakes Lahontan and Bonneville when the latter overflowed into the Snake River Valley producing the debacle described in the text. (From Wright's "Man and the Glacial Period.") (By courtesy of D. Appleton and Co.)



Map showing Pocatello, Nampa, and the valley of the Snake River. (From Wright's "Man and the Glacial Period.") (Courtesy of D. Appleton and Co.)

rived is not necessarily more than a few thousand years old. For the deposition of quicksand and clay might in favoring conditions take place very rapidly, and there are readily discernible indications of a flooded condition of the valley within comparatively recent times, and while it retained about its present relative altitude and slope. During the Glacial epoch, when glaciers came down as they did from the Teton Mountains on to the edge of the lava plains in the upper part of the Snake River Valley, there must have been a great increase in all the streams which poured in from the surrounding mountains, especially upon the final melting away of the ice. The results of such floods would be various. In certain places it would deposit great quantities of gravel; and in other places, where there were eddies or back water, there would be a deposit of quicksand and clay, thus accounting for these extensive deposits of silt in the lower part of the Snake River Valley. Fully to appreciate the situation, however, we must turn to the description given by Dr. Gilbert of the enormous debacle which occurred in the valley of the Snake River in connection with the vicissitudes of Great Salt Lake during the Glacial epoch.[8]

Great Salt Lake in Utah is now a shallow body of water, covering about 2,000 square miles, and averaging about thirteen feet in depth, the deepest portion not being over fifty feet. This lies in one of the enclosed basins of a vast arid region, extending from the Rocky Mountains and Sierra Nevada over a width of several hundred miles. The rainfall of the basin is now barely enough to supply the waste of evaporation from the surface of the lake. From all the data which we have obtained since Captain Bonneville's party visited the lake in the early part of the last century, we should have nothing to warrant us in expecting any marked change in the condition of the lake in the future, nor would these observations point with decisiveness to any great change in the past. There are fluctuations of level in the different seasons of the year, and slight fluctuations from year to year; but nothing upon which to base sound inferences with reference either to the distant past or the distant future.

Yet the circumstantial evidence discovered by careful investigation compels us to suppose that the region has undergone great changes during the Post-Tertiary epoch. There is conclusive evidence, that, coincident with the formation of great glaciers upon the Wahsatch Mountains, the rainfall was so increased and the evaporation so diminished over the area that the lake swelled beyond its present barrier, and covered an area ten times that of the present lake, and increased in depth till it was eighty times as deep as it now is; that is, the lake swelled in proportions till it contained eight hundred times the present volume of water, covering an area of twenty thousand square miles and being one thousand feet deep.

A moment's reflection reveals here a most interesting condition of things. The surface of the present Great Salt Lake is more than four thousand feet above the sea. In glacial times, when the depth of the lake was greatest, the surface was more than five thousand feet above the sea. The shore lines indicating this can be easily noted all around upon the mountains along the sides of the basin, and upon those which rise in solitude from its central portion. We have thus a reservoir, containing four thousand cubic miles of water, supported at an elevation of between four and five thousand feet above the sea. Considered even in respect to its weight in avoirdupois, this is no insignificant element in its effect upon the equilibrium of forces which maintains the stability of that portion of the earth's crust.

But more interesting still is the preparation which had been slowly going on for a catastrophe when this water should burst the barriers which at first separated it from the peaceful Snake River Valley on the north. The barrier between this elevated and increasing body of water, known now as Lake Bonneville, and the Snake River Valley is a mountain elevation, of moderate dimensions, with its lowest pass at Red Rock between Cache Valley on the south and the Port Neuf River Valley on the north, which joins the Snake River plain at Pocatello. Up to 625 feet above the present level of Salt Lake, the barrier at this pass is a ledge of limestone rock, forming an invincible dam; but the upper 375 feet of it was nothing but a dirt dam, consisting of the delta of a mountain stream coming in from the east. Slowly this stream had brought in the wash of the eastern hills, and built up its broad delta upon the limestone foundation. When, at length, the waters of Lake Bonneville rose above the level of the limestone ledge, and finally approached the very summit of the pass, it would have taken no prophet's eye to foresee a catastrophe of the first order; for this dirt dam, though built by nature, possessed every element of insecurity which belongs to artificial products of the same kind. Just so soon, therefore, as the water rose high enough to run over the pass into the Port Neuf River, it began to enlarge a channel for itself, which would increase in arithmetical ratio until the whole barrier had given away, when twenty thousand square miles of water 375 feet deep would begin to empty itself through the Port Neuf Valley into the Snake River with all the speed which it was possible for it to acquire.

In tracing out the results of this catastrophe, Mr. G. K. Gilbert found abundant evidence in the Port Neuf Valley of the occurrence of the debacle which he perceived must have passed through it. Where the valley is a mile in width, and descends thirteen feet to the mile, there was evidence of the former existence of a stream filling it from side to side to a depth of from seven to twenty feet, and rushing with such force as to sweep bowlders of great size along the bottom. Nor was this debacle the mere passing wonder of a day; but, by a simple mathematical calculation, Mr.

Gilbert arrives at the conclusion that a stream the size of Niagara would be occupied for twenty-five years in drawing off the upper 375 feet of the lake which was pouring into it. Here, therefore, we have a most startling catastrophe resulting from a slowly accumulating cause. For thousands of years the Port Neuf was an insignificant stream, and everything seemed to remain as it was. Then for a quarter of a century it became a rushing, mighty torrent, in whose way nothing could stand; while now again for thousands of years the quiet of ancient times has rested on the place.

Where this debacle entered the Snake River Valley, it is about two hundred and fifty miles distant from Nampa, and about two thousand feet higher; so that there would have been a descent of about eight feet to the mile. Just how it would have worked its way across the plain to these lower levels, it is perhaps impossible to tell, on account of the subsequent disturbances of the surface which have been produced by the overflow of lava. But the bare statement of the above facts is sufficient to impress us with the impossibility of depending upon present rates of change in the valley as a standard for those that were taking place at the time that the peaceful village of ancient Nampa was overwhelmed and buried first by a flood and then by a vast stream of red-hot lava, which has sealed it up and preserved it until the present time.

On passing to the flanks of the Sierra Nevada in California, where the relics of man have been found beneath lava deposits approximately corresponding in date with those in the Snake River Valley, we find a somewhat analogous condition of things. The Sierra Nevada Mountains were mainly uplifted during the end of the Tertiary and the beginning of the Glacial epoch on the western coast. This uplift was connected with vast eruptions of lava, which took place before the erosion consequent upon the increased elevation of the mountain axis had proceeded to a very great extent, and the lava poured down the shallow valleys, burying up and protecting everything beneath it, including the works and remains of man. By pretty general consent the glaciation of the Sierra Nevada is believed to have continued to a much later period, and perhaps to have begun at a much later period, than that of the eastern part of America. The steep gradient of the river channels on the western flanks of these mountains, connected with the increased volume of the streams during the Glacial epoch, would provide for an enormous acceleration in the rate of erosion in all those channels; so that, even if we suppose the whole of the gorge occupied by such streams as the Stanislaus, the Tuolumne, and the Merced to have been eroded since the lava flow, the period may not have been so enormously long as might at first be supposed.

Many things, however, indicate that much of the erosion of the present streams may have been produced before the eruptions of lava took place. If it is asked, how this can be, when the present Stanislaus cuts directly across the old valley, which was filled by the Table Mountain lava flow, the answer would be, that it seems by no means impossible that at some places the lava followed not the valley then occupied by the water course, but a deserted valley which had been left at a higher level in the general progress of erosion.

The possibility of such a procedure is shown by the report by Mr. Diller [9] upon a remarkable cinder cone and lava field in the vicinity of Lassen Peak, in Northern California. From various data, Mr. Diller is able to show that this lava field, which covers about two square miles, is the product of an eruption which has occurred within the last two hundred years; the flow of lava, however, has not proceeded in a straight line from the orifice, but has turned in almost a complete circle, — not because the depression lay in that direction, but because cooled masses of lava at the front dammed up its course, so that, upon a renewal of the flood, it was easier to break through the side than through the front. Thus it would seem that in the vicinity of Murphy's and Angel's camp, where the Calaveras skull was found, there was such an accumulation of rather loose volcanic ash as might have served to divert the basalt flow to the left, and carried it down by Sonora over a channel that was then independent of the Stanislaus. Thus it is by no means improbable that the age of Table Mountain, as estimated by the erosion subsequent to its formation, may be greatly reduced both by the probable intensification of the erosive agencies during the Glacial epoch and by a considerable reduction of the known amount of erosion which has taken place. Still, with all this reduction, it is probable that we have in these relics of man upon the Pacific coast some of the oldest that have yet been found.

A vivid impression of the antiquity of this period is given by observing the complete change which has taken place in California in the plants and animals of the region since man first began to occupy it. The existing forests of the Pacific slope consist almost entirely of coniferous trees. The deciduous, or hardwood, trees familiar on the Atlantic coast are either entirely absent from the Pacific side of the continent, or are of smaller size and poorer quality. The Pacific coast has indeed maples, ashes, poplars, walnuts, oaks, and in Washington, birches, but they all compare unfavorably with their brethren upon the Atlantic coast, and are so inferior in economic value, that, as Professor Gray said, "a passable wagon wheel cannot be made of California wood, nor a really good one in Oregon." But California has, at the present time, no birch, beech, elm, holly, gum tree, magnolia, catalpa, mulberry, linden, or hickory. The flanks of the Sierra above the altitude of two thousand feet are covered with majestic but monotonous forests of pine, cedar, spruce, *Sequoia gigantea,* and tamarack, interspersed in the lower portions with inferior kinds of black oak and the diminutive California buckeye and manzanita.

But from the vegetable remains found associated with traces of man in the deposits under Table Mountain it would appear that, at the time of that volcanic outflow, there were no coniferous trees on the flanks of the Sierra, whereas many of the hardwood trees above mentioned as now peculiar to the Atlantic States flourished there in abundance. Primeval man in California found shelter in forests very similar to those which, on the discovery of America by Columbus, covered the whole eastern part of the continent. The elm, the beech, the willow, the poplar, the sycamore, the gum tree, the magnolia, and maple spread for him their protecting branches, while the beech tree, as well as the oak and the fig, added its fruit to his limited stock of vegetable food.

As already remarked the animal companions of man upon the Pacific coast were also, in this early period, as different from the existing species as were the plants. From the remains of animals found associated with man in the deposits beneath Table Mountain, or others equally old, we find that he was then as familiar with the mastodon and the unwieldly form and the long, curved tusks of the mammoth as the modern inhabitant of India or Africa now is with the reduced dimensions of the elephant; cartloads of their fossil bones have been collected from the gold-bearing gravels, as might well be inferred from Truthful James's account of the Row upon the Stanislow. The llama, an ally to the camel, now confined to South America, was another companion of man in California at that time. The rhinoceros can scarcely be said to have been his companion, but from the remains discovered it could have been no unusual event for the hunter in those days to have encountered this animal in his haunts. Those were times, too, when beggars could have ridden on horseback, had they been able to domesticate any one of the several species which then abounded in the region. Extinct gigantic species of the cow and deer are also proved, by their remains, to have been then living in companionship with man; while, as is to be expected, the wolf was present to worry and trouble him.

A closing remark will be in place concerning the bearing of the recent discoveries upon the Pacific coast, where both glacial and post-glacial man effected his entrance upon the continent, upon theories as to the original condition and origin of the human race. So far, indeed, the evidences upon the western part of the continent do not indicate, according to modern standards, a high degree of civilization. There is as yet no evidence that man in America had risen above the culture of the stone age. But the artistic ability shown in the graceful lines and symmetrical form of the Nampa figurine, like those of the Venus impudica, indicates a caliber of mind no whit behind that of the average man of the present time. The average man now is incapable of producing such works of art. But, as Professor Putnam has somewhere observed, the imitation of natural forms in objective representations is one of the earliest demonstrations of the great natural capacity of undeveloped man.

And so we have from this unexpected quarter of the globe some of the most important of all facts bearing upon the origin of the human species. Our earliest knowledge of man is of a being fully formed and in possession of all the faculties of his kind. So far no evidence has appeared of any transitional stage between the ape and the man. From the indications with reference to the lines of migration in this country it would seem that there was a process of degradation in the tribes that reached the outskirts of the continent. The more civilized races of Idaho, Mexico, and Peru, are not a development from the ruder tribes of the Atlantic coast, but the reverse. It seems more likely that the tribes of the Atlantic were, in glacial as in post-glacial time, the degenerate descendants of those on the Pacific slope.

CHAPTER IX

REMAINS OF GLACIAL MAN IN EUROPE

In Europe the evidence of glacial man is not quite so clear as in America; for there drainage to the south was not so free as it was in America, except possibly over portions of Russia. For, the principal localities in Europe in which prehistoric human relics have been found, lie outside of the boundary of the glaciated region. The earliest, and in some respects the most important, of these were in France at Amiens and at Abbeville in the valley of the Somme, and Chelles, on one of the eastern tributaries of the Seine, not far from Paris.[1] While it is not supposed that glacial ice ever covered this portion of France, the deposits in these valleys are connected with the Glacial epoch by the indications in them that there was an excessive amount of floating ice present in the streams when the gravel was deposited, and by other indications of a much colder climate than exists in that region at the present time. The strata of moderately fine gravel which compose the terraces, occasionally contain angular blocks of stone two or three feet in diameter, which could have been carried only by large cakes of floating ice; while the bones found interstratified are those of animals which are otherwise known to have existed during the Glacial epoch, but to have become extinct soon after its close.

A great sensation was produced when in 1859 the leading geologists in France and England gave their adhesion to the theory that certain flint implements found in the high-level river gravels of Northern France were of glacial age. The discovery of such implements, however, had been reported as early as 1842, by Boucher de Perthes, a physician residing at Abbeville near the mouth of the river Somme. Soon after, Dr. Rigillout of Amiens, forty miles farther up the river, having visited Abbeville and seen the discoveries there, began to find flint implements in similar situations in the high-level gravels near his home. In the course of a few years he had found several hundred specimens. Still the scientific world was incredulous until 1855, when Sir Charles Lyell, Sir Joseph Prestwich, Sir John Evans, MM. Pouchet and Gaudry visited the place and accepted the genuineness of the discoveries. Since that time the number of implements discovered has grown to enormous proportions — more than four thousand having been reported in 1890. For the last few years the collections have principally been made by M. Commont, principal of the schools of Amiens, whose publications upon the subject are of the highest value. As excavations are in progress near his own door, he is able to classify them into lower and higher according to their occurrence in different elevations of the bank, and to compare their relative stage of culture. The implements are all of chipped flint, made from nodules, which occur abundantly in the gravel. The ultimate origin of the nodules is the chalk which everywhere underlies the soil. There can be no doubt that the implements are the work of man. The age of the gravels, however, will demand closer attention.

At the present time, the river Somme is a small stream, flowing leisurely in a valley half a mile wide, and winding from side to side through a low flood plain. But on the margin of the trough, at Amiens and Abbeville, there are accumulations of gravel, marking a period of floods out of all proportion to anything that can now occur. These accumulations run up to a height of ninety feet or more. The manner of their formation, however, is something of a question. In the opinion of the early investigators the bottom of the valley was nearly at the level of the upper gravel at the beginning of the period of greater precipitation which accompanied the glacial conditions approaching from the north, while at the same time the gradient of the river was somewhat reduced by a depression of land about the headwaters of the stream. Between that time and the return of a warmer climate and the establishment of present conditions, they supposed the stream to have gradually eroded its trough down to the present level. This would of course imply an enormous lapse of time.[2]

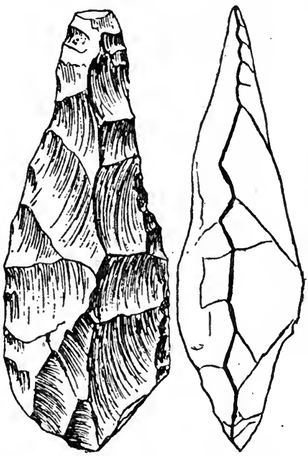
But closer examination of the terraces seems to show that they are not remnants of continuous strata of gravel reaching from side to side of the trough, but that they are accumulations of material deposited as " fans " during the period of excessive precipitation which characterized the Glacial epoch, and when perhaps the trough was occupied by stagnant ice, making them analogous to esker terraces, described later (p. 308).

The facts which more than any others delayed the acceptance of the genuineness of these discoveries at Amiens and Abbeville were that the implements were associated in the gravel with the bones of numerous extinct animals which had been supposed to belong to a geological age preceding the advent of man. Among the unfamiliar animals present with man on the banks of the Somme at that time were the mammoth, the woolly rhinoceros, the reindeer, and the hippopotamus, all of whose bones are found in the gravels of Amiens

Cut in the esker terrace in the Big Miami Valley, at Dayton, Ohio.
(Photograph by Mr. Ralph Wells.)

alongside of human implements. Of these the mammoth and the woolly rhinoceros have long been extinct, while the reindeer has retired to regions far to the north, and the hippopotamus to the lagoons of Africa.

Similar discoveries of flint implements in gravel deposits of corresponding character and age were soon reported from many other quarters, especially at Chelles, on one of the eastern branches of the Seine, near Paris. From the number and perfection of the specimens found there, a type of implements has been named "Chellean."



Chellean boucher. (Sollas.)

In England, also, numerous discoveries of similar character were made soon after. In the Thames we have a river whose headwaters, if not in the glaciated region, are so closely adjoining it that there was an overflow of glacial floods into it. For, as has been shown by Dr. F. W. Harmer,[3] the Scandinavian ice advancing over the eastern coast of England, obstructed the drainage of the Ouse and turned it into the headwaters of the Thames, thus providing the conditions implied by the extensive gravel terraces which flank all its lower reaches. A considerable portion of London is built upon the terrace, especially that which lies near the British Museum. This, according to Sir Charles Lyell, is from one to two miles wide, and traceable for a distance of fifty miles. The gravel varies from five to fifteen feet in thickness.

As long ago as 1715 a palæolithic implement was discovered by Mr. Conners in a gravel pit excavated at Black Mary's, near Gray's Inn Lane, London. This can now be seen in the British Museum, where it continues to testify to the identity of the races living in France, England, and America during glacial times. As in France so in England the bones of an extinct species of elephant were everywhere associated with the remains of glacial man.

At Biddenham, near Bedford in the valley of the Ouse, numerous well-developed palæolithic implements were found in the gravel terrace which borders the valley, and in close connection with them bones of the elephant, rhinoceros, and hippopotamus. The valley is here two miles wide and the gravel terrace reaches the height of ninety feet. The terrace in which the discoveries were made, however, was only thirty feet above the banks of the present stream.

A most remarkable discovery of implements of this age was made by Mr. John Frere in 1801 at Hoxne, near Diss, on the Waveney River in Suffolk County. So numerous were they that the "workmen emptied baskets of them into the ruts of the adjoining road before becoming aware of their value." As many as five or six to the square yard are said to have been found.

Other localities where similar discoveries have been made in England, are the valley of the Wey; near Guilford; near Whitstable in Kent; near Thetford and Bury-St. Edmunds in Suffolk County; near Salisbury in Wiltshire County; and on the borders of the Solent near Southampton.

More recently specially important discoveries have been reported of human remains at Galley Hill, in the valley of the Thames, and at Ipswich on the east coast.

The Galley Hill remains consist of a nearly complete skeleton, found by Messrs. Elliott and Matthew Heys in 1888. The skeleton was said to have been *in situ,* at a depth of more than eight feet, in Pleistocene high-level river drift, which there rises from ninety to one hundred feet above the Thames.

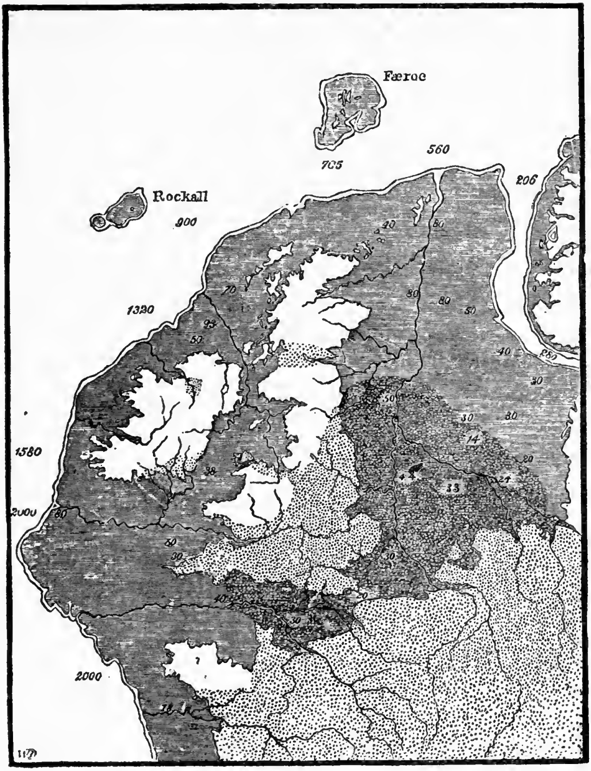
The Galley Hill deposits show about eight feet of gravel and sand at the surface, and underneath a clay deposit two or three feet thick. The skeleton was found in the clay deposit. This discovery assumes special importance from the fact that it furnishes the first skull which had been found actually in Pleistocene river gravels anywhere in England, or indeed, anywhere in Europe. But more than all, it is interesting from the fact that the skull is closely related to that of the modern European. It is dolichocephalic (long-headed) and has a capacity of 1,360 cubic centimeters, which is a good average for one of his stature. The cranial capacity of a number of distinguished modern scholars and statesmen is only slightly above this, Leibnitz's brain having a capacity of only 1,422 cubic centimeters, while that of Gambetta was still less.[4]

The Ipswich discovery was made October 6, 1911, by Mr. J. Reid Moir, who on that day was notified by Messrs. Bolton and Laughlin, local brickmakers, that one of their workmen while removing surface clay to reach the underlying gravel had encountered human bones. After the bones had been carefully removed and preserved, together with the matrix in which they were encased, three eminent geologists, Dr. J. E. Marr, F.R.S., Mr. W. Whitaker, F.R.S., and Mr. George Slater, F.G.S., were called in to examine the section. According to their report the skeleton was found four and one-half feet beneath the surface of the chalky bowlder clay, which is spread over East Anglia. The clay above the skeleton appeared in every respect the same as that which extended for some distance on each side of it, while the calcareous band underlay the skeleton and likewise extended indefinitely on either side. It was embedded partly in glacial sand, showing clear lines of stratification conformable with that underlying it, and partly in the bowlder clay. From this it would seem that there could be no reasonable doubt that the skeleton was in the original deposit and was not the result of an interment. It is hardly possible that these various deposits should not show signs of disturbance if there had been a burial, however long ago. The skeleton is that of a man about five feet ten inches in height. Judging from the skull fragments and the brain cast, Dr. Keith concludes that the head did not differ essentially from that of modern Europeans.[5]

On the Continent the remains of River Drift man have been reported in three important localities besides the valleys of the Somme and the Seine, namely at Helin, in the valley of the Lys, Belgium; at Mauer, in the valley of the Neckar, a few miles southeast of Heidelberg, Germany; and at Kiev on the Dneiper in Southern Russia. But as all these localities are outside of the glaciated region except the last, the accumulation of their gravel deposits took place under conditions very different from that of those which line the south flowing streams emerging from the glaciated area in North America. It will be best, therefore, at this point to enter into the particulars which have a bearing upon the age of the deposits. This is all the more important from the fact that most of the earlier investigators fell into serious error in the interpretation of the facts and so became instrumental in propagating extremely exaggerated estimates of the age of the human relics in question.

According to the theory of these early interpreters, as intimated above, the high-level gravel deposits in the valley of the Somme were laid down when the river was flowing on a bottom nearly a hundred feet higher than now, and the erosion of the lower portion of the valley has been accomplished during the Pleistocene (Glacial) epoch. As the bed of the Somme is now more than a hundred feet below the level of some of these implement-bearing gravels and the trough is about half a mile wide, this theory would imply an enormous lapse of time or an incredible activity of the eroding power of the stream. But later more extended and careful investigations have led to an entirely different interpretation of these river troughs and their bordering gravel deposits. According to present light the rock erosion of the streams in Great Britain and Northern and Western Europe was completed in preglacial time, when in Europe as in America there was an extensive continental elevation of the land.

Indeed, a map of Europe at the close of the Tertiary period would scarcely be recognized at the present time. Ample evidence has been given in the sixth chapter that Europe shared in the general elevation of land in the Northern Hemisphere preceding the Glacial epoch. But geologists are not altogether agreed as to the extent of this elevation. Dr. Warren Upham,[6] apparently with the best of evidence, supposes the preglacial land elevation of Northern Europe to have been from twelve to fifteen hundred feet. That the elevation was half that amount is generally accepted. Even this would be sufficient to lay bare the whole of the German Ocean (furnishing pasture land for the herds of elephants whose bones are dredged up from the present bottom) and to add to the continent a border of from fifty to one hundred miles in width to the west of Spain, France, and



Geography of Northwestern Europe in late Pleistocene age.

Ireland, — furnishing a passageway for the African Mammalia to rove as far north as the British Isles. Such an elevation would obliterate the Irish Sea and the Straits of Dover, as well as the German Ocean.

Soundings permit us to trace across these submerged plains the courses of the great rivers which then carried off their drainage to the ocean. The Rhine proceeded upon its majestic way northward to the Arctic Sea, being augmented by the Elbe, the Thames, and several other tributary streams, including one of great size from the region of the Baltic. The Seine conveyed the drainage of Northern France and Southern England far out to the westward of the English Channel and debouched through a deep gorge into the abyss of the Atlantic, a hundred miles beyond the furthest points of Brittany and Cornwall. At the same time the drainage from both sides of the Irish Sea, joined by that of the Bristol Channel, flowed parallel with the preceding and eroded a deep gorge through the border of the continental shelf a hundred miles southwest of Cape Clear.

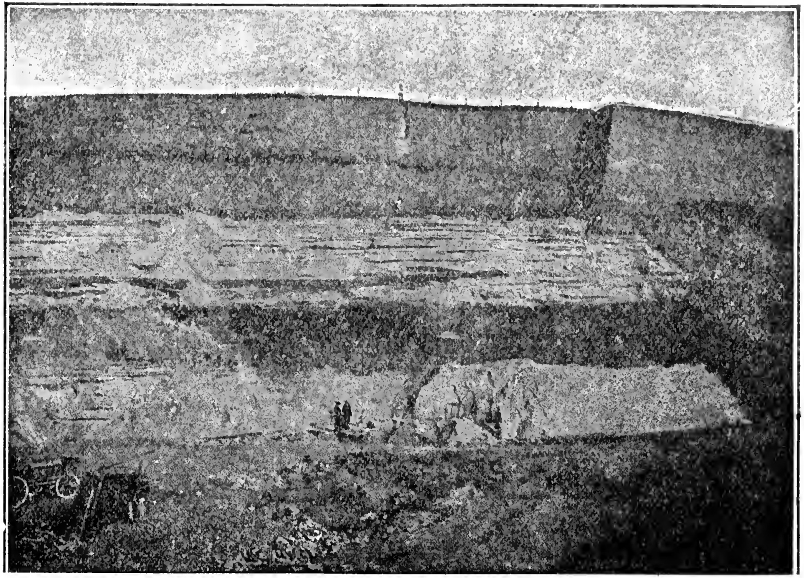
Farther south a wonderful submerged river course is traced across the continental shelf, westward from Cap Breton, running nearly parallel with the northwest shore of Spain. This seems to be a continuance of the river Adour. The depression has been accurately traced by soundings for seventy miles. An even more remarkable submerged channel across this shelf can be traced westward from the river Congo.[7]

This continental uplift produced significant results in the basin of the Mediterranean, separating it into two inland seas, obliterating the Strait of Gibraltar and exposing a broad isthmus stretching from Tunis across Sicily to the southern point of Italy, thus furnishing an easy passage for the animals of Africa to reach the southern shores of Europe and, ranging northward around the border of Spain, to pass with man into the fertile plains of France and Belgium and thence into the equally fertile pasture lands of Southern England and of the elevated rolling prairie lands extending across the bottom of the German Ocean.

It was during this slow continental elevation, continuing through the latter half of the Tertiary period, that the Thames, the Somme, the Lys, the Seine, and the Neckar eroded the rock gorges on whose borders occur the gravel deposits containing the oldest known relics of man in Europe. In this they are all in perfect analogy with the streams in the glaciated area of the United States. But, as already remarked, the gravel accumulations in the two countries took place under different conditions. In Southern England, Northern

France, and Belgium there was no active glacial ice, but it is quite possible, if not indeed probable, that stagnant ice filled the valleys and had much influence in determining the position of the gravel deposits. At any rate it is pretty certain that the climatic conditions which sent glacial ice southward to the vicinity of London, and which enveloped Switzerland and Northern Italy in one vast covering of ice thousands of feet in thickness, would not have been without its effect over the intervening area; for, the Glacial epoch was preëminently one of widespread increased precipitation, as well as of lower temperature. Some, indeed, have been in the habit of calling it the "pluvial" period. This great increase in the precipitation, coupled with the high elevation, furnishes us with the adequate cause for producing the peculiar gravel deposits whose age we are considering.

In all these instances the gravel is of local origin, that is, it is derived from the rocks which are in place in the drainage basin of the streams mentioned; while the river Somme, at Amiens, is joined by two tributary streams, the Noye and the Arve, — all three, flowing through a gently rolling country two or three hundred feet above the present level of the river at Amiens. The gravel accumulation so prominent at Amiens does not follow down the course of the stream in distinct terraces bordering the trough, as is the case in our American glacial streams, but is in the shape of "fans" deposited by the several streams as they reached the broader preglacial valley. Nor are the streams at Amiens well defined as one might be led to suppose from the earlier descriptions. Tylor, Ladrière, and others [8] have demonstrated that the Somme gravel and sand everywhere has a gentle slope from the sides towards the center of the valley, presenting a terrace escarpment only where marginal parts of these deposits have been later carried away by the undermining action of the present diminutive stream. Throughout this gravel there are, as already remarked, numerous indications that the streams which deposited it were at times gorged with floating ice, bearing rocks of considerable size which were deposited in the mass without having suffered appreciable trituration. Over all, both in the valley of the Somme and of numerous other streams in the region examined by M. Ladrière, there is a blanket of finer material, extending from the summit to the bed of the stream, which has accumulated by the action of much gentler agencies than those which deposited the gravel of earlier age. Indeed, Ladrière believes he is able to discriminate three stages in the accumulation, marking successive amelioration in the activity of the agen-



Gravel pit at Mauer. (From Sollas's "Ancient Hunters.")
(By courtesy of Macmillan and Co.)

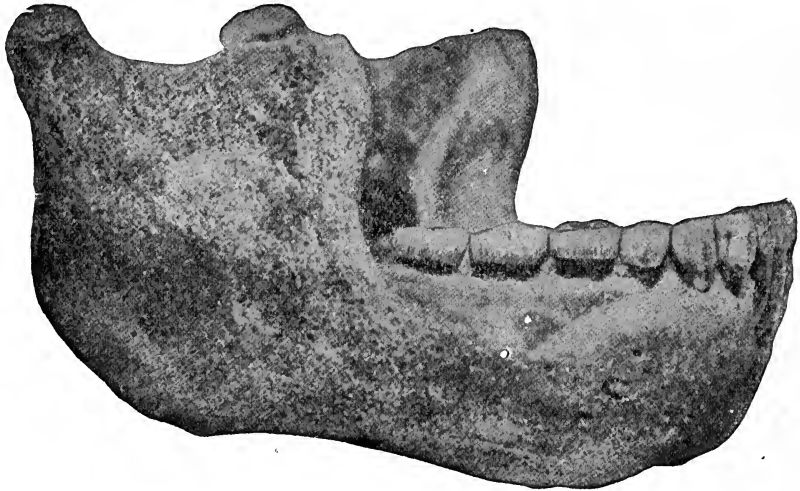
cies at work This is like the esker terraces observed in America which were formed by streams of water held in place by a barrier of ice which upon melting left high-level gravel deposits. (See p. 294.)

At Mauer and Helin in the valleys of the Lys and of a tributary of the Neckar we have apparently a simpler problem. Here would seem to have been great accumulations of gravel at the beginning of the "pluvial" period, completely filling the preglacial trough for a considerable distance, corresponding with those of American rivers at the close of the Glacial epoch, while later there has been deep erosion by the action of the streams when reduced to approximately their present volume, laying bare the strata in which remains of man have been found.

In none of these cases do we have any but the most imperfect means of making estimates concerning the time which has elapsed since the deposition of the implement-bearing gravel. For trustworthy estimates we are compelled to fall back upon the general considerations bearing upon the date of the Glacial epoch.

It is significant, however, that the implements found in these gravels are of a type that everywhere else are characteristic of glacial man; while the animal remains associated with the gravels are those which are characteristic of the Glacial epoch, and which, in the case of many species, became extinct during or soon after its close.

The discovery at Mauer is of special importance since it is that of a human jaw. It was made October 21, 1907, by Professor Schoetensack,[9] according to whom the specimen represented a new species which he named *Homo heidelbergensis*. But the evidence upon which it is deemed worthy to make this classification appears to be slight; for though the absence of chin suggests simian characteristics and "the neck constriction is very slight, approaching in this respect the anthropoid form, the teeth have a distinctly human stamp, not only in their general appearance, but also in point of size — larger than the average, but smaller than in exceptional cases to be found among the Australians." The jaw occurred beneath eighty feet of stratified sand and gravel in the valley of the Elsenz, a tributary of the Neckar, which joins the Rhine at Heidelberg. Of the probable manner and period of the deposition of these gravels we have already treated in connection with the deposits in the valley of the Somme. The great antiquity of the skull is confirmed by the occurrence in these gravels at Mauer of the bones of extinct species of the elephant, rhinoceros, horse, and bear, together with bones of deer, bison, and beaver, which now are found farther north.



Side view of lower jaw, found at Mauer. The dentition is completely human, and, according to Sollas, "in some respects less simian than that which can sometimes be observed in existing primitive races, such for instance as the Australians." (By courtesy of Records of the Past.)

