THE PREHISTORIC WORLD: or, VANISHED RACES.

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THIS volume the author has sought to lay before the reader a description of life and times lying beyond the light of history. This is indeed an extensive subject, and calls for some explanation, both as to the general design of the work and what steps have been taken to secure correct information.

History is a word of varied import. In general, when we talk about history, we mean those accounts of past events, times, and circumstances of which we have written records. Not necessarily meaning alphabetical writing, because hieroglyphic records have furnished much true history. Hieroglyphic writing, which long preceded alphabetical writing, is itself a comparatively recent art. In no country do we find any records carrying us further back than a few thousand years before the Christian era. We have every reason to believe that the historical part of man's life on the globe is but an insignificant part of the whole. This historic period is not the same in all countries. It varies from a few centuries in our own country to a few thousands of years in Oriental lands. In no country is there a hard and fast line separating the historic period from the prehistoric. In the dim perspective of years the light gradually fades away, the mist grows thicker and thicker before us, and we at last find ourselves face to face with the unknown past.

This extensive period of time is not, however, utterly lost to us. We have simply to gather our information in some other way. Enthusiastic explorers, digging beneath the ashes of Vesuvius, have brought to light the remains of an entombed city. Of this city we indeed have historic records, but even if all such records had long since disappeared, we would gather much information as to the nationality of the inhabitants, their customs, and manners, by a simple inspection of the relics themselves. Everywhere over the earth, entombed beneath the feet of the living, or crumbling on the surface, are the few relics of a past far antedating the relics of Pompeii. They are the proofs positive that some people inhabited the land in far away times.

Our object is to gather together the conclusions of the scientific world as to primitive man. We wish to see how far back in the geological history of the globe we can find evidence of man's existence, and we desire to learn his surroundings and the manner of his life. There can be no more important field than for us to thus learn of the past. To read the story of primitive man, to walk with him the earth in ages long ago, with him to wage war on the huge animals of a previous epoch, to recede with him before the relentless march of the ice of the Glacial Age, to watch his advance in culture, to investigate whether there are any races of men now living which are the direct descendants of this primeval man.

The author makes no claims to original investigations. He trusts, however, it will not be considered impertinent for a mere loiterer in the vestibule of the temple of science to attempt to lay before others the results of the investigations of our eminent scholars. He has endeavored faithfully to perform this task. As far as possible technical language has been avoided. This is because he has written not for the distinctively scientific men, but rather for the farmer, the mechanic, and the man of business. Constant references are made to the authorities consulted. The reader his a right to know who vouches for the statements made in the text.

The pleasantest part of an author's duty is to return thanks for assistance. After the manuscript was prepared with what care could be bestowed on it, it was determined to submit it to some of our best American scholars for criticism. Accordingly, each of the gentlemen named on the title page were requested to review one or more chapters. As far as possible, each one was asked to review that chapter or chapters for which, either by reason of the position they held, or the interest they were known to take in such subjects, they would by common assent be acknowledged as eminently fitted to sit in judgment. In justice to them, it should be stated that they were not expected to concern themselves with the literary merits or demerits of the manuscript, but to criticise the scientific statements made therein. To each and all of these gentlemen the author would acknowledge his deep obligations.

We are indebted to Rev. J. P. MacLean, the well-known archaeologist, both for many valuable suggestions, and for the use of wood-cuts on pages 60, 138 and 396. We are also under obligation to Rev. S. D. Peet, editor of the *American Antiquarian*, for cuts illustrative of the effigy mounds of Wisconsin. The officials of the Smithsonian Institution, and the Bureau of Ethnology have our thanks for many cuts, for which credit is given them throughout the work.

Finally, the author wishes to say that it was the intention to make this work the joint production of the author and his partner, Mr. S. C. Ferguson, but before any progress was made it was deemed advisable to change the programme. While the literary work has all been performed by the author, the many details necessarily connected with the publication of a book were attended to by Mr. Ferguson.

E. A. ALLEN.

Cincinnati, *January* 1, 1885.

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HOU unrelenting Past! Strong are the barriers round thy dark

domain— And fetters, sure and fast, Hold all that enter thy unbreathing reign.

Far in thy realm, withdrawn, Old empires sit in sullenness and gloom; And glorious ages, gone, Lie deep within the shadow of thy womb.

Full many a mighty name Lurks in thy depths, unuttered, unrevered: With thee are silent fame, Forgotten arts, and wisdom disappeared. W. C. BRYANT.

Chapter I

INTRODUCTION.

Difficulties of the subject—Lesson to be learned—The pursuit of knowledge—Recent Advances—Prehistoric past of the Old World—Of the New—Of Mexico and the South—The Isles of the Pacific—Similar nature of the relics—The wonders of the present age—History of popular Opinion on this subject—The teachings of the Bible—Nature of the evidence of man's antiquity—Geology—Astronomy—Unfolding of life—Nature of our inquiry.

CAN read the book of the past? Who can tell us the story of Creation's morn? It is, not written in history, neither does it live in tradition. There is mystery here; but it is hid by the darkness of bygone ages. There is a true history here, but we have not learned well the alphabet used. Here are doubtless wondrous scenes; but our stand-point is removed by time so vast, the mist of years is so thick before us, that only the ruder outlines can be determined. The delicate tracery, the body of the picture, are hidden from our eye.

The question as to the antiquity and primitive history of man, is full of interest in proportion as the solution is beset with difficulties. We question the past; but only here and there a response is heard. Surely bold is he who would attempt, from the few data at hand, to reconstruct the history of times and people so far removed. We quickly become convinced that many centuries, and tens of centuries, have rolled away since man's first appearance on the earth. We become impressed with the fact, "that multitudes of people have moved over the surface of the Earth, and sunk into the night of oblivion, without leaving a trace of their existence: without a memorial through which we might have at least learned their names." [1]

To think of ourselves, is to imagine for our own nation an immortality. We are so great, so strong, surely nothing can move us. Let us learn humility from the past: and when, here and there, we come upon some reminder of a vanished people, trace the proofs of a teeming population in ancient times, and recover somewhat of a history, as true and touching as any that poets sing, let us recognize the fact, that nations as well as individuals pass away and are forgotten.