At Helin, near Spiennes, on the river Lys, Belgium, M. Rutot reports the occurrence of numerous flaked implements made from flint or brown chert, deeply buried in Pleistocene gravels. The implements are mostly scrapers and rude knives, with some hammer stones; but there was an absence of anything which had the appearance of weapons. The Lys, like the Somme, flows through a broad valley, the floor of which is from three to five hundred feet below the general level of the country. The gravels in which the implements are found are upon the side of the valley, and less than two hundred feet above it. These constitute what Rutot calls the fourth terrace, numbering from the top. But there is nothing definite to indicate their age. Here, again, as in so many other cases, the antiquity of man is dependent upon our interpretation of the general evidence bearing on the chronology of the Glacial epoch and upon our general theories concerning the progress of evolutionary forces in the production of the changes which mark the development both of animals and man.[10]

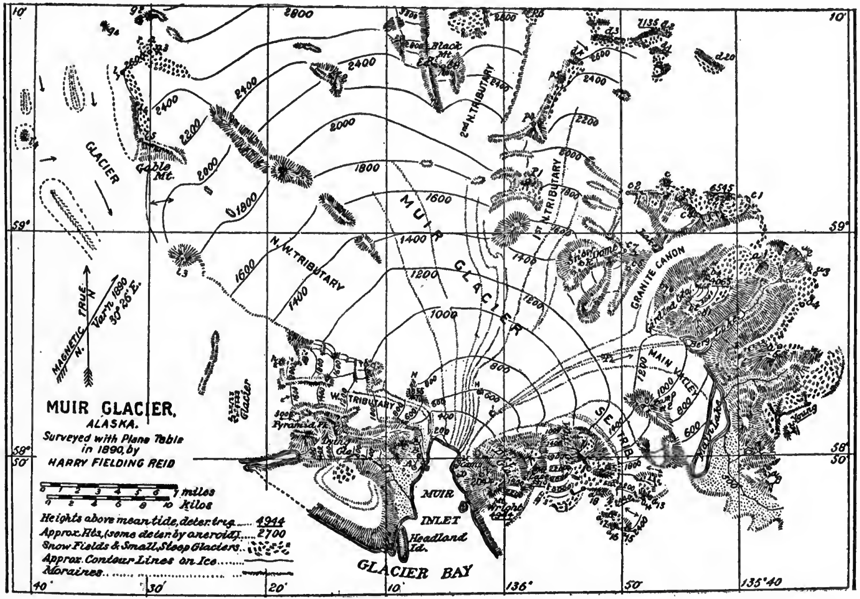
The discovery at Kiev, on the Dnieper, in Russia, was made in 1893 by Professor P. Armaschevsky. At this place the summit of the high bordering bluff is 350 feet above the river. The upper fifty-three feet of the bluff consists of typical loess, breaking off in perpendicular fractures. Beneath this body of loess and resting on the original glacial deposit containing Scandinavian pebbles there were found "instruments fashioned from pieces of flint, larger or smaller knives, scrapers and points with all the characteristic indications of the work of man's hand. The nuclei or cores of flint, from which fragments have been detached, were so numerous that they had accumulated in heaps. The flint implements were accompanied by a large quantity of mammoth bones, especially of their means of defense, their molar teeth, the bones of their fore- and hind-feet, apparently from at least five individuals. Several of these bones show distinct evidence of having been broken with the aid of sharp-edged instruments. At the same time a number of objects were found testifying to the use of fire, as a quantity of partly charred wood proves, some pieces of wood and half burned bones, as well as two blocks of granite, which had been submitted to the action of fire. All these objects were found here in such abundance that the charcoal, small bones and fragments of flint formed two thin beds in the sand called the 'bed of human culture.'"[11]

Five other places in European Russia are mentioned by Professor Armaschevsky as furnishing similar objects in early Pleistocene deposits. These are as follows: "1, at the village of Gontsy, Loubny district, province of Poltawa; 2, at the village of Karatcharowo, Mourom district, province of Nijni-Novgorod; 3, at the village of Kostensk, province of Woronéj; 4, in the neighborhood of the village Stoudénitsy, Podolie; 5, in the vicinity of Kamenets-Podolsk. The principal ones are those of Gontsy and Karatcharowo, also considered under the geological report. Heaps of objects shaped from fragments of flint have been found there by the side of charcoal and mammoth bones in a bed of loess, but at a depth of not over four feet." [12]

According to Professor Armaschevsky it is probable that at the time of these deposits, Central Russia "was still covered by its mantle of ice and southern Russia had a climate cold enough to be favorable to the existence of the mammoth, rhinoceros, and musk ox." [13]

From Siberia, also, come reports of the remains of man associated with the bones of the mammoth buried deeply beneath the surface. In 1896 Professor Kaschenko had found "remains of a mammoth twelve feet below the surface of a cliff which stands 136 feet above the present level of the river Tom. Only a few small bones of the skeleton were missing, and with it were associated thirty flint knives, besides scrapers and about one hundred flakes. The large bones were split in the usual way for the extraction of the marrow, and there were other clear indications of the presence of man. . . . The position and various other circumstances exclude any recent data for the find." [14]

We must not omit to notice the account given by Professor Albrecht Penck of the occurrence of palæolithic implements in a cavern at Wildkirchli, Canton Appenzell, Switzerland. As early as 1861 Rütimeyer announced the presence of bones of the cave bear in the floor of this cavern, but it was not until 1903 and 1904 that stone implements were discovered by Bächler. The recent deposits underlying the floor were found to be about fifteen feet thick, and to cover an area of several hundred square yards. In the portions of this accumulation already explored the bones of two hundred individuals of this species had been found. They occur at all levels below the upper two feet, and are everywhere accompanied by implements, both of stone and bone. The material from which most of the implements were made had been brought up from the valley one or two thousand feet below, while a few made of greenish flint must have come from a distance. The implements all displayed crude workmanship. Professor Penck fixes the period of



In 1906 the front had retreated to the 1000-foot line. See above page 204.

the prehistoric occupation of the cave at a time preceding the Würm glacial episode, corresponding to the Wisconsin episode in America. During this episode the snow line, on the Alps, descended nearly a thousand feet below the level of the cave, hence it is evident that it could not have been occupied then. As the animals associated with man in the cave are those which characterize the middle part of the Glacial epoch, it would seem certain that the occupation took place during an interglacial episode, separating the Riss episode of advance from the Würm, this corresponding to that between the Illinoisan and the Wisconsin in America. The sterile layer, nearly two feet thick at the top of the floor, represents the accumulation since the close of the Glacial epoch.[15]

But in estimating the lapse of time since these periods, Mr. Penck makes assumptions which are not supported by our observations in America. Penck estimates thirty thousand years for the post-glacial period and as much more for the continuance of the Würm or Wisconsin episode of advance, and thus would fix the date of these accumulations as one hundred thousand years ago. But the evidence in America indubitably shows that post-glacial time cannot be extended for more than ten thousand years; while abundant evidence comes from the Alaskan glaciers of a rapidity, both in the advance and the retreat of glaciers, which throws all ordinary calculations out of account. The evidence which I advanced in 1886, showing that the great Muir Glacier in Alaska had retreated twenty miles in a hundred years, and that during the same time the thickness of it in the upper part of Muir Inlet had diminished more than three thousand feet has been amply supported by all subsequent investigations. Indeed, the front of the glacier, a thousand feet thick when I was there in 1886, retreated in the following twenty-four years seven and one-half miles, carrying it back to a point where at the time of my observations the surface of the glacier was a thousand feet thicker than it was at the front at that time. Nearly all the glaciers in that region have retreated to a corresponding extent. In short, the observations upon Alaskan glaciers during the last twenty-five years show that we are so ignorant of the causes of the climatic changes which are now going on that we are utterly unable to establish any rate for the growth and decay of such gigantic ice streams as now exist in Alaska, and formerly existed in Switzerland. It is far more reasonable to *guess* that the interglacial period during which man inhabited the Alpine cavern under consideration occurred fifteen thousand years ago, than it is to *guess* that it was a hundred thousand years ago. No offhand estimates concerning such dates can have any value which do not take into account the facts brought to light by our observations in America.[16] (See accompanying map and illustrations on pp. 202, 203.)

The establishment of the existence of man during the River Drift period, in the valley of the Somme in 1859, and of his association with a large number of extinct animals, at once gave new interest to the discoveries that had been made of a similar coëxistence in the remains found in numerous prehistoric caves in England and on the Continent.[17]

Kent's Hole, near Torquay in Devonshire, had been carefully explored in 1826, by Rev. J. MacEnery, a Roman Catholic priest, residing in the vicinity. But owing to his premature death, and to the incredulity with which his reports were received, his discoveries were not published until 1859, when a cave at Brixham, in the neighborhood, was explored by Mr. Pengelly, under the supervision of a number of eminent members of the British Association for the Advancement of Science. The facts concerning the Brixham cave being so similar to those from Kent's Hole, there was no longer any doubt about the genuineness of Mr. MacEnery's discoveries, which had been so carefully recorded by him thirty years before.

These caves had been resorted to for shelter by man from the earliest time of his existence to a comparatively recent period. In the soil forming the surface of the floor, which was only a few inches deep, were found Roman pottery, iron and bronze spearheads, polished stone weapons, mingled with the bones of various domestic animals, including the horse. Below this was a stalagmite floor, from one to three feet thick. Under this was a compact deposit of red earth from two to thirteen feet thick. Implements of flint and bone abounded in this stratum, mingled with the bones of the cave bear, the cave lion, the mammoth, the woolly rhinoceros, the wild ox, the horse, the Irish elk, and the reindeer. Flint implements were also found in a brecciated deposit still below this.

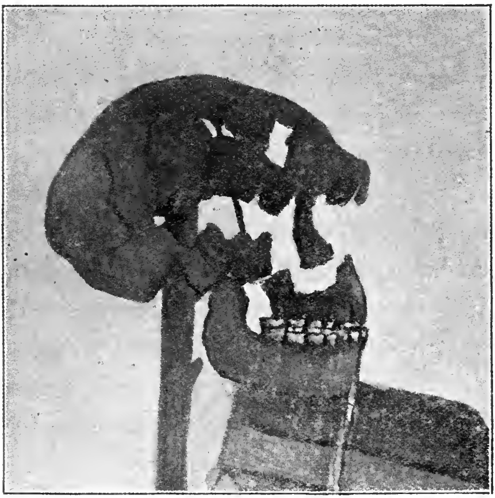
A cave at Wookey Hole, near Wells, in Somerset, explored by Professor Boyd Dawkins, yielded a large number of palæolithic specimens, together with an enormous number of the bones of the extinct animals just mentioned. At Cresswell Crags, in Derbyshire, other caves were equally prolific in the remains of man and his congeners of the Glacial epoch. In one of these there were found also the bones of the Machairodus, a tiger which originated in the Tertiary period, and became extinct in prehistoric times.

But it is not necessary to multiply details. The caves of Southern England bear abundant testimony to the existence of a prehistoric race in Great Britain, contemporary with the River Drift man of the eastern counties and of Northern France.

On the Continent, discoveries of human remains attributed to this same age began to be made in the year 1700, in caverns at Canstadt, a small village near Stuttgart, in Württemberg, where at that time a skull of a very primitive type was found associated with bones of the extinct animals, which later were found to be characteristic of the Glacial age. Little was thought of this until the discovery by Dr. Schmerling of a similar skull in the cave at Engis, a village on the left bank of the Meuse, about eight miles above Liege, in Belgium. There were here also the same associated remains of extinct animals, that had been noted in the high-level river drift deposits, and in the caves of England and Canstadt.[18] The shallowness of the skull and the projecting eyebrows presented such a similarity to the skull of an ape that its great age was at once assumed, and the "Engis skull" became the common designation of that of primitive man. But as the skull at Canstadt had been discovered earlier, the Germans claimed the name by right of priority, so that we now speak of the Canstadt race as one of the most primitive in Europe.

But Germany was destined to produce a still more genuine type of what was supposed to be the primitive race, in the Neanderthal skull discovered in 1857 by some workmen in the valley of the Neander, a small stream tributary to the Rhine near Düsseldorf.[19] This was long supposed to be the most apelike human skull that had been found. The jaw, however, was absent. But notwithstanding the apelike appearance of the skull its capacity was estimated by Huxley to be 1,250 cubic centimeters, which is far above that of the highest apes, and equal to that of the average capacity of Polynesian and Hottentot skulls. Later estimates of the Neanderthal skull, however, bring its capacity up to 1,600 cubic centimeters, which is more than that of the average European at the present day. Though there was little to connect the Neanderthal skull with the Glacial epoch except its supposed low character, it has been so much discussed that it stands as the best known representative of primitive man. Huxley pronounced it the most apelike of all skulls that had been discovered in his day.

A far more important discovery, however, was that made in 1886 by Messrs. Fraipont and Lohest at Spy, in the province of Namur in Belgium.[20] Fortunately in this case there were two complete skeletons, a male and a female, and the jaw bones and most of the other part of the body framework were still intact. Fortunately, also, the cavern floor had not been disturbed until it was subjected to strict scientific observation. In the underlying deposits there were three distinct beds containing bones, separated by strata of stalagmite. In the upper stratum modern implements only were found. In the second stratum implements



Skull of the Man of Spy. (Photograph by Mr. S. Prentiss Baldwin.)

of ivory occurred and some fragments of pottery, together with the characteristic bones of extinct species of glacial animals.

The skeletons occurred in the lowest bed, and were associated with abundant remains of rhinoceros, mastodon, cave hyena, and other extinct animals. Flint implements were also found, but they were of the so-called " Mousterian " type, supposed to belong to the middle of the palæolithic period. The discussion of the characteristics of these skeletons must also be deferred to the chapter on the physiological argument.

A still more important field for investigating the state of early cave man is found in Southern and Central France, especially in Dordogne. The most important of all discoveries in this region seems to have been that of considerable portions of a human skeleton found in 1908 by Abbés J. and A. Bouyssonie and L. Bardon.[21] The cave is situated near the village of La Chapelle aux Saints, about fifteen miles south of Brive in the district of Corrèze. The fragments include the cranium and lower jaw, which closely resemble the same parts in the man of Spy. But while the lower jaw is remarkable for its size, and the frontal projections over the eyes are unusually prominent, the capacity of the skull is estimated at 1,626 cubic centimeters, which, as we have said in connection with the Neanderthal skull, is somewhat more than that of the average European of the present day. There is nothing to indicate the glacial age of this skeleton, except its association with the rude stone implements, and the remains of the bison, reindeer, horse, and rhinoceros, characteristic of that period.

Another important discovery was made in Dordogne by Herr O. Hauser, in 1908, in Combe-Capelle, near Mont Ferrand-Périgord. This was of a nearly perfect skeleton, associated with palæolithic implements; but the skull was dolichocephalic and of the average capacity of modern skulls, resembling in many respects that already described as having been found at Galley Hill, near London.

So far we have not paid attention to the minute classification of palæolithic implements which has been attempted, and by which their age is thought to be determined by the character and relative perfection of the implements themselves. We have felt it the less important to do this from the conviction that such evidence of age is of little value compared with that which is derived from the actual geological position in which they are found. The implements upon which this classification is based largely come from caverns outside of the glaciated areas, where the geological evidence is not available. However, the association of these various classes of implements with animal remains characteristic of the Glacial epoch fixes their position with reasonable certainty.

The palæolithic series is provisionally divided by Professor Sollas [22] into three groups — an upper, a middle, and a lower. And these are subdivided into stages as follows:

Upper Palæolithic	Magdalenian	stage
	Solutrian	"
	Aurignacian	"
Middle Palæolithic	Mousterian	"
Lower Palæolithic	Acheulean	"
	Chellean	"
	Strepyan	"
	Mesvinian	"

"The Mesvinian implements are mostly simple flakes of flint or brown chert, roughly shaped and irregularly chipped at the margin. . . . The absence of any forms which could have served as weapons is worthy of note."

"The distinctive character of the Strepyan industry, according to M. Rutot, is that all the implements retained a considerable part of the original crust of the flint nodule from which they have been fashioned."

But I have myself at Amiens obtained implements with this characteristic.

The Chellean implements are dressed by flaking on both sides forming an edge which presents a wavy line, and having commonly somewhat the shape of an almond. This implement is called by Professor Sollas a "boucher," and is evidently shaped to be held in the hand, and to be used without the intervention of a haft. Indeed, M. Commont insists that the thick butt end was evidently fitted to accommodate the thumb and fingers as it was held in the hand. It has been frequently remarked as singular that few of the Chellean implements of this sort show signs of use, but held in the hand it would be a deadly weapon in contending with either man or beast. Implements of this sort were very widely disseminated during the Glacial epoch, being found all over Western Europe and in America.

The Acheulean implements differ so little from the Chellean that it is difficult to draw a dividing line between them, but in general they are flatter and lighter and the flaking is not so coarse.

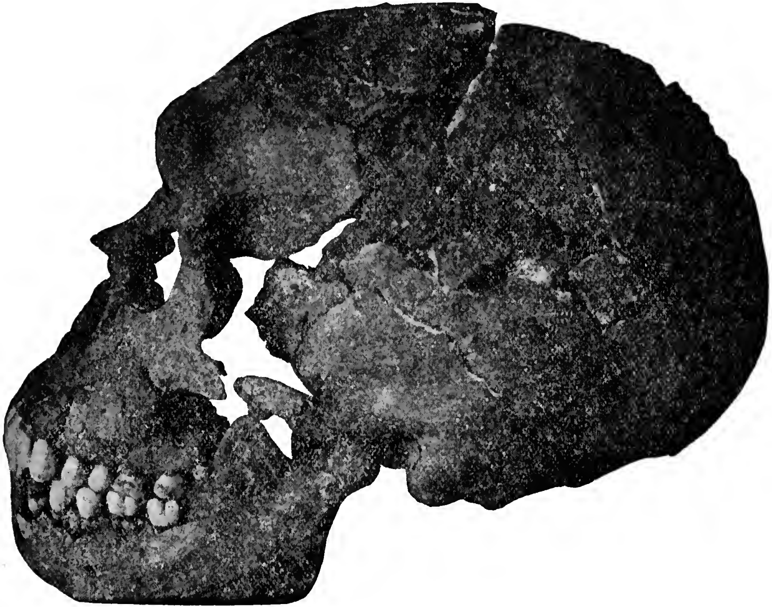
The Mousterian stage is characterized by implements made for the most part from simple flakes struck off from a core which had been trimmed to a convenient shape for producing those of the right shape and size. These flakes were then trimmed so as to give a rounded outline to the base and to reduce the edges where they were too fragile. The large implements (" bouchers ") fitted at their bases to the whole hand, so characteristic of Chellean industry, are almost wholly absent from the Mousterian deposits. The flakes struck off from the boucher often had a close resemblance to the Mousterian form. Skillfully made scrapers are also characteristic of the Mousterian age. The edges of these were often notched so that they could be used as saws. Occasionally also a lance head is found, notched near the base to permit its being fastened to a shaft by a ligature.

The period takes its name from the cave of Le Moustier in the valley of the Vézère, Dordogne. Implements of this character are found for the most part in caves, though they occur to some extent in river gravels, from which some geological evidence is derived concerning their relative age. This, however, does not seem to be of any very definite value. It should be stated, however, that implements supposed to be characteristic of the lower stages already described are not altogether absent from the caves principally characterized by the presence of Mousterian implements.

The animal remains of the Mousterian stage are similar to those of the previous stages, except that the hippopotamus and a species of rhinoceros and of elephant supposed to belong to a warmer epoch, have disappeared, and mammoth remains have become predominant. The remains of the northern reindeer, and the musk ox, which now inhabits Northern Greenland, also occur; likewise of the arctic fox, the arctic hare, the chamois, and the lemming. But it is important to notice that with these animals now confined to cold regions are associated remains of the lion, hyena, and leopard now living only in warmer regions.

Probably the most important relic classified as of Mousterian age is the human skull found near the village of La Chapelle aux Saints, already referred to. This skeleton was surrounded by a great number of well-worked Mousterian implements. Here also, a year later, another skeleton of similar character was found.

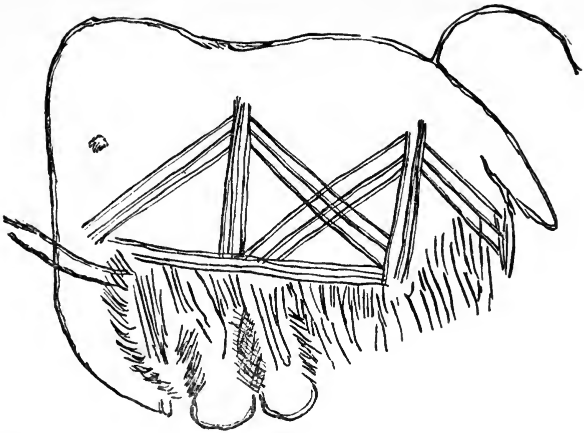
These skulls so closely resemble the Neanderthal skull and the one found at Spy, near Liege, in Belgium, in 1885, that they may be properly classed together as of Mousterian age. But it would be unwarranted to consider them as the sole representatives of the Mousterian age, since there is much evidence of the existence of other races in deposits equally old. It is interesting to notice, also, that after extensive com-



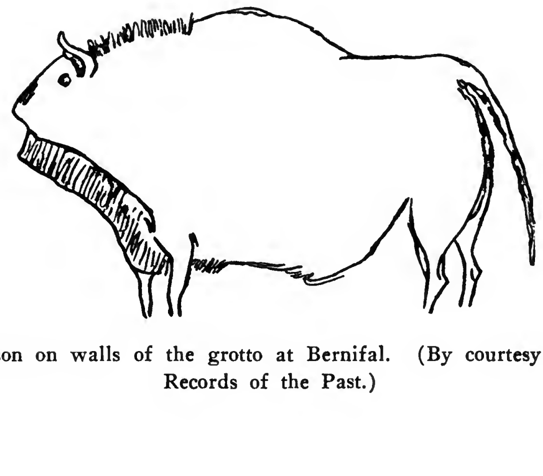
Man of La Chapelle aux Saints. (By courtesy of Records of the Past.)

parisons, both of skeletons and implements, Professor Sollas finds that there is a close resemblance between the present races of Australia and the Mousterian cave dwellers of Europe in glacial times so that he speaks of the Australians as "the Mousterians of the Antipodes."[23]

The upper division of the palæolithic age of man is divided, as already said, into three stages, the lower of these the Aurignacian, named from the town of Aurignac, in the department of the Haute-Garonne near the foot of the Pyrenees Mountains, where the discovery of the sepulchral cave was made in 1852. The implements classed as of Aurignacian age show a marked improvement in the art of working flint, while for the first time bone implements of various kinds become frequent. But more important than all, skillful drawings of various animal forms were found in a cave of this age at Altamira, some of which were colored with pigments of red, brown, black, and yellow. Sketches in black and white, showing marked skill, were found in various other caverns soon after. These drawings and sketches represent the bison, the deer, the horse, the mammoth, and various fishes, together with numerous fantastic imaginary forms. Numerous figurines showing great skill in carving, were also found, some of which were made from stone and



Mammoth on walls of the grotto at Bernifal. (By courtesy of Records of the Past.)



Bison on walls of the grotto at Bernifal. (By courtesy of Records of the Past.)

others from ivory. The head is usually absent from these. One cannot fail to be struck with the resemblance of one of these, the Venus impudica, carved from ivory, to the Nampa figurine found beneath the volcanic formations in the Snake River Valley, in Idaho, of which an acount has been given in a preceding chapter. (See p. 268.)

The animals in all three stages of the upper palæolithic period are notably different from those of the preceding stages. From this it is inferred that the climate had considerably ameliorated during the transition from the Mousterian to the Aurignacian stage. Bones of the reindeer are rare, while those of the horse, the cave lion, and the hyena are abundant. It is also to be noted that remains attributed to the Aurignacian stage are frequently met with in the open country buried in deposits of loess.

The second stage of the upper palæolithic epoch, the Solutrian, shows a still greater advance in the manufacture of flint implements of all sorts, as well as in the fashioning of bone and ivory, while an occasional carving is found upon bones. The horse was the prominent animal of this age. About some of the caverns in France the bones of the horse were found in immense quantities, indicating that this animal was a favorite source of food, — the piles of bones surrounding the caverns appearing to be refuse heaps similar to the kitchen middens.

The Magdalenian stage, with which the palæolithic epoch closes, followed closely upon the Solutrian, but instead of there being an improvement in the type of stone implements there was a marked decadence. On the other hand the implements and weapons of bone, deer's horn and ivory show a very marked improvement. Arrowheads and spearheads now appear, with barbed harpoons and evident arrangements for fixing them upon shafts, while skillful drawings of animal forms occur on many of their ivory implements, and domestic utensils occasionally appear, and numerous objects designed as ornaments. Of the animals figured upon their implements and weapons we find the reindeer, the Irish deer, the bison, horse, ass, musk ox, saiga, antelope, glutton, arctic hare, and lemming, indicating a colder epoch than that which preceded it. Of the animal remains those of the horse are much less numerous than they were in the Solutrian stage, but those of the reindeer have increased so much that it has been called the " reindeer age," indicating, as it is thought, that a subarctic climate characterized the period in Europe.

CHAPTER X

SUPPOSED EVIDENCE OF TERTIARY MAN

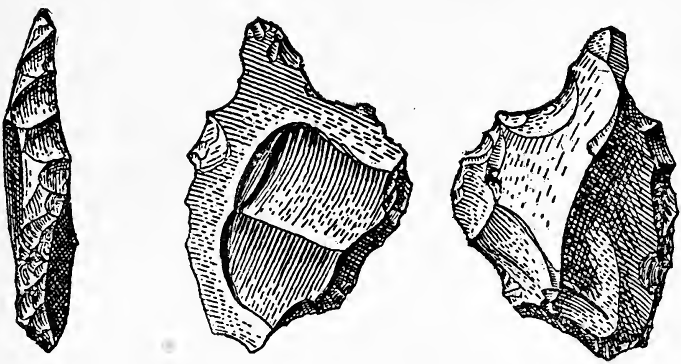
WHILE the Glacial epoch was, as we have seen, of relatively short continuance, and characterized by abnormal rapidity in the earth movements and consequent climatic changes, the Tertiary period was one of long continuance (from fifty to one hundred times that of the Glacial epoch) and was characterized by comparatively stable conditions, slower earth movements, and relatively uniform climatic conditions. In short, the Glacial epoch was a catastrophe resulting from the culmination of the effects of slow moving causes leading up to it in the latter part of the Tertiary period, when the vast continental uplifts of which we have spoken were taking place, not merely in the Northern Hemisphere but in the whole world.[1] The question, therefore, of the existence of man far back in the Tertiary period is one of supreme importance and interest. Space, however, will not permit us to give more than a brief summary of the discussions of the subject which have been carried on during the last quarter of a century.

The evidence for the existence of Tertiary man mostly centers in certain rude chipped pieces of flint which have been found in undisturbed strata of supposed Tertiary age. The instances of human bones thought to have been found on the Italian coast in Tertiary formations proved to be interments, and so were long since left out of the question. Likewise, cuts or breaks in animal bones of Tertiary age, originally supposed to be the work of man, are now all accounted for by natural movements of the soil enclosing sharp substances like fractured flint, or as having been marked by sharks' teeth, whose fossil remains occur in connection with them.

But in 1867, and later, the Abbé Bourgeois discovered a large number of chipped flint flakes in Tertiary deposits at Thenay, near Tours, France. These, however, were all of small dimensions, so small, indeed, that it was difficult to imagine any use which they could have served. The deposit containing these objects is classed by geologists as Miocene, or middle Tertiary.

A little later, in 1871, M. Ribeiro began to discover chipped flints in a lacustrine deposit of Miocene age at Otta in the Tagus Valley, not far from Lisbon. The distinguished anthropologist G. de Mortillet regarded the flints as chipped by design; but did not attribute them to an existing species of man (*Homo* *sapiens*), but to a semihuman precursor, who had just wit enough to pick up a stone and use it for some temporary purpose, as apes have been known to use stones for the purpose of cracking cocoanuts. But after an extended canvassing of the subject the majority of anthropologists have concluded that in both cases the chipping of these flints is natural and not artificial, having been produced by the friction and impact connected with the irregular settling of strata in which they occurred, or by the variations in temperature when exposed to the hot rays of the sun by day and to the chilling frosts by night.[2]

Again, in 1877, Mr. J. B. Rames discovered chipped flints in middle Tertiary deposits at Puy Courny, near d'Aurillac, in the department of Cantal, Auvergne.



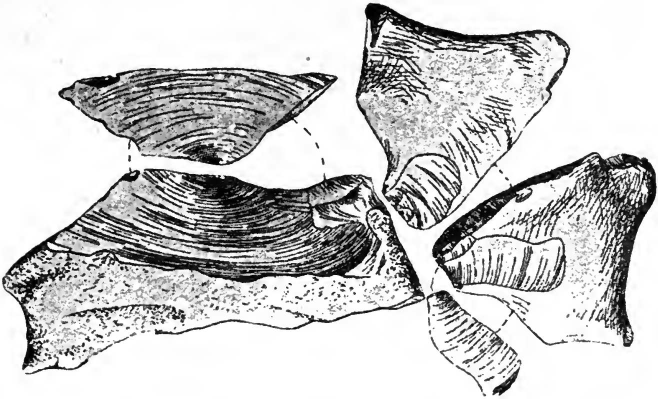
An eolith from Puy Courny. (After Mayet, *L'Anthr.*, natural size.)

The age of the deposits was established by the presence of the remains of extinct mammals characteristic of that period. The only question of dispute relates to the artificial character of the flints. The contest upon that point was as vigorous as that concerning the discoveries at Thenay and Otta, no less authorities than Quatrefages, Rutot, and Mortillet maintaining their artificial character.

In 1885, Mr. B. Harrison, of Ightam, in the valley of the Thames, a short distance below London, brought to the notice of Professor Prestwich a number of chipped flints which he supposed to be of artificial origin, but which undoubtedly dated from far back in the Tertiary period. At any rate the amount of valley erosion which has taken place since the formation of the deposits in which these flints occur has been enormous as compared with post-glacial erosion. To indicate their apparent age the name "eolith" has been invented, and that will be the word hereafter used in referring to them. The age of the eoliths is inferred not only from their position but from their primitive appearance. According to Prestwich, the eoliths are almost all more or less stained like the broken drift flints with which they are associated; they generally show considerable wear, as though they had been knocked about; the trimming is also often very slight and has generally been made on the natural edges of broken flints which were picked up on the surface. Thousands of these eoliths have already been found in England, in twenty-five or thirty localities, in deposits far above those of the River Drift period.

But in the last few years the discoveries of Professor A. Rutot [3] have largely monopolized attention. These have been chiefly made in the Tertiary plateaus, or terraces, bordering the various streams in Belgium, where he finds a sharp distinction between the eoliths occurring in Tertiary deposits and a higher order of implements in the overlying Pleistocene strata.

But it would now seem that the evidence for the artificial character of the chippings on eoliths is insufficient to establish their genuineness. Further observations and experiments have shown that chippings of such a character can be, and are, the results of natural forces.[4] Mr. S. Hazzledine Warren has exhibited flints of a newly mended road broken by cart wheels, which closely resembled eoliths, showing that where a small pebble lies against a larger fragment a force coming upon the two forms a notch, the edge of which is later subject to secondary flaking, producing a form closely resembling the hollow scrapers frequently presented as eoliths. Two adjacent peb-



Associated fragments of flints from the Thanet sands of Belle-Assize (Oise) produced by flaking *in situ.* (After Breuil, × about 1-2.) (From Sollas's "Ancient Hunters.")

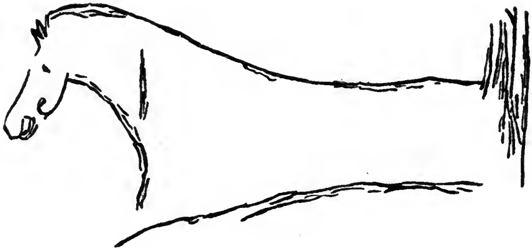
bles may produce a double notch, leaving between what would be classed as a boring point. The irregular settling of superincumbent beds is sufficient to provide the force necessary for producing these effects. M. Commont, of Amiens, figures examples where such forms have been actually produced by the natural pressure of the soil. Furthermore, M. Boule has collected from a revolving mass of chalk and clay, which is being mixed for the production of cement, any number of forms of flint possessing all the characteristics of eoliths. The flint nodules contained in the chalk are subjected to a succession of violent impacts in the mass, which is kept in motion for twenty-four hours, with a velocity at the outer edges of twelve or fifteen feet per second, about that of a river flood. After the mixture is completed the mud is drawn off and the flints remain.

But notwithstanding these results of Boule's experiments, the artificial character of eoliths was still maintained by Rutot and his followers. Within the year past, however, Abbé Breuil [5] has apparently been able to give a finishing touch to the evidence discrediting the artificial character of the eoliths. We will content ourselves with quoting the summary of this evidence as given by Professor Sollas. "These [eoliths] were found by the Abbé Breuil in Lower Eocene sands (Thanétien) at Belle-Assize, Clermont (Oise). M. Breuil shows in the most convincing manner that they all owe their formation to one and the same process, *i.e.* to movements of the strata while settling under pressure of the soil. The flint nodules crowded together in a single layer are thus squeezed forcibly one against the other, and flaking is the inevitable result. As this process has been active during a very long period so the eoliths have been produced at very different dates, some are ancient and these are distinguished by a dense patina, others are recent and the fractured surfaces of these are perfectly fresh, without even incipient patination. In many cases the flakes are still to be found in connection with the parent nodule, lying apposed to the surface from which they have been detached. They display just the same forms as other Tertiary 'eoliths,' ranging from the obviously purposeless to those which simulate design and bear bulbs of percussion and marginal retouches. Among the most artificial looking are a few which

a *a'* *b* *b'*

Naturally formed flint flakes from the Thanet sands of Belle-Assize. (After Breuil, nat. size.) (From Sollas's "Ancient Hunters.") (By courtesy of Macmillan and Co.)

present an astonishing degree of resemblance to special forms of genuine implements; attention may be directed to two in particular, which are compared by the Abbé Breuil, the one to Azilio-Tardenoisian flakes, and the other to the small burins of Les Eyzies; in their resemblance to artificial forms these simulacra far transcend any 'eoliths' which have been found on other horizons of the Tertiary series. On the important question of man's first arrival on this planet we may for the present possess our minds in peace, not a trace of unquestionable evidence of his existence having been found in strata admittedly older than the Pleistocene."



Horse on walls of the grotto at Bernifal. (By courtesy of Records of the Past.)

CHAPTER XI

GLACIAL MAN IN CENTRAL ASIA

THE fact that man has penetrated and become a denizen of every portion of the land surface of the earth raises most important and interesting questions concerning the place of his origin and the probable routes of his dispersion. As preliminary to the immediate subject of this chapter it will be profitable, therefore, to give a general summary of what is known concerning the routes of early migration open to the human race. For light upon these questions we may turn with considerable profit not only to the well-known recent changes of land levels in the Northern Hemisphere, already noted, but also to the limitations of the habitat of plants and animals with which he has been associated. (See pp. 168, 301.)

One of the most obvious facts concerning the distribution of plants and animals is that the species which are most alike are distributed around the world in the Northern Hemisphere where the land contours approach nearest to each other, and the oceans are so shallow that a moderate elevation would join the continents and furnish natural routes for migration.

It is thus that we have an arctic realm and a north temperate realm circling the whole earth. But as we proceed southward where the projecting portions of continents become farther and farther separated from each other, the species of plants and animals become more and more dissimilar and more and more ancestral in their forms. But the range of many animals and plants in the Northern Hemisphere is such that we are compelled to suppose great changes in land levels to account for their original migration. One of the most perplexing instances is that of the reindeer, which are distributed over the northern parts of Europe, Asia, and America, and are so closely alike that no specific differences between them can be detected. Yet not only are these animals found upon the continents now separated by Behring Strait, but upon the island of Greenland, which is separated from the continents by a still more impassable barrier. Large colonies of this remarkable animal exist in Southern and Eastern Greenland, separated from those in the northern part of the island by the icy barriers of Melville Bay and of Humboldt Glacier, which would seem to render migration under present conditions impossible. To account for this distribution it must be supposed that there was, in comparatively recent times, an elevation of land which connected Greenland with North America or with Europe or with both. To accomplish this result the elevation would have to amount to four or five thousand feet. Such an elevation over the region north of the sixtieth parallel would not only establish broad land connection with Europe and America, but lay bare great areas over which vegetable growths would spread to furnish feeding ground for the immense herds of animals that at one time frequented the arctic zone. So great an elevation as this in late Tertiary times is by no means out of analogy with the general facts already referred to concerning earth movements. Late Tertiary elevations all along the western coast of the Americas and throughout Central Europe and Asia, amounting to ten or twelve thousand feet, are familiar facts in geological history. It should be noted, also, that the present elevation of the central portions of Greenland is largely, if not wholly, due to accumulations of snow. It is quite probable that if the glaciers were removed from Greenland there would be left nothing but an archipelago, with scattering islands in the interior and disconnected mountains of low elevation on the eastern and western borders.

As already shown, an elevation of less than one thousand feet would obliterate Behring Strait, and join Alaska to Siberia by a broad belt of land covering a large part of Behring Sea. A similar elevation would lift above water level a border of considerable width extending all along the Pacific coast of North America and even to the end of South America, while on the Eastern continent it would obliterate the German Ocean and the Strait of Dover and extend the border of Northwestern Europe far out beyond Scotland and Ireland and add materially to the borders of France and Spain, while it would separate the Mediterranean Sea into two or three fresh-water lakes, emptying into the Atlantic through the Strait of Gibraltar, if indeed they did not become enclosed basins.

When now we come to trace the movements of various extinct animals connected with the early life of man, they bear unmistakable evidence of a late Tertiary land connection between Asia and America, between North America and South America, and between Europe and Africa, permitting an extensive interchange of species between these regions. Among the extinct Post-Pliocene animals of North America, we find the remains of horses, camels, and elephants, which are now confined to the Old World, and of llamas, tapirs, and gigantic Edentata, including the Megatherium and the Megalonyx, which are peculiarly South American types. That these South American types were late immigrants is clear from the fact that the remains of not one of them have been found in the Pliocene deposits of North America. At the same time we find in the cave deposits of South America of recent date the remains of the horse, the mastodon, and various other animals which had evidently migrated from North to South America. Under present conditions this interchange of species would be well nigh impossible. Such a migration points to an elevation of land of two or three thousand feet in the latitude of the Caribbean Sea which would permit of a free interchange of animals between North and South America; while the peculiar development of earlier species in South America would indicate a previous isolation.

During late Pliocene times the Mediterranean ceased to be a barrier between Africa and Europe; so that numerous animals of African origin were able to migrate to the north shore of the Mediterranean and penetrate a long distance into the interior of Europe. On the island of Malta, for example, three extinct species of elephants, two of them of very small stature, and an extinct hippopotamus have left their remains in late Pliocene or Post-Pliocene deposits. Remains of the hippopotamus are also found in the caves of Gibraltar, and are scattered over the greater part of England as far north as Leeds in Yorkshire.

The connection between the species of the Old World and the New is somewhat difficult to make out in all particulars, but the following facts may be taken as well established:

The Primates appear in the Eocene deposits of both, but in the Miocene deposits the Old World forms are the most highly organized, making it altogether probable that the true monkey and man, his nearest ally, developed in the Eastern continent.

Of the Carnivora true bears are, in Europe, traced back to the older Pliocene, while in North America they do not appear until the Post-Pliocene period. According to Wallace,[1] bears seem to have passed into America from the Palæarctic in the latter part of the Pliocene period. They probably came in on the northwest, and passed down the Andes into South America, where one isolated species still exists.

Of the Ungulata, the true horse appears in the older Pliocene of Europe, but not until the newer Pliocene or Post-Pliocene of America; and this notwithstanding the fact that the earlier forms of the family are most fully represented in the Eocene and Miocene deposits of America. From all the facts the conclusion appears probable that the finishing touches in the development of the horse were given in the Old World, and that the most specialized species of the present time passed into North America from the Palæarctic region.