The past guards its secret well. To learn of it we must seek new methods of inquiry. Discouraged by the difficulties in the way, many have supposed it hidden from the present by a veil which only thickens as time passes. In the remains of prehistoric times they have failed to recognize the pages of history. They saw only monuments of ancient skill and perseverance: interesting sketches, not historical portraits. Some writers have held that we must give up the story of the past, "whether fact or chronology, doctrine or mythology—whether in Europe, Asia, Africa, or America—at Thebes, or Palenque—on Lycian shore, or Salisbury plain—lost is lost and gone is gone for evermore." Such is the lament of a gifted writer,[2] amongst the first to ponder over the mysteries of the past. At the present day, with better means at hand, a more hopeful view

is taken. But here a caution is necessary; for, in attempting to reconstruct the history of primitive times, such is the interest which it inspires, that many allow imagination to usurp the place of research, and write in terms too glowing for history.[3]

The human mind is sleepless in the pursuit of knowledge. It is ever seeking new fields of conquest. It must advance: with it, standing still is the precursor of defeat. If necessary it invents new methods of attack, and rests not until it gains its objective point, or demonstrates the hopelessness of its quest. The world needs but be informed that on a given point knowledge is dim and uncertain, when there are found earnest minds applying to the solution of the mystery all the energies of their natures. All the resources of science are brought to bear; every department of knowledge is made to contribute of its store: and soon a mass of facts is established and a new science is added to the department of human knowledge.

Thus, with our knowledge of prehistoric times, what so seemingly vain as to attempt to roll back the flight of time, and learn the condition of primeval man? All the light of ancient history makes but little impression on the night of time. By its aid we can but dimly see the outlines of the fortieth century back; beyond is gloom soon lost in night. But a few short years ago, men did not think it possible to gain further information. With the materials at hand this could not be done. The triumph of the intellect was simply delayed, not hopelessly repulsed. Geology was but just beginning to make good its claim to a place among the sciences. This unfolded to man the physical history of the world as read from the rocks, and deals with times so vast and profound that we speak no longer of years, but of ages. And with the aid of Geology grand secrets were wrung from the past, and new light was thrown on the manners and customs of primitive man. Thus the foundation for still another science was laid, called Archæology, or the science of Human Antiquities. These two sister

sciences are the keys by whose aid we have not only acquired much information of a past that seemed a hopeless enigma—but, as Columbus on the waste of waters could perceive traces of land as yet invisible, so can the present seekers after knowledge trace the signs of a satisfactory solution of many of the great questions relating to the origin and history of the vanished races of mankind.

In whatever land we commence our investigations, we quickly come upon the evidences of an ancient life long antedating all historical information. Ancient Egypt has been a fruitful theme for the antiquarians pen. The traveler has moralized over the ruins of her past greatness, and many pointed illustrations of national growth and decay have been drawn from her history.

Here was the seat of an ancient civilization, which was in the zenith of its power many centuries before Christ. The changes that have passed over the earth since that time are far more wonderful than any ascribed to the wand of the magician. Nations have come and gone, and the land of the Pharaohs has become an inheritance for strangers; new sciences have enriched human life, and the fair structure of modern civilization has arisen on the ruins of the past. Many centuries, with their burden of human hopes and fears, have sped away into the past, since "Hundred-gated Thebes" sheltered her teeming population, where now are but a mournful group of ruins. Yet to-day, far below the remorseless sands of her desert, we find the rude flint-flakes that require us to carry back the time of man's first appearance in Egypt to a past so remote that her stately ruins become a thing of yesterday in comparison to them.

In the New World, mysterious mounds and gigantic earth-works arrest our attention. Here we find deserted mines, and there we can trace the sites of ancient camps and fortifications. The Indians of the prairies seem to be intruders on a fairer civilization. We find here evidences of a teeming population. In the presence of their imposing ruins, we can not think that nomadic savages built them. They give evidences rather of a people having fixed habitations

and seem to imply the possession of a higher civilization than that of the Indians. These questions demand solution; but how shall we solve the problem? Save here and there a deserted camp, or a burial mound, containing perhaps articles of use or adornment, all traces have vanished. Their earth-works and mounds are being rapidly leveled by the plow of modern times, and the scholar of the future can only learn from books of their mysterious builders.

In Mexico, and farther south, we find the ruins of great cities. To the student of antiquity, these far surpass in interest the ruined cities of the Nile or Euphrates valley. Babylon of old, with its walls, towers, and pleasure resorts, was indeed wonderful. In our own land cities, if not as ancient, yet fallen in more picturesque ruin, reward the labors of the explorer. Uxmal, Copan, and Palenque, invite our attention. Here are hieroglyphics in abundance, but no Rosetta Stone supplies the key by whose aid a Champollion can unravel the mystery.

The luxuriant vegetative growth of the tropics, with its fierce storms, is every year hastening the obliteration of these ruins, and we must improve the time well, if we would learn from them what they have to say of the past.

The isles of the Pacific give evidence that, long before the dawn of authentic history, man lived there. Indeed, as the islands which gem that ocean, from their configuration and position, seem to be but the elevated plateaus and mountain peaks of a continent that has gone down beneath the blue wave of the Pacific, so, throughout Polynesia can be traced the fragmentary remains of a civilization, the greater portion of which has been completely buried by the waters of oblivion, leaving only here and there a trace to reconstruct, if we can, the entire structure.

The earliest remains of man are very similar in all lands. They consist of weapons of war and of the chase, implements of domestic use, and articles of personal adornment. Few and simple

as they are, they are capable of imparting useful information as to early times. By their aid we become eye-witnesses of the daily life of primitive man. We learn that though lacking in almost every thing we consider essential for comfort and happiness, yet they were actuated by much the same hopes and fears as the men of the present age. The great burden of life was the same then as now. There was the same round of daily labor made necessary by the same ceaseless struggle for existence. Rude forts and warlike implements show there was the same encroachment of the strong on the weak as now.

This is a wonderful age in many respects. In none, however, more wonderful than in the wide-spread diffusion of knowledge. The ordinary people now understand more of nature's secrets than the wise men of old. They are to-day interested in researches that a former generation would have relegated to the scholar and the man of leisure. No department of knowledge is retained for the researches of a favored few. The farmer, the mechanic, and the man of business are alike interested in a knowledge of prehistoric times. The rude implements of the past appeal to the curiosity of all. We arise from a study of the past with clearer ideas of man's destiny. Impressed with the great advancement in man's condition from the rude savagery of the drift, to the enlightened civilization of to-day, what may we not hope the advancement will be during the countless ages we believe a beneficent Providence has in store for his creature, man?

A history of the popular opinion of the antiquity of man is not only of interest, but should teach a lesson to all who think others are wrong because not holding the same views as they do. Hardly fifty years have passed since scientific men began to attribute to the human race an antiquity more remote than that assigned them by history and tradition. At first these views met with general opposition, much as did the theory of the present system of astronomy when it was first proclaimed. We laugh now at the

ignorant fear's and prejudices used to combat both.

It was claimed that the Bible taught that man had lived on the globe scarcely six thousand years. The Bible is the book to which the Anglo-Saxon mind clings with the greatest reverence. The memories of childhood are associated with its pages, and its very appearance recalls the prayers of long ago. It is not strange then that the Christian world guards with jealous care against any thing which may be thought to weaken the force of its statements.

But it is human nature to go to extremes: and, when we give our support to one way of thinking, we find it difficult to be patient with those of the contrary opinion.

Now, the researches of some of the most eminent men and learned divines have amply shown, that there are no data given in the Scriptures on which to base an estimate as to the antiquity of man. Happily the Christian mind no longer shrinks from the conclusions reached by the scientist: and, indeed, it is the contemplation of the stupendous periods of Geological times, and the infinite greatness of the works of Creation as disclosed by Astronomy, with the extreme lowness of man's first condition as made evident by Archæology, that lend new force to the words, "What is man, that thou art mindful of him!"

The evidences on which we predicate an extreme antiquity for man are necessarily cumulative. It is not from one source alone that we obtain information, but from many. Eminent men in nearly every department of knowledge have lent their aid to the elucidation of this subject. It can only be understood by those who will fairly weigh the facts that modern discoveries have unrolled before their eyes. There are many who have not done this, and are consequently unable to project their mental vision so far back into the very night of time, as is now demanded for the beginning of man's first appearance on the earth. And, indeed, so enormously has this period been extended—so far back does it require us to

go—that even the most enlightened investigator may well recoil in dismay when he first perceives the almost infinite lapse of years that are required by his calculation since the creation of man.

At this day the scholar must be ready to explain the steps by which he reaches his conclusions. Not necessarily explaining the minutiæ of his journey hither, but the main outlines of his course. This seems to call for a slight outline of Geology. The animal and vegetable tribes which have come and gone upon the earth, following each other like the shadows of passing clouds on a Summer's day, have left their remains in the rocks which at that time were forming. A close investigation of these remains shows that they form the record book of nature, wherein we are permitted to read somewhat of her secrets. This had long been a sealed book to man; but science, as we have seen, constantly extending her domain, at length taught him the alphabet.

And the Geologist now unfolds the past age of our world with a variety of detail, and a certainty of conclusion well calculated to inspire us with grateful admiration.

It is no longer a question that many ages must have rolled away, during which our world was totally unfit for life of any kind, either animal or vegetable.

The nebular theory of Laplace, as modified by the modern astronomers, so satisfactorily explains many of the phenomena of the solar system, that it takes rank almost as a demonstrated fact. According to the terms of this theory, our Earth, now so dependent on the sun for light and warmth, was itself a glowing orb, and as a bright star radiated its light and heat into space. Grand conception, and probably true. It is now useless to speculate as to how many cycles of almost infinite years had begun and ended, before Earth's fading fires gave notice that they must soon expire in night.

The stages through which the Earth passed in turn await the sun,

save that there is no further beneficent luminary to give him light and heat: when time shall have quenched his fiery glow, death and night shall reign supreme, where now is life and light.

Time is long, and nature never hurries. She builds for infinite years, and recks not the time of building. The human mind is far too feeble to comprehend the duration of time that sped away and was gone ere the slowly falling temperature of the Earth admitted the formation of a crust over her surface. When that came, the first great scene was closed. The star had expired, the planet rolled in her annual course around the still glowing central sun. Now came the formative age of the world, when the great continents were outlined.

The atmosphere gradually freed itself from its weight of water-vapor, the rains descended, and the ocean took form and contour. We are concerned only with the outlines of Geology, not with its details. It is full of the most interesting facts, but is foreign to our present purpose. We will only say, there is a marked progression in the scale and importance of life forms.

The lower forms of animals appear first to be followed in time by the higher. It is true that some forms have survived through all the changes of Geological time to the present: yet, speaking generally, some forms of life are peculiar to each age, and the general phase of animal life is different with each period. They thus form epochs in the history of the world as read from the rocks, and though the beginning and ending of each age may blend by insensible gradations with that of the preceding and following, yet, taken as a whole, we observe in each such singularities of form and structure as to give name to each particular age.

In the fullness of time man appears; and it is our pleasant task to trace the evidence of his primitive state, his growth in culture, and his advancement made before the dawn of history. Our inquiry, then, is as to his prehistoric state. We use this term in the same

sense as Dr. Wilson uses it: that is, to express the whole period disclosed to us by means of archæological evidence, as distinguished from what is known through historical records. We can not doubt but that this includes by far the largest portion of man's existence. The time embraced within historical records, though different in different portions of the world, is but a brief period in comparison to the duration of time since he first went forth to possess the Earth. If we can make plain to our readers that man has lived in the world an extremely long time, going back indeed to a former Geological age—that his first state was very low and rude—that he has risen to his present high estate by means of his own exertions continued through long ages—and from this form a prophecy of a golden age to come in the yet distant future, we shall feel that we have not written in vain.