True tapirs, too, evidently originated in the Old World, appearing in the lower Miocene in Europe, but in America not until the Post-Pliocene.

The camel, on the other hand, seems to have originated in North America, where it is now extinct, but in the Pliocene period six or seven species of a genus closely allied to the camel have been found in Kansas, Nebraska, and Texas; while in the Miocene period several specimens of allied genera have been found in various places, including Virginia. The camel, therefore, probably passed from America to the Old World in late Pliocene or Post-Pliocene times.

The Cervidæ, or the deer, abounded in Europe in Miocene times, but appear in North and South America only in the later Pliocene and Post-Pliocene periods.

True oxen, also, while appearing in India in Miocene time, do not appear in Europe until the Pliocene period, and in America not until the Post-Pliocene period.

The Elephantidæ, which are represented at the present time by only two species, the African and the Indian, formerly ranged over the whole Palæarctic and Nearctic regions, fourteen species of the elephant and a still larger number of mastodons having become extinct. In Europe and Central India they go back to Pliocene times, and in India to the upper Miocene; while in America the elephant is limited to Post-Pliocene times, though the mastodon appeared in the Pliocene period. In Europe the mastodon appeared in the upper Miocene, and in India still earlier. From the distribution of this family it is clear that they originated in the Old World, and migrated to America during that elevation of land which characterized the latter part of the Pliocene period.

Thus everything points to the Eastern continent, and to be more particular to the southern part of Asia, as the place from which the immediate ancestors of the most highly specialized animals associated with man had their origin in the latter part of the Pliocene period. With the elevation of land which characterized that period, easy routes of migration were opened to Northwestern Europe and through Northeastern Asia to North America. There can be scarcely any doubt that these were the routes followed by the mastodon, whose remains are found so widely scattered over the whole Northern Hemisphere. But the very conditions which in the latter part of the

Pliocene period favored this wide distribution of the animals which originated in the Palæarctic region also brought on the Glacial epoch, and in consequence a reversal of all the conditions which have favored the existence of a large number of highly specialized animal species. In consequence, as we may believe, of the widespread elevation of land which joined the continents together during that period, the Glacial epoch came on, and produced temporary isolation of species both by the reduction of temperature and by the subsequent depression of the land so as again to separate the continents even more widely than they are now separated. Man alone has been able to overcome these obstacles presented by the Glacial epoch and pass from one region to the other across both the climatic and the oceanic barriers. (See maps on pp. 161, 173.)

A study of the earliest known centers of human development and their relation to the changing conditions which characterized the Post-Pliocene period also leads us, as we have seen, to Central and Western Asia as the center where the races of mankind were first developed and from which they have migrated to all parts of the world. It also indicates late Pliocene or early Post-Pliocene times as the period of the earliest development of the species. It is in the valley of the Euphrates and in the southern border of the Aral-Caspian depression that we find the earliest traces of civilization, whose antiquity is reckoned approximately as ten thousand years. At that time cities of considerable importance had arisen in both these centers, a large number of the most useful animals and plants had been domesticated, and most of the important arts necessary for human welfare had been evolved.

The study of language leads us to the same center of original dispersion. The Aryan tongues, in all probability, originated in the oases which spread out from the base of the mountains which form the southern border of the Aral-Caspian depression. From here, in prehistoric times, Aryan-speaking tribes migrated to Persia and India on the one side, and on the other to Russia and the rest of Europe. This also seems to have been the center of dispersal for the tribes using the agglutinative forms of speech. For these tongues are still peculiarly characteristic of the region between the Ural and the Altai mountains and very naturally spread to Finland on the one side, and on the other to the shores of America, and to various places in Eastern and Southern Asia.

From the earliest times there have gone forth from this center migrations of men, marking epochs in the world's history. The conquests of Genghis Khan and Timur the Tartar, and the invasions of Europe by the Turks and the Huns are more recent examples of these movements.

Ethnologists have been led to similar conclusions from study of the relation of different races to a common center. Following is a statement of Quatrefages upon this point.

"We know that in Asia there is a vast region bounded on the south and south-west by the Himalayas, on the west by the Bolor mountains, on the north-west by the Ala-Tau, on the north by the Altai range and its offshoots, on the east by the Kingkhan, on the south and south-east by the Felina and Kuen-Loun. Judging from the present state of things, this great central region might be regarded as having contained the cradle of the human species.

"In fact, the three fundamental types of all the human races are represented in the populations grouped around this region. The black races are the furthest removed from it, but have, nevertheless, marine stations, where we find them either pure or as mixed races, from the Kioussiou to the Andaman Islands. Upon the continent they have intermixed with almost every inferior caste and class of the two peninsulas of the Ganges; they are still found pure in both, ascend as high as Nepaul, and extend west as far as the Persian Gulf and Lake Zareh, according to Elphinstone.

"The yellow race, either pure or in place mixed with white elements, seems to be the only one which occupies the space in question; it peoples all the north, east, south-east, and west. In the south it is more mixed, but forms, nevertheless, an important element in the population.

"The white race, from its allophylian representatives, seems to have disputed the central area itself with the yellow race. In early times, we find the Yu-tchi and the Ou-soun to the north of the Hoang-ho; and in the present day cases of white populations have been observed in Little Thibet and in Eastern Thibet. The Miao-Tsé occupy the mountain region of China; the Siaputh are proof against all attack in the gorges of the Bolor. Upon the confines of this area we meet with the Aïnos and the Japanese of high caste, the Tinguianes of the Philippine Islands; in the south with the Hindoos. In the south-west and west the white element, either pure or mixed, reigns supreme.

"No other region of the globe presents a similar union of extreme human types distributed round a common centre." [2]

At the present time a population of many millions is supported upon the belt of irrigated land which borders the vast mountain systems which for thousands of miles stretch along the south side of the Aral-Caspian depression. The water for the needed irrigation is afforded by innumerable streams large and small which come down from the mountain ranges, and which, in many cases, are fed by glaciers still existing at all heights above the twelve thousand-foot line. In every case these streams either disappear in the desert or end in land-locked basins like Lake Balkash and the Aral Sea. Among the larger streams are the Ili, the Chu, the Syr Daria (ancient Jaxartes), the Amu Daria (ancient Oxus), the Murgab, the Tejend, and the Atrek, with thousands of smaller ones all descending from the northern slopes of the vast bordering mountain system; while in the interior there is the Tarim River with its numerous tributaries ending in Lob Nor; and on the south the Indus carrying fertility to the Punjab; besides innumerable streams of less individual importance deploying over the plains of Persia.

To appreciate the natural attractiveness of this region it is necessary only to refer to what Strabo writes concerning Hyrcania, through which the River Atrek flows to empty into the Caspian Sea. On account of its fertility and genial climate it is described as "highly favored of heaven"; where a single vine had been known to produce nine gallons of wine, and a single fig tree ninety bushels of figs; while grain did not require to be sown, but sprang up from what failed to be gleaned in previous years.

GLACIAL HISTORY OF CENTRAL ASIA

But it is only a study of the succession of events connected with the Glacial epoch which can reveal the former possibilities of this region and the physical changes which have taken place in it calculated first to stimulate man's mental activities and secondly to force his migration to other parts of the world.

Considering the extent of the glacial ice sheets in North America and Europe it was a great surprise to find that Northern Siberia had never been invaded by glacial ice. This, however, was scarcely more surprising than the fact previously discovered that Alaska north of the mountains which border the Pacific Ocean showed no signs of general glaciation. In both regions, however, the soil is still deeply frozen, the frost penetrating at Yakutsk to a depth of six hundred feet, while both in Siberia and Alaska stagnant ice is prevalent over large areas, in many cases being buried by a few feet of soil on which flourishes an abundant vegetation, the ice serving as a rock. The effect of the sun and the warmth of summer is felt only a few inches below the surface, and yet even so it is sufficient to support a growth of trees, shrubs, and other vegetation which is ample for the sustenance of a great variety of animal species.[3]

In Northeastern Siberia it would seem that the conditions were somewhat the same during the Glacial epoch as they were in Alaska. According to my own observations, there were no extensive glaciers coming down from the Vitim Plateau, either to the east into the Chita Valley, or to the southwest, into the valleys of the Uda and Selenga rivers; while, according to Professor Schmidt, who has made extensive explorations in the region, there are no certain signs of glacial action in the Yablonoi Mountains. Farther north, however, in the latitude of Okhotsk, there are, according to Professor Tschernyschev, indications of an extensive glacial occupation of the Stanovoi Mountains above the sixtieth parallel of latitude; while there are extensive areas of stagnant ice over the lower part of the Lena Valley and in the Arctic Littoral, and upon the New Siberian Islands from which so many remains of the mammoth have been derived. Baron Toll speaks of this as a "fossil glacier," supposing, it would seem, that there had been a movement of ice from the continent to these islands. It has been shown by Dr. A. C. Lane, however, that where the average summer and winter temperature is that of Yakutsk, frost would in time penetrate to a depth of six hundred feet.

At the present time numerous glaciers exist both in the Tian Shan and Altai mountains. An ice cap covers the summit of Khan-tengri, which rises to a height of twenty-four thousand feet, and projects glaciers down upon all sides through the various river troughs to a level of about twelve thousand feet. Another glacial center is about one hundred miles to the west directly south of the east end of Issyk-kul, from which glacial streams descend both into the Tarim basin and into the Naryn River, which flows into the Syr Daria. Another glacial center of considerable extent is found just south of Verni, in the Western Ala-tau range. From this, glacial streams are sent forth both into the headwaters of the Ili and of the Chu. Still another glacial center along the main range of the Tian Shan Mountains is found south of Aulieata, from which perennial streams flow north into the Talas, and south into the Chatkal, which flows past Tashkent.

Still another center of glaciers is found in the Alai

Tagh range between Kokand and the upper basin of the Syr Daria and the Waghesh River, one of the head tributaries of the Amu Daria, forming the northern boundary of the Pamir. There are as many as four of these, covering the summits above ten thousand feet, from which perennial streams flow into both the Amu Daria and the Syr Daria, and from the western one into the Zerafshan, which waters the valley of Samarkand and Bokhara.

South of the Waghesh in the Pamir, Mount Kaufmann (22,500 feet) and Mustagh Ata (25,800 feet), together with two or three other peaks rising to an elevation of nearly twenty thousand feet, sustain glaciers of considerable extent.

In the Altai Mountains, though the elevation is nowhere much above eleven thousand feet, glaciers are still found which would compare favorably with those in the Alps.

But, as already stated, though the glaciers of Central Asia and Siberia never descended far enough to become confluent upon the plains which spread out from the base of the mountains, as in Switzerland the glaciers of the Alps filled the valleys on either side, there was a great extension of glaciers during the Glacial epoch. Professors William M. Davis and Ellsworth Huntington[4] in crossing the Tian Shan

Mountains encountered extensive moraines upon both sides of the range at an approximate level of seven thousand feet above the sea, which is five thousand feet lower than glaciers of these mountains descend at the present time. The significance of these facts will be discussed later after giving the data more in detail concerning the spread of man over Northern Asia during the Glacial epoch in company with various extinct animal associates especially the mammoth.

MAN AND THE MAMMOTH

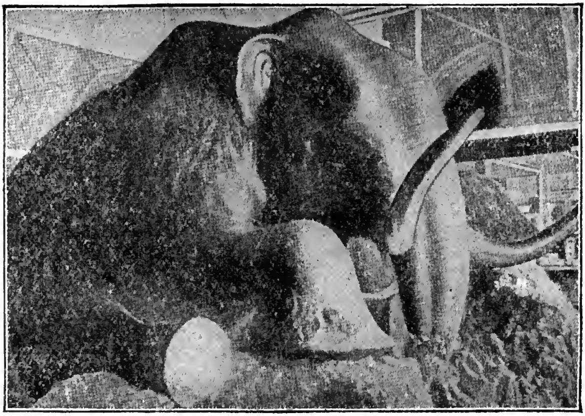
The association of man with the mammoth in their wanderings over the Northern Hemisphere presents many difficult and important problems connected with the physical conditions which favored their original migrations, but which in the end proved fatal to the mammoth. The evidence of the coexistence of man and this species of elephant is found in all parts of the north temperate zone. In Western Europe, not only are the bones of the mammoth and palæolithic implements found together in high-level river gravels and in caves, but the forms of the animal were pictured by man on slabs of stone and pieces of bone with a high degree of artistic skill. In Russia and Siberia, stone implements and mammoth remains are found in close juxtaposition. In the valley of the

Obi, near Tomsk, the implements were found in connection with bones representing an entire skeleton, some of them showing that they had been split by man for the extraction of the marrow. In America, the mammoth also was occasionally sketched on stone by the aborigines, and mounds were made to represent the form of the animal. The evidence is also indubitable that the mammoth long survived the close of the Glacial epoch, since his remains are frequently found in post-glacial peat bogs and quagmires. He was not killed by cold but by warmth.

It is in Siberia and the adjoining islands that the most startling facts concerning the history of this animal have been brought to light. So abundant are his remains in that region that the principal industry along the northern rivers and on the New Siberian Islands has been the ivory trade.[5] An idea of the enormous number of the remains can be gained from some of the reports on the ivory exported. In 1840 Middendorff calculated that during the previous two hundred years, 20,000 mammoths had been discovered. Reclus speaks of the annual output of ivory as fifteen tons, which represents the tusks of about two hundred animals; while Stadling says that at the present time there are seventeen tons of ivory taken out annually in the Yakutsk district alone.

To add to the interest of the subject we must be content with a single illustration. A perfect specimen of the mammoth was discovered and brought to St. Petersburg in 1900 by Messrs. Herz and Tolmatschow.[6] From the position in which the carcass was found it appears that the animal "died during the pleasant occupation of feeding. He probably rolled off a precipice while reaching out for a coveted branch or plant; the position of his forelegs shows that almost to a certainty. . . . In gliding down the mountain-side, the animal's hind legs were forced into a horizontal position and got under his body, which circumstance made it completely impossible for the mammoth to raise himself by his own efforts.

"The impromptu grave into which the animal plunged was made of sand and clay, and his fall probably caused masses of neighboring soil to loosen and cover him completely. This happened in the late fall, or beginning of winter, to judge by the vegetable matter found in the stomach; at any rate, shortly afterward, the grave became flooded, ice following. This completed the cold storage, still further augmented by vast accumulations of soil all around — a shell of ice, hundreds of feet thick, inclosed by yards upon yards of soil, that remained frozen for the greater part of the year. Thus the enormous carcass



Mammoth from Siberia mounted in the Museum at St. Petersburg.

This mammoth was found in the year 1900. Its skin and skeleton were transported to St. Petersburg by Mr. I. P. Tolmatschow. The carcass was at the bottom of a steep slope which rises to a height of 170 feet above the flood-plain of the Beresowka River. At this height a terrace stretches back for half a mile, where the land rises 300 or 400 feet higher to the general level of a forest-covered plain. The mammoth was completely enveloped in the frozen soil until washed out by the river. The appearance was as if, in stretching out to reach twigs, he had slid down backward in the position shown in the illustration, and there perished, to be frozen into the accumulating ice, and preserved for an unknown period of time.

was preserved, for how long no one knows." (See illustrations in *Records of the Past,* vol. ii. p. 315.)

Foxes, bears and wolves devoured most of the flesh, but the stomach, with its undigested food, was preserved. The hairy covering was extremely thick and averaged seven inches in length, and the mane was three or four feet long. Under the coarser hair there was a very close growth of wool, like that which covers a young camel. Thus the animal was so protected that he would not feel even the extremest cold. The food found in his stomach showed that his diet had largely consisted of the young shoots of the fir and pine.

Besides the mammoth there are many remains of the rhinoceros, bison, horse, tiger, saiga, and the wapiti, found in such positions as to prove without doubt that they lived where they were found, even as far north as 74° North Latitude, while now none of them live north of 60° North Latitude.

The distribution of the mammoth and his final extinction have been the occasion for a multitude of theories concerning the climatic conditions of the Northern Hemisphere during Pleistocene times. This much is certain that the climate was more mild and equable in Northern Siberia during the time they maintained existence there than at present. The stomachs of some of the mammoths which have been discovered contained leaves of trees whose present habitat is hundreds of miles south of the locality where the animals perished; while the great abundance of their remains in the New Siberian Islands renders it certain that at one time within the period of their existence there was a continental elevation sufficient to provide land connection between these islands and Siberia. It is clear, therefore, that great physical changes have taken place in Northern Asia since its joint occupation by man and this unwieldy species of elephant.

But so many complicated causes conspire on the one hand to favor the life of a species and on the other to bring about its extinction that it is difficult to untangle them and estimate the individual effect of each conspiring cause. Of one thing, however, we are certain, that the main cause has been the changing climate of the Glacial epoch. This epoch originated new conditions of life which acted in innumerable ways both to favor and destroy it. The continental elevations connected with its inception enlarged the land areas about the arctic circle, and thus favored an increase in numbers and opened the way for extensive migrations. In certain localities, however, as in the Southern United States and in Europe, the advancing ice limited the habitable areas and produced overcrowding. To a still greater extent overcrowding was caused by the continental depression of land at the close of the Glacial epoch; while the vast glacial floods which poured forth from the melting ice must have been destructive to a high degree. All these changes brought on successively a new adjustment of animal species to one another, during which now one enemy was favored and now another. In short, the host of indirect causes brought in operation by such changed conditions as are connected with the Glacial epoch are beyond calculation. Still the facts are such that careful study of them points to conclusions which are of some help in solving the main problem relating to the distribution of man and the animals associated with him during the prehistoric period, and permits us with some confidence to present a provisional theory respecting the succession of events connected with man's occupation of Central Asia and the surrounding region in prehistoric times.

PROVISIONAL THEORY

Paradoxical as it may seem, it was soon after the culmination of the Glacial epoch that the conditions in Central Asia were most favorable for the support of a dense population both of animals and man; for it was at that time that the oases on every side were expanded to their greatest extent, and that the climate was most salubrious. The more ice there was to melt upon the mountain heights, the larger the streams which sent their life-giving waters to the fertile belt of soil spreading out in every direction from the base of the mountains. Of the former enlargement of all these streams there is abundant evidence. The river Chu, which now ends in an insignificant lake in the midst of the desert, formerly overflowed and emptied into the Syr Daria. The Syr Daria and the Amu Daria, each with a volume of water at the present time equal to that of Niagara, were formerly large enough to fill the Aral Sea to overflowing, and pour an immense current of water through a well-defined channel, now dry (the Usboy), into the Caspian, while the Caspian Sea itself overflowed through a channel (the Manytch), only a few feet above tide level, into the Black Sea.

The fertility given by the Nile to Egypt is even now insignificant compared with that which is poured upon Central Asia by the innumerable melting glaciers nourished at the more than Alpine heights which look down upon the region from every side. The overflow of the Nile is dependent upon the seasonal rainfall in Central Africa and is liable to be interrupted by the accumulation of débris in the outlets of the great interior lakes of the continent. But in Central Asia the supply of water, such as it is, is unfailing, being kept in cold storage perpetually until it is liberated by the progressive heat of the summers; while the area which can be rendered fertile by irrigation is many times greater than that of Egypt. But during the Glacial epoch this area was immensely increased.

For it is evident that the irrigated belt at the base of the mountains of the Aral-Caspian depression must vary in size in proportion to the extent of the glaciers in the mountains, and to the rapidity with which they are melting. Thus the period just subsequent to the climax of the Glacial epoch would witness the greatest extension of the irrigated belt in Central Asia, and furnish the conditions most favorable for the support of a large population. But, at the same time that conditions were so favorable for the increase of population in this region, they were absolutely prohibitive of the existence of man in what are now the most fertile portions of Europe. When the enlarged glaciers in the Tian Shan and Hindu Kush mountains were pouring their life-giving streams into the alluvial plains of Turkestan, vast accumulations of glacial ice rested over Russia, Scandinavia, Northern Germany, the British Isles, and Switzerland.

But the decline of the period reversed these conditions. As the glaciers diminished in the mountains of Central Asia, the irrigating streams which flowed from them were gradually bereft of their full supply of water. The oases fed by these streams became contracted in their areas, and the whole irrigated belt at the base of the mountains grew narrower. The natural effect of all this was to intensify the struggle for existence, both among the plants and animals, including man, and to compel migration.

Fortunately the same causes which wrought this destruction in Central Asia opened up the most fertile portions of Europe, and invited their occupation. As the glaciers diminished in the mountains of Central Asia the ice withdrew from the plains of Southern Russia and Northern Germany, opening there opportunities for man to reach the highest attainments of civilization. In America the field exposed by the melting away of the glacial ice remained hid for a longer time. But now the glacial deposits of the Mississippi Valley and the Red River of the North are filling the granaries from which city populations the world over will draw their food supplies for centuries to come.

At first thought it might appear that the climatic conditions during the Glacial epoch in Central Asia would have been unfavorable for man. This, however, was by no means the case. The Glacial epoch was not merely one of a depression of temperature, but was still more a period of increased precipitation, since an increase of snowfall is more effective for the extension of a glacier than is a decline in the temperature. Central Asia, at the present time, is handicapped by an insufficient rainfall. Over the lower areas only a few inches of rain fall in each year. Besides, the extremes of temperature are almost unbearable. While the thermometer rises on the plains of Turkestan to 130° F. in summer, it descends to the freezing point of mercury in the winter, all due to the dryness of the atmosphere. As it is, the population is compelled to seek shelter in the base of the mountains both from the heat of summer and from the cold of winter. The moist climatic conditions which brought on the Glacial epoch must have spread a most grateful amelioration of both the summer and the winter climate over these now arid regions. In short, it is no unwarranted stretch of the imagination to conceive of this region as the original paradise of the human race.

CHAPTER XII

THE PHYSIOLOGICAL ARGUMENT

The numerous physiological facts bearing upon the mode of man's origin and the antiquity of his history, though complicated and difficult of interpretation, cannot be passed by without notice. But in weighing the argument drawn from them, we shall be compelled to move with peculiar circumspection, both from the danger of converting a mere analogy into an argument, and from fear of being unduly influenced by various natural but ill-founded prejudices.

The great difficulty in reasoning upon the physiological facts bearing upon the question is that we have no satisfactory knowledge either of the rate at which changes have taken place in nature or of the extent to which they may proceed through the action of resident forces. A generation or two ago the unity of the human race was vigorously questioned. To the physiologists of that time the differences between the various races of men seemed so great and so persistent that it passed the bounds of their comprehension that these should have had a common origin. In color of skin, in texture of hair, in shape of skull, and in the development and adjustment of various bones in the frame, there is such diversity between the races of mankind, and these diversities are traced back to such an early period, — having been found to exist even at the earliest dawn of history, — that it seemed incredible that they could have had the same ancestry.

But now that through the work of Darwin and his followers even the natural differentiation of a genus into species has become not only conceivable, but the belief in it an essential part of our mental furniture, no one would think of denying a common origin to the human races by reason of the superficial differences which separate them from one another. Two questions, however, are not so easily answered by the thoroughgoing Darwinian. The first relates to the length of time required, on that theory, for the original race of man to have become so diversified as we find him at the dawn of history. Even the oldest Egyptian monuments which contain representations of the human form show that the Negro race was then characterized by its well-known features, while the Egyptian and Semitic features were as characteristic of the ruling races then as they were at the beginning of the Christian era. At first, one might be tempted to solve the problem by applying here the simple rule of three, and endeavoring to estimate the amount of change which has taken place in the Negro, the Egyptian, and the Semite during the many centuries which have elapsed since the building of the pyramids, and then estimating how far back, at a similar rate, we should have to go to find the common stock. But apparently this would send us out upon parallel lines, which never converge; for, so far as we can see, there are absolutely no changes in the anatomical and physiological characteristics of the race since the earliest monuments were decorated with their features. So that, from considerations of this sort, we should be prepared or inclined to throw the origin of man far back into the hundreds of thousands of years, or even to place it in a distant geological period.

Reflection, however, will lead us to hesitate about committing ourselves to such a result. That doctrine of evolution which best adjusts itself to both the geological and the biological facts of the world, is one which admits of paroxysmal development at certain epochs of progress. There is nothing inconsistent in rapidity of change in certain conditions at the same time that there is fixity of character for long periods at other times. It is easy to see that, with continuity of development, the ordinary course of things may at certain periods be interrupted so as to compel a rapid readjustment of species to their surroundings. For instance, a slow subsidence of the Isthmus of Panama might proceed for centuries without subjecting the marine life upon the opposite shores of the isthmus to any specially new conditions; but when this subsidence has proceeded a little farther, so that there is a commingling of the waters, the species upon both sides of the continent will immediately be compelled to struggle for existence amid many new conditions of life. New species peculiar to the Atlantic side will commence a struggle for existence with those that have been developed in the waters of the Pacific. The stability of species arising from the long-continued uniformity of conditions in the midst of which they had come into existence, would suddenly be broken up by the necessity of adapting themselves to the changed environment, and of maintaining themselves in the presence of new competitors.

For, it is not possible to maintain a theory of evolution without putting forward changes of environment as the principal factor determining the rapidity of changes which take place in the organism in its struggle to maintain existence. When an organism becomes adapted to its conditions, all abnormal changes are a disadvantage. The very idea of adaptation implies stability of conditions as related to the physiological changes which take place in the struggling organism. But at once, upon a change of conditions of any kind or degree, some variations which in a previous condition had been abnormal will now become normal, that is, specially adapted to the new sphere of conditions. For example: if the vegetation of a country has become adjusted to a rainfall of forty inches pretty evenly distributed over the year, all those variations by which it might adjust itself to greater or less degrees of humidity will be disadvantageous, and there will be little change so long as present conditions continue; but if, from any cause, the climate becomes arid, at once there begins a rapid substitution of those plants which vary in directions better adapted to the drier climate. The change from one type of plants to another would be almost as rapid as the change in conditions. This is brought about, however, not by any direct effect of the conditions upon the organism, but by that inevitable sifting process which remorselessly suffers the ill-adapted variations to go to waste, and infallibly preserves from destruction the variations adapted to the new conditions.

From these considerations it follows that, even if we admit the derivative origin of the human race so far as his physical organization is concerned, we have not thereby obtained any well-defined means of determining the date of his origin. Our experience of the changeability of human races is limited to that period of their existence in which there is peculiar stability of conditions. This stability, however, arises in large part from the capacity of man to mold the conditions of life for himself through the marvellous power of his mental capacity. Of the profound and far-reaching influences of the reasoning powers of mankind we shall speak more fully in a subsequent chapter, but a few observations upon it are appropriate in this connection.

In remarking upon this point, it is important, at the outset, to observe the indeterminateness of the underlying principle in the prevailing theory of evolution. Herbert Spencer invented the happy but somewhat delusive phrase "survival of the fittest," and the whole theory of evolution has come to be familiarly expressed in the truism that, amid any change of conditions to which an organism is subjected, it is the fittest only which will survive. From this most obvious truth, however, many fallacious inferences have been drawn. It has been tacitly assumed by many that this was a doctrine of upward progression, leading by inevitable necessity to the development of higher and better and more noble forms of life. A moment's reflection, however, will show that this is an entirely mistaken view. Whether the survival of the fittest shall be the survival of the higher and better and nobler forms of existence depends upon the prior question, whether the conditions of life have been previously arranged by creative design to secure this result.

Atheism can have no theory of the distant future. It is well nigh impossible for any one to study the development of life which has actually appeared in the world, the evidences of which are unfolded to us in geological strata, without being convinced that the conditions and the capacity of life have been both created and adjusted by an all-wise and benevolent Architect. Whether raw cotton when thrown in at one end of the mill will at the other end come out a web of cloth depends both upon the adjustment of the machinery and upon the nature of the material. So, whether life when introduced into the complex material environment of the world shall come out a higher form or a lower, or even shall escape destruction altogether, depends upon such an adjustment of all the existing forces as demands the oversight of an infinite Creator's mind. Whether, again, it is possible for the web of life to be woven into all its patterns without the interference, here and there, of that same creative power which initiated the movement, is a question of philosophy, and not of natural science. Yet it is one which the man of science is by no means at liberty wholly to set aside. Indeed, he cannot set it aside, except by committing himself to a philosophy of creation which lies entirely outside the realm of observation.

The essential truth in the modern theory of evolution is the *continuity of life*. Evidently the principle of life which has been introduced into the complex mechanism of the material universe is extremely plastic, and capable of expressing itself in an almost infinite variety of material forms and of appropriating an astonishing range of material forces. Whether the moral and higher intellectual powers of the human mind are direct outgrowths of this original principle of life, or whether it is more philosophical to suppose a direct ingrafting of divinely related qualities upon the highest form of life attained by natural selection, is a question which we shall consider more fully in the chapter upon the psychological evidence of man's origin and antiquity.

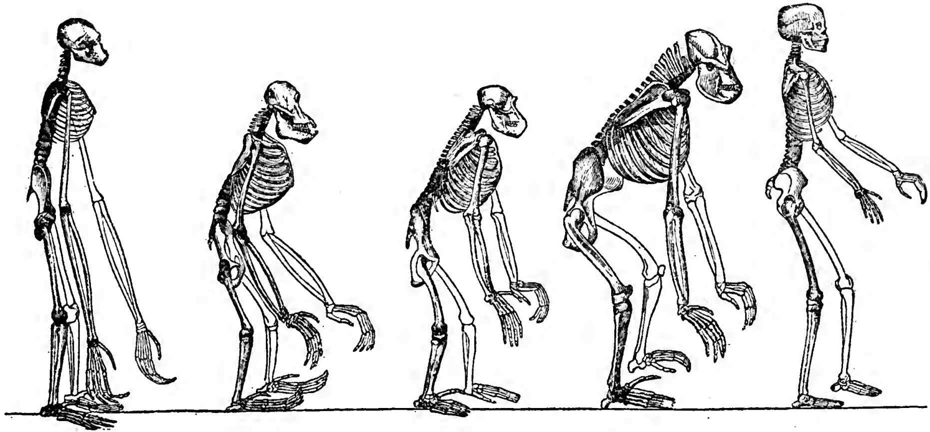
The point for us to consider here is the arrest of development in the physical constitution of the human race which is produced by the enormous enlargement of man's mental powers, which are his crowning glory. So predominant are the mental powers of man over his physical conditions, that it becomes at once the element upon which natural selection fixes for the development of the race. With man knowledge becomes power. He knows how to profit from the experiences of the past. He protects himself, not so much by instinct, as by forethought, against heat, and cold, and disease, and accident; and guards himself against enemies of all kinds by widespread political organization. Through irrigating schemes he makes the desert blossom like the rose. By dikes and drains he protects himself from the inundation of streams, and renders the malarious lagoon a suitable place of habitation. Through the invention of more and more effective missiles of war, and the perfection of military and judicial organizations, the weak are made strong, and vast bodies of men can unite their strength and act as a unit against all outward enemies.

The effect of all this upon the physical organization of man is peculiar. It preserves the abnormally developed brain, rather than the abnormally developed muscle. If David was superior to Goliath by reason of his skill in the use of a sling, how much more is Edison superior to the tall tribes of Patagonia by virtue of his control over the thunderbolts of heaven! Thus in a thousand ways man's inventive capacity counteracts natural selection.

Upon comparing the bodily structure of man with that of the higher animals associated with him, the argument in favor of a common origin, so far as physical structure is concerned, becomes almost overwhelming. Zoölogically considered, man does not constitute an order by himself. The grounds upon which Blumenbach, Cuvier, and others have given to him the dignity of a separate order are mostly based upon his mental qualities. Linnæus limiting himself to anatomical and physiological considerations was content with placing himself at the head of the Quadrumana, under the title of Primates. The modern zoölogists, however, who continue this classification, and give to man the same ancestral origin with that of the anthropoid apes, do not suppose that he was descended from any of the branches of that family now existing. The supposition is that he and they are descended from some common variety which has long since become extinct, and that perhaps each differs as much from the common stock as they do from one another.

The varying points of anatomical resemblance between man and the anthropoid apes are worthy of special note. "The gorilla approaches nearest to man in the structure of the hand and foot."[1] But his arms are nearly twice as long as man's and the lower part of his face is developed to an enormous extent, even when compared with the most inferior human races; while his chest and neck are developed in adaptation to the stooping gait made necessary by his general structure. The chimpanzee approaches more nearly to man in the shortness of his arms and in the structural details of the skull. But still his arms are much longer than those of man, and his breast is developed to suit his stooping posture, and the lower part of his face is out of all proportion to the upper part. The orangoutang approaches man most nearly in the structure of his brain, though the absolute mass of brain is larger in the chimpanzee than in the orangoutang; but in the orangoutang the convolutions of the brain are more numerous, and the frontal lobe, which is the more direct organ of intellectual activity, is more prominent in him than in any other variety of the anthropoid apes.[2]

Indeed, one of the most striking differences between man and the highest of the apes appears in the size of the brain. "The average human brain weighs 48 ounces, while that of a large gorilla is not over 20 ounces,"[3] that is, the weight of the largest brain of a gorilla is considerably less than half that of the



Gibbon. Orangoutang. Chimpanzee. Gorilla. Man.

average man, and only about one-third that of the best-developed individuals of the human race. Upon comparing the extremes among men, however, it is found that the difference between the weight of the brain in the highest and lowest men is greater than that between the lowest man and the highest ape. According to Huxley, "The largest recorded human brain weighed between 65 and 66 ounces,"[4] while the smallest weighed thirty-two ounces, that is, there is an absolute difference of thirty-three ounces, or of one-half, in the weight of different human brains, while there is only a difference of twelve ounces between the weight of the smallest human brain and that of the largest known brain of an ape; or, estimating it by cubic inches, the largest human brain yet measured contained one hundred and fourteen cubic inches, while the smallest was but sixty-three cubic inches, showing a difference of fifty-one cubic inches.[5] The largest brain of a gorilla yet observed contained thirty-four and one-half cubic inches, or twenty-nine cubic inches less than that of the lowest man.

Measured, therefore, either by the weight or cubical contents, there is both absolutely and relatively a greater difference in size of brain between the highest man and the lowest man than there is between the lowest man and the highest ape. Among the apes, also, the differences are as great among themselves as they are between one man and another, or between man and the highest apes. The cranial capacity of gorillas, for example, varies as much as from thirty-four and one-half cubic inches in the highest to twenty-four cubic inches in the lowest.

Following the most recent classification, man is to be placed at the head in an order of animals containing seven families, which, arranged in descending order according to their relative rank, would be as follows: (1) Man; (2) the Catarrhine, or narrow-nosed apes, comprising the higher species found in the Old World; (3) the Platyrhine, or broad-nosed, apes, comprising all but one of the New World species; (4) the Marmosets of the New World; (5) the Lemurs; (6) the Cheiromys, a subspecies of the lemur, containing many features of rodents; and (7) the flying lemur, Galeopithecus, a species resembling the bat in some respects. The gradations connecting these species are pronounced by Huxley to be extraordinary, "leading us insensibly from the crown and summit of the animal creation down to creatures, from which there is but a step, as it seems, to the lowest, smallest, and least intelligent of the placental Mammalia." [6]

But great as the break is between man and the anthropoid apes, there is a still more significant break between the anthropoid apes and the lemur. Quoting Huxley again, "So far as cerebral structure goes, therefore, it is clear that man differs less from the chimpanzee or orang, than these do even from the monkeys, and that the difference between the brain of the chimpanzee and of man is almost insignificant when compared with that between the chimpanzee brain and that of a Lemur," and again, "It is a remarkable circumstance that though, so far as our present knowledge extends, there *is* one true structural break in the series of forms of Simian brains, this hiatus does not lie between man and the manlike apes, but between the lower and the lowest Simians, or in other words, between the Old and New World apes and monkeys, and the Lemurs. Every Lemur which has yet been examined, in fact, has its cerebellum entirely hidden, posteriorly, by the its posterior lobe, with the contained posterior cornu and hippocampus minor, more or less rudimentary. Every marmoset, American monkey, Old World monkey, babboon, or manlike ape, on the contrary, has its cerebellum entirely hidden, posteriorly, by the cerebral lobes, and possesses a large posterior cornu with a well-developed hippocampus minor."[7]

In view of all these facts, it is difficult to resist the conclusion that, so far as his physical organism is concerned, man is genetically connected with the highest order of the Mammalia, but it is equally evident that he is not descended from any existing species of that order, and this Darwin himself was always careful to say, referring to the ancestor of man as an "ape-like creature."

But after his separation from the central stock of the Primates, man must have made most significant and phenomenal advances in his physical organization, adapting it to the wants of the higher intelligence with which he became endowed. Briefly summarized, the advances lay in the following particulars: (1) the increased size and complexity of the brain, which serves as the seat of mental and nervous activity; (2) the diminution of the canine teeth and of the size of the lower part of the face in general, bringing the animal in marked subordination to the intellectual features of the countenance; (3) the development of the lower limbs in adaptation to the habitual upright position in which he moves; (4) a corresponding adaptation of the vertebral column to the erect posture; (5) the development of the thumb and great toe in man in adaptation to man's upright position and to the great variety of uses to which the hand is put; (6) the loss of that hairy covering which nature has provided for all of man's humbler relatives. Wallace thinks, that all "these numerous and striking differences . . . point to an enormously remote epoch when the race that was ultimately to develop into man diverged from that other stock which continued the animal type and ultimately produced the existing varieties of anthropoid apes." [8]

But up to the present time the geological strata have yielded no forms which bring us any nearer to our probable ancestry than do these degenerate cousins of the anthropoid family. All further reasoning from these premises concerning the date of the actual beginning of the human race must, therefore, be theoretical. The question, How did this ancient anthropoid form take on the distinctively human peculiarities? will be closely connected with the other question, How long ago were these specific qualities assumed? In the next chapter it will come in our way to dwell more specifically upon the mental characteristics most distinctive of the human race. Our question now is, How did man obtain those physical peculiarities which separate him so widely from the rest of the animal creation, and which respond in such a marvellous manner to the behest of his mental endowments?