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Chapter II

EARLY GEOLOGICAL PERIODS.[1]

Necessity of a general acquaintance with the outlines of Geology—A time in which there was no life possible on the globe—Length of this period—On the formation of rocks—The record imperfect—The three great periods in animal life on the globe—Paleozoic age—Animal and vegetable life of this period—The Mesozoic age—Animal and vegetable life of this period—

Advance noted—Abundance of reptilian life—First appearance of birds—Nature's methods of work—The Cenozoic age—Geological outline—Sketch of the Eocene age—Of the Miocene age—What is sufficient proof of the presence of man—Discussion of the Thenay flints—The Pliocene age—Animal and vegetable life of this age—Was man living during this age?—Discussion of this subject—Summing up the evidence—Conclusion.

A CLEAR understanding of questions relating to early man, a more or less extensive acquaintance with Geology is required. This is by no means a difficult task to accomplish. What so interesting as to understand at least the outlines of the history of life on the globe? To see how, following a definite plan, the vast continents have grown to their present size and form; to see how animal and vegetable life have evolved successively higher and higher forms; to see where in this wondrous drama of creation, this strange unfolding of life, the first faint, indecisive traces of man's presence are to be found; to learn what great changes in climate, in Geogony, and in life, had occurred before man's appearance, let us pass in brief review the history of early geological periods.

As we have already stated, there must have been a very long period of time during which no life was possible on the globe. Of this era we know but little; for we find no strata of rocks of an earlier date than we know life, in its simplest forms, to have existed.[2] Still we are not less confident of the existence of this era, and the mind can dimly comprehend the scene, when a nearly shoreless ocean surged around the globe.[3]

As to the extent of time during which there was no life, we have no means of determining. That it was almost infinitely long is made apparent by the researches of eminent scholars on the cooling of lava. Toward the close of this extended period of time faint traces of life appear. Not life as we are apt to think of it. No nodding flowers were kissed by the sunshine of this early time.

The earliest forms of flowerless plants, such as sea-weeds, and in dry places possibly lichens covering the rocks, were the highest forms of vegetable life. Animal life, if present, for the fact is denied by some, occurs in the very lowest form, merely structureless bodies, with no especial organs of sense, or nutrition: and their motion consisting simply in protruding and withdrawing hair-like processes.[4] Such was the beginning of life. This vast period of time, which includes the beginning, is known among geologists as Archean time.

From the close of this age, the history of life properly commences. It might be well to explain the means which the geologist uses to interpret the history of the globe. It is now understood that the forces of nature have always produced the same results as they do now. From the very earliest time to the present, rocks have been forming. There, where conditions were favorable, great beds of limestone, formed from shells and corals, ground up by the action of the sea[5]—in other places, massive beds of sandstone or of sand, afterward consolidated into sandstone—were depositing. On the land surface, in places, great beds of vegetable *débris* were being converted into coal. Now we can easily see how the remains of organic bodies, growing at the time of the formation of these beds, should be preserved in a fossil form. Limestone rocks are thickly studded in places with all sorts of marine formations. Coal fields reveal wonders of early vegetative growth. From sandstone rocks, and shaly beds, we learn strange stories of animal life at the time they were forming. From a careful study of these remains together with the formation in which they occur, not only in one locality but all over the earth, geologists have gradually unfolded the history of life on the globe. It is admitted that, at best, our knowledge in that direction is fragmentary. This arises from errors in observation as well as that fossil formations are rare, or at least localities where they are known to exist are but few. So our knowledge of the past is as if we were examining some record from which pages, chapters, and

even volumes, have been extracted.

In consequence of this imperfect record we can not, as yet, trace a gradual successive growth from the low forms of animal and plant life, that characterized the closing period of Archean time, to the highly organized types of the present. The record suddenly ceases and when we again pick up the thread we are surrounded by more advanced types, higher forms of life. Though we may hope that future discoveries will do much toward completing the records, we can not hope that they will ever really be perfected. So, from our present stand-point, the history of life on the globe falls naturally into three great divisions.[6] This is no more than we might expect, when we reflect that nature's laws are universal in their action, and that the world, as a whole, has been subjected to the same set of changes.

The period following on after Archean time is called, by geologists, Paleozoic time.

During the long course of time embraced in this age, the forms of life present wide differences from those of existing time.

This period produced the great beds of coal we use to-day. But the vegetation of the coal period would present strange features to our eyes. The vegetation commenced with the lowest orders of flowerless plants, such as sea-weeds; but, before it was brought to a close, there was a wonderful variety and richness of plants of the flowerless or Cryptogamic division. In some of the warmest portions of the globe, we have to-day tree-ferns growing four or five feet high. During the closing part of the Paleozoic time, there were growing all over the temperate zone great tree-ferns thirty feet or so in height. Some varieties of rushes in our marshes, a foot or two in height, had representatives in the marshes of the coal period standing thirty feet high, and having woody trunks.[7] Near the close of the Paleozoic time, vegetation assumed a higher form

of life. Flowering plants are represented. Pines were growing in the coal measures.

In animal life a similar advance is noted. The class of animals having no backbone, or invertebrate animals, were largely represented. But, toward the close of the Paleozoic time, we meet with representatives of the backbone family. The waters swarmed with fishes.[8] Besides these, there were amphibians; [9] and reptiles in the closing portions.[10]

Thus we see what a great advance was made in life during this period. The forms of life during the early stages of this age were inferior in this, also, that they were all water species.[11] But, before it closes, we have a rich and varied terrestrial vegetation, and also air-breathing animals. The class Mammalia, to which man belongs, had no representative on the earth during the extended Paleozoic time.