Our answer to this question is, in brief, that obviously this finishing off of man's physical organization was concurrent with the impartation to him of his higher mental qualities. How this impartation took place it may not be possible for us to comprehend, but that it did take place, through creative interference or creative prearrangement, at a definite epoch of history, is as easily comprehensible as that the germ in which we each as individuals originate is quickened into true spiritual life, and becomes endowed with reason, at a definite point in its existence. When the embryo really becomes human and is endowed with the prerogatives of immortal existence is as much a mystery to the Christian philosopher as the question, When in the line of development did the natural ancestry of the human race become endowed with its higher human prerogatives?

When studied from the point of view of adaptive economy, the human form is the noblest physical work of God. Considered merely in his physical aspect, "What a piece of work is man. . . . In form and moving, how express and admirable; in action, how like an angel. . . . The beauty of the world, the paragon of animals." All these elements constituting his peculiar nobility of structure would, on the theory of natural selection, be rapidly developed upon the impartation to man of his higher mental qualities; so that the strict Darwinian, even, is not warranted in assigning an indefinitely long period to the earlier stages of the development of man's peculiar physical qualities.

PEHISTORIC HUMAN SKELETONS

The discoveries of prehistoric human skeletons which are most important for comparison are those of the so-called Neanderthal skeletons of Europe, and the so-called *Pithecanthropus erectus* of Java. The apelike characteristics of the Neanderthal type of skulls, as exhibited in that from Canstadt, that from the valley of the Neander, and that from the cavern at Spy in Belgium, have attracted wide attention and have led to voluminous discussions. At first it was widely supposed that the missing link had indeed been found. The simian affinities of the skulls appeared in the enormous thickness of the bony ridge over the eyes, in the retreating forehead, in the general shallowness of the brain cavity, and in various other particulars which it would require more technical language to describe than is profitable or necessary in a popular presentation of the subject. In the case of the skeletons from Spy, we are fortunate in having the lower jaw, as well as most of the other bones, preserved. In addition to the other Neanderthal characteristics we find here an enormously heavy lower jaw, almost no projecting chin, exceptionally large teeth with the last molar as large as the others, in all which respects they sensibly approach the features characteristic of the highest anthropoid apes. The other parts of the skeletons show that they were powerfully built individuals with strong, curiously curved thigh bones, the lower ends of which are so fashioned that they must have walked with a bend in the knee. (See p. 322.)

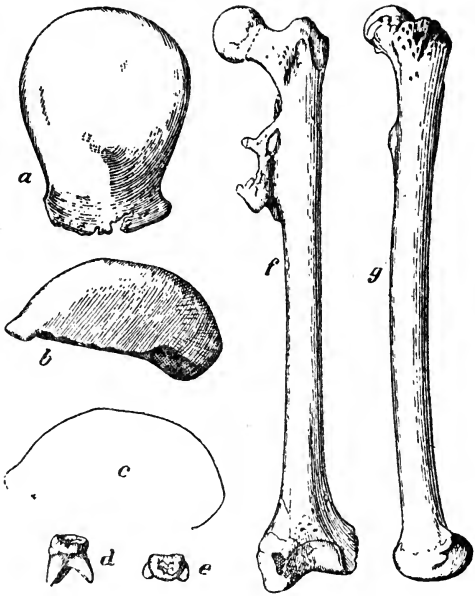
But in the discussions aroused by the discovery of these prehistoric skulls, much stress was properly laid on the fact that skulls of the same type are known to occur at the present day, even among the civilized races of Europe. Indeed, it was pointed out that some men of note have possessed skulls closely resembling that from the Neanderthal. St. Mansui, Bishop of Toul in the fourth century, possessed, as it would appear from portraits, a forehead still more receding and a vault more depressed and elongated than those of the Neanderthal type; while the skull of the Scotch hero Bruce would be recognized at once as belonging to that type.

Furthermore, recent investigations have tended constantly to increase the gap separating the brain capacity of man from that of apes, and to diminish, if not indeed entirely to remove, the gap which was supposed to exist between Pleistocene (Glacial) and modern man.[9] These facts have been mainly presented in a previous chapter, but for convenience will here be summarized. According to Sollas, the cranial capacity of the Neanderthal man, as well as of the man of the Chapelle aux Saints, and of Spy, all of them of glacial age, amounted to a little more than 1,600 cubic centimeters (97.6 cu. in.), whereas the average capacity of European skulls is not above 1,550 cubic centimeters (94.55 cu. in.), while the average Australian skull has a capacity of only 1,250 cubic centimeters (76.25 cu. in.), and the capacity of the brain of Leibnitz is only 1,422 cubic centimeters (86.742 cu. in.). Thus the Australian, so far as cranial capacity is concerned, stands on a much lower plane than that of glacial man in Europe. The capacity of the largest brain of the gorilla, yet observed, was less than half that of the Neanderthal skull.

Still, both Professor Huxley and Professor Fraipont think it proper to suggest that the skeleton of the man of Spy gives us some clue to the rate of development leading up from the anthropoid apes to the present condition of the human species. According to Professor Fraipont, "If the most ancient ethnic type known has been capable of being modified during the Quaternary epoch to the extent of giving rise to races as different as that of Cro-Magnon and those of Furfooz, if during this epoch it has been capable of losing so many inferior characteristics, and of gaining so many others terminating in the brachycephalic men of Grenelle, it is not too difficult to believe that Pliocene man had perhaps more inferior characteristics than the man of Spy, and that those of the Miocene possessed perhaps more pronounced simian and less numerous human characteristics." In the same strain, Professor Huxley remarks, that these facts "give us some, however dim, insight into the rate of evolution of the human species, and indicate that it has not taken place at a much faster or slower pace than that of other mammalia. And if that is so, we are warranted in the supposition that the genus *Homo* . . . was represented in pliocene, or even in miocene times. But I do not know by what osteological peculiarities it could be determined whether the pliocene, or miocene, man was sufficiently sapient to speak or not; and whether, or not, he answered to the definition 'rational animal' in any higher sense than a dog or an ape does."[10]

Pithecanthropus erectus[11] is the name given to the species supposed to be represented in discoveries made by Dr. Dubois in Central Java in 1894. The specimens consist of two teeth found at different times a few yards from each other, the top part of a skull found about a yard from one of the teeth, and a femur found about fifteen yards distant. These were all obtained at different times, in volcanic tufa on the bank of the river Bengawan, near Trinil. Little can be inferred, however, concerning the age of the remains from the hardness of the rock in which they occurred, for volcanic outflows of various sorts have occurred at all geological ages, even down to the present. But the deposits were inferred to be Tertiary from the associated vertebrate fauna, which were classified as late Tertiary. This, however, is subject to the doubt already referred to in speaking of the mammalian remains in the auriferous gravels of California, as to whether there is a hard and fast line to be drawn between Tertiary and Post-Tertiary fossils, and whether the same species became extinct at the same time in all parts of the world.

The cranium of the *Pithecanthropus erectus* is indeed remarkable for its small brain capacity. But even so it is separated a great ways from that of the highest apes, and is not inferior to that of some ex-



Pithecanthropus erectus, Dubois. a, The skull cap seen from above; b, in profile; c, in sagittal section; d, e, the first found molar tooth, seen from the side and from above; f, g, the femur, seen from in front and in profile. (After Dubois, × 1-6, except d, e, which are × 1-3.) (From Sollas's "Ancient Hunters.") (By courtesy of Macmillan and Co.)

isting races of men. According to Cope,[12] it had a brain capacity of 1,000 cubic centimeters (61 cu. in.), as against 1,500 cubic centimeters (91.5 cu. in.) normal human, and about 500 cubic centimeters (30.5 cu. in.) for the gorilla. But Virchow gives 950 cubic centimeters (57.95 cu. in.) as the cranial capacity of some Negritos and only 860 cubic centimeters (48.46 cu. in.) for an inhabitant of New Britain. The tooth might do for a gorilla but the femur is long and straight, entirely human. From the shape of the femur it is evident that the individual to which it belonged walked erect, which implies the remarkable adjustment of the cervical vertebræ between the spinal column and the head, which, more than any other anatomical peculiarity, differentiates man from the apes. Hence comparative anatomists like Cope and Lyddeker have no hesitation in pronouncing the specimens entirely human. They are those of a man and not of a connecting link.[13]

EVIDENCE OF UNITY AND EQUALITY

The unity and the substantial anatomical equality of the different races of mankind become more evident upon careful scientific investigation. What were supposed to be anatomical peculiarities of lower and prehistoric races are found, upon wider comparison, not to be peculiarities. The variation in the form of the temporal bone of the skull by which it comes in contact with the frontal bone, which was supposed to be characteristic of lower races, is found to exist among all races, though with unequal frequency. The lateral flatness of the tibia "observed in skeletons of the oldest remains of man in Europe, and also in the skeletons of various races," and various other abnormal forms, "are found among all races, but the degree of variability is not everywhere the same." [14] But in every anatomical arrangement showing the gap between man and animal, and the variations between races, man is widely separated from animals and but slightly separated from his fellows. According to Boas, "The European and the Mongol have the largest brains; the European has a small face and a high nose; — all features farther removed from the probable animal ancestor of man than the corresponding features of other races. On the other hand, the European shares lower characteristics with the Australian, both retaining in the strongest degree the hairiness of the animal ancestor, while the specifically human development of the red lip is developed most markedly in the negro. The proportions of the limbs of the negro are also more markedly distinct from the corresponding proportions in the higher apes than are those of the European." [15] According to Manouvrier, as summarized by Boas, "all the investigations that have been made up to the present time compel us to assume that the characteristics of the osseous, muscular, visceral, or circulatory system, have practically no direct relation to the mental ability of man." [16]

Estimates of the size of the brain, it is true, show a slight superiority for the white race. "According to Topinard," as given by Boas, "the capacity of the skull of males of the neolithic period in Europe is about 1560 cc. (44 cases); that of modern Europeans is the same (347 cases); of the Mongoloid race, 1510 cc. (68 cases); of African negroes, 1405 cc. (83 cases) and of the negroes of the Pacific Ocean, 1460 cc. (46 cases)." [17]

In analyzing these statistics it is instructive to notice that the brain of neolithic man was no larger than that of palæolithic and was equal to that of the modern European, and that the brain of the so-called lowest race averages larger than that of the lower members of the white race. Furthermore, it is to be observed that the brain of women is found to be lighter than of men of the same stature, while, as already stated, a few eminent men are known to have possessed unusually small brains. Hence it is by no means certain but that a well-developed small brain can equal a larger one in the amount of high-class work that it does. Darwin, in commenting upon the mental activities of the ant, significantly remarks that when we consider the size of its brain and the variety of its activities it would seem that its brain is the most highly organized segment of matter of which we have any knowledge.[18]

On surveying the whole subject, it appears to be evident that little confidence can be placed in any chronological calculations based upon the rate of the physiological changes by which man has become separated into races, and by which he may have advanced from the strictly anthropoid to the truly human stage. The element of uncertainty in this class of calculations lies chiefly in our ignorance of the extent to which the possession of man's mental faculties may be a disturbing factor in the ordinary course of evolution, but partly, also, in our ignorance of the relation of changing physical environment to the rapidity of modification of physiological characteristics.

Even Mr. Darwin did not seem to be fully aware of the wide range of individual variation constantly going on in nature; so that he was constantly assuming and asserting an excessively slow rate of change in species. Mr. Wallace[19] has some just criticisms upon Darwin's statement of this point. But facts are continually coming to light which show that the amount of variability in all widely dispersed species is so great that adaptations to new conditions may take place very rapidly, and this partly accounts for the fact that genera, both of plants and animals, have been so successful in surviving the great geological changes. For the most interesting and exhaustive collection of facts upon the extent of variability in wild species of animals, we are indebted to Mr. J. A. Allen, whose patient work [20] in examining the actual extent of variation among the mammals and winter birds of East Florida really marks an epoch in the Darwinian theory of evolution. From the facts collected by him it appears that the variations constantly going on in the wild birds of Florida affect every part of the frame, modifying the length of the body, of the wing, of the tail, of each toe, and of the bill. In amount the variations reach from twelve to twenty-five per cent, that is, in a thousand birds of a single species, in addition to those of average size, there will be a considerable number that were more than ten per cent above the average size in these several parts, and an equal number that were ten per cent smaller in these parts. It requires but a moment's reflection to perceive what a rapid engine of progress such an amount of variability furnishes. The variations are always present, standing ready to be caught up and carried farther on in the same line by any propitious series of circumstances. If, for example, there should come about a change of climate, such as to render it more difficult for birds to obtain their food, and that difficulty was such as to be overcome by the possession of a bill a quarter of an inch longer than the average, or of a wing ten per cent more powerful than the average, the individuals to survive would be those that possessed these bills, and that could make use of those more powerful wings. If we may suppose that there were a million birds to be subjected to this sifting process, all might perish but the favored ten thousand, and the preparation of species would henceforth go on from this selected remnant, that is, we would have in nature an even more powerful selective agent than we have in man while endeavoring to improve domestic varieties.

It has been a current objection to Darwinism,— that the minute variations he assumed would be of no advantage to an individual in time of trial. Of what advantage, for example, would it be to a woodpecker in time of scarcity of grubs to have a bill a thousandth of an inch longer than its fellow? The question is certainly pertinent, and the objection involved in it is valid. The variations, in order to furnish any opportunity for the action of natural selection, must be appreciable. And such we find them actually to be, — far more appreciable and marked than Darwin in his caution ever fully perceived.

From these facts concerning the extent of variability constantly affecting all portions of the organism, we can see at a glance that upon subjecting a species to new conditions, a variety with a uniform variation of ten per cent from the former average development of any part might be established in a few generations; and so long as the conditions remain permanent, the variety would remain permanent, and so become established as an actual matter of fact. Upon a subsequent change of conditions, these peculiarities might be still farther exaggerated. From our brief and imperfect experiments with domestic animals, we cannot tell how rapidly such changes might take place. But it is altogether more probable that the changes have taken place through what might be called a *paroxysm of nature,* than through an inch-by-inch process. The changing conditions of nature may be compared to a ratchet wheel, by which variations of a definite amount only are seized hold of and preserved, and that after a definite amount of change in the conditions.

As already remarked, the crowning physiological feature in man in which his superiority over the lower animals appears, is in the size and quality of his brain, — the average human brain [21] weighing three times as much as the average brain of the gorilla. By what process of natural selection can we conceive this great difference to have come about? To form any conception of it by the processes of natural selection, we are compelled to go back, and imagine some branch from the anthropoid family of early Tertiary times to have been led along by some kind of intelligent selection in the line of man's physical characteristics; while the full assumption of the human form may at last have come about with great rapidity. For the skull and brain cavity seem to be as variable in animals as any other portion of the system. Mr. Wallace affirms, for example, that the orangoutangs' skulls which he collected in Borneo "differed remarkably in size and proportions. The orbits varied in width and height, the cranial ridge was either single or double, either much or little developed, and the zygomatic aperture varied considerably in size. . . . As an instance of the amount of variation in the skulls of fully developed male orangs, I found the width between the orbits externally to be only 4 inches in one specimen and fully 5 inches in another." [22] The skulls of various other mammalia are found to be equally variable. Dr. Gray of the Britism Museum found in the skulls of ten bears examined by him variations to the extent of from one-eighth to one-fifth.

From this general survey of facts concerning variability, it is easy for us to see that, without disturbing the theory of the continuity of development, the finishing touch to man's physical organization securing that multitude of minute peculiarities which altogether separate him, by an immeasurable distance, even in a physical point of view, from his simian ancestry, may have been brought about in a comparatively short period of time; while those more moderate changes which have resulted in the peculiarities of race would demand even a shorter period. When that point was reached in which the reasoning powers of man became predominant and took the helm, the variations in the direction of the perfect human system would be seized upon and preserved with such constancy as to transform the physical appearance of the race with extreme rapidity.

Beyond question the physical organization of man is maintained at its present high level of perfection by its remarkable adaptedness to carry out the behests of his intellect. The human body is an admirable complement to the human mind. The size of the brain and the complexity of its convolutions are adjusted to the intellectual faculties of which it is the organ. The free and shorter arms with the delicately adjusted thumb and fingers upon the extremity, together with the well-developed lower limbs and the broad-soled foot, give to man the best conceivable form for the expression and accomplishment of his intellectual and rational purposes.

The same adaptive forces of natural selection which keep the human form within its typical limits, and may have operated with great rapidity toward the original perfection of that form, are still operative in the production of changes. Even now it is thought that high civilization is sensibly modifying many of the features of the race by preserving slight changes which favor economy of force. The diminution of the lower jaw, so characteristic of higher races, as compared with the upper, is not improbably thought by some to arise from the correlation between an increase of brain and a diminution of more functionless parts. Strength of jaw does not play the same rôle in assisting digestion among civilized that it does among savage nations. So, too, the loss of the hairy covering upon the body may be advantageous, by leaving more of the energy to be bestowed upon the organ of mental operations. There is an economy of force in wearing the hair of another animal over that of producing it for one's self. The full development of the mental faculties seems in many ways to be correlated with the diminution or disuse, and perhaps loss even, of some lower functions of the body. Intellectual power is gained in Germany by impairing the eyesight of school children, where now almost all have to use spectacles. And so, in general, the acuteness of the senses is dulled by our dependence upon invented processes and mechanisms.

When we come down to the final question of the mode of the origin of the human race, we meet in its fullest form the familiar problem concerning design in nature, and it has been convincingly argued by Wallace and others, that man's physical structure bears indubitable marks both of long-continued foresight in general preparation for its development and of intelligent selection in its final adaptation to the incoming mental powers of which it was to be the organ. It may be impossible for us to explain just how the designing Artificer of all things has woven his pattern. But that it has been woven by him is beyond all reasonable doubt.

CHAPTER XIII

THE PSYCHOLOGICAL EVIDENCE

In a strange fit of despondency Sir William Hamilton fell into the mistake of supposing that modern science was in danger of robbing life of its highest incentives and its noblest joys by clearing up all the mysteries of the universe, and banishing wonder and reverence from the mind of man. Nothing, however, could be farther from the truth than this. The portion of nature's realm which can be illuminated by the torch of science is but infinitesimal in comparison with the whole domain. Newton brought more mysteries into the horizon than had ever been dreamed of before. Darwin has raised ten thousand questions where he has answered one. Every secondary cause brought to light by scientific research reveals a vast array of other causes necessary to account for the one already partially comprehended. The man of science can never push his processes of thought far enough back to explain the real origin of anything. Instead, therefore, of diminishing wonder, and of undermining the foundations of reverence, his work legitimately increases wonder and magnifies the mystery of the creation.

The doctrine of evolution as it appears in modern science is not a doctrine pertaining to ultimate things, but to the secondary processes of nature, and does not in any way interfere with the legitimate arguments of theism. The processes of evolution demand a creator of infinite power and wisdom to set them in motion. Speaking in general terms, there are three prevalent modes of attempting to conceive of the Creator's relation to the universe; namely, the mechanical, the immanent, and the supervisory.

The mechanical theory represents the Creator as impressing upon the original molecules of matter comprising the universe such capacities and movements that there should eventually come out of them all the combinations revealed by the science of chemistry, and of astronomy; while some would maintain that even life itself was involved in the combinations, so that it should come into being by spontaneous generation. Nor would it stop with the production by natural forces of the phenomena of life. Even the higher qualities of the human mind are brought into the grasp of the theory, and thought is looked upon as a secretion of the brain, as bile is of the liver.

Various names imperfectly describe this theory. In a former century it would have been called deism,[1] which so magnified the exertion of creative power in the beginning as to shut off all necessity for its presence and interference at any subsequent stage of progress. This is not atheism. At any rate, it is not so in fact, whatever it may be in name, for if it rejects the name of the Deity, it cannot help transferring to the original elements of the universe all the potencies ordinarily attributed to the Creator.

2' At the other extreme lies the doctrine of the divine immanency, which aims to save both nature and man from the inexorable rule of fate and mechanical forces by robbing them of all real independent existence. This view of the universe would represent it as the constant product of an ever-acting deity. It distinguishes itself from pantheism by insisting upon the freedom of the divine activity. What are ordinarily called laws of nature are under this theory regarded merely as the lines of permanent activity which the wisdom of the Creator has imposed upon himself. These lines of activity are more or less permanent or subject to variation, somewhat after the manner of the adjustment between the constitutional and statute laws of a nation. Those natural forces which exhibit themselves in such phenomena as those of chemistry and astronomy are the permanent lines of the Creator's activity corresponding to the principles of constitutional law; while in the more variable phenomena of animal and plant life and the still more complex phenomena of human history, we have what corresponds to statute law, which the legislature is free to change from day to day. It is enough to say of this theory, that it meets its most formidable difficulty in the prerogative of independent choice which belongs to the human will, and which in the most emphatic manner declares that man in the realm of his moral activity is not an automaton, but a free and independent power, having in his own consciousness the highest possible evidence that in the realm of moral choice he is the architect of his own fortunes.

In its ultimate analysis, however, the doctrine of the divine immanency as held by the majority of its advocates does not differ essentially from the theory which supposes the Deity to be both the creator and the supervisor of the universe. According to both theories, the ordinary progress of events was directly provided for in the creation, or what we may call the constitution of nature, while, on either theory, it is not believed that all contingencies are thus provided for. This view of the universe does not rest upon mere *a priori* principles, but is one which is forced upon us by the study of nature itself, and especially by the questions that arise in attempting to account for the origin of the human race. Nor does this theory interfere with the continuity of nature: it does not necessarily suppose a break in the course of nature at any point. The web of nature is continuous, but additional threads are inserted from time to time to increase the complexity and add to the beauty of the figure.

However much we may emphasize the continuity of nature, it is difficult not to admit that there have been at least three stages of development in which something new has been added to, or, as we might say, grafted upon, the course of nature. Granting that the nebular hypothesis, or something like it, is proven, and that the worlds are but nuclei condensed by gravitation from more widely disseminated spheres of matter, the conditions were at first utterly incompatible with the existence of living organisms. But in due process of time vegetable life sprang into existence upon the world. Some have endeavored to maintain that the first forms of life were the direct products of chemical action. But all efforts to produce life independent of preëxistent life germs have heretofore failed. Spontaneous generation is a figment of the imagination originating neither in experiment nor observation, but in a preconceived and proofless theory concerning what *might* have happened in a condition of things which is beyond the reach of experiment or observation. This Mr. Huxley frankly admitted. Abandoning, however, for a moment, the light of science, he had faith that somehow in the chemical interactions of a cooling universe there was developed that unique power which meets us in a living organism.[2] But to most well-balanced minds it must still seem to be more in accordance with the facts to regard the active principle which produced the phenomena of vitality as a positive addition to the forces of the world, if not of the universe.

In distinction from all known chemical agencies, the living principle has the power of growth and reproduction. It adapts itself to conditions, and appropriates to its uses the materials and forces surrounding it, but it also overcomes their agency, and acts in opposition to them, and finally through a microscopical germ transmits to its successor all its own powers. In the language of Genesis, it "has seed in itself." Such is its ability to conquer nature, that from a single germ planted in favoring conditions in the most obscure part of the earth, it is only a question of time when its progeny will have spread over the whole surface of the globe; yes, more, when, according to the theory of evolution, it will have diversified itself so as, in the course of ages, to appear in the hundreds of thousands of botanical species into which the men of science have classified the vegetable world.

It is impossible rationally to believe that such a principle of life is the product of chemical forces. It is rather a coördinate force which furnishes the physiological foundation for any well-considered doctrine of the derivative origin of species. Chemical and physical forces are but the machinery of a mill. Machinery cannot make cloth of itself: there must be put into it the cotton or the wool or the silk, for the machinery to work upon. The product is the joint result of the work of the one and the qualities of the other. If any one wishes to believe that the marvellous adaptive capacities of plant life sprang from the dead forces of nature, he is at liberty to do so, but at the risk of his reputation for sanity. In the absence of all scientific evidence he is not at liberty to impose it on any one else for belief.

If we admit that these primordial germs of vegetable life had within them the power and potency of developing into the hundreds of thousands of species which now cover the dry land from pole to pole, and even invade the sea and support themselves on its bosom, we must still find it hard to believe that plant life has had within itself from the beginning the power of ultimately taking upon itself the forms and prerogatives of animal life; and this, even though it must be admitted that it is impossible to determine whether some of the lowest forms of life belong to the animal or to the vegetable kingdom. For, so nearly alike are some of these forms that Mr. Francis Darwin has humorously suggested that the only practicable way of determining to which kingdom they belong would be to ascertain what class of animals would eat them, — whether Herbivora or Carnivora. It should be observed, however, that this difficulty of distinguishing plants and animals exists only in the very lowest forms of life. As a rule, there is no difficulty in distinguishing an animal from a plant. Animals give evidence of having sensation and intelligence, and, so far, approach the dignity of companionship with man. They give evidence of having pleasure and pain; so that we recoginze them as having rights which we are bound to protect, and organize societies for the prevention of cruelty to them — a thing we should never think of doing for plants.

If any wish to believe that the germs of plant life have by their own power assumed these higher characteristics of sensation and intelligence, they are free to do so, but it is well for them to be reminded that in making this supposition they are acting on evidence of no scientific value, and are ascribing to infinitesimal germs an amount of flexibility and latent power which seems to most people not only incredible, but absurd. Especially is this so if one step farther is taken, and this vegetable germ which has been supposed to contain in it the powers and potencies of animal life, is itself also to be resolved into some special combination of molecular motion. To imagine that animal life has developed from vegetable life, and that vegetable life is a spontaneous development from the fire mist, and that from nothing or *next to nothing,* is the same as resting the argument upon nothing, or next to nothing. To say that the Creator has power originally to impress upon matter the ability at a proper time to transform itself into vegetable germs, and at another time to rise to the higher level of animal feeling and intelligence, is to utter statements which are incapable of proof, and are harder to believe than the statement that the Creator has from time to time added new forces to the unfolding material system.

But it is not necessary to perplex ourselves unduly with the metaphysical questions concerning the manner in which these new things have been incorporated into the system. Even if, with Locke, we should grant the possibility that it is as easy for the Creator to endow matter with the power of thought as it is to create an independent substance capable of thought and join it to matter, we cannot avoid the fact that these manifestations of the higher powers of life and thought come in at successive stages of the material development, and are connected with peculiar effects upon the particles of matter with which they are associated. Vegetable life controls matter, and builds up a form for itself. In animals some low forms of apparently conscious thought make use of matter. To be sure, in one sense it is mechanical force which makes the dog's tail wag, but it is something different from mechanical force which makes the dog wag his tail. It is perhaps the memories of a long-lost voice, which is in no sense a physical force, that sets the train of associations in motion and rouses the joyous feeling of which the movement of the muscles is the sign and effect. If these germs of animal and plant life were in the original elements of the universe, the mystery of their lying dormant for such endless ages, and then awaking into life, surpasses comprehension. Mention has already been made of the gauntlet which the forms of life are compelled to run after once they have been ushered into the world amid the warring material forces of nature. It is not many millions of years since there was such a condition of things in the world that life could not exist at all; at least in connection with any of the material forms in which it is now organized. Ten millions of years ago, say some of the astronomers, the sun was so hot that all the oceans were dried up, and water — that indispensable accompaniment of organic life — was nowhere to be found in the world. Ten millions of years in the future, and the heat of the sun will so diminish that all the waters of the ocean will be frozen solid, and again there will be no water upon the earth to help the growth of the organized products of life. Between these two extremes of heat and cold, the organized products of life are maintaining a precarious existence.

ORIGIN OF MAN'S MENTAL FACULTIES

That man incorporates into his earthly nature all the essential elements present in the lower orders of being is evident to all. His body is built up of various chemical compounds. Dust he is, and, upon the sundering of soul and body, unto dust he will return. In his bodily organization, also, he is patterned after other members of the animal creation. So great is this likeness, that we are not compelled in reason to suppose that in the creation of man there has been an observable break in the order of nature. We may well believe that the law of parsimony has here, as everywhere else, been observed, and that there has been no unnecessary interference with the course of nature in the production of man. The question immediately before us is, Has there been any interference at all, or is a man a mere development from some of the germs of the animal nature? This is now the real battle ground between, we will not say contending schools of evolution, but contending schools of fundamental philosophy. On the one hand it is maintained that there is no radical difference between the mind of man and that of the higher animals, and that there is no impassable gap between the mental faculties of the human race and those of the higher animals. To prove this proposition, the highest mental activities of the highest animal are brought into comparison with the mental activities of the lowest races, and with the individual man in the lowest stages of his development.

Thus Mr. Romanes [3] supposes that he traces a significant parallelism between the intellectual development in the ascending orders of animals and that in the infant of the human species in the first few months of its development. To animals he ascribes a series both of emotional and intellectual activities, reaching as high in the order of complexity as those attained by the child at the age of fifteen months. He believes that the Echinodermata exercise memory; that the larvæ of insects possess primary instincts and exhibit surprise and fear; that mollusks exercise association by contiguity; that insects and spiders recognize their offspring, have some parental affection and social feeling, exercise pugnacity, industry, and curiosity; that reptiles and cephalopods recognize their friends and their enemies; that the Hymenoptera are able to communicate their ideas and to feel the bond of sympathy; that birds recognize pictures, understand words, dream, and have the emotions connected with emulation, pride, resentment, æsthetic love of ornament, and terror; that the Carnivora, rodents, and ruminants appreciate to some extent the construction of machinery, and experience the emotions connected with grief, hate, cruelty, and benevolence; that monkeys and elephants use tools to some extent, and are moved with the feelings of revenge and rage; and, finally, that anthropoid apes and dogs have a rudimentary conscience and an indefinite idea of morality, and exhibit the feelings associated with shame, remorse, deceitfulness, and whatever is ludicrous. This is as high a point of development, Mr. Romanes contends, as is attained by the child at the age of fifteen months.

According, therefore, to the argument from gradual approach, he maintains that we cannot in logical consistency refuse to supply the other rounds in the ladder which by some adverse fate are acknowledged to be absent, and to maintain the solidarity of the animal creation, and a true brotherhood between man and the lower animals.

But it is hardly fair to the human race to estimate its capacities by the development of a child fifteen months old, when he is at the very commencement of his marvellous intellectual career. It is later than this that his high powers of conceptual thought come into free play, and link their products with the rapidly acquired forms of grammatical speech. It is much later still that the mind of the child begins to grasp the connected facts of the universe surrounding him, and to enter upon that endless path of inductive reasoning which enables him to accumulate knowledge without measure. It is later still that his eyes and ears are open to the beauties and harmonies of the universe and that the moral nature begins fairly to assert itself, and to bring in upon the mind thoughts of God and duty, with their associated visions of immortality.

The marvellous rapidity with which the development of these higher elements of our nature takes place cannot fail to be a matter of astonishment even to the superficial observer. Mr. Romanes confessed that "there is some reason to think that when this growth has attained a certain point, it makes, so to speak, a sudden leap of progress, which may be taken to bear the same relation to the development of the mind as the act of birth does to that of the body. In neither case is the development anything like completed. Midway between the slowly evolving phases *in utero* and the slowly evolving phases of after-growth, there is in the case of the human body a great and sudden change at the moment when it first becomes separated from that of its parent. And so, there is some reason to believe, it is in the case of the human mind. Midway between the gradual evolution of receptual ideation and the no less gradual evolution of conceptual, there appears to be a critical moment when the soul first becomes detached from the nutrient body of its parent perceptions, and wakes up in the new world of a consciously individual existence." [4]

This power of the soul to take such a leap of progress, and to wake up in the new world of conscious individual existence, is certainly something that needs accounting for. In its significance it covers the whole breadth of the discussion. The possession of such a latent power makes all the difference between the man and the animal. Mr. Romanes' way of minimizing the difficulty is successful only as a form of words. It is as if he were to say, The only difference between this black powder and that appears to be that when a match is touched to one it explodes, while the other does not. But this is the most striking difference between gunpowder and sand. Or it is like saying of two bipeds. They walked together along the edge of the precipice: the principal difference between them seemed to be that one had the power to leap off the precipice without falling to the ground, while the other could not do it. This is easily enough stated, but anatomically considered, it expresses a radical difference between a man and a bird. In reality, this difference which Mr. Romanes so slightingly expresses is that between a being capable of endless progress in knowledge and of one limited to a very narrow sphere of possible attainment.

It signifies but little to say, that there is no radical difference between men and animals in the matter of using tools, because, perchance, a chimpanzee has been known to make use of a stick to pry open a door, or an ape to pick up a stone to crack a cocoanut, or an elephant to seize a broken-off branch of a tree with which to brush the flies from the inaccessible portions of his body. To say nothing of modern machinery, there is really no just comparison between these instinctive acts of animals in appropriating to their use the ready-made products of nature and that of the lowest savage who skillfully constructs his sling and bow and fashions his stone arrow-point, or axe, or lance-head.

In the use of fire, also, it is of small significance to find that many of the animals appreciate its benefit and seek its genial influence; as cats do when they stretch themselves in front of the kitchen stove, or as apes do when they huddle about the smouldering trunk of a tree which has been struck by lightning. But man alone has been able so to profit from his observations as to keep fire from day to day by burying its embers, or to create it anew by use of steel and flint and tinder, or by the still more primitive process of igniting two sticks of wood by rubbing them vigorously together.

It is an unworthy travesty on musical art to compare, as a recent writer has done, the din created by a company of chimpanzees drumming on hollow trees and accompanying the sound with loud yells, to "sopranos and tenors of strong pulmonary powers, trying to outshriek the clash of a Wagnerian orchestra." [5]

Man has no occasion to disparage the capacities of the animal world; for he himself is certainly in large part animal; but the difference between his mental capacities and theirs is enormous, and most far-reaching in its significance. The power of unlimited progression does not exist in the lower animals, while it is possessed by all races of men, and has everywhere exhibited itself in marvellous results. Not only is this seen in the products of modern civilization, but it appears in striking light, at the very dawn of definite history, in such structures as the pyramids of Egypt and the dolmens of Northern Europe, in the vaulted arch constructed in the earliest ages of Babylonian history, in the early discovery of processes for separating iron from its ore, and for making and hardening bronze, and the scarcely less remarkable discovery and use of the elasticity of the bow, and of the susceptibility for domestication and improvement of various plants and animals and of their actual appropriation for the use of man. These higher powers of the human mind must be distinguished from the instincts, which both in man and animals are effective in inverse ratio to the power of inductive reasoning.

Animals and men are indeed the common possessors of many instinctive powers which, at the very dawn of life, and in numerous emergencies in after years, operate directly without instruction for the accomplishment of purposes which are essential for the preservation of the species. The first act of the bird in his nest is to open his bill to receive food. The first act of the young of all mammals, including man, is to bring into use the coördinate muscles used in extracting the mother's milk. The range of things accomplished by instinct in animals is surprising. By instinct we mean those activities for the preservation of self or of the species which are entered upon without instruction, and, so far as we can see, without consciousness of the ends which are to be secured by them. These activities which are so numerous and wonderful in the animal creation are largely supplanted in man by the guidance of his cumulative wisdom. But instinct is perfect at the outset: it is not amenable to instruction: it does not perceive its ends through any process of inductive reasoning. As we have said, man has indeed a limited number of these instincts, but their influence in the history of the race appears in inverse proportion to the development of his inductive powers of reasoning. It is in these powers of inductive reasoning, we repeat, that the real superiority of man appears, and the marvel does not grow less either in quantity or quality as we carefully scan his attainments.

The difference between the limitations of animal intelligence and those of man's is readily enough seen if one attempts to teach an animal any inductive science. A dog can be taught a little; he can be taught to stand upon his head, to utter a peculiar bark when he wishes to be fed, to go in search of his master when he is lost, and even to scour the snowclad summits of the Alps in search of unknown travellers who have missed their way. But the enlargement of knowledge which he is able to make beyond what is directly revealed to his senses is extremely limited in comparison with the lowest attainments of inductive science. So keen is the dog's scent, that if he is shown the stocking of the child who has strayed from home, he can follow his steps through the crowded mart of the city and find the hapless object of his charge far quicker than he could be found by the whole detective force of the government. But if one undertakes to teach a dog such a science as geology, he will see at once the nature of the dog's limitations. Undertake, for instance, to get into the mind of a dog the theory of the Glacial epoch. Take him with you to look at the scratched surfaces of rock from Maine to Alaska, endeavor to get him to understand the significance of the kames, and osars, and gravel plains, and the sheet of till spread over the millions of square miles of the glaciated area; show him in Southern Ohio a granite bowlder from the Laurentian highlands and a nugget of copper from the shores of Lake Superior, and what hope will you have of arousing any idea in his brain?

Yet the human mind is everywhere capable, if not of interpreting, at least of understanding the interpretation of, such widely distributed facts. There is not an audience anywhere to be found in the world which, if you can get their attention, cannot be made to see the connection of these facts with one another through the causal bond of a glacial period, and there is not a hearer so stupid that he will not ask, What is the cause of the glacial period which you say is the cause of these phenomena? The human mind is, by nature, inquisitive to a degree that renders the rudiments of inquisitiveness in the lower animals utterly insignificant. If we call this impulse an instinct of man, it is the instinct which impels one to seek for the cause of all things, and does not allow him to rest until he has formulated some idea of the first cause, that is, of the Deity. This is really the foundation of the religious nature of man, so that, properly enough, he has been defined as "a religious animal." Underlying all the superstitious practices of the heathen world, there is a pervasive sense of a divinity ruling over all.

There is no end to the enumeration of the subtle clues of nature which the human mind can take up and follow out to most interesting and comprehensive results. To draw another illustration from the science which has played such a part in the present discussion: suppose that one insists that he is not interested in the subjects of archæology and the evidences of man's connection with the Glacial epoch; he does not care to consider such vulgar things as glacial dams and glacial mill ponds and the erosion of ice-laden streams, still we would not despair of interesting him in our subject. Perhaps he cares for botany, and admires the tiny flower that nestles in the wall, and the luxurious vine that covers with its mass of verdure the decaying oak, or the stately cedar that mantles Lebanon with its solemn shadow. But in studying the distribution of these over the earth he will find himself unwittingly paying deference to glacial geology. For what was it but the great ice sheet that drove down to their present habitat from the far north the bald cypress of the Southern States, the gigantic Sequoias of the Pacific coast, and their near relative the Chinese Glyptostrobus to the mountains of Japan and Northern China? And, again, what but this far-reaching force of glacial action could have driven down from the colder climates the arctic plants now inhabiting the summit of Mount Washington, and what but this could have forced the patriotic Scotch heather to leave its native mountains and take up a lonely residence on the barren hills of Eastern Massachusetts?

If now our inquisitor says that he is not particularly interested in botany, and we ask him, In what then are you interested? he will perhaps attempt to indicate something which might seem as far removed as possible from our subject, and answer, Of all things in the world, I delight in the study of butterflies. But, alas, he is caught in his own devices, and unwittingly has attached himself to our triumphal glacial car! For has not Mr. Scudder described whole colonies of arctic butterflies living in lonely isolation about the summits of Mount Washington, and how could they by any possibility have migrated thither except under the conditions furnished by the Glacial epoch? And are not the relatives of these colonies found in the Rocky Mountains and in the Alps, where they bear testimony to the same pervasive influence?

At last in despair, he says, But I am more interested in human history and archæology. Wherefore, then, is a glacialist asked to discourse on the origin and antiquity of the human race except that the Glacial epoch has come in these latter days to be one of the most important and productive collateral branches in historical and archæological investigation. And this is a connection which man wherever found has intellectual capacity to understand. But how absurd the idea of imparting this information to an animal!

But these are only a few of the ten thousand illustrations of the superior capacity of man's mind to interpret nature and to accumulate knowledge concerning its operations both in distant space and in distant time. Man has, and so far as we can see no other animal has, the marvellous power to transcend the bounds of space and time and to find

> "tongues in trees, books in the running brooks,
> Sermons in stones, and good in everything."

The student of science is often asked for the utility of his investigations. As answer, he might put in evidence all the material accomplishments of modern civilization. But, better still, he may point to the enrichment of the intellectual life of all who become cognizant of the facts ascertained and the principles established by scientific investigation. To add a comprehensive thought or an important principle to the accumulating stock of the world's ideas is to increase the value of human life beyond all pecuniary estimate. The world was made for other things than the production of bread and butter. Man alone is possessed of these marvellous powers of thought and investigation, while the whole world is adapted to evoke these powers to the utmost, and to give to him the highest mental satisfaction.

In considering the means by which the great attainments of modern civilization have been reached, we find that of language standing out most prominently of all. It is by articulate speech and written language that men are able to formulate their thoughts and to communicate them to one another. Thus the wisdom of each becomes the wisdom of all, and the attainments of one generation are passed onward to serve as the starting point of progress for the next. There is really no comparison between the service rendered to man by human speech and that rendered to animals by their imperfect and rudimentary methods of communicating with each other. Romanes thinks that if dogs had the parrot's power of speech, or if a parrot had a dog's brain and intelligence, it would be only a question of time when they would attain the mental capacity of some of the lower races of mankind. On the contrary, thought precedes language. The very existence of language implies all the essential human powers of thought. It is because men have thoughts to be preserved and communicated that they fix upon conventional sounds and signs in which to embody their ideas. It is an impressive fact that human language is everywhere essentially alike. Every language has a grammar; every language contains the essential concepts of human thought. The sublimest thoughts of the world can be translated into the most barbarous dialects in existence.

This is illustrated in a remarkable manner in the history of modern missions. Whatever one may say about the final character of the religious conceptions of the Book, all must grant that the Bible is to be reckoned among the noblest literatures of the world. Yet to-day there is no nation so degraded that it has not a language into which the Bible can be translated, and with little loss of power. The evidence of this is witnessed to, the world over, in the results of Christian missions. Hundreds of languages have been reduced to writing by missionaries, and the Bible has been translated into them and disseminated for the enlightenment of the people. No one has borne more positive testimony than Mr. Darwin has to the transforming effect of these influences upon the savage tribes of Polynesia, where, even before his visit, group after group of islanders had been changed by the persuasive influence of the religion embodied in the Bible from cannibals to well-ordered communities in which a shipwrecked sailor's life would be as sacred as in England or America. In the opinion of Mr. Darwin the natives of Patagonia were possessed of about as little mental capacity, and were sunk down as low in degradation, as it is possible to conceive human beings to be. Yet the efforts of missionaries to improve their character, and to impart to them the noble and humanizing effects of Christian ideas, were so successful that he became a constant and liberal contributor to the funds supporting them in their work.

When, now, we come to seek the bearing of these facts upon the question of the origin and antiquity of the human race, we shall find that they are both direct and significant. These characteristics of man which we have taken as the indications of his higher nature are the products of his mental capacities, rather than their cause. It is not the use of tools that has produced his mental capacity. It is his mental capacity which has invented tools and made them the means of his progress; and among the most important of these tools we must reckon the fire with which he cooks his food and makes himself independent of climatic changes. It is not language which has produced the brain of man, but it is the mental capacity associated with the brain which has first made a demand for, and then created, the language. All the endless progress of the inductive sciences and the higher conceptions of the obligation to love his fellows and to reverence his God reveal elements of human nature that have but at least a rudimental development in the highest of the lower animals.

That there is not the difference in mental capacity between the races of men which is sometimes supposed is ably maintained by Mr. Franz Boas from his comparison of the ancient civilizations of the Old World and the New. "The civilizations of ancient Peru and Central America," he maintains, "may well be compared with the ancient civilizations of the Old World. In both we find a high stage of political organization: we find division of labor and an elaborate ecclesiastical organization. Great architectural works were undertaken, requiring the coöperation of many individuals. Animals and plants were domesticated, and the art of writing had been invented. The inventions and knowledge of the peoples of the Old World seem to have been somewhat more numerous and extended than those of the races of the New World, but there can be no doubt that the general status of their civilization was nearly equally high"; [6] adding that the rapidity of development in the Old World is no proof of greater ability.

In answering the question Why then has there been greater progress in the Old World than in the New? Boas would say that it is explained by the "laws of chance." We prefer to say that, substituting the word "Providence" for "laws of chance," the adequate explanation is, that the Old World was favored by the rise of lawgivers, inventors, and leaders of special ability who have made contributions of world-wide significance to man's stores of knowledge and stock of artistic efficiency, and thereby have started him forward upon a career of cumulative progress. Menes in Egypt, Hammurabi in Mesopotamia, Moses in Israel, Solon in Greece, the Cæsars in Rome, Galileo in Italy, Gutenberg in Germany, Newton and Watt in England, Morse and Gray and Edison and Wilbur Wright in America, and such as they, have led in a line of progress in which the multiude could only follow. Bereft of the additions which these and such as they have made, man would still everywhere be in a state of primitive barbarism.

The more probable scientific hypothesis with reference to the origin of those higher capacities of the human race is that they appeared in the world as an addition and positive increment to the intelligent forces before in existence. If we adhere to the derivative origin of man, we should say that to the man of science he appeared as what breeders would call a "sport." But we need not commit ourselves to any particular method by which the Creator secured the result. In any event it must have come about in accordance with a well-ordered plan. If it took place by direct interference, we may rest assured the interference did not occur until the fullness of time. If by foreordination, it was still a divine gift inwrought into an orderly system.

At any rate, there is no greater philosophical difficulty attending the theory of the evolution of man from nature by divine appointment, than there is in the well-known fact of the evolution of the individual soul from its parents. Whence came our individual souls? The theologians are divided into two schools, according as they maintain that the soul is derived by natural law from the parents, or that the soul is in every case a direct gift from the Creator. The first are called Traducianists, the second Creationists. So long as they continue to contend over this question of the mode of the origin of the individual soul, one may be pardoned for asking liberty of conviction with reference to the mode of the origin of the higher qualities of the race itself.

But history forbids us to draw any confident inferences concerning the antiquity of man from the known rate of the progress which he has already made. Progress in the world has been by fits and starts. Menes arises, and with him Egyptian civilization. Alexander comes upon the field, and the whole world changes front. Copernicus gazes upon the stars, and the earth no more seems to stand still, while the sun ceases to be thought of as in motion. The mariner's compass is discovered, and the stormy ocean ceases to be a barrier between the continents. Stevenson and Watt and Franklin and Field bring forth their speculations about the nature of steam and electricity, and we live and move and have our being in a new world. Yet all these thousands of years the larger part of the human race have been stationary in their development. The habits and customs of their ancestors have settled down upon them like a midnight pall and quenched all the progressive impulses of their souls. There has been no law of progress in human history from which we can infer the length of time required for the race to attain the development of the earliest recorded history. The glittering generalities of evolution do not help us to any definite chronology.

CHAPTER XIV

THE BIBLICAL SCHEME

THE men of science belie all their own pretensions to candor and thoroughness when they without consideration contemptuously set aside the evidence of the Bible relating to the origin and antiquity of the human race. For, in addition to the great antiquity of the documents incorporated into the book of Genesis, its account of the origin and distribution of the human race bears such internal marks of truthfulness that it cannot be ignored in any really scientific treatment of the subject.

But in considering the evidence of these Biblical documents it is important to give them a fair interpretation according to the character of the literature to which the several documents belong. The first chapter of Genesis is highly rhetorical in its form, and has not inaptly been termed by some a "poem of creation." But even so its conformity to the modern conceptions of science, as well as to those of theology, is so striking that it has drawn from Haeckel the following well-deserved tribute: "Its extraordinary success is explained not only by its close connection with Jewish and Christian doctrine, but also by the simple and natural chain of ideas which runs through it, and which contrasts favorably with the confused mythology of creation current among most of the ancient nations. . . .Two great and fundamental ideas, common also to the non-miraculous theory of development, meet us in the Mosaic hypothesis of creation with surprising clearness and simplicity — the idea of separation or *differentiation,* and the idea of progressive development or *perfecting*. . . . In his [Moses'] theory there lies hidden the ruling idea of a progressive development and a differentiation of the originally simple matter. We can therefore bestow our just and sincere admiration on the Jewish lawgiver's grand insight into nature, and his simple and natural hypothesis of creation, without discovering in it a so-called Divine Revelation." [1]

Conformably to the teachings of science, the writer of Genesis represents man as the latest born of creation, and states the fact in a form that need give no offense to modern science. He has a very inadequate knowledge of the meaning of words who would limit the significance of "dust of the earth" to unorganized clay and sand. At the same time it will be difficult, if not impossible, for any one to account for the higher nature of man in any better way than it is done in Genesis. It is most in accordance with the facts to look upon the higher nature of man as a divine gift; and the method of stating this by the sacred writer is too sublime not to be true. "And God said, Let us make man in our image, after our likeness." "And the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul."

In respect to the account of the creation of woman, it is sufficient to say, with Dr. Bartlett,[2] that "the fact of sex, not only in the human species, but throughout animated life, and its unfailing adjustment from the beginning, is a fact before which, when fairly considered, the most enthusiastic evolutionist has nothing satisfactory to offer. So infinite are the probabilities against a single individual appearing in exactly the right time and with the right constitution to be in perfect correlation to another individual for the continuation of the species, and so inconceivably infinite against this occurrence taking place through the hundreds of thousands of species and countless millions of individuals, and in such wise as to insure its never-failing continuance, that one need hardly hesitate to pronounce the statement of the direct creation of the first woman to be the most simple and the most probable explanation. Nothing certain can be alleged against it, and nothing certain, if anything probable, can be advanced instead of it." [2]

It is proper, however, to add that the word translated "rib" has no such definite meaning in Hebrew as our translators have given it. Elsewhere it is given the generic meaning of "side." As the object of preserving this account is to enforce the sanctity of marriage, much liberty must in reason be given to the use of figurative language; and there is room, also to regard with favor those who would understand the account of woman's creation as being a vision of the first man, when, as represented, he had fallen into a deep sleep. The straits to which naturalists are driven in their efforts to account for sex is shown in Darwin's suggestion that, in conformity with the mythology of the ancient Greeks, the remote original ancestor of man was an hermaphrodite. The discussions between the polygenists and the monogenists are well nigh a thing of the past. The unity of the human race is now so generally accepted that it is scarcely necessary to consider it as needing defense.

Mankind has distributed itself from some common center. The question as to how the finishing touches were put on to the species may never be known, and need not seriously concern us in the present discussion. The mystery is not lessened by the assumption that it was done by gradual approach through insensible stages of the progress. But it is as unscientific to tie the hands of the Creator to that process as to any other. In the words of Quatrefages, "Man is evidently an exceptional or aberrant type among mammals. He, alone, is constructed for a vertical position; he, alone, has true hands and feet; he, alone, exhibits the highest degree of cerebral development, and possesses that superiority of intelligence which makes him master of all around him.

"To allow that the human type, though the most perfect of all types, the exceptional genus in the midst of all others, has come into existence in several centers of appearance without characterising any, would be to make him a solitary exception.

"However strong may be our polygenistic tendencies, and however many species we may admit, we cannot help acknowledging that the original localisation of the human *genus* in a single centre of appearance and the characterisation of this centre by him are the logical consequence of all facts attested by zoölogical geography."[3]

It is significant, moreover, that the original center of the human race is located by the Hebrew Scriptures somewhere in the vicinity of that which has been indicated by all scientific inquiry. Science no less than the Bible has a "Garden of Eden," somewhere in, or near, Southern Asia, where man could at first live in paradisaical conditions and from which both he and the most important animals and plants upon which he is dependent for sustenance have migrated to the ends of the earth. According to the best interpretation, the Garden of Eden described in Genesis was located in the lower part of the Euphrates Valley, near the head of the Persian Gulf, where the Karun and the Kerkhah rivers, coming down from the east, join the Satt el-Arab, formed by the junction of the Tigris and Euphrates.

As to the date of the appearance of man at this center, there seems to be a serious discrepancy between the statement of Scripture and the scientific inductions which we have so confidently made. To remove this discrepancy it is necessary to give close attention to the question of Biblical chronology. On the face of them the genealogies in the fifth and tenth chapters of Genesis limit the antiquity of the human race to about six thousand years. To obviate this objection we can do no better than to incorporate entire an article upon "Primitive Chronology" by the able and orthodox Professor William Henry Green of Princeton, prepared at my solicitation, and published in the *Bibliotheca Sacra*, April, 1890, and ever after referred to by him as embodying his mature wisdom upon the subject.

THE question of the possible reconciliation of the results of scientific inquiry respecting the antiquity of man and the age of the world with the Scripture chronology has been long and earnestly debated. On the one hand, scientists, deeming them irreconcilable, have been led to distrust the divine authority of the Scripture; and, on the other hand, believers in the divine word have been led to look upon the investigations of science with an unfriendly eye, as though they were antagonistic to religious faith. In my reply to Bishop Colenso in 1863, I had occasion to examine the method and structure of the Biblical genealogies, and incidentally ventured the remark[4] that herein lay the solution of the whole matter. I said: "There is an element of uncertainty in a computation of time which rests upon genealogies, as the sacred chronology so largely does. Who is to certify us that the antediluvian and ante-Abrahamic genealogies have not been condensed in the same manner as the post-Abrahamic? . . . Our current chronology is based upon the *prima facie* impression of these genealogies. . . . But if these recently discovered indications of the antiquity of man, over which scientific circles are now so excited, shall, when carefully inspected and thoroughly weighed, demonstrate all that any have imagined they might demonstrate, what then? They will simply show that the popular chronology is based upon a wrong interpretation, and that a select and partial register of ante-Abrahamic names has been mistaken for a complete one." Further reflection has confirmed me in the correctness of the opinion then expressed.

At the courteous request of the Editors of the *Bibliotheca Sacra* I here repeat, with a few verbal changes, the discussion of the Biblical genealogies above referred to, and add some further considerations which seem to me to justify the belief that the genealogies in Genesis, chapters v. and xi., were not intended to be used, and cannot properly be used, for the construction of a chronology.

It can scarcely be necessary to adduce proof to one who has even a superficial acquaintance with the genealogies of the Bible, that these are frequently abbreviated by the omission of unimportant names. In fact, abridgement is the general rule, induced by the indisposition of the sacred writers to encumber their pages with more names than were necessary for their immediate purpose. This is so constantly the case, and the reason for it so obvious, that the occurrence of it need create no surprise anywhere, and we are at liberty to suppose it whenever anything in the circumstances of the case favors that belief.

The omissions in the genealogy of our Lord as given in Matt. i. are familiar to all. Thus in verse 8 three names are dropped between Joram and Ozias (Uzziah), viz., Ahaziah (2 Kings viii. 25), Joash (2 Kings xii. 1), and Amaziah (2 Kings xiv. 1); and in verse 11 Jehoiakim is omitted after Josiah (2

Kings xxiii. 34; 1 Chron. iii. 16); and in verse 1 the entire genealogy is summed up in two steps, "Jesus Christ, the son of David, the son of Abraham."

Other instances abound elsewhere; we mention only a few of the most striking. In 1 Chron. xxvi. 24 we read in a list of appointments made by King David (see 1 Chron. xxiv. 3; xxv. 1; xxvi. 26), that Shebuel,[5] the son of Gershom, the son of Moses, was ruler of the treasures; and again in 1 Chron. xxiii. 15, 16, we find it written, "The sons of Moses were Gershom and Eliezer. Of the sons of Gershom Shebuel was the chief." Now it is absurd to suppose that the author of Chronicles was so grossly ignorant as to suppose that the grandson of Moses could be living in the reign of David, and appointed by him to a responsible office. Again, in the same connection (1 Chron. xxvi. 31), we read that "among the Hebronites was Jerijah the chief"; and this Jerijah, or Jeriah (for the names are identical), was, according to xxiii. 19, the first of the sons of Hebron, and Hebron was (ver. 12) the son of Kohath, the son of Levi (ver. 6). So that if no contraction in the genealogical lists is allowed, we have the great-grandson of Levi holding a prominent office in the reign of David.

The genealogy of Ezra is recorded in the book which bears his name; but we learn from another passage, in which the same line of descent is given, that it has been abridged by the omission of six consecutive names. This will appear from the following comparison, viz:—

1 Chron. vi. 3–14.	Ezra vii. 1–5.
1. Aaron	Aaron
2. Eleazar	Eleazar
3. Phinehas	Phinehas
4. Abishua	Abishua
5. Bukki	Bukki
6. Uzzi	Uzzi
7. Zerahiah	Zerahiah
8. Meraioth	Meraioth
9. Amariah	
10. Ahitub	
11. Zadok	
12. Ahimaaz	
13. Azariah	
14. Johanan	
15. Azariah	Azariah
16. Amariah	Amariah
17. Ahitub	Ahitub
18. Zadok	Zadok
19. Shallum	Shallum
20. Hilkiah	Hilkiah
21. Azariah	Azariah
22. Seraiah	Seraiah
	Ezra

Still further, Ezra relates (viii. 1, 2):—

"These are now the chief of their fathers, this is the genealogy of them that went up with me from Babylon, in the reign of Artaxerxes the king. Of the sons of Phinehas, Gershom. Of the sons of Ithamar, Deniel. Of the sons of David, Hattush."

Here, if no abridgement of the genealogy is allowed, we should have a great-grandson and a grandson of Aaron, and a son of David coming up with Ezra from Babylon after the captivity.

This disposition to abbreviate genealogies by the omission of whatever is unessential to the immediate purpose of the writer is shown by still more remarkable reductions than those which we have been considering. Persons of different degrees of relationship are sometimes thrown together under a common title descriptive of the majority, and all words of explanation, even those which seem essential to the sense, are rigorously excluded, the supplying of these chasms being left to the independent knowledge of the reader. Hence several passages in the genealogies of Chronicles have now become hopelessly obscure. They may have been intelligible enough to contemporaries; but for those who have no extraneous sources of information, the key to their explanation is wanting. In other cases we are able to understand them, because the information necessary to make them intelligible is supplied from parallel passages of Scripture. Thus the opening verses of Chronicles contain the following bald list of names without a word of explanation, viz.: Adam, Seth, Enosh; Kenan, Mahalalel, Jared; Enoch, Methuselah, Lamech; Noah, Shem, Ham, Japheth.

We are not told who these persons are, how they were related to each other, or whether they were related. The writer presumes that his readers have the book of Genesis in their hands, and that the simple mention of these names in their order will be sufficient to remind them that the first ten trace the line of descent from father to son from the first to the second great progenitor of mankind; and that the last three are brothers, although nothing is said to indicate that their relationship is different from the preceding.

Again the family of Eliphas, the son of Esau, is spoken of in the following terms in 1 Chron. i. 36: "The sons of Eliphaz: Teman and Omar, Zephi and Gatam, Kenaz and Timna, and Amalek."

Now, by turning to Genesis xxxvi. 11, 12, we shall see that the first five are sons of Eliphaz, and the sixth his concubine, who was the mother of the seventh. This is so plainly written in Genesis that the author of the Chronicles, were he the most inveterate blunderer, could not have mistaken it. But trusting to the knowledge of his readers to supply the omission, he leaves out the statement respecting Eliphaz's concubine, but at the same time connects her name and that of her son with the family to which they belong, and this though he was professedly giving a statement of the sons of Eliphaz.

So, likewise, in the pedigree of Samuel (or Shemuel, ver. 33, the difference in orthrography is due to our translators, and is not in the original), which is given in 1 Chron. vi. in both an ascending and descending series. Thus in verses 22–24: "The sons of Kohath; Amminadab his son, Korah his son, Assir his son; Elkanah his son, and Ebisaph his son, and Assir his son; Tahath his son," etc.

The extent to which the framer of this list has studied comprehensiveness and conciseness will appear from the fact, which no one would suspect unless informed from other sources, that while the general law which prevails in it is that of descent from father to son, the third, fourth, and fifth names represent brothers. This is shown by a comparison of Ex. vi. 24, and the parallel genealogy, 1 Chron. vi. 36, 37. So that the true line of descent is the following, viz.:—

In ver. 22–24—	Kohath	In ver. 37–38—	Kohath
	Amminadab		Izhar
	Korah		Korah
Assir, Elkanah,	Ebiasaph		Ebiasaph
	Assir		Assir
	Tahath, etc.		Tahath, etc.

The circumstance that the son of Kohath is called in one list Amminadab, and in the other Izhar, is no real discrepancy and can create no embarassment, since it is no unusual thing for the same person to have two names. Witness Abram and Abraham; Jacob and Israel; Joseph and Zaphenath-paneah, Gen. xli. 45, Hoshea, Jehoshua, Num. xiii. 16 (or Joshua) and Jeshua, Neh. viii. 17, Gideon and Jerrubbaal, Judg. vi. 32, Solomon and Jedidiah, 2 Sam. xii. 24, 25, Azariah and Uzziah, 2 Kings xv. 1, 13, Daniel and Belteshazzar, Hananiah, Mishael, Azariah and Shadrach, Meshach, Abednego, Dan. i. 7; Saul and Paul, Thomas and Didymus, Cephas and Peter, and in profane history Cyaxares and Darius, Octavianus and Augustus, Napoleon and Bonaparte, Ferretti and Pius IX.

The genealogy of Moses and Aaron is thus stated in the sixth chapter of Exodus:—

Ver. 16. "And these are the names of the sons of Levi, according to their generations; Gershon, and Kohath, and Merari: and the years of the life of Levi were an hundred and thirty and seven years."

17. "The sons of Gershon . . . ."

18. "And the sons of Kohath; Amram, and Izhar, and Hebron, and Uzziel; and the years of the life of Kohath were an hundred and thirty and three years."

19. "And the sons of Merari . . . ."

20. "And Amram took him Jochebed his father's sister to wife; and she bare him Aaron and Moses: and the years of the life of Amram were an hundred and thirty and seven years."

21. "And the sons of Izhar . . . ."

22. "And the sons of Uzziel . . . ."

There is abundant proof that this genealogy has been condensed, as we have already seen that so many others have been, by the dropping of some of the less important names.

This is afforded, in the first place, by parallel genealogies of the same period; as that of Bezaleel (1 Chron. ii. 18–20), which records seven generations from Jacob; and that of Joshua (1 Chron. vii. 23–27), which records eleven. Now it is scarcely conceivable that there should be eleven links in the line of descent from Jacob to Joshua, and only four from Jacob to Moses.

A still more convincing proof is yielded by Num. iii. 19, 27, 28, from which it appears that the four sons of Kohath severally gave rise to the families of the Amramites, the Isharites, the Hebronites, and the Uzzielites; and that the number of the male members of these families of a month old and upward was 8,600 one year after the Exodus. So that, if no abridgement has taken place in the genealogy, the grandfather of Moses had, in the lifetime of the latter, 8,600 descendants of the male sex alone, 2,750 of them being between the ages of thirty and fifty (Num. iv. 36).

Another proof equally convincing is to be found in the fact that Levi's son Kohath was born before the descent into Egypt (Gen. xlvi. 11); and the abode of the children of Israel in Egypt continued 430 years (Ex. xii. 40, 41). Now as Moses was eighty years old at the Exodus (Ex. vii. 7) he must have been born more than 350 years after Kohath, who consequently could not have been his own grandfather.

This genealogy, whose abbreviated character is so clearly established, is of special importance for the immediate purpose of this paper, because it might appear, at first sight, as though such an assumption was precluded in the present instance, and as though the letter of Scripture shut us up to the inevitable conclusion that there were four links, and no more, from Jacob to Moses. The names which are found without deviation in all the genealogies are Jacob, Levi, Kohath, Amram, Moses (Ex. vi. 16–20; Num. iii. 17–19; xxvi. 57–59; 1 Chron. vi. 1–3, 16–18; xxiii. 6, 12, 13). Now unquestionably Levi was Jacob's own son. So likewise Kohath was the son of Levi (Gen. xlvi. 11) and born before the descent into Egypt. Amram also was the immediate descendant of Kohath. It does not seem possible, as Kurtz proposed, to insert the missing links between them. For, in the first place, according to Num. xxvi. 59, "The name of Amram's wife was Jochebed, the daughter of Levi, whom her mother bare to Levi in Egypt," this Jochebed being (Ex. vi. 20), Amram's aunt, or his father's sister. Now, it is true, that "a daughter of Levi" might have the general sense of a descendant of Levi, as the woman healed by our Lord (Luke xiii. 16) is called "a daughter of Abraham"; and her being born to Levi might simply mean that she sprang from him (comp. Gen. xlvi. 25). But these expressions must here be taken in a strict sense, and Jochebed accordingly must have been Levi's own daughter and the sister of Kohath, who must in consequence have been Amram's own father. This appears from a second consideration, viz., that Amram was (Num. iii. 27) the father of one of the subdivisions of the Kohathites, these subdivisions springing from Kohath's own children and comprising together 8,600 male descendants. Moses' father surely could not have been the ancestor of one-fourth of this number in Moses' own days.

To avoid this difficulty Tiele and Keil assume that there were two Amrams, one the son of Kohath, another the father of Moses, who was a more remote descendant but bore the same name with his ancestor. This relieves the embarrassment created by the Amramites (Num. iii. 27), but is still liable to that which arises from making Jochebed the mother of Moses. And further, the structure of the genealogy in Ex. vi. is such as to make this hypothesis unnatural and improbable. Verse 16 names the three sons of Levi, Gershom, Kohath, and Merari; ver. 17–19, the sons of each in their order; ver. 20–22, the children of Kohath's sons; ver. 23, 24, contain descendants of the next generation, and ver. 25 the generation next following. Now, according to the view of Tiele and Keil, we must either suppose that the Amram, Izhar, and Uzziel of ver. 20–22 are all different from the Amram, Izhar, and Uzziel of ver. 18, or else that Amram, though belonging to a later generation than Izhar and Uzziel, is introduced before them, which the regular structure of the genealogy forbids; and besides, the sons of Izhar and the sons of Uzziel, who are here named, were the contemporaries of Moses and Aaron the sons of Amram (Num. xvi. 1; Lev. x. 4).

This subject may be relieved from all perplexity, however, by observing that Amram and Jochebed were not the immediate parents, but the ancestors of Aaron and Moses. How many generations may have intervened, we cannot tell. It is indeed said (Ex. vi. 20; Num. xxvi. 59), that Jochebed bare them to Amram. But in the language of the genealogies this simply means that they were descended from her and from Amram. Thus, in Gen. xlvi. 18, after recording the sons of Zilpah, her grandsons, and her great-grandsons, the writer adds, "These are the sons of Zilpah . . . . and these she bare unto Jacob, even sixteen souls." The same thing recurs in the case of Bilhah (ver. 25): "She bare these unto Jacob; all the souls were seven." (Comp. also ver. 15, 22.) No one can pretend here that the author of this register did not use the terms understandingly of descendants beyond the first generation. In like manner, according to Matt. i. 11, Josias begat his grandson Jechonias, and ver. 8, Joram begat his great-great-grandson Ozias. And in Gen. x. 15–18 Canaan, the grandson of Noah, is said to have begotten several whole nations, the Jebusite, the Amorite, the Girgasite, the Hivite, etc. (Comp. also Gen. xxv. 23; Deut. iv. 25; 2 Kings xx. 18; Isa. li. 2.) Nothing can be plainer, therefore, than that, in the usage of the Bible, "to bear" and "to beget" are used in a wide sense to indicate descent, without restriction to the immediate offspring.[6]

It is no serious objection to this view of the case that in Lev. x. 4 Uzziel, Amram's brother, is called "the uncle of Aaron." The Hebrew word here rendered "uncle," though often specifically applied to a definite degree of relationship, has, both from etymology and usage, a much wider sense. A great-great-grand-uncle is still an uncle, and would properly be described by the term here used.

It may also be observed that in the actual history of the birth of Moses his parents are not called Amram and Jochebed. It is simply said (Ex. ii. 1), "and there went a man of the house of Levi, and took to wife a daughter of Levi."

After these preliminary observations, which were originally drawn up for another purpose, I come to the more immediate design of the present paper, by proceeding to inquire, whether the genealogies of Gen. v. and xi. are necessarily to be considered as complete, and embracing all the links in the line of descent from Adam to Noah and from Shem to Abraham. And upon this I remark—

1. That the analogy of Scripture genealogies is decidedly against such a supposition. In numerous other instances there is incontrovertible evidence of more or less abridgement. This may even be the case where various circumstances combine to produce a different impression at the outset. Nevertheless, we have seen that this first impression may be dissipated by a more careful examination and a comparison of collateral data. The result of our investigations thus far is sufficient to show that it is precarious to assume that any Biblical genealogy is designed to be strictly continuous, unless it can be subjected to some external tests which prove it to be so. And it is to be observed that the Scriptures furnish no collateral information whatever respecting the period covered by the genealogies now in question. The creation, the Flood, the call of Abraham, are great facts, which stand out distinctly in primeval sacred history. A few incidents respecting our first parents and their sons Cain and Abel are recorded. Then there is an almost total blank until the Flood, with nothing whatever to fill the gap, and nothing to suggest the length of time intervening but what is found in the genealogy stretching between these two points. And

the case is substantially the same from the Flood to Abraham. So far as the Biblical records go, we are left not only without adequate data, but without any data whatever, which can be brought into comparison with these genealogies for the sake of testing their continuity and completeness.

If, therefore, any really trustworthy data can be gathered from any source whatever, from any realm of scientific or antiquarian research, which can be brought into comparison with these genealogies for the sake of determining the question, whether they have noted every link in the chain of the descent, or whether, as in other manifest instances, links have been omitted, such data should be welcomed and the comparison fearlessly made. Science would simply perform the office, in this instance, which information gathered from other parts of Scripture is unhesitatingly allowed to do in regard to those genealogies previously examined.

And it may be worth while noting here that a single particular in which a comparison may be instituted between the primeval history of man and Gen. v., suggests especial caution before affirming the absolute completeness of the latter. The letter of the genealogical record (v. 3) if we were dependent on it alone, might naturally lead us to infer that Seth was Adam's first child. But we know from chapter iv. that he had already had two sons, Cain and Abel, and from iv. 17 that he must have had a daughter, and from iv. 14 that he had probably had several sons and daughters, whose families had swollen to a considerable number before Adam's one hundred and thirtieth year, in which Seth was born. Yet of all this the genealogy gives us no inkling.

2. Is there not, however, a peculiarity in the construction of these genealogies which forbids our applying to them an inference drawn from others not so constructed? The fact that each member of the series is said to have begotten the one next succeeding, is, in the light of the wide use of this term which we have discovered in other cases, no evidence of itself that links have not been omitted. But do not the chronological statements introduced into these genealogies oblige us to regard them as necessarily continuous? Why should the author be so particular to state, in every case, with unfailing regularity, the age of each patriarch at the birth of his son, unless it was his design thus to construct a chronology of this entire period, and to afford his readers the necessary elements for a computation of the interval from the creation to the deluge and from the deluge to Abraham? And if this was his design, he must of course have aimed to make his list complete. The omission of even a single name would create an error.

But are we really justified in supposing that the author of these genealogies entertained such a purpose? It is a noticeable fact that he never puts them to such a use himself. He nowhere sums these numbers, nor suggests their summation. No chronological statement is deduced from these genealogies, either by him or by any inspired writer. There is no computation anywhere in Scripture of the time that elapsed from the creation or from the deluge, as there is from the descent into Egypt to the Exodus (Ex. xii. 40), or from the Exodus to the building of the temple (1 Kings vi. 1). And if the numbers in these genealogies are for the sake of constructing a chronology, why are numbers introduced which have no possible relation to such a purpose? Why are we told how long each patriarch lived after the birth of his son, and what was the entire length of his life? These numbers are given with the same regularity as the age of each at the birth of his son; and they are of no use in making up a chronology of the period. They merely afford us a conspectus of individual lives. And for this reason doubtless they are recorded. They exhibit in these selected examples the original term of human life. They show what it was in the ages before the Flood. They show how it was afterwards gradually narrowed down. But in order to this it was not necessary that every individual should be named in the line from Adam to Noah and from Noah to Abraham, nor anything approaching it. A series of specimen lives, with the appropriate numbers attached, was all that was required. And, so far as appears, this is all that has been furnished us. And if this be the case, the notion of basing a chronological computation upon these genealogies is a fundamental mistake. It is putting them to a purpose that they were not designed to subserve.

and to which from the method of their construction they are not adapted. When it is said, for example, that "Enosh lived ninety years and begat Kenan," the well-established usage of the word "begat" makes this statement equally true and equally accordant with analogy, whether Kenan was an immediate or a remote descendant of Enosh; whether Kenan was himself born, when Enosh was ninety years of age or one was born from whom Kenan sprang. These genealogies may yield us the minimum length of time that it is possible to accept for the period that they cover; but they can make no account of the duration represented by the names that have been dropped from the register, as needless for the author's particular purpose.

3. The abode of the children of Israel in Egypt affords for our present purpose the best Scripture parallel to the periods now under consideration. The greater part of this term of 430 years is left blank in the sacred history. A few incidents are mentioned at the beginning connected with the descent of Jacob and his family into Egypt and their settlement there. And at its close mention is made of some incidents in the life of Moses and the events leading to the Exodus. But with these exceptions no account is given of this long period. The interval is only bridged by a genealogy extending from Levi to Moses and Aaron and their contemporaries among their immediate relatives (Ex. vi. 16–26). This genealogy records the length of each man's life in the principal line of de-

scent, viz., Levi (ver. 16), Kohath (ver. 18), Amram (ver. 20). The correspondence in the points just indicated with the genealogies of Gen. v. and xi., and the periods which they cover, is certainly remarkable. And as they proceeded from the same pen, we may fairly infer from the similarity of construction a similarity of design. Now it has been shown already that the genealogy from Levi to Moses cannot have recorded all the links in that line of descent, and that it could not, therefore, have been intended to be used as a basis of chronological computation. This is rendered absolutely certain by the explicit statement in Ex. xii. 40. It further appears from the fact that the numbers given in this genealogy exhibit the longevity of the patriarchs named, but cannot be so concatenated as to sum up the entire period; thus suggesting the inference that the numbers in the other genealogies, with which we are now concerned, were given with a like design, and not with the view of enabling the reader to construct the chronology.