We can easily see, from the foregoing, how appropriately this period has been named that of old life forms. In imagination we can recall a scene of this old age. The air is sultry and full of vapors. The soil seems hot and steaming. This is a veritable forest, but we see none of the beautiful flowers which we associate with tropical vegetation to-day. In the branches of the graceful tree-ferns, we will look in vain for birds. They were yet far in the future. Neither were there any of the higher orders of animals present. Not a single representative of the great class of mammals enlivened the depths of the forest. There were fishes in the waters, but not the fishes of to-day. Some true reptiles and amphibians disported themselves in swampy jungles, but they were unimportant. Almost the only sound to break the stillness, was the hum of marsh-loving insects, the whistling of the wind, and the roar of the tempests, which we may well believe raged with the more than tropic severity of the present.[12]

The time at last came for the dawning of a new era. Vast changes had been taking place in the geography of both continents. The region to the south-west of the Green Mountains was upturned. The Alleghany Mountains were formed, and the region east of the Mississippi River became part of the stable land of the continent.[13] In Europe, nearly as great changes occurred. The conditions of life must have been greatly modified by these geographical changes. The life-forms bear testimony to this changed condition. Old forms die away, and are succeeded by those approaching more nearly our own times. The name of this period is the Mesozoic time, or the period of middle life forms.[14] It is instructive to notice the steady advance in the type of life, both animal and vegetable. The abundant flowerless vegetation of the coal formation of the preceding epoch dwindles away. But the flowering trees increase in number and importance until, in the closing period of Mesozoic time, we have trees with deciduous leaves. A great many of our forest trees had representatives in the forests of that epoch.

Palms and species like the big tree of California were growing side by side with species akin to our own common trees. But in the animal world there were many strange forms. This was the age of reptiles. They domineered on the land, in the air, and in the sea. On the land there stalked huge reptiles fifty and sixty feet long, and, when standing erect, at least thirty feet high.[15] Some of these huge creatures were carnivorous, living on other animals. Others fed on the foliage of trees. In the air, huge reptilian bats, veritable flying dragons with a spread of wings from ten to twenty feet, disported themselves.[16] In the sea there swam great reptilian whales, seals, and walruses.[17] There was a marvelous abundance of reptilian life. At the present day, there are not more than six species of reptiles in the whole world having a length of over fifteen feet, and not more than eighteen species exceeding ten feet in length. But from one limited locality, representing but one era of this age in England,

there have been discovered four or five species of carnivorous reptiles twenty to fifty feet long, ten or twelve species of crocodiles, lizards, and swimming reptiles from ten to sixty feet long—besides multitudes of great flying reptiles and turtles. Doubtless similar scenes of animal life were everywhere represented.

Birds made their first appearance during the Mesozoic time, and here we obtain a clear view of nature's methods of work. There is no longer a doubt but that the first birds were simply modified reptiles. The first bird had a long jointed tail, and a bill well supplied with formidable teeth.[18] It was during this period that the first representative of the class Mammalia, to which man belongs, appears.[19] It is in the rocks of this era that we meet with remains of marsupials, the order to which opossums belong. This is the lowest of the Mammalian class. To the class Mammalia belong the most highly organized animals. They have been the ruling animals since the close of Mesozoic time. We must now watch their development with especial care. For this brief review, as far as it has gone, has shown a steady and gradual progress in life forms, the lower invariably preceding the higher. We therefore feel that it will be vain to seek for any trace of man until we find undoubted proofs of the existence of all the forms of animals below him. The last great division of time is called Cenozoic.[20] This means new life forms. In this age, the forms of life are much nearer our own. As it was some time during this epoch when man makes his appearance, we deem it best to go into more detail, and give the subdivisions of this period. It has been amply sufficient to give simply the outlines of the other periods. In order to fix more clearly the sequence of life, we will give an outline showing the periods we have reviewed, and also the subdivisions of the Cenozoic time, which we are now to examine with more care.

OUTLINE.

LIF	**Archæan Time**	*The Beginning.*

<table>
<tr><td rowspan="5">E.</td><td>.</td><td colspan="2">Includes the long lapse of time when the globe could not support life, but towards its close faint traces of life, both animal and vegetable appeared.</td></tr>
<tr><td>Paleozoic Time.</td><td colspan="2">The Period of Old Life Forms.
Forests of flowerless trees; but pines grew in the coal measures. Animal life largely invertebrate; but amphibians and reptiles among the vertebrate appear at the close.</td></tr>
<tr><td>Mesozoic Time.</td><td colspan="2">The Period of Middle Life Forms.
Flowering trees increasing in number and importance. Deciduous trees make their appearance. Animal life largely reptilian. The class Mammalia represented by marsupials.</td></tr>
<tr><td rowspan="2">Cenozoic Time.</td><td>Tertiary,
or
Age of Mammals.</td><td>Eocene.
Miocene.
Pliocene.</td></tr>
<tr><td>Quaternary,
or
Age of Man.</td><td>Glacial or
Pleistocene.
Recent.</td></tr>
</table>

At the close of the Mesozoic time, great elevations of land took place in both America and Europe, especially in the northern portions.[21] This could not fail to have a great effect on life, both animal and vegetable.

During the Eocene, or first division of the Tertiary Age, we have simply to note the steady progress of life. There were forests of species of oaks, poplars, maples, hickories, and other common trees, and others now found only in tropical regions. Palm trees were growing in the upper Missouri region of the United States. And England was decidedly a land of Palms, as no less than thirteen species are known to have been growing there. Cypresses, yews, and pines graced the scene.[22] Our special interest centers, however, in the mammals of this epoch.

In the preceding epoch marsupials only were represented. But in beds of the middle and closing portions of the Eocene period we meet with a sudden increase of Mammalian life. Whale-like animals were especially abundant in the seas; and on our Western plains were animals like the tapirs of India, and rhinoceros- like

animals as large as elephants[23] but having no trunks, and diminutive little animals not larger than foxes, from which have come our horses. Europe also had a varied Mammalian fauna. There were numerous hog-like animals. Animals, like the tapirs of tropical Asia and America, wandered in the forests and on the banks of the rivers. Herds of horse-like animals, about the size of Shetland ponies, fed on the meadows.[24] Animals that chew the cud were present, or at least had near representatives.[25]

Among the flesh-eating animals were creatures resembling foxes, wolverines, and hyenas.[26] This shows what a great advance had been made. But, besides all these, we are here presented with representatives of the order of Quadrumana, or four-handed animals. Several genera of lemurs are found in both America and Europe.