4. In so far as a valid argument can be drawn from the civilization of Egypt, its monuments and records, to show that the interval between the deluge and the call of Abraham must have been greater than that yielded by the genealogy in Gen. xi., the argument is equally valid against the assumption that this genealogy was intended to supply the elements for a chronological computation. For altogether apart from his inspiration Moses could not have made a mistake here. He was brought up at the court of Pharaoh, and was

learned in all the wisdom of the Egyptians, of which his legislation and the marvellous table of the affinities of nations in Gen. x., at once the admiration and the despair of ethnologists, furnish independent proof. He lived in the glorious period of the great Egyptian monarchy. Its monuments were then in their freshness and completeness. None of the irreparable damage, which time and ruthless barbarism have since wrought, had been suffered then. The fragmentary records, which scholars are now laboriously struggling to unravel and combine, with their numerous gaps and hopeless obscurities, were then in their integrity and well understood. Egypt's claim to a hoary antiquity was far better known to Moses, and he was in a position to gain a far more intelligent comprehension of it than is possible at present; for exuberant materials were ready at his hand, of which only a scanty and disordered remnant now survives. If, then, Egyptian antiquity contradicts the current chronology, it simply shows that this chronology is based upon an unfounded assumption. It rests upon a fundamentally mistaken interpretation of the ante-Abrahamic genealogy, and assigns a meaning to it which Moses could never have intended that it should have.

As is well known, the texts of the Septuagint and of the Samaritan Pentateuch vary systematically from the Hebrew in both the genealogies of Gen. v. and xi. According to the chronologies based on these texts respectively, the interval between the Flood and the birth of Abraham was 292 (Hebrew), 942 (Samaritan), or 1172 years (Septuagint). Some have been disposed in this state of the case to adopt the chronology drawn from the Septuagint, as affording here the needed relief. But the superior accuracy of the Hebrew text in this instance, as well as generally elsewhere, can be incontrovertibly established. This resource, then, is a broken reed. It might, however, be plausibly imagined, and has in fact been maintained, that these changes were made by the Septuagint translators or others for the sake of accommodating the Mosaic narrative to the imperative demands of the accepted Egyptian antiquity. But if this be so, it is only a further confirmation of the argument already urged, that the ante-Abrahamic genealogy cannot have been intended by Moses as a basis of chronological computation. He knew as much of the age of Egypt as the Septuagint translators or any in their day. And if so brief a term as this genealogy yields, was inadmissable in their judgment, and they felt constrained to enlarge it by the addition of nearly nine centuries, is it not clear that Moses never could have intended that the genealogy should be so interpreted?

Furthermore, it seems to me worthy of consideration whether the original intent with which these textual changes were made, was after all a chronological one. The principle by which they are obviously and uniformly governed, is rather suggestive of a disposition to make a more symmetrical division of individual lives than to protract the entire period.

The effect of these changes upon the chronology may have been altogether an afterthought.

Thus in the Hebrew text of Gen. v. the ages of different patriarchs at the birth of the son named are quite irregular, and vary from sixty-five to one hundred and eighty-seven. But the versions seek to bring them into closer conformity, and to introduce something like a regular gradation. The Septuagint proceeds on the assumption that patriarchs of such enormous longevity should be nearly two centuries old at the birth of their son. Accordingly, when, in the Hebrew, they fall much below this standard, one hundred years are added to the number preceding the birth of the son and the same amount deducted from the number following his birth; the total length of each life is thus preserved without change, the proportion of its different parts alone being altered. The Samaritan, on the other hand, assumes a gradual diminution in the ages of successive patriarchs prior to the birth of their son, none rising to a century after the first two. When, therefore, the number in the Hebrew text exceeds one hundred, one hundred is deducted and the same amount added to the years after the son was born. In the case of Lamech the reduction is greater still, in order to effect the necessary diminution. Accordingly the years assigned to the several antediluvian patriarchs before the birth of their son in these several texts is as follows:—

	Hebrew.	Septuagint.	Samaritan.
Adam	130	230	130
Seth	105	205	105
Enosh	90	190	90
Kenan	70	170	70
Mahalalel	65	165	65
Jared	162	162	62
Enoch	65	165	65
Methuselah	187	167[7] 187	67
Lamech	182	188	53
Noah	600	600	600

A simple glance at these numbers is sufficient to show that the Hebrew is the original, from which the others diverge on the one side or the other, according to the principle which they have severally adopted. It likewise creates a strong presumption that the object contemplated in these changes was to make the lives more symmetrical, rather than to effect an alteration in the chronology.

5. The structure of the genealogies in Gen. v. and xi. also favors the belief that they do not register all the names in these respective lines of descent. Their regularity seems to indicate intentional arrangement. Each genealogy includes ten names, Noah being the tenth from Adam, and Terah the tenth from Noah. And each ends with a father having three sons, as is likewise the case with the Cainite genealogy (iv. 17–22). The Sethite genealogy (chap. v.) culminates in its seventh member, Enoch, who "walked with God, and he was not, for God took him." The Cainite genealogy also culminates in its seventh member, Lamech, with his polygamy, bloody revenge, and

boastful arrogance. The genealogy descending from Shem divides evenly at its fifth member, Peleg; and 'in his days was the earth divided.' Now as the adjustment of the genealogy in Matt. i. into three periods of fourteen generations each is brought about by dropping the requisite number of names, it seems in the highest degree probable that the symmetry of these primitive genealogies is artificial rather than natural. It is much more likely that this definite number of names fitting into a regular scheme has been selected as sufficiently representing the periods to which they belong, than that all these striking numerical coincidences should have happened to occur in these successive instances.

It may further be added that if the genealogy in chap. xi. is complete, Peleg, who marks the entrance of a new period, died while all his ancestors from Noah onward were still living. Indeed Shem, Arphaxad, Selah, and Eber must all have outlived not only Peleg, but all the generations following as far as and including Terah. The whole impression of the narrative in Abraham's days is that the Flood was an event long since past, and that the actors in it had passed away ages before. And yet if a chronology is to be constructed out of this genealogy, Noah was for fifty-eight years the contemporary of Abraham, and Shem actually survived him thirty-five years, provided xi. 26 is to be taken in its natural sense, that Abraham was born in Terah's seventieth year. This conclusion is well-nigh incredible. The calculation which leads to such a result, must proceed upon a wrong assumption.

X

On these various grounds we conclude that the Scriptures furnish no data for a chronological computation prior to the life of Abraham; and that the Mosaic records do not fix and were not intended to fix the precise date either of the Flood or of the creation of the world.

THE TABLE OF NATIONS

The Biblical account of the creation and dispersion of the human race is remarkable for its statements that there were two dispersals from common centers, the second being that which took place after the recorded deluge, which, according to the sacred story, had destroyed all the inhabitants of the world except one family. The Bible does not concern itself, to any great extent, with the first dispersal; but in the table of nations found in the tenth chapter of Genesis there is a series of bold and remarkable statements concerning the dispersion of the tribes and peoples which in due time occupied all of the then known world. This dispersion is attributed to misunderstandings and conflicts originating in efforts to build a city and a tower in Babylonia that should make them a name and prevent their being "scattered abroad upon the face of the whole earth." Like all subsequent political combinations, this one broke into pieces, and the warring elements dispersed to the four quarters of the globe. "The table of nations" which follows is recognized by all as a document of great antiquity.[8]

It is true that some of the higher critics, on purely *a priori* grounds, have assigned it to a late date in Jewish history. But the document contains indubitable marks fixing its date as anterior to that of Abraham (about 1700 B.C.). Sodom and Gomorrah are referred to as still existing, though they were destroyed in Abraham's time. Tyre is not mentioned; though, after the time of David, it was a more important city than Sidon, the other Phœnician city which is mentioned. Neither is Persia mentioned, though the older kingdom which preceded it, Elam, finds a prominent place. Again, Ninevah (ver. 11, 12) appears as one of four distinct settlements which from the time of Sennacherib (about 700 B.C.) were united as one under that common name. Various other names, also, which appear in later Jewish history, are conspicuous for their absence.

Of special interest is the group of nations said to be descended from Japheth, namely, Gomer, Magog, Madai, Javan, Tubal, Mesheck, and Tiras, the majority of which have been identified as belonging to the great Aryan-speaking races. Gomer represents a group of peoples that finally settled in Cappadocia. Madai is Media. Javan represents the Ionians. Tubal and Mesheck are tribes referred to in Assyrian inscriptions as located in Central Asia Minor. Magog represents a collective series of peoples coming from the north, corresponding to the Scythians. In the minor divisions we find among the descendants of Gomer various tribes which are known to have dwelt in Armenia. Of the descendants of Javan we have tribes dwelling in Greece, various islands of the Mediterranean, and Tarshish, ordinarily believed to be the Tartessus of Spain.

The sons of Ham are distributed in their proper place in Ethiopia, Egypt, and Libya, with representatives, also, in Arabia and Canaan, which accords with the facts as brought out by later investigations. The descendants of Shem are correctly represented as occupying Elam, Syria, and Assyria, the centers of Semitic civilization.

The obscurities connected with this table need not concern us, since we have no other sufficient historical evidence with which to compare the entire table. But, so far as comparison is possible, its correctness is established beyond all reasonable question. It is sufficient for our present purpose, therefore, to call attention again to the fact that this second dispersion of the human race indicated in the Bible proceeds from the region in Central Asia already indefinitely outlined by the evidence given in our eleventh chapter. From the mountains of Ararat (Armenia) the descendants of Noah would naturally spread in all directions, especially, under the climatic conditions then existing, eastward towards the Caspian Sea and the fertile irrigated belt which we have described as extending all around the southern border of the Aral-Caspian basin, into which Alexander the Great led his conquering armies.

In explanation of the climatic conditions characterizing that period and favoring the support of a much larger population in that region at that time than now, it will be necessary to summarize briefly the evidence which I have elsewhere presented in detail, showing that at the close of the Glacial epoch there was a continental depression of land in all the northern part of the Eastern Hemisphere corresponding to that which produced the Champlain epoch of North America.[9]

As already detailed, the Glacial epoch in North America closed with a depression of land amounting to six hundred feet at Montreal, and one thousand feet farther north; so that, for a time, a great inland sea covered the St. Lawrence and Champlain valleys.

Map of Supposed Post-glacial Submergence in Asia.
Zigzag Line, our Itinerary in 1900.

In Europe, also, there is indubitable evidence that, in post-glacial time, the Scandinavian peninsula was depressed to the extent of one thousand feet in its central and northern portions. The evidence is equally plain in Northern and Central Asia that there was a much larger area, including the Aral-Caspian basin, which was depressed at the same period to the extent of seven hundred feet; and, as I believe, in Central Asia to the extent of two thousand feet; while the enclosed basins, such as we find in the valley of the Jordan and in that of the Tarim River, between the Tian Shan and the Kuenlun mountains, were, like that of the Great Salt Lake basin in America, filled with water to a depth of one thousand feet or more.

The most salient evidences of this are, first, the existence in Lake Baikal, and in the Caspian Sea, and formerly in the Aral Sea, of a species of seal which are now found no nearer than the Arctic Ocean, two thousand miles away. Lake Baikal is more than fifteen hundred feet above the sea, and the depression it fills is of late geological age.[10] The only satisfactory explanation of the existence of arctic seals in this lake is that, in very recent geological times, there was a depression of Northern Siberia and of the Aral-Caspian basin amounting to more than one thousand five hundred feet, thus facilitating the dispersion of this species of seal to the elevated and distant bodies of water in which they are now found; and that, in still more recent times, a gradual reëlevation of the land, cutting off direct connection with the ocean, left these animals corralled in the isolated bodies of water where they are now found, at the northern base of the extensive mountain system which runs through Central Asia.

Still more definite evidence of this post-glacial depression I myself discovered at Trebizond,[11] on the south shore of the Black Sea, where a very distinct shore line deposit of gravel and sand extends for a considerable distance along the northern face of the precipitous volcanic cliffs which rise back of the city. This shore line, or gravel terrace, is evidently of very recent geological age, and is seven hundred and fifty feet above the sea. Corresponding shore lines were, soon after, reported by Professor Charles R. Keyes at Soudak, on the south shore of the Crimea, nearly opposite Trebizond, and by Mr. Charles Tracy near Samsun, one hundred miles farther west, on the south side of the Black Sea; while at Baku, on the east side of the Caspian Sea, Professor William M. Davis describes corresponding Post-Tertiary shore lines six hundred feet above the sea.[12] With the exception of the Ural Mountains, the area including Northern

Germany, all Russia, the Aral-Caspian basin, and all Central and Western Siberia is less than six hundred feet above the sea; so that a depression such as I had witness of when I stood upon the shore line at Trebizond would have caused all this region to have been submerged to a considerable depth below sea level. Such a submergence is beyond reasonable doubt.

The great accumulation of water in the Tarim basin and in the Jordan Valley may have been partly due to an irruption of oceanic water from this depressed area; for the evidence of the depression of which we speak is found all along the eastern shore of the Mediterranean and in Egypt. But there the direct evidence does not indicate a depression of more than two hundred or three hundred feet. This, however, would be sufficient to carry the water over the valley of Esdraelon into the Jordan Valley. In the depression occupied by the Jordan there is ample evidence that it was filled by water to the height of one thousand four hundred feet above the present level of the Dead Sea; while in the Tarim basin there is evidence of a rise of water corresponding to that in the Dead Sea basin. But in both cases the enlargement of these lakes may be fully accounted for, as is that in the Great Salt Lake basin in the United States, by the climatic conditions of the Glacial epoch, which was a period of greatly increased precipitation and of diminished evaporation.

Without going further into details concerning the causes in operation, we may be sure that the period following the Biblical deluge (corresponding, as we believe, to the early post-glacial period) was one in which the climate of all Western and Central Asia was greatly ameliorated by the presence of an abnormal amount of moisture in the atmosphere, making the highlands of Armenia and of Persia and of all Central Asia far more attractive to population than they are at the present time. Into these conditions the immediate descendants of Noah entered, and had opportunity to flourish amid them for those indefinite periods which our chronology permits. If, as we suppose, the Biblical deluge was coincident with this extension of oceanic water to the base of the mountains of Central Asia, and the foregoing enlargement of Lob Nor in the Tarim basin and of the Dead Sea in the valley of the Jordan, we are permitted to believe in a gradual retirement of the waters through the slow reëlevation of the land which brought about conditions closely parallel to those described in the eleventh chapter, though resulting from an opposite cause. There we have shown that the coming on of glacial conditions, while it closed access to Northern Europe by the actual invasion of glacial ice, greatly extended the irrigated belt at the base of the mountains of Central Asia by reason of the increased flow of water in the innumerable streams fed by the enlarged glaciers which crept down their sides to the 7,000-foot line.

In corresponding order the gradual withdrawal of the waters as the land of Central Asia underwent a reëlevation would open up this fertile belt at the base of the mountains of Central Asia for the occupation of plants, animals, and man; while the plains of Russia and Northern Europe were still submerged. But when the glaciers of the mountains in Asia had retreated to approximately their present position, and the increased evaporation had reduced the size of the lakes in the Jordan and Tarim basins, at the same time that the water had disappeared from all the submerged areas spoken of, the desiccation of these Asiatic centers followed, and the overcrowded population found happy relief in emigration to the freshly uncovered plains of Northern Europe. The evidences of this desiccation of Asia are abundant; while, as we have seen, the distribution of languages, races, and religions, as well as of both wild and domesticated plants and animals, clearly points to this area in Central Asia as the original center from which they have set out to compass the world. It is no slight confirmation both of this theory and of sacred history, that the oldest ethnological table in the world, that of the tenth chapter of Genesis, and the account in the earliest chapters of Genesis, lead us back to the same center for the origin and dispersion of the human race.

CHAPTER XV

SUMMARY AND CONCLUSION

NOTHING can better illustrate the solidarity of the universe and the interdependence of all sciences than the variety of sources of information to which we are compelled to go to obtain an answer in any degree satisfactory to the questions, What is the origin, and what the antiquity, of the human race? Nor can anything bring out into stronger light the immense distance which separates the intellectual capacities of man from those of the rest of the animal creation. That the human mind should care to ask the questions concerning man's origin and antiquity betokens the possession of an exalted nature. That man should seek and be able to find answers to these questions from so many sources and so many realms of nature, betokens a rational faculty of which we have but the dimmest intimations even in the highest of the animals that are below him. We may profitably conclude our discussion of the subject by taking a rapid and comprehensive glance at the whole field of evidence traversed and of the conclusions which with more or less confidence we are permitted to draw.

In the earlier editions of his "Principles of Geology" Sir Charles Lyell assumed that geological time was practically unlimited, and attempted to prove that the Cambrian deposits, containing exquisitely formed trilobites, were 240,000,000 years old. From which it was justly inferable that the beginnings of geological history as recorded in the rocks were as far distant as 500,000,000 years. When Darwin first promulgated his theory of the origin of species, he followed the fashion of the times (for science as well as everything else has its fashion), and assumed that there were practically no limitations to the time during which natural selection might be supposed to have operated. Speaking of the time required for the extensive erosion that had removed the Wealden deposits in England, which he called "a mere trifle of geological time," he estimated it, as we have said, at 306,662,400 years. If this is a trifle, you are left to form your opinion as to what the total sum would be. In the second edition of the "Origin of Species" Darwin confesses that this was a rash statement, while in later editions it was quietly withdrawn. But it illustrates in a forcible manner the change of base which Darwinian evolutionists have been compelled to make, and the quiet manner in which they have made it. It is instructive, also, to observe, as we have seen, that out of the loins of the elder Darwin there has sprung a younger Darwin whose inherited genius has taken the turn of mathematics rather than of natural history, and has led him to some most startling conclusions, concerning the limits of time within which natural selection has been permitted to work; for, according to his calculations, geological history must find its beginnings within the limit certainly of 100,000,000, and probably of 50,000,000, years. At the same time calculations made from the rate of the erosion of the land surfaces and of the deposition of sedimentary strata, have led to a limitation of geological time. For from such data Alfred Russel Wallace [1] assigns to the oldest sedimentary rocks an age of only 28,000,000 years; while Charles D. Walcott, for many years the director of the United States Geological Survey, is a little more accurate, assigning to the oldest fossiliferous sedimentary strata an age of only 27,650,000 years: significantly adding, "Geological time is of great but not indefinite duration. . . . It can be measured by tens of millions, but not by single millions or hundreds of millions of years." [2]

Adopting Dana's distribution of geological time as in the ratio of 12 for the Palæozoic, 3 for the Mesozoic, 1 for the Tertiary, and 24,000,000 years as the absolute amount, we should have, as already seen, but a million and a half of years left since the beginning of the Tertiary period and since the introduction of the class of animals to which man belongs; namely, those which nurse their young, and whose young are born fully developed, — in scientific nomenclature the Placental Mammalia. Multiplying by three would give only 4,500,000 years for the Tertiary period.

Coming down to the consideration of the length of Pleistocene, or Post-Tertiary, time, which is the only geological age in which we find satisfactory evidence of the existence of man, there is ample evidence to show that relatively it was not more than one-fiftieth that of Tertiary time. With that estimate, the total length of the Glacial epoch would be only 30,000 years if we give 24,000,000 years as the age of the oldest sedimentary strata, and only 90,000 years if we allow for an increase of threefold. At the same time many lines of direct evidence from the recession of waterfalls, the accumulation of sediment in lake bottoms, the short continuance of glacial lakes, like that which covered the Red River Valley of the North during the glacial recession, and the small enlargement of post-glacial river channels, render incredible the current estimates of the length of post-glacial time. *Post-glacial time is to be reckoned by* *thousands of years, rather than by hundreds of thousands, or even tens of thousands.*

Inattention to the actual facts and lack of true scientific imagination have conspired to exaggerate beyond all reason the length both of geological time in general, and of post-glacial time in particular during which man has been an inhabitant of the earth. Recent observations have demonstrated that geologic forces are immensely more active than they were formerly supposed to be, and that there have been periods of rapid advancement when everything moved on by leaps and bounds. It now appears that at the present rate of removal of the soil from the surface of the earth, all the dry land, except a few mountain chains, would be carried into the sea within a few million years. At the present rate at which streams are scouring out their channels, the gorge of the Mississippi from St. Louis to Minneapolis, and of the Ohio from the Falls of Louisville to the headwaters of the Allegheny, would be worn in less than a million of years; while the vast cañon of the Colorado, three hundred miles long and in places six thousand feet deep, would require for its completion only a million and half of years, if we allow the stream two hundred and fifty years to lower its channel one foot.

Turning to the continental elevations and depressions of land which have taken place since the Tertiary period, it appears that at the rate at which the coast of New Jersey is known to have been subsiding for the past two or three hundred years, namely three feet in a century, it would in 30,000 years amount to as much as the total post-glacial subsidence in British America and Scandinavia. But there is indubitable evidence that the rate of changes of level was much more rapid in the vicinity of the center of glacial accumulation than anywhere else, and this both in the period of subsidence during glacial times, when the movement was accelerated by the weight of the ice, and during the reëlevation, when this weight was suddenly removed by the melting of the ice and the transfer of the water to occupy its earlier position in the bed of the ocean.

The whole question, too, of the possible rate of advancement in the variation of species has received new light since Darwin first promulgated his theory of the origin of species through natural selection. It is now seen that upon changed conditions which are perfectly within the range of credibility variations among animal species of 12½ per cent may take place in a single generation; so that a few hundred years, it may easily be conceived, would suffice for the production of changes sufficient to establish specific differences between the descendants of a common ancestor. We are no longer shut up to the conception of the infinitesimal rate of variation in species with which Darwin carried on his speculations.

In reference to the production of different races of mankind, one needs but make a simple calculation to see how easily these all may have been brought about in two or three thousand years through the simple operation of Darwin's law of natural selection.

If we suppose the human race to start with a single favored pair and to double once in twenty-five years (the present rate in Quebec), there would be at the end of five hundred years 1,000,000 living descendants from this single pair. If they should go on increasing at the same rate another five hundred years without check, there would be 500,000 million; or, if, instead of taking so large a ratio, we assume a ratio of increase which would double the population once in fifty years, we should then have our 1,000,000 people in the world at the end of one thousand years, and our 500,000 million people at the end of two thousand years. But as that number of people is about 300 times more than can be found in the world at the present time we are compelled to consider the counteracting agencies which secure slower growth.

In the earlier stages of human existence the whole world was before the race, and we can easily imagine that they spread out in quest of food and adventure, so as to become widely dispersed at a very early time, and to incur the liabilities to isolation which we have considered as likely to lead to new dialects and even to totally new languages. At this period of the history of such a species, the colonists would also be subjected to those new conditions of climate and modes of life which would rapidly fix the racial peculiarities.

The rapidity with which these adaptations of a race to its new conditions may proceed has already been discussed in due order. But a brief summary will not be out of place at this point.

The changes which are taking place in any body of colonists are so great that the favored variations will be selected out and accumulated with astonishing rapidity. This follows from the first law of natural selection. But when the constitutions of the colonists have become adjusted to the conditions, the race will remain permanent so long as the conditions remain unchanged. Certainly we have no positive grounds for asserting that all the diversifications of race and language may not have arisen by natural processes in the course of a very few thousand years, and we have much reason in the nature of the case for believing that they would thus arise within such a period; for we have the natural tendency of the human race to increase in geometrical ratio, coupled with the natural limitations of the earth in its capacity to provide for this geometrical increase of population, and the consequent enforced colonization of man, and his subjection to new and trying conditions of life. On the one hand, he was forced to eke out a precarious existence amid the arctic rigors of the north, and on the other to contend with the trying heat of the tropics.

The point, however, upon which our evidence specially hangs is that relating to the period of transition between the Tertiary and the Post-Tertiary periods. It is very evident that the early and middle portions of the Tertiary period were characterized by a great diminution of lands in the vicinity of the north pole. Northern British America, Greenland, Nova Zembla, Spitzbergen, were much depressed, so that the warm currents of water from the Pacific, and probably the Indian and the Atlantic oceans, had free access to what are now the icy regions of the north. This produced, or at any rate was accompanied by, a mild and equable climate in which there flourished over all that region now covered with arctic snow a forest vegetation closely resembling the present vegetation of Virginia and North Carolina. But, as the Tertiary period approached its close, there occurred a slow but gradual uprising of the northern lands on both continents until the northern parts of North America and of Europe stood two or three thousand feet higher than they do at the present time. The evidence of this meets us on every hand in the fiords of Norway and Alaska, in the submerged channels that stretch out from the mouths of almost all of our rivers to the margin of the narrow, submerged shelf which both around America and Europe forms the real continental border of the deep oceanic basin, and in the numerous buried channels brought to light by borings all over the northern part of the United States. The Hudson River in late Tertiary times occupied a gorge eight hundred feet deeper than now, and flowed through an extensive plain which extended out one hundred miles or more southeast of New York Harbor, and in this plain eroded a channel which towards its mouth was from fifteen hundred to two thousand feet in depth. The depths likewise of the fiords in Norway and of the Saguenay River in the eastern part of North America tell the story of the great amount of late Tertiary elevation in this region. It is in this almost universal elevation of lands in the northern part of Europe and America that we are probably to find the cause of the Glacial epoch. The accumulations of snow and ice characteristic of that period point to some such terrestrial, rather than to any astronomical, cause. It was from the mountains of Scandinavia in Europe as a center, and from Labrador and the Laurentian highlands in America, that those vast sheets of glacial ice crept out on either continent until it had carried débris from the central area to a distance of several hundred miles from its starting-point. There can be but little question that an elevation of two or three thousand feet in the centers mentioned would be ample to produce the results of the glacial phenomena that radiated from them. It has been estimated that even with the present amount of precipitation a fall of fourteen degrees in the temperature would produce a glacial period. Not only might this fall of the temperature be occasioned by such an elevation, but the precipitation of snow would doubtless be largely increased, so that from this double cause the phenomena of the Glacial epoch can be readily explained.

We come therefore to the immediate questions in hand, How long a time is requisite for the production of the phenomena of the Glacial epoch? How long a period must we allow for its growth, and how long for its decline? Especially will the answer to the last question bear upon the antiquity of man. The answers can be sought, first, in the calculations we may make as to the rate at which elevation of continental areas may proceed for a considerable period of time; and, secondly, from the rapidity with which glaciers may spread from their central area; and, thirdly, from the character of the deposits left by the ice in the course of its decline and final retreat.

As to the rate of elevation in continental areas, we have something to guide us in the changes which have taken place within the historical period. We are familiar with the fact that the land level is by no means a constant quantity. The coast of New Jersey is subsiding at such a rate that if it should continue for a million years the land would be carried down several thousand feet below the sea level. The most impressive scenes of recent continental elevation are found in the northern part of North America, and on the Scandinavian peninsula. During the last one hundred and forty years the northern part of Sweden has risen about seven feet. One hundred miles north of Stockholm it is estimated by Sir Charles Lyell that the average rate of elevation is between two and three feet in a century.[3]

A little calculation will show that the elevation from the level of Tertiary times in northern latitudes to a height sufficient to have produced the glacial phenomena may have proceeded at a very moderate rate, and still have produced the requisite conditions not more than one hundred thousand years ago. For example, if we suppose the rate of elevation in the northern latitudes toward the close of the Tertiary period to have been no greater than that which is taking place at the present time in portions of Scandinavia, namely, three feet a century, that would give us thirty feet in one thousand years, three hundred feet in ten thousand years, and three thousand feet in one hundred thousand years. Supposing this elevation to have begun fifty thousand years before the end of the Tertiary period, and to have culminated twenty thousand years ago, the rate of change supposed would be no greater than that with which we are familiar in historical times.

On the supposition that this continental elevation which brought on the Glacial epoch culminated twenty thousand years ago, there would be left a briefer period for the disappearance of glacial conditions than has popularly been supposed to be requisite. But we are to bear in mind that the depression of the northern land from its Tertiary elevation to its present level, or indeed to a level in some places twelve hundred feet lower than the present, would be aided by the great weight of ice which had accumulated over the region. It is a reasonable estimate that four million square miles in North America and two million in Europe, making six million in all, was covered with ice during the Glacial epoch to an average depth of a mile. This would give us six million cubic miles of ice piled up upon a definite area. All this had been abstracted from the ocean, so that the ocean beds were relieved from pressure to the same extent that the pressure was increased over the limited area subject to glaciation. The amount of water thus abstracted from the ocean would be sufficient to lower the whole ocean level two hundred and fifty feet. With such a force as this to assist in changing the equilibrium of the earth's crust, we need not be surprised that the subsidence of the glaciated area was several times as rapid as the elevation had been. It is believed, also, by many of the ablest geologists, that we have marks of this disturbance caused by the load of ice which covered the glaciated area, in the further oscillation of the crust in northern latitudes producing the extreme subsidence of six hundred feet at Montreal, one thousand feet in Labrador, and from fifteen hundred to two thousand feet in Western Greenland and Grinnell Land. When the abnormal load of ice had been removed, however, the elevatory forces reasserted their predominant influence, and are still at work in raising portions of this region to a level still higher than that which they have now reached.

The question, whether we can reasonably think of ice accumulating over so large an area to so great a depth and retreating from it during a limited period of eighty or one hundred thousand years which our previous calculation would allow for the period has been duly considered, and answered in the affirmative, by the late Sir Joseph Prestwich.[4] As elsewhere stated, he estimates from the numerous careful reports made by the Danish surveyors in Greenland that the amount of ice which runs off from the western coast of Greenland to drift away as icebergs would, if equalized throughout the whole extent of the coast, form a fringe one-eighth of a mile in width; that is, if, instead of concentrating its flow through the fiords, the Greenland ice moved steadily forward all along its edge, it would encroach upon the unglaciated border at the rate of a mile in eight years, or, allowing for some uncertainties in calculation, a mile in twelve years. At this rate, one hundred miles of border might be incorporated in the glaciated area in twelve hundred years. At the same rate the spread of the ice from the Laurentian highlands might have reached its limit of seven hundred miles in less than ten thousand years. When, therefore, we take into account the small amount of precipitation in Greenland, which is now less than one-half that over the Laurentian area, it will be seen that we are making no extravagant demands upon the forces of nature in supposing that the time, from the commencement of the accumulation of ice upon the Laurentian highlands and the rising plateaus of Scandinavia, to the culmination of the period when Scandinavian bowlders had been transported upon glacial ice over the plains of Russia to the banks of the Dnieper and to the base of the Carpathian Mountains, a distance of a thousand miles, and from the Laurentian highlands over the Great Lakes to the southern portion of the state of Illinois, and westward to the base of the Rocky Mountains, a distance likewise not much short of one thousand miles, need not be more than twenty-five thousand years, for that would be at only one-half the rate of progress that would be made by the ice fields of Greenland in similar conditions of surrounding land area. If the Greenland ice sheet could cover these fields at present rates in twelve thousand years, what might not the Scandinavian and Laurentian ice fields do with twice the snowfall and twice the time?

History, however, leaves us still a great way from the solution of the mystery surrounding either the origin or the antiquity of the human race. Whence came the civilization of Egypt, Babylonia, and Central Asia? Whence came the races of men that even then appeared upon the scene in all their present peculiarities? Whence were derived those diversities of language characteristic of human speech? and how long a time would have been necessary from the first origination of the human species to account for the condition of advancement at which they were found seven thousand years ago? A brief review of some of the principles already discussed will show that there is no scientific necessity for placing the origin of the human race many thousand years before the beginning of history. The simple arithmetical calculations made above show that, when once started, the dispersion over the world, the diversification of the races, the differentiation of languages, and the development of ancient civilization may easily have come about in the course of four or five thousand years, if not in half that time, and that the extension of prehistoric time for eight thousand years affords superabundant opportunity for the growth and development of all the peculiarities and institutions of man as first made known to us at the dawn of history.

But we are not left to general considerations alone to infer that post-glacial time may be limited to a few thousand years. We have adduced in a previous chapter evidence from the erosion of post-glacial waterfalls, from the silting up of a post-glacial lake, and from the small amount of enlargement of post-glacial water courses, together with the limited size of the beaches upon Lake Agassiz and the small extent to which the weathering of glaciated rocks has proceeded, that the continental glacier disappeared from North America not more than seven thousand years ago, and that its disappearance proceeded at a rate probably several times as rapid as its growth had been. The antiquity of man, therefore, so far as the question depends upon his connection with the Glacial epoch, is not proved to be, even when we allow a generous margin, greater than twelve or fifteen thousand years.

Taking now a rapid glance at the evidence as a whole, we find that from historical data the history of man is carried back in the valley of the Nile to a period which, according to the largest estimate, began about seven thousand years ago. At the same time in the valley of the Euphrates and in Turkestan it is probable there was a civilization of a somewhat earlier age. The striking thing about this historical evidence is that it brings to light compact national organizations with a written language, with noble ideas of the family and of both social and political duties, and in possession of a skill in most of the practical arts of life that has been little improved upon until within the last five hundred years of European civilization. A study of the history of the world reveals the further fact that there has been no marked tendency of improvement in the human race, except as it has been brought in contact with the developing civilization that appeared in these earliest historical times. The peasantry of Egypt are to-day substantially what they were seven thousand years ago. The Patagonians are no higher in their civilization than were the River Drift men of Northern France, while the Cave men of France and Belgium would compare favorably with some of the tribes of Australia. But, on the other hand, all civilization is traced back to that in the valleys of the Nile, the Euphrates and the Murgab which appears in full tide four or five thousand years before the Christian era. From Central Asia the world received in this dim prehistoric period the inestimable boon of the most of its domesticated plants and animals. From Egypt the world received an alphabet and a written language. The torch of Grecian civilization was lighted upon Egyptian altars; the culture of Rome is but a reflection of that which attained such gorgeous development in Greece; the rising tide of civilization in the nineteenth century receives its strongest impulses from that Semitic nation whose ancestors were sojourners in Egypt thirty-five hundred years ago, and whose greatest lawgiver and leader had it for one of his most distinguishing characteristics that he was brought up in the household of the Pharaohs and was learned in all the wisdom of Egypt. The history of the human race as we actually know it gives no countenance to any doctrine of universal and general progress among the races of mankind, but sustains rather a doctrine of predominant natural tendencies to degeneration, which is only counteracted by contact with specially favored nations and by voluntary acceptance of their most valuable ideas and practices.

While the antiquity of man cannot be less than ten thousand, it need not be more than fifteen thousand years. Eight thousand years of prehistoric time is ample to account for all known facts relating to his development. Whether he was a mere scientific "sport," or was assisted to his preëminence by divine intervention, is a question of philosophy. That it was by divine intervention will be the verdict of most sane and candid minds.

Appendix

CHAPTER I

NOTE 1, p. 6—Estimates of the absolute length of geological time vary from the 10,000,000 years of Tait to the 6,000,000,000 years of McGee (*American Anthropologist,* vol. ii. p. 309); at the present time most of the estimates come within 100,000,000 years, and the tendency is to settle down upon about 24,000,000 years (Dana, "Manual of Geology," 4th ed., pp. 1023–1026; Clarence King, *American Journal of Science,* January, 1893, pp. 1–20; Wallace, "Island Life," chap. x.; Newcomb, "Astronomy," p. 519; Young, "The Sun," chap. viii.; Ball, "Story of the Heavens," last chapter; Croll, "Climate and Time," chap. xx., "Stellar Evolution"; Upham, *Bibliotheca Sacra,* vol. l. pp. 131–149; *American Journal of Science,* March, 1893, pp. 209–220; and Wright's "Man and the Glacial Period," pp. 361–364). Dr. Charles D. Walcott, late Director of the United States Geological Survey, after an extended discussion of the whole subject, in which the views of others are fully summarized, fixes the limits of geological time, as shown in stratified deposits, to be between 25,000,000 and 70,000,000 years, and concludes that "Geologic time is of great but not of indefinite duration. I believe," he says, "that it can be measured by tens of millions but not by single millions or hundreds of millions of years" (Proceedings of the American Association for the Advancement of Science, vol. xlii. (1893) p. 169). Efforts have been made to destroy confidence in the calculations drawn from the theory of the nebular hypothesis and the rate at which heat radiates from the sun by dwelling upon the mysterious powers of radium, and by challenging the nebular hypothesis. But the most of the above calculations cannot be affected by such objections. George H. Darwin's calculations are based upon the effect of the tides resulting from the universal law of gravitation.

NOTE 2, p. 8.—"Manual of Geology" (4th ed.), pp. 1023–1026.

NOTE 3, p. 8.—*Journal of Geology,* vol. i. (1893) pp. 294, 295.

NOTE 4, p. 8.—*Bibliotheca Sacra,* vol. l. p. 146.

NOTE 5, p. 20.—Le Conte, "Elements of Geology," pp. 333, 402, 475.

NOTE 6, p. 24.—Lamplugh, Address before British Association for the Advancement of Science at York, 1906.