Now the Quadrumana are the order below man. Therefore it seems that in the Eocene period, all the forms of life *below* man are represented. The time seems to be at hand when we can look, with some confidence, for traces of the presence of man himself. We must therefore be more cautious in our investigations.

The epoch following on after the Eocene is designated as the Miocene. We must remember that, though recent in a geological sense, yet it is immensely remote when measured by the standard of years. We must inquire into all the surroundings of this far away time. The geographical features must have been widely different from the present.

In the first place, the elevation of land to the north must have been sufficient to have connected the land areas of the Northern Hemisphere—North America, with Asia[27] and Greenland; and this latter country must have been united with Iceland, and, through the British Islands, with Europe. But, to compensate for this land mass to the north, large portions of Central and Southern Europe were beneath the waves.[28] The proof of this extended mass of land is to

be found in the wide distribution of similar animals and plants in the Miocene time. All the chief botanists are agreed that the north Polar region was the center from which plants peculiar to the Eocene and Miocene epochs spread into both Europe and America.[29] We may mention that the famous big trees of California are simply remnants of a wide-spread growth of these trees in Miocene times. They can be found in a fossil state at various places in British America, in Greenland, and in Europe. They are supposed to have originated somewhere in the north, and spread by these land connections we have mentioned into both Europe and America. But this is not the only tree that grew in the Miocene forests of both continents. The magnolia, tulip-tree, and swamp cypress are other instances.[30] Eleven species, growing in the Rocky Mountain regions in Rocene times, found their way to Europe in the Miocene times,[31] driving before them the plants of a tropical growth that had hitherto flourished in England. Now this implies land connection between the two continents. Furthermore, animals both large and small are found common to the two countries.[32] The climate over what is now the North Temperate Zone, and even further. north, must have been delightful. There is ample testimony to this effect in the rich vegetative remains over wide areas.

In Spitzbergen, within twelve degrees of the pole, where now a dwarf willow and a few herbaceous plants form the only vegetation, and the ground is most of the time covered with snow and ice, there were growing, in Miocene times, no less than ninety-five species of trees, including yews, hazels, elders, beech, elms, and others.[33] But it is in the Miocene forests of the continent of Europe where we meet with evidence of a singularly mild climate.

There were at least eleven species of palms growing in Switzerland; and one variety of them grew as far north as Northern Germany.[34]

We can not give a list of all the species. On the one hand, there were elms, willows, poplars, oaks, and beeches, thus far similar to

the forest growth of temperate regions. Mingled with these were forests of trees like the tulip-tree, swamp cypress, and liquid amber or sweet gum of the southern part of the United States—plants whose home is in the warm and moist regions of the earth. But there were also representatives of the tropical regions—such as fig-trees, cinnamon-trees, and camphor-trees: these are found growing now in tropical countries. Fruit-trees of the cherry, plum, and almond species were also to be seen. Prof. Heer points out how all this should convince us that a large part of Europe, in the Miocene Age, possessed a climate not unlike that of the Madeira or Canary Islands to-day. He calls especial attention to the fact that these trees were nearly all of evergreen species, and that a severe winter would destroy them. He finds one hundred and thirty-one species of the Temperate Zone—species that can stand a moderate amount of cold, but not very hot and dry climates. He finds eighty-five species of tropical plants that could not possibly live where the Winters are severe. Mingled with these were nearly three hundred species whose natural home is in the warm, temperate portions of the earth. The only way you can explain this motley assemblage of trees is, to suppose that in what is now Europe was a climate free from extremes, allowing the trees to put forth flowers and fruits all the year round. "Reminding us," says Prof. Heer, "of those fortunate zones where Nature never goes to rest."[35]

Let us now inquire as to the animals that roamed through these great forests we have been describing. The Miocene period extended over a long lapse of time, and considerable change took place among the animals belonging to the different parts of this age. We will only give a general outline for the whole period. The marsupials lingered along into the early stages of this period, and then disappeared from Europe. The rhinoceros were present in the early stages, and continued through the entire age. We meet in this period animals of the elephant kind, two species, the mastodon and deinotherium. Antelopes and gazelles wandered in vast troops over

the plains of Hungary, Spain, and Southern France. Carnivorous animals resembling tigers and hyenas found abundance of animal food. Herds of horse-like animals fed on the rich herbage of the meadows. The birds were largely represented. In the woods were to be seen flocks of gayly feathered paroquets and trogons. On the plains secretary- birds hunted the serpents and reptiles, which furnished them food—and eagles were on the watch for their prey. Cranes waded in the rivers for fish. Geese, herons, and pheasants must have been abundant.

Our main interest centers in the order Quadrumana. We must remember that this order appeared in the Eocene. Several species were present in the Miocene. They wandered in the forests of France, Switzerland, Germany, and Italy, and doubtless found abundant food in the figs and bread-fruit, walnuts, almonds, dates, and other nuts growing there.[36] One of the most important is regarded as belonging to the same genus as the Gibbons.[37] This is the genus which has been sometimes regarded as making a nearer approach to man than any other monkey.[38] Others, however, consider it as belonging to an extinct family.[39] In addition to this species there were at least three other species: thus there was no absence of simian life in the Miocene.[40]

From the sketch we have thus far drawn of the Miocene Age, it seems to have been a very favorable one in every respect. One writer[41] affirms, that "the world never experienced a more beautiful period." And indeed it seems as if the facts bear out this statement. A genial, temperate climate was the rule, even to high northern latitudes. We need not doubt but that there were grassy plains, wooded slopes, and rolling rivers. Was man present to take advantage of all these favorable surroundings? Did he wander through the evergreen forests, and hunt the deer, antelope, and hogs—the hipparions, and mastodons, and deinotheres—then so numerous?[42] We know of no inherent improbability of his existence at that time. An ape belonging to a highly organized

genus was then living in Europe. Every condition considered necessary for the primeval Garden of Eden was then satisfied. Let us stop for a minute and examine the nature of the evidence considered sufficient to prove the presence of man during any of the past geological ages.

Should we be so fortunate as to find portions of the bones of the human skeleton in a geological formation in such positions that they could not possibly have been introduced there since the deposition of the containing bed, it would of course prove that man was at least as old as the formation itself. But it happens that human remains in beds of a previous geological age are very rare. Indeed, human remains in formations of the Pleistocene Age,[43] during which we have ample testimony, as we shall see, of the presence of man, are very rare. The cases in which there can be no doubt can be reckoned on the fingers. The explanation of this state of things is not at all difficult, for it is only under very rare circumstances that portions of the bones of animals even larger than man are preserved to us in geological strata. Vast numbers die and vanish away without leaving a trace behind them for every fragmentary bone we recover. In the case of man we must remember that, in previous eras, he was present in very small numbers; that, owing to his intelligence, he would not be as liable to be drowned and swept away, and so mingle his remains with beds of river detritus then forming, as were animals. Mr. Lyell has made some remarks on the draining of the Haarlem Lake by the government of Holland in 1853, which shows that even favorable circumstances do not always preserve remains for future inspection. Though called a lake, this body of water was an arm of the sea, covering about forty-five thousand acres. The population which had lived on the shores of the lake was between thirty and forty thousand souls. "There had been many a shipwreck, and many a naval fight on those waters, and hundreds of Dutch and Spanish soldiers and sailors had met there with a watery grave," yet not a solitary portion of the human skeleton was to be found in

its bed.[44] Thus we see that, in the majority of cases, we must rely on other evidence than the presence of human bones to prove the existence of man in the geological periods of the past. In the case of the Haarlem Lake again, there was found the wreck of one or two vessels, and some ancient armor. So, had it been a disputed point whether man was a denizen of this planet at the time when the area in question was covered by water, it would have been settled beyond a doubt by these relics of his industry, even though portions of the human frame itself were entirely wanting. And, in reality, proofs of this nature are just as satisfactory as it would be to discover human bones. If, on a desert island, we find arrow-heads, javelins, a place where there had been a fire, split bones, and other *débris* of a feast, we are as much justified in asserting that man had been there, as we would be had we seen him with our own eyes. In the same manner, if we detect in any strata of the past any undoubted products of human industry—such as weapons, or implements and ornaments—in such position that we know they could not have been deposited there since the formation of the bed itself, we have no hesitancy in asserting that man himself is of the same antiquity as the strata containing the implements. In the great majority of cases, this is the only kind of evidence possible to advance.

It is now well known that the first stage in the culture of any people, is what is called the Stone Age. That is to say, their weapons and implements were made from stone, or at least the majority of them were. We will discuss on another page this point, and also the grounds leading us to infer that many of the extremely rude forms are really the work of man.

Let us now return to the Miocene Age, in which we are to seek for the presence of man. In 1867 a French geologist, by the name of Bourgeois, who had been searching some beds of the Miocene Age, near Thenay, France, found a number of flints of such a peculiar shape, that he concluded they could only be explained by

supposing that man formed them. In this case there is to question as to the age of the stratum containing the flints. All geologists are agreed that it is of the Miocene Age. The question then is, whether the flints were artificially cut or not. On this question there has been a great division of opinion, and we can not do better than to examine and see where the Principal scientific men stand on this point.

In 1872, at the scientific congress in Brussels, this question was referred to a committee composed of the most competent men from the different countries of Europe. We are sorry to say that, after a thorough consideration of them, the judges were unable to agree. Some accepted them, others rejected them, and still others were undecided. Some of the latter have since become convinced by recent discoveries.[45]

Since this discovery, similar specimens have been described as having been found in Portugal, and from another locality in France. Some men of the highest authority accept these flints as proving the presence of man in Miocene times. This is supported by such men as Quatrefages, Hamy, Mortillet, and Capellini.[46] These are all known to be competent and careful geologists. Another class does not think the evidence strong enough to declare these flints of human origin, and so do not think it proved that man lived in Europe in Miocene times; but do believe that we will eventually find proofs of his existence during that era in the warm and tropical regions of the globe. This is the view of such men as Lubbock, Evans, Huxley, and Winchell. Still others say that, during the vast lapse of years since Miocene times, all the species of land mammals then alive have perished[47]—their place being taken by other species—and therefore it is incredible that man, the most highly specialized of all animals, should have survived. And hence, if these Thenay flints are really artificial in their origin, it is more reasonable to suppose they were cut by one of the higher apes, then living in France, than by man. This is the view of Prof. Dawkins

and Prof. Gaudry.[48] As to the last view, it is surely but reasonable to suppose, with Quatrefages,[49] that the superior intelligence of man would serve to protect him from the operation of causes that would effect the extinction of lower animals. Hence, unless some evidence be produced to show that species of apes are known to make rude stone implements, or some evidence that they did this in past ages, we must believe, with Geikie and others, that these flints prove that Miocene man lived in France, unless indeed we refuse to believe that they are artificial.

It also seems to us that those who hold to the view that man was living in other parts of the world, as Asia, during the Miocene Age, ought readily to admit that a few wandering bands might penetrate into Europe.[50] The climate was tropical, there was an abundance of animal life, and, if man was living anywhere, it is very reasonable to suppose that, at some epoch during the course of the Miocene Age, he would have found his way to Europe, unless shut off by the sea. It therefore seems to us that the presence of those cut flints is conclusive of the presence of man in Europe during the Miocene Age. At the same time we can not affirm that this is the conclusion of the scientific world. They seem to have heeded the remark of Quatrefages, that "in such a matter there is no great urgency," and are waiting for further discoveries.