CHAPTER II

NOTE 1, p. 31.—Rev. James Baikie, "The Sea Kings of Crete" (London, Black, 1910, pp. xiv, 288. Imported by Macmillan Co., N. Y.); R. Burrows, "Discoveries in Crete, and their Bearing on the History of Ancient Civilization" (London, Murray, 1907, pp. xvi, 244); C. H. Hawes and H. B. Hawes, "Crete, the Forerunner of Greece" (London and New York, Harper Bros., 1909, pp. xiv, 157); Angelo Mosso, "The Dawn of Mediterranean Civilization" (N. Y., Baker, pp. xxiii, 424); Arthur J. Evans, "Palace of Knossos," "Reports of Excavations 1900–05" in Annual of British School at Athens, vol. vi. ff., "The Prehistoric Tombs of Knossos" (1906).

NOTE 2, p. 41.—Winckler and some other authorities would bring this date down to 3000 B.C.; but there seems no sufficient reason for discrediting the conclusion of Nabonidus, especially as there are so many other considerations supporting an early date for the civilization of the region. Indeed, the discoveries of De Sarzec at Telloh, and of Haynes and Hilprecht at Nippur, would seem to trace Babylonian civilization back to 5000 B.C. The latest information bearing on Babylonian chronology is afforded by a tablet discovered by Professor Vincent Scheil of Paris, who was the first to publish and interpret the Code of Hammurabi. According to this tablet the earliest dynasty of all had its center at Opis, a city not far from the modern Bagdad. The Opis dynasty lasted ninety-nine years and was followed by the Kish dynasty, which continued 126 years, the Urich dynasty twenty-five years, when it was followed by the famous Sargon who introduced the dynasty of Agade (Accad) which lasted 197 years. Then follow other dynasties continuing to that of Hammurabi, about 2000 B.C. But the interval between Sargon and Hammurabi is not much more than 400 years. According to these figures, therefore, the date of Sargon would be brought down to about 2500 B.C.

NOTE 3, p. 42.—Maspero, "The Dawn of Civilization" (London, 1896); "The Struggle of the Nations" (London, 1896); McCurdy, "History, Prophecy, and the Monuments" (New York, 1894), vol. i.; Jastrow, "Religion of Babylonia and Assyria" (Boston, 1898), p. 36; Hilprecht, "The Babylonian Expedition of the University of Pennsylvania" (Philadelphia, 1896); Hommel, art. "Babylonia," Hastings' Dictionary of the Bible, vol. i. p. 223; J. P. Peters, "Nippur, or Explorations and Adventures on the Euphrates, being the Narrative of the University of Pennsylvania Expedition to Babylonia in 1888–90" (New York, 1897), vol. ii.; A. T. Clay, "Light on the Old Testament from Babel," pp. 31–34; on pp. 44, 138, 196, he mentions an inscription of Lugal-zaggisi, whom he places at about 4000 B.C. He also places, pp. 30, 117, a pavement of Sargon I. and his son at about 3800 B.C. See his discussion of this subject under the heading, "The Great Antiquity of Man," *loc. cit.,* chap. ii. pp. 23 ff.

NOTE 4, p. 45.—A. T. Clay, "Light on the Old Testament from Babel," pp. 55, 56.

NOTE 5, p. 46.—Winckler, "History of Babylonia and Assyria," pp. 49, 141, 142.

NOTE 6, p. 47.—"Contra Apion," book i. chap. 14.

Note 7, p. 47.—Bunsen, "Egypt's Place in History," vol. i. pp. 601 ff.

Note 8, p. 50.—Brugsch, "Egypt under the Pharoahs," vol. i. p. 92.

Note 9, p. 51.—Baedeker, "Egypt" (1897).

Note 10, p. 52.—For the extracts here given see the translation made by Dr. Howard Osgood in *Bibliotheca Sacra,* vol. xlv. (October, 1888) pp. 648–688.

Note 11, p. 63.—Raphael Pumpelly, Editor, "Explorations in Turkestan, Expedition of 1904" (2 vols., 494 pp.), esp. vol. i. chaps. iii. and iv. pp. 37–75.

Note 12, p. 67.—Brugsch, "Egypt under the Pharaohs," vol. i. p. 7.

CHAPTER III

Note 1, p. 72.—A. T. Clay, "Light on the Old Testament from Babel," pp. 136–138.

Note 2, p. 73.—The languages of Egypt and Babylonia show affiliation in the earliest inscriptions. The affinity is most pronounced in grammatical constructions. (1) They have the same masculine and feminine gender endings. (2) Identical pronominal suffixes. (3) The peculiar adjectival termination "nisbeh." (4) Identity of several numerals. (5) Identity of several verbal inflections. (6) Verbal nouns with prefixed "m." (7) Correspondence between fifteen or more Semitic and Egyptian consonants, including *aleph, vauv, ayin.* (8) The lack of written vowels.

But (1) The correspondence of root words is slight. (2) The Egyptian does not have triliteral roots. (3) The Babylonian written language had almost entirely lost its pictorial character in the earliest inscriptions. But the pictorial writing in Egypt maintained a parallel existence with the hieratic and demotic down to late times. It was peculiarly used for sacred literature and ornamental inscriptions (see art. "Egypt," in Hastings' Dict. of Bible; Boscawen, "The Bible and the Monuments"; Erman, "History of Egypt").

Note 3, p. 77.—But see a comparative grammar of the Semitic and Aryan languages entitled, "Semitisch und Indogermanisch," by Professor Hermann Möller of the University of Copenhagen. It appears to be a most thorough and careful work and seems to prove the original oneness of these two great linguistic families.

Note 4, p. 79.—W. D. Whitney, "Language and the Study of Language," p. 331.

Note 5, p. 81.—W. D. Whitney, "Life and Growth of Language," p. 260.

Note 6, p. 82.—*Ibid.,* p. 261.

Note 7, p. 83.—This word is instructive; for it shows the agglutinative side of the Sanskrit, which almost rivals the languages of the American Indians in its capacity for such combinations, although it is a highly inflected tongue. The word is made up as follows:—

bhā*nd*a, "pot"; pūr*n*a, "full" or "filled"; kumbha; "jar"; kāra, "maker"; ma*nd*apikā, "little shop"; eka, "one"; deça, "place." It is typical of many Sanskrit compounds, the parts of which must be sought in the lexicon and then put together by the translator. The elements are somewhat more complex than those used in agglutinative languages usually are; but in other respects the word in question is a good example of an agglutinative form, and it shows how the three types of languages cross and recross one another in their formations. The word "inapplicabilities," cited above, is also a case in point. It is made up of in, ad, plic-, able, -i-ty, and -e-s, the plural sign. The component parts are more simple than those used in the Sanskrit word; but the compound itself is also more of a unit. It is, in fact, a genuine compound, though agglutinative, while the Sanskrit word is only loosely so, each element retaining its individuality and distinctive meaning more sharply than is possible in the English example. Such cases help to illustrate the difficulties which beset the linguistic argument on every side; for they go to show how intricate and confusing the problem really is. The different threads are now so interwoven and entangled that the utmost patience is necessary to obtain even tentative results. There is, however, another side to the matter; for these agglutinative tendencies in inflected languages point toward an ultimate origin that was the same for the whole human race, since they show the same forces at work in languages otherwise totally different. German is often strongly agglutinative, especially in some of its technical terms; and it was the same capacity in the Greek which enabled Aristophanes to coin his famous word for "hash," by joining together the names of all the ingredients used for such compounds.

NOTE 8, p. 83.—"Language and the Study of Language," p. 347.

NOTE 9, p. 84.—"The Origin of Languages and the Antiquity of Speaking Man," an address by Horatio Hale, Vice President of the Anthropological Section of the American Association for the Advancement of Science. See the Proceedings of the Association, vol. xxxv. (1886) pp. 280–333.

NOTE 10, p. 92.—This account is given in Hale's address noted above, pp. 286–288.

NOTE 11, p. 93.—"Singular Development of Language in a Child," *Monthly Journal of Psychological Medicine* (1868); the substance of the article is given in Hale's address, pp. 289–292.

NOTE 12, p. 99.—See Hale's address, p. 300.

NOTE 13, p. 101.—As to the ultimate origin of language, concerning which much has been written, little need be added to what has already been said. External stimuli usually cause animals to give utterance to inarticulate cries denoting rage, fear, hunger, joy, etc., and these cries are easily understood. Under precisely similar conditions, though in a much broader field, primitive man must have uttered sounds that were articulate, and these must have speedily crystalized into words which thus became a means for representing the related things. An interchange of ideas on a limited scale then became possible, and this tendency once started, was bound to grow. In the last analysis, this may be what Heyse had in mind when he formulated his much ridiculed "Ding-dong" theory, according to which each substance in nature has its own peculiar ring, so that primitive man must have "possessed an instinctive 'faculty for giving articulate expression to the rational conceptions of his mind.'" Two other theories, the "Bow-wow" and the "Pooh-pooh," have been opposed to this. The first teaches that language began with onomatopoetic signs formed by the imitation of natural sounds; the second, that interjections were the first articulate words and therefore the ultimate beginnings of speech.

The importance of the two latter theories is recognized by Whitney, who groups them together, making the third subordinate to the second. The other theory he rejects, although it seems quite possible to make it include both of these without unduly stretching it. Max Müller doubtless carried it too far; but the examples given above appear to indicate its general soundness at bottom. Moreover, if man had been without "an instinctive 'faculty for giving articulate expression to the rational conceptions of his mind,'" he would have been as helpless as a parrot, so far as framing a language was concerned. Whitney is right in maintaining that language, properly so-called, involves the perception of quality, and that terms expressive of quality ultimately became the chief foundation on which the linguistic superstructure was reared; but that does not by any means exclude the basic idea of the "Ding-dong" theory. Nor does his other contention that the desire to communicate with one another was the real source of language. The capacity had to be there at the beginning, and no language could possibly have been produced without it. A parrot can learn to speak; but he cannot originate anything. He imitates sounds; but he never coins words from them. That province was reserved for man, and he alone can occupy it.

CHAPTER IV

NOTE 1, p. 104.—For the facts relating to Origin of the Races of Europe we are largely indebted to "The Races of Europe, A Sociological Study," N. Y., D. Appleton and Co., 1899, pp. xxxii, 624, with numerous maps and photographs. By William Z. Ripley, Ph.D., Assistant Professor of Sociology in the Massachusetts Institute of Technology, and Lecturer on Anthropology at Columbia University in the City of New York.

NOTE 2, p. 107.—Lyell, "Antiquity of Man," chap ii.

NOTE 3, p. 110.—See paper of Edmund Andrews, *American Journal of Science,* 2d ser., vol. xlv. pp. 180–190 (March, 1868).

NOTE 4, p. 111.—Ripley, "Races of Europe," p. 458.

NOTE 5, p. 113.—*Ibid.*, p. 54.

NOTE 6, p. 114.—"Urgeschichte Europas, Grundzuge einer prähist. Archæologie," Strassburg, 1905.

NOTE 7, p. 116.—Ripley, "Races of Europe," p. 176.

NOTE 8, p. 122.—*Ibid.*, pp. 366, 367.

NOTE 9, p. 127.—*Ibid.*, p. 502.

CHAPTER V

NOTE 1, p. 130.—Lewis Morgan, "The Consanguinity and Affinity of the Human Family," Smithsonian Report, vol. xvii. (1871); "Indian Migrations," *North American Review*, vol. cix. (1869) pp. 391–442, vol. cx. (1870) pp. 33–82.

NOTE 2, p. 141.—*Records of the Past* (Washington) vol. vii. (Oct. 1908) pp. 219–232.

CHAPTER VI

NOTE 1, p. 159.—*Records of the Past* (Washington), vol. v. (1906) p. 187.

NOTE 2, p. 162.—Chamberlin and Salisbury, "Geology," vol. iii. p. 357.

NOTE 3, p. 162.—Author's "Ice Age in North America."

NOTE 4, p. 163.—Author's "Asiatic Russia," p. 510; also, especially the report of William M. Davis and E. Huntington, in "Explorations in Turkestan," Expedition of 1903 under the direction of Raphael Pumpelly, Washington, D. C., published by the Carnegie Institution, April, 1905, pp. 84–92.

NOTE 5, p. 167.—Author's "Scientific Confirmations of Old Testament History," pp. 334–347.

NOTE 6, p. 167.—Author's "Ice Age in North America" (5th ed.), pp. 366–372.

NOTE 7, p. 167.—O. D. von Engeln, "Phenomena associated with Glacier Drainage and Wastage, with especial reference to observations in the Yakutat Bay Region, Alaska," *Zeitschrift für Gletscherkunde,* vol. vi. (1911) pp. 104–150.

NOTE 8, p. 170.—Proceedings of the Victoria Institute, vol. xl. p. 151; also vols. xxx., xxxi., xxxii.

NOTE 9, p. 180.—*Baptist Quarterly* for July, 1884.

NOTE 10, p. 182.—Author's "Ice Age in North America" (5th ed.), pp. 565–567.

NOTE 11, p. 186.—Bulletin of the Geological Society of America, vol. iv. (1893) pp. 423–427; author's "Ice Age in North America" (5th ed.), p. 542.

NOTE 12, p. 187.—"Recent Earth Movement in the Great Lakes Region," U. S. Geol. Surv., 18th An. Report, pt. ii. pp. 601–647.

NOTE 13, p. 188.—"The Glacial Lake Agassiz," pp. 238–244.

NOTE 14, p. 192.—Author's "Ice Age in North America" (5th ed.), pp. 572–575.

NOTE 15, p. 193.—"A Thermographical Record of the Late Quaternary Climate," *Postglaziale Klimaveranderungen,* Stockholm, 1910, p. 309.

NOTE 16, p. 194.—Bulletin of the Geological Society of America, vol. ii. p. 196.

NOTE 17, p. 195.—" Lake Lahontan," U. S. Geol. Survey, Monograph, XI, p. 273.

NOTE 18, p. 195.—See *Quarterly Journal of the Geological Society,* vol. xxxix, 1883, in Proceedings, pp. 67–69; cf. id., vol. xlii. pp. 527–539; Bulletin of the Geological Society of America, vol. i. pp. 306, 308; Geological Survey of Canada, Report of Progress, 1875–76, p. 90; also author's " Ice Age in North America " (5th ed.), p. 568 f.

NOTE 19, p. 197.—" Collected Papers on some Controverted Questions of Geology," pp. 40, 41.

NOTE 20, p. 204.—Author's " Ice Age in North America " (5th ed.), pp. 55–68.

NOTE 21, p. 204.—See, among others, the paper by Professor I. C. Russell, *Scottish Geographical Magazine,* 1894, and the reports of Professor H. F. Reid on " Variations of Glaciers," in the *Journal of Geology,* from year to year.

NOTE 22, p. 206.—*American Journal of Science,* vol. xvii. 1879, pp. 133–144.

NOTE 23, p. 206.—*American Geologist,* vol. x. pp. 25–44.

NOTE 24, p. 214.—Author's " Ice Age in North America " (5th ed.), pp. 151–166; also, especially, his art. " Post-glacial Erosion and Oxidation," Bulletin of the Geological Society of America, vol. xxiii. (June, 1912) pp. 277–295.

NOTE 25, p. 217.—Isaiah Bowman, "The Geologic Relations of the Cuzco Remains," *American Journal of Science,* 4th ser., vol. xxxiii. (April, 1912) pp. 306–325.

CHAPTER VII

NOTE 1, p. 219.—Report by Lewis and Wright in vol. Z of the 2d Geol. Survey of Pa.; also author's "Ice Age in North America" (5th ed.), pp. 625 ff.

NOTE 2, p. 222.—Abbott, "Primitive Industry"; Professor Henry W. Haynes' report published in the author's "Ice Age in North America" (5th ed.), pp. 619–622.

NOTE 3, p. 225.—Report of Professors Hollick, Libbey, Mercer, Abbott, and G. F. Wright, in Proceedings of the A. A. A. S., 46th meeting held at Detroit, Aug. 1897, pp. 344–399; also *Records of the Past,* vol. x. (1911) pp. 273–282.

NOTE 4, p. 225.—Ernest Volk, "Archæology of the Delaware Valley," vol. v. of the Papers of the Peabody Museum of American Archæology and Ethnology, Harvard University, pp. xvi, 258. Cambridge, Mass., 1911.

NOTE 5, p. 226.—*Popular Science Monthly,* July, 1891, May, 1893, and December, 1895; also "Man and the Glacial Period," 2d ed., preface, p. xv; also "Ice Age in North America" (5th ed.), pp. 645–648.

NOTE 6, p. 228.—"Ice Age in North America" (5th ed.), p. 642.

NOTE 7, p. 229.—Paper of Dr. Warren Upham before Boston Society of Natural History, December 31, 1887, summarized in "Ice Age in North America" (5th ed.), pp. 654–666; also N. H. Winchell, "Pre-Indian Inhabitants of Minnesota," chapter i. of the "Aborigines of Minnesota," published by the Minnesota Historical Society, 1911, first printed in *Records of the Past,* vol. vi. (1907) pp. 145–157, 163–181.

NOTE 8, p. 230.—Paper of G. F. Wright and Miss Luella Owen on "Evidence of the Agency of Water in the Distribution of Loess in the Missouri Valley," *American Geologist,* vol. xxxiii. pp. 205–222; also vol. xxxv. pp. 236–240; also *Records of the Past,* vol. ii. pp. 119–124; but especially N. H. Winchell on the "Pleistocene Geology of the Concannon Farm near Lansing, Kansas," *American Geologist*, vol. xxxi. (May, 1903) pp. 263–308, summarized in "Ice Age in North America" (5th ed.), pp. 678–683.

NOTE 9, p. 232.—Author's "Origin and Distribution of the Loess in Northern China and Central Asia," Bulletin of Geological Society of America, vol. xiii. pp. 127–138; also his "Scientific Confirmations of Old Testament History," pp. 272–343.

NOTE 10, p. 233.—Author's "Asiatic Russia," p. 502; "Scientific Confirmations of Old Testament History," p. 302; and "Origin and Distribution of

Loess in Northern China and Central Asia," *op. cit.*, p. 133.

NOTE 11, p. 234.—Author's "Scientific Confirmations," as above, chap. xi.

NOTE 12, p. 235.—See Warren Upham, *American Geologist*, vol. xxx. pp. 135–150; Winchell, as above, *American Geologist*, vol. xxxi. pp. 263–308; author's "Age of the Lansing Skeleton," *Records of the Past*, vol. ii. pp. 119–124, *Bibliotheca Sacra*, vol. lx. pp. 28–32.

NOTE 13, p. 235.—Nebraska Geological Survey, vol. ii. pt. v. pp. 318–327, pt. vi. pp. 331–348; also *Records of the Past*, vol. vi. pp. 34–39.

NOTE 14, p. 238.—Henry Fairfield Osborn, "Age of Mammals" (New York, Macmillan, 1911), pp. 501–509; also author's "Ice Age in North America" (5th ed.), pp. 436–438.

NOTE 15, p. 240.—Author's "Scientific Confirmations of Old Testament History," pp. 347–355; W. Boyd Dawkins, "Early Man in Britain," p. 266.

NOTE 16, p. 241.—Professor J. E. Todd called my attention some years ago to strata of this volcanic ash appearing underneath the loess forming the bluffs on the western side of the Missouri River, north of Omaha. In the first volume of Professor Barbour's report on the geology of Nebraska we learn that this volcanic ash is found in nearly every county of the state of Nebraska, the deposits growing thicker and coarser towards the west, where they often reach a depth of a hundred feet or more. The deposits are found also in Kansas and to a limited extent in Iowa and South Dakota. The material must have been poured forth from volcanic vents several hundred miles to the southwest and have been transported by wind during the closing stages of the Glacial epoch. In a large number of cases, however, it seems to have fallen into bodies of still water.

NOTE 17, p. 246.—Author's "Ice Age in North America" (5th ed.), pp. 500–510; "Scientific Confirmations of Old Testament History," chap. viii.

NOTE 18, p. 247.—Hiram Bingham, "The Discovery of Prehistoric Human Remains near Cuzco, Peru," *American Journal of Science,* 4th ser., vol. xxxiii. (April, 1912) pp. 297–305; George F. Eaton, "Report on the Remains of Man and of Lower Animals from the Vicinity of Cuzco, Peru," *Ibid.,* pp. 325–333.

CHAPTER VIII

NOTE 1, p. 250.—These facts can be found clearly stated in any standard geology and various government reports upon the region; but one would get the most vivid impression of the facts from Sir Archibald Geikie's "Geological Sketches," pp. 186–192.

NOTE 2, p. 255.—J. D. Whitney, "Report on the Auriferous Gravels of the Sierra Nevada," 1879, p. 258 f.

NOTE 3, p. 260.—Bulletin of the Geological Society of America, vol. ii. p. 192.

Note 4, 246.—William J. Sinclair, "Recent Investigations Bearing on the Question of the Occurrence of Neocene Man in the Auriferous Gravels of the Sierra Nevada," vol. vii. No. 2 of the publications of the University of California in American Archæology and Ethnology.

Note 5, p. 266.—For the detailed evidence see Proceedings of the Boston Society of Natural History, vol. xxiv. pp. 424–450, and vol. xxv. (Feb. 1891) pp. 242–246.

Note 6, p. 269.—W. J. Sollas, "Ancient Hunters," p. 261. The Venus impudica here figured is carved from ivory. Of the perfection of some of the carvings of Aurignacian age M. Salomon Reinach remarks that "by their realism and intelligent rendering of the female form they are superior to all the artistic productions of the Ægean and Babylonia."

Note 7, p. 274.—The reader will get a most vivid impression of these lava deposits by referring to Sir Archibald Geikie's "Geological Sketches," pp. 237–245, where he describes his personal impression on visiting the region.

Note 8, p. 278.—G. K. Gilbert, "Lake Bonneville," Monograph I, of the U. S. Geol. Survey.

Note 9, p. 284.—Bulletin of the U. S. Geol. Survey, No. 79 (1891), being a report by Joseph S. Diller on "A Late Volcanic Eruption in Northern California."

CHAPTER IX

NOTE 1, p. 290.—The reader will do well to go back to the earliest description found in Lyell's "Antiquity of Man" and Prestwich's "Geology."

NOTE 2, p. 293.—Lyell's "Antiquity of Man," pp. 140–144.

NOTE 3, p. 295.—A convincing paper in the *Quarterly Journal* of the Geological Society of London, vol. lxiii. pp. 470–514.

NOTE 4, p. 298.—A large number of facts are given by W. J. Sollas in his "Ancient Hunters," p. 160.

NOTE 5, p. 299.—For the account of the Galley Hill skeleton see art. by Professor George Grant MacCurdy in *Records of the Past,* vol. x. (Nov.–Dec. 1911) pp. 322–331; and for the Ipswich man an article by the same in *Science,* March 29, 1912, pp. 505–507.

NOTE 6, p. 301.—"Primitive Man in the Somme Valley," *American Geologist,* vol. xxii. pp. 350–362.

NOTE 7, p. 304.—Professor Edward Hull's recent volume, "Monograph on the Sub-oceanic Physiography of the North Atlantic Ocean" (London, Stanford, 1912).

NOTE 8, p. 306.—See A. Tylor's papers, "Quaternary Gravels," *Quarterly Journal* of the Geological Society of London, Feb. 1869, pp. 57–100, and "The Amiens Gravels," Proceedings of the Geological Society of London, 1867, pp. 103–125. A full summary of M. Ladrière's investigations will be found in Geikie's "Great Ice Age" (3d ed.), pp. 629–635.

NOTE 9, p. 309.—For more details see W. J. Sollas, "Ancient Hunters," pp. 40–50.

NOTE 10, p. 311.—See again Upham's observations upon "Primitive Man in the Somme Valley," noted above.

NOTE 11, p. 312.—"Human Remains below the Loess of Kiev, Russia," *Records of the Past,* vol. i. (1902) p. 276.

NOTE 12, p. 313.—*Ibid.,* p. 277.

NOTE 13, p. 313.—Professor Armaschevsky's report prepared for the International Geological Congress, held in St. Petersburg in 1897, translated in *Records of the Past,* vol. i. (1902) pp. 275–278. For the manner in which the deposits have taken place see his "Memoirs of the Geological Committee of Russia," vol. xv. no. 1, being a report upon the geology of Poltava, Charkov, and Obojan, 1903. The first part of the report is in Russian, but the second part, dealing specially with the origin and distribution of the loess, and filling sixty quarto pages, is in German.

NOTE 14, p. 314.—A. H. Keane, "Man Past and Present," p. 269.

NOTE 15, p. 316.—See evidence detailed in full by George Grant MacCurdy in *Records of the Past,* vol. viii. (1909) pp. 33–38.

NOTE 16, p. 318.—Author's "Ice Age in North America" (5th ed.), chap. iii.

NOTE 17, p. 318.—For fuller details and references see author's "Man and the Glacial Period," pp. 267–293.

NOTE 18, p. 320.—A. de Quatrefages, "Human Species," pp. 142–143.

NOTE 19, p. 321.—Lyell, "Antiquity of Man," pp. 75–79; Huxley, "Man's Place in Nature," pp. 168–187.

NOTE 20, p. 321.—Author's "Man and the Glacial Period," pp. 275–278; Sollas, "Ancient Hunters," pp. 45, 153, 162.

NOTE 21, p. 323.—"Somatology and Man's Antiquity," by G. G. MacCurdy in *Records of the Past,* vol. x. (1911) pp. 322–331; see Sollas, "Ancient Hunters," pp. 146–167.

NOTE 22, p. 325.—W. J. Sollas, "Ancient Hunters," p. 99.

NOTE 23, p. 330.—*Ibid.,* chap. vi.

CHAPTER X

NOTE 1, p. 334.—Warren Upham's collection of facts in author's "Ice Age in North America" (5th ed.), chap. xix.

NOTE 2, 336.—W. J. Sollas, "Ancient Hunters," p. 56.

NOTE 3, p. 338.—*Ibid.,* pp. 63, 104, 112, 116; Prestwich, "Controverted Questions in Geology," pp. 49–80; "The Eolithic Problem," MacCurdy in

American Anthropologist, vol. vii. (1905) pp. 425–480.

Note 4, p. 338.—Professor H. W. Haynes, Appendix to "Man and the Glacial Period," pp. 365–374; also in *Records of the Past,* vol. v. pp. 83–85.

Note 5, p. 340.—W. J. Sollas, "Ancient Hunters," pp. 67–69.

CHAPTER XI

Note 1, p. 348.—Alfred Russel Wallace, "The Geographical Distribution of Plants and Animals," vol. i. p. 154.

Note 2, p. 354.—A. de Quatrefages, "The Human Species," pp. 175, 176.

Note 3, p. 357.—Author's "Asiatic Russia," pp. 395, 510.

Note 4, p. 359.—"Explorations in Turkestan," Expedition of 1903, edited by Raphael Pumpelly, pp. 84–88.

Note 5, p. 361.—Author's "Asiatic Russia," pp. 107–109, 512, 513; D. Gath Whitley, "Buried Elephants in the Arctic Regions," *Gentleman's Magazine,* Sept. 1894, pp. 275–288; also his "Ivory Islands in the Arctic Ocean."

Note 6, p. 362.—*Records of the Past,* vol. i. pp. 127, 128; vol. ii. pp. 313–317; art. by Frederick Bennett Wright, vol. ii. pp. 243–252.

CHAPTER XII

NOTE 1, p. 381.—Haeckel "Evolution of Man," vol. ii. p. 181.

NOTE 2, p. 381.—Mivart, "Man and Apes," p. 144.

NOTE 3, p. 381.—Brinton, "Races and Peoples," p. 26.

NOTE 4, p. 383.—"Man's Place in Nature," ed. of 1901, p. 143.

NOTE 5, p. 383.—*Ibid.*, pp. 106, 107.

NOTE 6, p. 384.—*Ibid.*, p. 146.

NOTE 7, p. 385.—Quoted in Darwin "Descent of Man," pp. 201, 202.

NOTE 8, p. 387.—Wallace, "Darwinism," p. 454.

NOTE 9, p. 391.—W. J. Sollas, "On the Cranial and Facial Characters of the Neandertal Race," Philosophical Transactions of the Royal Society of London, ser. B, vol. cxcix. pp. 281–339; "Ancient Hunters," pp. 157 ff.

NOTE 10, p. 392.—"The Aryan Question and Prehistoric Man," *Nineteenth Century*, vol. xxviii. (1890) p. 775.

NOTE 11, p. 393.—Eugène Dubois, "Pithecanthropus Erectus, eine Menschenaehnliche Uebergangsform aus Java" (Batavia, 1894); "Pithecanthropus Erectus, a Form from the Ancestral Stock of Mankind," Smithsonian Institution, An. Report, 1898, pt. i. pp. 445–449, being part of a paper read before the Berlin

Anthropological Society, December, 1896, and translated from the *Anatomischer Anzeiger,* vol. xii. pp. 1–22; O. C. Marsh, Review of Dubois' book in *American Journal of Science,* 3d ser., vol. xlix. (Feb. 1895) pp. 144–147; O. C. Marsh, Abstract of Communication to the National Academy of Sciences at Washington, in *American Journal of Science,* 4th ser., vol. i. (June, 1896) pp. 475–482; also in *Science,* new ser., vol. iii. (May 29, 1896) pp. 789–793; Prince Kropotkin, report on Pithecanthropus, in *Littell's Living Age,* vol. ccix. (April 11, 1896) pp. 76–78, taken from the *Nineteenth Century* for 1896; D. J. Cunningham, "Dr. Dubois' So-called Missing Link," abstract of a report at the Royal Dublin Society meeting January 23, 1895, *Nature,* vol. li. (Feb. 28, 1895) pp. 428, 429; also his "Place of 'Pithecanthropus' on the Genealogical Tree," *Nature*, vol. liii. p. 296; abstract of paper by Eugène Dubois reported in *Nature,* vol. liii. (Dec. 5, 1895) pp. 115, 116; also his "Place of 'Pithecanthropus' in the Genealogical Tree," *Nature,* vol. liii. pp. 245–247; W. J. Sollas, "Pithecanthropus Erectus and the Evolution of the Human Race," *Nature,* vol. liii. pp. 150, 151.

Note 12, p. 395.—"Primary Factors," 1896, pt. i. chap. ii.

Note 13, p. 395.—Views of Cope summarized by Professor George Macloskie, *Bibliotheca Sacra,* vol. lx. p. 269.

Note 14, p. 396.—Franz Boas, "Mind of Primitive Man," p. 20.

NOTE 15, p. 396.—*Ibid.*, p. 22.

NOTE 16, p.397.—*Ibid.*, p. 24.

NOTE 17, p. 397.—*Ibid.*, p. 25.

NOTE 18, p. 398.—" Man's Place in Nature," ed. of 1901, p. 203.

NOTE 19, p. 398.—" Darwinism," p. 82.

NOTE 20, p. 399.—" On the Mammals and Winter Birds of East Florida, with an examination of certain assumed specific characters in Birds, and a sketch of the Bird Faunæ of Eastern North America," published in the Bulletin of the Museum of Comparative Zoölogy at Harvard College, Cambridge, Mass., in 1871.

NOTE 21, p. 402.—Wallace, " Darwinism," p. 458.

NOTE 22, p. 402.—*Ibid.*, pp. 69–71.

CHAPTER XIII

NOTE 1, p. 408.—See author's " Scientific Aspects of Christian Evidences," pp. 63–66.

NOTE 2, p. 411.—See Enclclopædia Britannica, 9th ed., art. " Biology."

NOTE 3, p. 417.—" Mental Evolution in Man," 1889.

NOTE 4, p. 420.—*Ibid.*, p. 208.

NOTE 5, p. 422.—*Atlantic Monthly*, Feb. 1892, p. 184.

NOTE 6, p. 434.—Franz Boas, " Mind of Primitive Man," pp. 7, 8.

CHAPTER XIV

Note 1, p. 438.—" History of Creation," English translation, vol. i. pp. 37, 38.

Note 2, p. 439.—" Veracity of the Hexateuch," pp. 209, 210.

Note 3, p. 441.—A. de Quatrefages, " The Human Species," p. 174.

Note 4, p. 443.—" The Pentateuch Vindicated from the Aspersions of Bishop Colenso," p. 128 footnote.

Note 5, p. 445.—He is called in 1 Chron. xxiv. 20 a son of Amram, the ancestor of Moses; for Shubael and Shebuel are in all probability mere orthographic variations of the same name.

Note 6, p. 454.—In Ruth iv. 17 Ruth's child is called " a son born to Naomi," who was Ruth's mother-in-law and not even an ancestor of the child in the strict sense. Zerubbabel is called familiarly the son of Shealtiel (Ezr. iii. 2; Hag. i. 1), and is so stated to be in the genealogies of both Matt. i. 12 and Luke iii. 27, though in reality he was his nephew (1 Chron. iii. 17–19). That descent as reckoned in genealogies is not always of actual parentage appears from the comparison of the ancestry of our Lord as given by Matthew and by Luke.

Note 7, p. 464.—The number varies in different manuscripts.

Note 8, p. 467.—A. de Quatrefages, " The Human Species," pp. 175, 176.

NOTE 9, p. 496.—Author's "Scientific Confirmations of Old Testament History," chaps. vii.–xi.

NOTE 10, p. 471.—Bulletin of the Geological Society of America, vol. xiii. pp. 127–138, and 530; author's "Asiatic Russia," pp. 75–77; also his "Scientific Confirmations," pp. 207, 211, 305.

NOTE 11, p. 472.—Bulletin of the Geological Society of America, vol. xiii. pp. 127–138; author's "Scientific Confirmations," pp. 315, 316.

NOTE 12, p. 472.—William M. Davis, "Explorations in Turkestan" (Carnegie Institution, Washington. 1905), pp. 28–36.

CHAPTER XV

NOTE 1, p. 479.—Alfred Russel Wallace, "Island Life," p. 212.

NOTE 2, p. 479.—Charles D. Walcott, "Geologic Time; as indicated by the Sedimentary Rocks of North America," Proceedings of the American Association for the Advancement of Science, vol. xlii. pp. 168–169.

NOTE 3, p. 488.—Sir Joseph Prestwich, "Geology," vol. i. p. 232; Sir Charles Lyell, "Principles of Geology," vol. i. p. 133.

NOTE 4, p. 491.—*Quarterly Journal of Geological Society*, Aug. 1887; "Geology," vol. ii. pp. 441–535.

IMPLEMENTS DEEMED TO BE OF GREAT AGE FROM STUDY OF THE PATINATED SURFACES

Since the body of this work was in press there has come into my hands a paper of Professor N. H. Winchell (to be published in the *Records of the Past,* Washington, vol. xi. pt. iv, July-August, 1912) describing a collection of artifacts gathered by the late Mr. J. V. Brower from an area in eastern Central Kansas lying outside the glacial boundary. Mr. Winchell's study of them, however, has convinced him that they are of the same age with those that have been found connected with the glacial deposits. This conclusion is reached not only by the study of the forms of the implements, but especially by attention to the extent of the patina upon their surface. The artifacts under consideration "are fashioned from a blue-gray chert, or from a yellowish-gray chert which has resulted from it by weathering. . . . Usually from exposure these artifacts have acquired a patina consisting of a smooth glossy surface, with a thin scale of altered rock immediately below the gloss. . . . Frequently one side of a flat specimen is more patinated than the other. All degrees of weathering and decay can be found, so that it seems the fabrication of rude artifacts continued from palæolithic time in Kansas to the neolithic. On the other hand can be found in the same region, and sometimes on the same sites, implements of higher culture which are not weathered or patinated; and on closer and wider examination it is found that this higher culture is itself so old that the specimens that manifest it have also acquired a semi-gloss, indicating that they have also been exposed, but for a shorter time, to the same destructive agents as the palæoliths. In many cases the implements that show this higher culture are quite like those of the neolithic people of post-Glacial time. . . . The culture of the palæoliths, however, is markedly different from and ruder than that of these semi-patinated specimens. These semi-patinated specimens embrace implements known as knives, points, scrapers, etc., all of which are excluded from the palæolithic group by the simple fact that they are never found carrying palæolithic patina, and by the significant fact that patinated palæolithic implements were used, in many cases, for the making of the specimens of higher culture. The different dates of the two chippings are perfectly evident on the same specimen by reason of the patina on the one and its absence on the other."

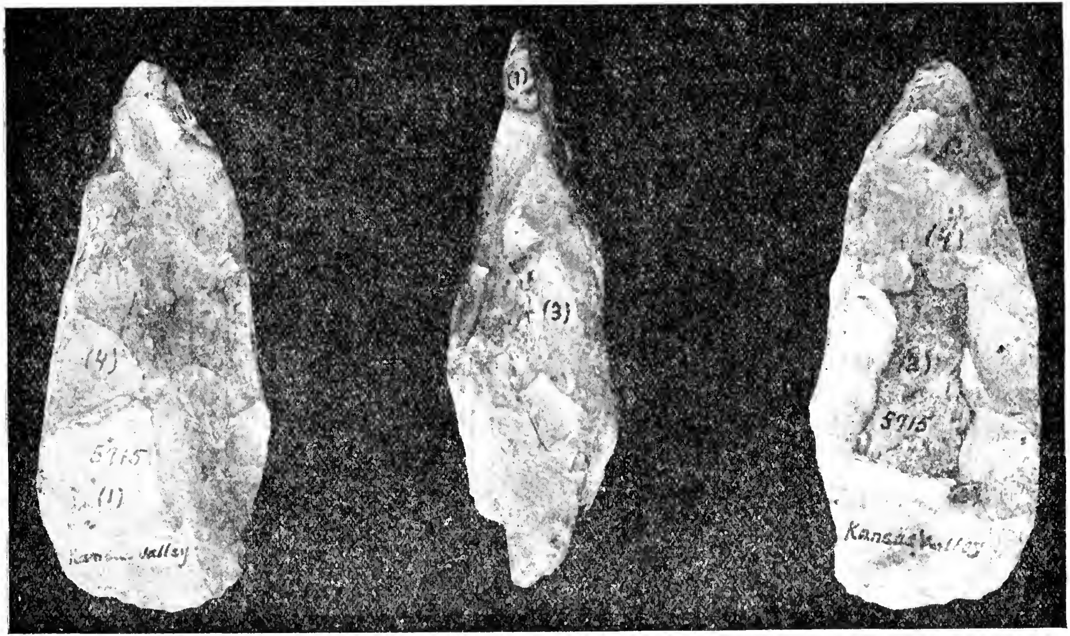
It is worthy of note also in this connection that close study of the Newcomerstown implement reveals to Professor Winchell a degree of patination corresponding to that of these oldest implements in Mr. Brower's collection. Professor Winchell's conclusions, also, correspond with those of Dr. W. Allen Sturge of Mildenhall (Suffolk), England, detailed in the Proceedings of the Prehistoric Society of East Anglia for 1908, 1909, and 1910, thus greatly increasing the evidence of the early date of prehistoric man and of his wide distribution over the surface of the earth. We cannot, however, accept Dr. Sturge's conclusions concerning the actual age of these implements, since he follows Croll's estimates of glacial time from astronomical evidence without proper acquaintance with the accumulation of geological evidence made since the publication of Croll's theory. Estimates made from patinated surfaces of the implements can at present relate only to the relative age.

DESCRIPTIVE NOTE BY N. H. WINCHELL.

This specimen has the same shape as the Newcomerstown palæolith of Ohio, but is a little larger. It is of blue-gray chert, abundant in the Upper Carboniferous formation of the Kansas valley. Its form is not uncommon among the specimens collected there, but few are as perfect as this. The long edges and the large end show a battering which has resulted from use, indicating that the implement had reached the state of completion. Its shape and size warrant the name *celt.* The facets show the feature that is common on surfaces of forced fracture, i.e., an undulatory, circular, alternation of elevation and depression, the size of the waves increasing with distance from the ictus-point, and furnishing a guide to the place of the bulb of percussion, although such bulb may have been destroyed by the later chipping. The surfaces are numbered, beginning with the oldest, viz.

(1) Has a thick patina of a dirty white color, but no gloss. It is seen on one side and one edge. There is no demonstration that this is artificial, and it may date from the time of contact with the parent rock. If so it may be called *prepalæolithic.*

(2) Has a distinct, brown patina and a dull gloss. It is seen on one side, near the center, outlined by the arêtes formed by the later chipping, and at the small end. This is distinctly an artificial fracture surface, since it shows the



Specimen No. 5,715 of the Brower Register of the Minnesota Historical Society.

wavy contours both at the point and at the lower right hand of the larger area. The thickness of the patina is about that of writing paper It indicates early palæolithic time.

(3) Is found only on one edge. It has a nearly white patina similar to No. (1), and it appears older than No. (2), having no gloss. It is also probably *early palæolithic.*

(4) The most of the specimen is covered by No. (4). It is of the color of the interior of the specimen, blue-gray. There is in some places a tendency to a white patination, but in general the age of this surface is indicated only by the glossiness which reflects the sunlight in all directions as the specimen is turned about. It is a characteristic indication of *palæolithic* date, although a similar glossiness, of less pronounced character, is found on many artifacts of *early neolithic* date. The specimen, as it is, dates certainly from pre-Wisconsin, and probably from pre-Kansas time.

August 15, 1912.

INDEX

Abbeville, France, glacial man in, 290, 291, 293.
Abbott on amount of silt in the Mississippi River, 181.
Abbott, C. C., palæolithic discoveries at Trenton, 219 ff.
Acheulean stage of the palæolithic period, 326.
Adour River, 303 f.
Agassiz, Alexander, on the geology of America, 18.
Agglutinative languages, 81 ff., 90, 352, 502 ff.
Alexander, mentioned, 35, 68.
Algonquins, distribution of, 138.
Allen, J. A., on variations of animals in Florida, 399 f.
Alps, the, 21.
Altai Mountains, glaciers of the, 359.
Amenhotep III, mentioned, 33.
American languages, 83, 98, 129.
Amiens, France, glacial man at, 290, 291 ff.
Amu Daria, the, 367.
Anau, 59 ff., 86.
Andes Mountains, 21; glaciation of, 217.
Andrews on the age of lake dwellings, 110.
Animals associated with prehistoric man, 238 ff., 248, 265, 287 f., 293 f., 296, 309, 313, 314, 319, 323, 324, 327 f., 332, 333, 346 ff.; distribution of, 287 f., 293 f., 301, 303, 304, 343; instinct of, 423 f.; limitations of their intelligence, 424 f.; of the Tertiary period, 23, 250 f.
Ants, brains of, 398.
Appalachian Mountains, 20.
Aral-Caspian depression, 355; former climate of, 370; former fertility of, 367 ff.; geology of, 57 f.
Armaschevsky, P., discovers implements at Kiev, 311 ff.
Art, of neolithic man, 125 f.; of palæolithic man, 330.
Aryan languages, 75 ff., 85 f., 90, 352.
Arve, the, 305.

Asia, Central, centers of glaciation in, 358 f.; climate of, after the deluge, 474; glacial history of, 356 ff.; water supply of, 367 f., 370.

Asia, Central and Western, original home of man, 351 ff.

Asia, Southern, original home of animals associated with man, 350.

Asiatics, hair of, 111.

Assouan, quarry at, 49 f.

Assurbanipal, 42.

Aurignacian stage of the palæolithic period, 330 f.

Australia, uniformity of language in, 99.

Australians resemble Mousterian man, 330; skulls of, 391.

Babbitt, Miss Franc E., palæolithic discoveries at Little Falls, Minn., 229.

Babylonian chronology, 499 f.

Babylonians, architecture of, 46; astronomy of, 46; language of, 501 f.; literature on, 500; writing of, 46.

Bächler finds stone implements at Wildkirchli, 314.

Balk, 58.

Barbour, E. H., on the Nebraska loess man, 235; on volcanic ash, 512 f.

Bardon and Bouyssonie, discoveries by, 323 f.

Bartlett, S. C., quoted on sex, 439.

Basques, the, 117 ff.; language of, 83, 117; skulls of, 118.

Baum mounds, 146.

Baumes-Chaudes, discoveries in cave of, 115.

Bear River, 272.

Bears, migration of, 348.

Becker, George F., on a stone mortar found under Table Mountain, 259 f.; quoted on the recentness of the withdrawal of glacial ice, 194.

Behring Strait, a favorable route for migration from Asia to Alaska, 134.

Bell, Robert, cited, 195.

Bible, the, can be translated into every language, 431; chronology of, 442 ff.; evidence of, relating to the origin and antiquity of man, 437 ff.
Biddenham, Eng., palæolithic discoveries at, 296.
Bingham, Hiram, discovers human remains near Cuzco, Peru, 247.
Black Mary's, Eng., palæolithic discovery at, 296.
Blumenbach's classification of man, 380.
Boas, Franz, quoted on racial differences, 396; on the ancient civilization of the Old World, and the New, 433.
Bolt, Thomas, on decay of rocks in Nicaragua, 207.
Boule, M., on eoliths, 339 f.
Bourgeois, Abbé, discoveries at Theney, 335.
Bouyssonie and Bardon, discoveries by, 323 f.
Bowlders, 158, 159, 160, 163, 210.
Bowman, Isaiah, glacial investigations in South America, 217, 247 ff.
Brachycephaly, definition of, 112; in Bosnia, 119; in the Alps, 113; in Russia, 119.
Breuil, Abbé, discredits artificial character of eoliths, 340 f
Brixham, Eng., discoveries at, 318 f.
Brooks, C. W., on Japanese wrecks on American shores, 134.
Brower, J. V., collects artifacts in Central Kansas, 524.
Bruce, skull of, 390.
Brugsch, Dr., quoted on the Fellahin of Lower Egypt, 66 f.
Burrows, R., explorations in Crete, 31.
Butterflies, distribution of, 428.

Cæsar, mentioned, 35.
Cahokia Mound, 142.
Calaveras skull, 261 ff.
Camel, original home of, 349.
Canaanites, 72.
Canstadt skull, 320, 389 f.
Caspian Sea, 57 f.
Caucasians, distribution of, in Asia, 354.

Cave bear, 314.
Caves, prehistoric remains in, 314, 316, 318 ff.
Chamberlin, T. C., on transportation of glacial material, 162.
Chellean, stage of the palæolithic period, 326.
Chelles, France, glacial man in, 290, 295.
Chillicothe, Ohio, mounds at, 143 ff.
China, date of authentic history of, 30.
Chinese language, 79 ff.
Chronicles, genealogies of, 447 ff.
Chu River, 367.
Civilization, prominent names connected with, 434, 436; sources of, 495 f.
Clay, Albert T., quoted on the art and culture of the Babylonians, 45.
Coleman, A. P., on the interglacial episode at Toronto, 212 f.
Colenso, Bishop, reply to, 443 ff.
Columbia River, 252; mouth of, center for dispersion of Indian tribes, 135.
Columbus, mentioned, 36.
Combe-Capelle, France, discovery at, 324.
Commerce, prehistoric, 108.
Commont, M., on eoliths, 339; on the Chellean implements, 326; palæolithic discoveries of, 291 f.
Conners, Mr., palæolithic discovery of, 296.
Cope on the brain of Pithecanthropus, 395; on classification of, 395.
Coptic language, 74.
Creation, mechanical theory of, 407 f.
Cresswell Crags, Eng., discoveries in caves at, 319.
Crete, archæology of, 31; archæological literature on, 498 f.
Croll, J., theory of the cause of the Glacial epoch, 174 f., 216.
Cro-Magnon race, 115 ff.
Cuvier's classification of man, 380.
Cuzco, Peru, human remains near, 247; geology of, 247 f.

Dana, Charles D., estimates of geological time, 8; on the formation of the Appalachian Mountains, 20.

Darwin, Charles, and the origin of species, 372; assumed too slow a rate of variation of species, 398; estimates of geological time, 2, 478; has not solved the mystery of creation, 406; objection to his minute variations in species, 400 f.; on sex, 440; on the ant's brain, 398; on the effect of the Bible on savage races, 431 f.
Darwin, Francis, on the way to determine the difference between the lowest plants and animals, 413.
Darwin, Sir George H., estimates of geological time, 479.
Davis, William M., on moraines of the Tian Shan Mountains, 359 f.; reports terraces on the Caspian, 472.
Dawkins, Boyd, explores cave at Wookey Hole, Eng., 319.
De Sarzec, discoveries at Telloh, 499.
Deer, distribution of, 349.
Deluge, the, date of, 474.
Demavend Mountain, height of, 57.
Denmark, forests of, 106; kitchen middens of, 105 f.
Deschutes River, 253.
Diller, Mr., on a cinder cone in California, 284.
Divine immanency, doctrine of, 408 ff.
Dolichocephaly, characteristic of the prehistoric European, 113 f., 118 f; definition of, 112; in France, 114 f.
Dolmens, 122 ff.
Dordogne, France, cave man in, 323 f.
Dubois, Eugène, discovers Pithecanthropus erectus, 393.

Egypt, antiquity of, 47, 50 f.; language of, 501 f.
Elamites, 42.
Elbe River, 303.
Elephants, distribution of, 349 f.
Elevation of land, at close of Tertiary period, 168 ff., 301 ff., 343 ff., 486, 488; relation to distribution of animals, 301 f., 304, 344 ff.; of man, 171 f., 304.
Elsenz River, 309.
Engeln, O. D. von, on rate of melting of glacial ice, 167.
Engis skull, 116, 320.

Eoliths, 337 ff.
Esker terraces, 294, 308.
Eskimos, 236 f.
Etruscan art, 103.
Euphrates Valley, date of man's history in, 494; early history in the, 33 f., 38 ff.
Europe, complexion of the races of, 110 ff.; in the Tertiary period, 301 ff., 346; origin of the races of, chapter on, 102–127; skulls of, 112 ff.
Europeans, hair of, 111; skulls of, 112 ff.
Evans, Arthur J., explorations in Crete, 31.
Evans, Sir John, on the discoveries in the Somme Valley, 291.
Evolution, bearing of, on man's appearance, 7; theories of, 6, 373 ff., 407.
Exodus, date of the, 48.
Ezra, genealogies of, 445 f.

Fellahin, the, 66 f.
Fiords, 168 f., 171, 303 f., 486.
Floods at the close of the Glacial epoch, 243 ff.
Fort Ancient, 143.
Fort Hill, 143.
Fraipont, Professor, quoted on the rate of development from apes to man, 392; and Lohest discover skeletons at Spy, 321 ff.
Frere, John, palæolithic discoveries of, 297.

Galley Hill, Eng., geology of, 298.
Galley Hill skeleton, 297 f.
Garden of Eden, location of, 442.
Gaudry, M., 291.
Geer, Baron de, on a post-glacial lake bed in Sweden, 193.
Genealogies of the Bible are frequently abbreviated, 444 ff.; not to be used for chronological purposes, 444.
Genesis i. conforms to modern science, 437 ff.
Genesis v. and xi., genealogies of, not complete, 455 ff.

Genghis Khan, 58 f., 353.
Geological time, 8, 478 ff.; literature on estimates of, 497.
German Ocean, elevation of, 302.
Gilbert, G. K., on the rate of post-glacial elevation, 187; on the geological history of Great Salt Lake, 278 ff.
Gilder, Robert F., finds human bones at Omaha, Neb., 235.
Gizeh, pyramid of, 49.
Glacial boundary in Europe, 160; in North America, 163.
Glacial débris, depth of, 159, 163.
Glacial epoch, cause of, 22, 486 f.; characteristics of, 305, 334, 370; date of, 174 ff.; of the close, 494; depression of land at the close of, 469 ff.; effect of, on Central Asia, 368 f., 474 ff.; on drainage, 24, 164 ff.; on land levels, 22, 168 ff., 351; extent of, in America, 162 f., 490; in Europe, 160 f., 490; in Southern Hemisphere, 216 f.; length of, 195 ff., 334, 480, 491 f.; significance of, chapter on, 157–217.
Glacial ice, depth of, 159, 160, 162.
Glacial man, in Central Asia, chapter on, pp. 334–370; remains of, in Europe, chapter on, 290–333.
Glacier Bay, former extent of ice in, 204 f.
Glaciers in Central Asia, 164.
Granville, Ohio, mound at, 148.
Gray, Asa, quoted on California wood, 286.
Gray, Dr., on variations of bear's skulls, 403.
Great Salt Lake, 278 ff.
Green, William Henry, article by, on "Primitive Chronology," reprinted, 443 ff.
Greenland, geology of, 344 f.; movement of ice in, 491.
Greenland glaciers, movement of, 201.

Haeckel quoted on the first chapter of Genesis, 437.
Hale, Horatio, on conditions favoring growth of different languages, 97 f.; on linguistic stocks in Oregon, 84; on origin of the various languages, 91.
Hallstatt, Austria, archæology of, 103 f.

Hamilton, Sir William, on a supposed danger in modern science, 406.
Harmer, F. W., on Scandinavian ice in England, 295 f.
Harrison, B., discovers chipped flints at Ightam, 337.
Hauser, O., discovery by, in Dordogne, France, 324.
Haynes, Mr., explorations at Nippur, 43, 499.
Helin, Belgium, geology of, 308; implements found at, 311.
Helland on the motion of the Greenland ice sheet, 200.
Herz and Tolmatschow discover a perfect specimen of mammoth, 362.
Heys, Messrs. Elliott and Matthew, discover skeleton at Galley Hill, 297.
Heyse, K. W. L., "ding-dong" theory of, 505.
Hicks, Professor, on Raccoon Creek, 180 f.
Hilprecht, H. V., discoveries at Nippur, 499.
Himalayas, the, 21.
Hindu Kush Mountains, 368.
Hippopotamus, 347 f.
Holst, N. O., glacial discoveries near Malmö, 213 f.; on a chalk bowlder, 159.
Homer, poems of, 31.
Homo heidelbergensis, 309.
Hopewell mounds, 145.
Horse, distribution of, 348 f.; in America, 251.
Hoxne, Eng., palæolithic discoveries at, 297.
Hubbs, Paul K., finds relics under Table Mountain, 256 f.
Hudson River, geology of, 486.
Humphreys on amount of silt in the Mississippi River, 181.
Hunn, E. R., account of a language invented by children, 93 ff.
Huntington, Ellsworth, on moraines of the Tian Shan Mountains, 359 f.
Hurlbut, Rev., on Algonquin verbs, 82.
Huxley, T. H., on spontaneous generation, 411; on the Neanderthal skull, 321; quoted on the brains of man and

apes, 383, 385; on the classification of mammals, 384; on the rate of development of man from apes, 392.
Hyrcania described, 355 f.

Ightam, Eng., chipped flints discovered at, 337.
Illinoisan deposits, 208 f.
Indian corn, origin of, 137.
Indians, American, antiquity of, 154 f.; culture of, 130; customs of, 130 f.; language of, 83, 98, 129; migration from Eastern Asia, 134; migration in America, 138 f.; mode of reckoning blood relationship, 131 ff.; origin of, chapter on, 128–156; relation to the Mound Builders, 141 ff.; to the Tamils, 84, 131, 133.
Ipswich, Eng., geology of, 299.
Ipswich skeleton, 298 f.

Java, lava deposits of, 393.
Jordan Valley, geology of, 473.

Kakimna's Treatise on Manners, 51 ff.
Kansan deposits, 206 ff.
Kansas, artifacts found in, 524 f.
Kaschenko, Professor, finds remains of man and mammoth, 313 f.
Keil assumes two Amrams, 452 f.
Keith, Dr., on the Ipswich skeleton, 299.
Kemp, J. F., finds two mortars in Southern Oregon, 261.
Kent's Hole, Eng., discoveries at, 318 f.
Keyes, Charles R., reports a terrace at Soudak, 472.
Khufu, 50.
Kiev, Russia, geology of, 311 f.; implements found at, 312,
King, Clarence, on a pestle found under Table Mountain, 260 f.
Kitchen middens, 105 f.
Knossos, discoveries in, 31.
Kudur-Mabug, 72.

Kurtz, M. A., finds the Nampa image, 266.

La Chapelle aux Saints, skulls discovered near, 323 f., 328.
Labyrinth, the, 31.
Ladrière, on the Somme gravel deposits, 306.
Lake Agassiz, 188 ff.
Lake Bonneville, 280 ff.
Lake dwellings, 107 ff.
Lane, A. C., on the stagnant ice of Siberia, 358.
Language, origin of, 504 ff.; relation to modern civilization, 430 ff.
Languages, diversifications of, 96 f.; invented by children, 91 ff.
Lansing, Kansas, skeleton found at, 230.
Latin language, 88 f.
Laugerie Basse, discoveries near, 115.
Lava deposits in Western United States, 240 ff., 252 ff., 272 ff.
Le Conte, Joseph, quoted on the transition from the Silurian to the Devonian formation, 19.
Les Eyziès, discoveries near, 115.
Lesquereux on the age of the deep placers, 265.
Lincoln, Abraham, influence of, 37.
Linnæus' classification of man, 380.
Little Falls, Minn., palæolithic discoveries at, 228 f.
Little Miami River, mounds on, 143, 147.
Locke on the origin of thought, 414 f.
Loess, 231 ff.
Logan, Sir William, on recentness of glaciation, 195.
Lohest and Fraipont discover skeletons at Spy, 321 ff.
London, built on a gravel terrace, 296.
Loveland palæolith, 228.
Lugal-zaggisi, 72, 500.
Luther, Martin, mentioned, 35.
Lyddeker on classification of Pithecanthropus, 395.
Lyell, Sir Charles, 291; estimate of geological time, 478;

on the London terrace, 296; on the rate of continental elevation, 488; on the recession of Niagara Falls, 178; theory of uniformitarianism, 14 ff.

Lys River, 304; geology of, 311.

MacEnery, Rev. J., discoveries at Kent's Hole, Eng., 318.

McGee, W J, estimate of geological time, 497.

Machairodus, 319.

McTarnahan, M. C., finds a mortar under Table Mountain, 259.

Madisonville palæolith, 228.

Magdalenian stage of the palæolithic period, 333.

Mammoth, 260 ff.; found in Siberia, 313 f.

Man, advances over the other Primates, 386 f.; and the lava beds of the Pacific Coast, chapter on, 250–289; and the mammoth, 360 ff.; body cf, adapted to his mind, 404 f.; classifications of, 380, 384; compared with the anthropoid apes, 380 ff.; definitions of, 10 f., 91, 426; diversification of the races of, 372 f., 376; in the Glacial epoch, chapter on, 218–249; mental powers of, 379, 416 ff., 426 f.; prehistoric, culture of, 288 f.; prehistoric, not anatomically different from modern man, 395 f.; unity of the races of, 371 f.

Manetho, 47.

Manouvrier on bearing of physical characteristics on mental, 396 f.

Maracanda, 58.

Marr, J. E., on the geology of Ipswich, Eng., 299 f.

Marietta, Ohio, fortifications at, 142.

Mattison, Mr., discovers the Calaveras skull, 261 ff.

Mauer, geology of, 308; human jaw discovered at, 309.

Mediterranean Sea, 304.

Menes, 66, 434, 436.

Mental capacity of neolithic man, 122 ff.

Merv, 58.

Mesopotamia, mentioned, 72.

Mesvinian stage, of the palæolithic period, 325.
Metz, C. L., finds palæoliths at Loveland and Madisonville, Ohio, 228.
Middendorff on the mammoth in Siberia, 361.
Mills, W. C., discoveries in Baum mounds, 146; finds palæolithic implement at Newcomerstown, 226.
Minos, not a fabulous monster, 31.
Mississippi River, amount of silt in, 181.
Mississippi Valley, mounds in, 141 ff.
Möller, Hermann, Semitic and Aryan grammar by, 502.
Mohammed, mentioned, 36.
Moir, J. Reid, discovers skeleton at Ipswich, Eng., 298.
Mongolians, distribution of, 354.
Monoliths, 125.
Moorehead, Warren K., discoveries in Hopewell mounds, 145.
Morgan, Lewis H., on the customs of the American Indians, 130 f., 140; on their mode of reckoning relationship, 132 f.
Morlot, on the age of lake dwellings, 109 f.
Mortillet, G. de, on the chipped flints found at Otta, 335 f.; at Puy Courny, 337.
Moses, 434; qualified to make correct genealogies, 460 f.
Mound Builders, 141 ff.
Mousterian stage of the palæolithic period, 326 ff.
Müller, Sophus, on the source of European culture, 114.
Mugheir. *See* Ur.
Muir, Sir W., on the traditionals about Mahommet, 30.
Muir Glacier, Alaska, 317; retreat of, 204 f.
Muir Inlet, glaciation in, 204.
Murray, explorations in Crete, 31.

Nabonidus, cylinder of, 40; his conclusions not to be discredited, 499.
Nampa, Idaho, geology of, 266 f., 275, 277.
Nampa image, 265 ff., 288.

Napoleon on the pyramids, 48.
Narâm-Sin, 40, 41, 43, 44, 46.
Nations, table of, 466 ff.
Neanderthal skull, 321, 328, 389 f.
Neckar River, 304.
Negroes, distribution of, 353 f.; hair of, 111.
Neolithic man, brain of, 397.
New Jersey, subsidence of the coast of, 488.
New Siberian Islands, 365.
Newark, Ohio, embankments at, 143.
Newcomerstown palæolith, 226, 228.
Newton, Sir Isaac, 406.
Niagara Falls, a glacial chronometer, 176 ff.
Nile River, 367 f.
Nile Valley, date of man's history in, 494; early history in, 33 f., 47 ff.
Nippur, excavations at, 43 f.
Noye River, 305.

Obi Valley, prehistoric remains in, 361.
Ohio Valley, mounds in, 141 ff.
Omaha, Neb., human bones found at, 235.
Otta, discoveries at, 335 f.
Oxen, distribution of, 349.

Pacific coast, animals of, 287 f.
Palæolithic implements, classification of, 324 ff.
Palæolithic man, art of, 360, 361.
Patagonia, effect of missions in, 432.
Patinated surface, a test of age, 524 f.
Pawnees, distribution of, 138.
Penck, Albrecht, on the geology and date of the cave deposits in Switzerland, 314 f.
Pengelly, Mr., explores a cave at Brixham, Eng., 318.
Persian Gulf, mentioned, 72.
Perthes, Boucher de, palæolithic discoveries of, 291.

Phœnicians, 72.
Pithecanthropus erectus, described and discussed, 393 f.; literature on, 519 f.
Plants, distribution of, 427 f.
Pleistocene climate, 364 f.
Plum Creek, a glacial chronometer, 182 ff.
Polynesia, effect of the Bible in, 431.
Pouchet, M., on the discoveries in the Somme Valley, 291.
Powers, Stephen, on the languages of California, 84.
Prestwich, Sir Joseph, 291; on characteristics of eoliths, 337 f.; on length of the Glacial epoch, 197, 491 f.
Primates, original home of, 348.
Prisse Papyrus, 51 f.
Ptah-Hotep's Treatise on Morals, 51 ff.
Pumpelly, Raphael, excavations by, 59 ff.; on dissolution of limestone in Missouri, 207; on the oxidation of the Kansan deposits, 206.
Putnam, F. W., on the Calaveras skull, 264; on the Nampa image, 267, 271.
Puy Courny, France, chipped flints at, 336 f.

Quatrefages on clipped flints at Puy Courny, 337; quoted on a common center for the origin of man, 441; on Asia as the original home of man, 353 f.

Raccoon Creek, a glacial chronometer, 180 f.
Rames, J. B., discovers chipped flints at Puy Courny, 336.
Reclus on the mammoth of Siberia, 361.
Red River of the North, 187.
Reinach, Salomon, on the perfection of Aurignacian art, 514.
Reindeer, distribution of, 344 f.
Rhine River, 303.
Ribeiro, discoveries by, at Otta, 335 f.
Rigillout, Dr., palæolithic discoveries of, 291.
Ripley, William Z., quoted on the anthropological history of

Northeastern Europe, 120 ff.; on the Cro-Magnon race, 115 f.; on the hair of the negro, 111; on the prevalence of broad-headed races in Central Europe, 113; on the source of early European culture, 127.
Rocky Mountains, 21, 22.
Romance languages, 88 ff.
Romanes, George J., on requisites to make dogs and parrots equal the lower races of men, 430; on the difference between man and an animal, 421; on the intellectual development of animals, 417 ff.; quoted on the growth of the human mind, 420.
Rütimeyer finds bones of the cave bear at Wildkirchli, 314.
Russell, I. C., quoted on the recentness of the withdrawal of glacial ice, 194.
Rutot, A., discovers eoliths in Belgium, 338; on chipped flints at Puy Courny, 327; reports implements at Helin, 311.

St. Anthony, Falls of, a glacial chronometer, 179.
St. Louis, Mo., mound near, 142.
St. Mansui, skull of, 390.
Saint-Gaudens, discoveries near, 115.
Samaritan Pentateuch version of Gen. v. and xi., 461 ff.
Samarkand, 59.
Sanskrit, 502 f.
Sargon, 40 f., 42, 44, 46, 499 f.
Scheil, Vincent, discovers a Babylonian tablet, 499.
Schleicher represents a Chinese sentence in English, 79.
Schmerling, Dr., discovers skull at Engis, 320.
Schmidt, Professor, on glaciation of the Yablonoi Mountains, 357.
Schoetensack, Professor, discovers human jaw at Mauer, 309.
Seine River, 303, 304.
Semitic languages, 71, 74 ff., 85.
Septuagint version of Gen. v. and xi., 461 ff.

Serpent mounds, 148 f.
Sex, origin of, 439 f.
Shell heaps. *See* KITCHEN MIDDENS.
Shoshones, distribution of, 139.
Siberia, geology of, 356 f.; palæolithic implements found in, 313 f.
Sierra Nevada Mountains, geology of, 283; trees of, 286 f.
Sinclair, William J., discredits the Calaveras skull, 264 f.
Sioux, distribution of, 138.
Slater, George, on the geology of Ipswich, Eng., 299.
Slavs, skulls of, 119.
Snake River, 253, 273; line of migration of Indian tribes, 136 f.
Snell, Dr., finds relics under Table Mountain, 256.
Sollas, W. J., on the classification of palæolithic implements, 325 ff.; on the skulls of glacial man, 391; quoted on eoliths, 340 ff.
Solutrian stage of the palæolithic period, 332 f.
Somme River, geology of, 292 f., 300 f., 304 ff.
Soul, origin of the, 435.
South America, glaciers in, 217; origin of inhabitants of, 140 f.; prehistoric man in, 247 ff.
Southern Hemisphere, glaciation of, 216 f., 247 ff.
Species, origin of, 411 ff.; variations of, 372, 373 ff., 399 ff.
Spencer, Herbert, and "the survival of the fittest," 376 f.
Spy, Man of, 321 ff., 328, 389 f.
Stadling on the mammoth of Siberia, 361.
Stanislaus River, 254, 284, 285.
Steenstrup on the date of the stone age, 107.
Stevens, Oliver W., discovers marble bead under Table Mountain, 258.
Strabo on Hyrcania, 355 f.
Strepyan stage of the palæolithic period, 325.
Sturge, W. Allen, on the age of palæolithic implements, 525 f.
Sumerians, 81; cities of the, 39.
Sweden, kitchen middens of, 105 f.

Switzerland, lake dwellings of, 107 ff.
Syr Daria, the, 367.
Table Mountain, 254 f.; age of, 285; relics from, 255 f.
Tait, estimates of geological time, 497.
Talmatschow and Herz discover a perfect specimen of mammoth, 362.
Tamils related to American Indians, 84, 131, 133.
Tapirs, original home of, 349.
Tarr, Ralph S., on oxidation of the Kansan deposits, 206; on rate of melting of glacial ice, 167, 245.
Telloh, discoveries at, 45.
Terrace epoch, the, 218 f.
Terraces, 24 ff., 167, 181, 188, 218 ff., 226, 290, 292, 293, 296, 472.
Tertiary man, supposed evidence of, chapter on, pp. 334–342.
Tertiary period, characteristics of, 334, 485 f.; climate of, 485; elevation of land at the close of, 168 ff., 301 ff., 343 ff., 486, 488 f.
Thames River, 295 f., 303, 304.
Thenay, France, discoveries at, 335.
Thucydides, mentioned, 31.
Tian Shan Mountains, 368; glaciers of the, 358; moraines of the, 359 f.
Tiele assumes two Amrams, 452 f.
Timur the Tartar, 59, 353.
Todd, J. E., on volcanic ash, 512.
Toll, Baron, on the stagnant ice of Siberia, 357 f.
Topinard on the skulls of ancient and modern men, 397.
Toronto, Can., interglacial episode at, 212 f.
Tracy, Charles, reports terrace at Samsun, 472.
Tradition, value of, 29 f.
Trebizond, Turkey, old shore line at, 472.
Trenton, N. J., geology of, 219 f.
Trojan War, date of, 31.
Troy, mentioned, 33.

Trumbull, Mr., on compounds in Indian languages, 82.
Tschernyschev, Professor, on glaciation of the Stanovoi Mountains, 357.
Tschudi, Baron von, on languages in South America, 99.
Turkestan, ancient religion of, 63; antiquity of civilization in, 56 ff.; temperature of, 370.
Turner mounds, 146, 148.
Tylor, A., on the Somme gravel deposits, 306.

Upham, Warren, estimates of Post-Tertiary time, 8; on Lake Agassiz, 188 ff.; on preglacial elevation of Europe, 301; on the loess deposits at Lansing, Kan., 235; on the rate of post-glacial erosion, 187.
Ur, 39, 40.

Venus impudica, 269, 514.
Vézère Valley, discoveries in, 115.
Village Indians, 139 f., 149 f.
Virchow on cranial capacity of Negritos and inhabitants of New Britain, 395.
Volcanic ash, 241, 512 f.
Volk, Ernest, palæolithic discoveries at Trenton, N. J., 224 f.

Walcott, Charles D., on limits of geological time, 479, 497.
Wallace, Alfred Russel, estimates of geological time, 479; on migration of bears, 348; on the foresight shown in man's physical structure, 405; quoted on the remoteness of the divergence between man and apes, 387; on variations in skulls of orangoutangs, 402.
Warren, S. Hazzledine, on method of formation of eoliths, 338 f.
Washington, George, influence of, 37.
Watson, Miss E. H., on a language invented by children, 92 f.
Wheeling, W. Va., mounds near, 142 f.

Whitaker, W., on the geology of Ipswich, Eng., 298 f.
Whitney, J. D., investigates the discoveries at Table Mountain, 257 f.; the Calaveras skull, 263.
Whitney, W. D., on the origin of language, 505 f.; quoted on the American languages, 81, 83.
Whittlesey, Col., on signal mounds, 151 f.
Wildkirchli, Switzerland, geology and implements of, 314 f.
Williams, E. H., investigations of, sustain the moderate estimates of glacial time, 214 ff.
Williams, Henry S., estimates of geological time, 8.
Willoughby Island, glaciation on, 204.
Winchell, Alexander, on the Quaternary lava flows, 241.
Winchell, N. H., estimates of geological time, 8; on the loess deposits at Lansing, Kan., 235; palæolithic discoveries at Little Falls, Minn., 228 f.; study of Falls of St. Anthony, 179; of artifacts found in Kansas, 524 f.
Winckler, on the date of Babylonian civilization, 499; quoted on Babylonian art, 46.
Wisconsin, mounds in, 148.
Wisconsin deposits, 210 ff.
Women, brains of, 397.
Wookey, Hole, Eng., discoveries in cave at, 319.
Wright, S. G., on the Ojibway word for father, 81 f.
Würm glacial episode, 316.

Yaho, dynasty of, 30.

tools &c = man in [illegible]-
. no royal road to Kn. of man's antiquity-
. Exodus - Pyramids 4000 B.C.
. early books.
. older Kurgan 8000 B.C.
. early Egypt'n. articles &c.
. Retirement & Questions.
. Rapid change of language -
5. Primitive Aryan Speech
6. original centre of same
. origin of language -
. diversity of language doubtful proof of antiq'y.
. successive Scandinavian forests &c.
. age of L. Villages in Switz'd.
. Cro-Magnon -
4. Route from Asia to N. America
. Mound Builders.
. Ice field of Europe in Gl. Per'd. & America
. changes since the Gl. Per'd Rivers &c.
. Date of G. P. Factors for deciding.
. Niagara erosion -

Babylonian civil - in pre-flood

197. Commencet of G. P. date · 25' or

200. approxte ext. of G.P.

201. Velocity of glaciers.

212 interglacial periods.

219 Man in "Terrace Epoch" Trenton G

~~235~~6. Lansing Man

237. Esquimaux

240. Volcanic -

248. S. American human remains.

257. horse in America -

258. man under lava -

261. [illegible].

265. Idaho figurine Nampa.

289. Earliest Am. man - degeneration.

297. Galley Hill -

298. Ipswich -

309. Mauer (Heidelberg) jaw.

311. Specimens — Kiev.

317 Muir glacier - retreat -

318. English lakes. Kent's Hole. [illegible]

320. [illegible]

5. Money – otta –
36. Pay Country. –
37. Eoliths
45. Reindeer Distribution.
51. Mammoth ivory – large amts. of
6. Central Asia Oft. Per.
71. Unity of human race – 440.
2. How long for diversification of man.
3. Epochs of paroxysmal develop^t.
7. Survival of fittest – which way? [illegible]
a accelor.
8. Continuity of life & plasticity of life-elements.
76. Genetic reltn. of man & mammalia.
78. How did the physical change take place?
6. Simian Non-S. characters in
diff^t. races –
15. Nate of evtn. of man – no [illegible] –
9. Extent of variability in wild ani^s.
1. appreciable varns.
4. Man's body & mind co-adaptable
07. Doctr. of evtn. no argt. agst. Theism

414. Creative interferences -
417. origin of man -
430. Language -
432. products of man's mental charac
436. glittering generalities of ern[illegible] Chronology -
439. Woman - how did she come to be.
442. Garden of Eden.
443. Primitive Chronology -
466. Summary of same -
471. post-glacial dep[n]. in Asia -
474. Deluge -
478. Geological Time. 497
480. post glacial time.
483. rate of increase of human race:
493. Length of man on earth.
495. Spread of civilisation - 496 -

WRIGHT, G.F. GN 350 .W8

Origin and antiquity of man.