Thus far in our review we have noticed the steady progress in the forms of life. In the Miocene Age we have seen all the types of life below man present, and some indications of the presence of man himself. We must now learn what we can of the Pliocene Age, the last division of the Tertiary Age.

The Pliocene Age need not detain us long. Considerable changes in the geography of both Europe and America were going forward during the Miocene Age, and the result was quite a change in climate. There was a steady elevation of the Pacific coast region of America, and, as a consequences a period of great volcanic outbursts in California and Oregon.[51] At the same time the bridge

connecting Asia and America was severed.[52] In Europe the Mediterranean area was elevated; but the land connecting Greenland with Europe sank, allowing the cold waters of the Arctic to communicate with both the North Sea and the Atlantic—England at that time forming part of the great peninsula extending north and west from Europe.[53] The climate during the Pliocene Age was cooler than that of the Miocene. This is marked in the vegetation of that period. The palms and the cinnamon trees, which in Miocene times grew in Germany, flourished no farther north than Italy during the Pliocene.[54]

Count DeSaporta, who made special researches in the flora of this period, found the remains of a forest growth buried under lava on the side of a mountain in Cantal France, at an elevation of about four thousand feet above the level of the sea. This consisted principally of pines. This shows that probably all Northern Europe was covered with somber forests of pine. In the same section he found, buried under volcanic ash, a vegetation consisting mostly of deciduous trees—maples, alders, poplars, willows, elms, and ashes. As this was growing at the height Of about twenty-three hundred feet in Cantal France, it probably represents the vegetation of Britain and Northern Germany. Finally, the vegetation of Central and Southern France, as well as Northern Italy, was intermediate in character between the luxuriant evergreen forests of the Miocene Age and that now growing there. The tropical character of the vegetation was evidently passing away. The climate over a large part of Europe was now temperate, though probably warmer than at present.[55]

In the Mammalia we have to notice the disappearance of some species, and the arrival and spread of some others. The apes living as far north as Germany in the Miocene Age were restricted to Southern France and Italy in the Pliocene, and, at its close, vanished altogether from Europe. The first living species of mammals is found in the remains of the hippopotamus that

frequented the rivers of Pliocene times. The mastodon of Miocene times was still to be seen, but along with it was a species of true elephants. The hipparion survived into this epoch, but the horse also makes its appearance. Great quantities of deer roamed over the land; and, as might be expected where they were so abundant, the carnivorous animals allied to the bears and wolves, panthers, linxes, and tigers, were also to be found. "At night," says Mr. Dawkins, "the Pliocene forests of Central France echoed with the weird laughter of the hyena."

The gradual lowering of the climate is also shown by the remains of the mollusks deposited in beds of marine or sea formation during different eras of this age. It is found that the earlier the bed, the more southern mollusks are found in it. This shows us that, all through the Pliocene Age, the waters of the seas surrounding England were gradually growing cooler, thus compelling the retreat of those mollusks fitted only for a warm climate, and allowing a gradual increase in those species fitted for cold or northern latitudes. We also find, in deposits made near the close of Pliocene times, numbers of stone which show all evidence of having been borne thither by means of ice. So we may conclude that rafts of ice came floating down the North Sea during the closing period of the Pliocene Age.[56] Still, during the entire length of the Pliocene Age, Europe certainly offered an inviting home for man. Not only were the higher orders of animals present, but at least one living species was known. We find more proofs of his presence, but whether they are sufficient to convince us that man really lived during that epoch is to be seen.

Prof. Whitney has brought to the attention of the scientific world what he considers ample evidence of the presence of Pliocene man in California. We reserve this for discussion in another place. We will only remark, at present, that the evidence in this case is regarded as sufficient by some of the best of American Scholars.[57] We simply mention them here, so that they may be borne in mind

when we see what evidence Europe has to offer on this point. In 1863, M. Desnoyers, of France, discovered, in a stratum which he considered Pliocene, some bones of elephants and other animals cut and scratched in such a manner that he considered the cuts to be the work of man. As showing how cautious geologists are of accepting such conclusions, we mention this case. There was found in the same bed the remains of an extinct beaver. The question was at once raised, whether rodents by gnawing these bones could not have produced the cuts in question. Sir Charles Lyell, by actual experiments in the Zoological Gardens in London, soon showed that this was probably the fact.[58] Yet Sir John Lubbock thinks it quite likely some of them were of human origin.[59] Subsequently, however, M. Bourgeois discovered in the same bed worked flints, about the human origin of which there seems to be no doubt;[60] but a more careful study of the formation in which they occur has raised questions as to its age. Though usually held to be Pliocene, some careful observers consider it to be of a later age. Geologists can not be accused of rashly accepting statements as to the antiquity of man.

In 1867 there was discovered, in Northern Italy, a human skull in a railway cutting at a depth of nearly fifty feet. This stratum contains remains of several Pliocene animals. This is held to prove the existence of Pliocene man by several eminent observers, amongst others Prof. Cocchi, of Italy, and Forsyth Major.[61] But in this case Mr. Dawkins contends that it was not found under such conditions as render it certain that the stratum had been undisturbed, and so does not prove to a certainty that it was of the same age as the stratum.[62] And Mr. Geikie thinks that the stratum itself is of a later age than the Pliocene.[63] It is but right that geologists should thus carefully scan all the evidence produced.

In 1876 Prof. Capellini discovered, in a Pliocene deposit in Italy, the bones of a whale, which were so marked with cuts and

incisions that he thought the only explanation was to say they had been cut by men. In this case[64] there is no dispute as to the age of the stratum. Neither is there much doubt but that the cuts are the work of man. It is quite true that Mr. Evans has suggested that they may be the work of fishes. In this he is followed by Prof. Winchell.[65] But there appears to be little ground for such belief, because the cuts are all on the outside faces of rib-bones, and the outer faces of the backbones. From the position occupied by the remaining portions of the skeleton, Prof. Capellini is sure that the animal had run aground, and, in that condition, was discovered and killed by men, who then, by means of flint knives, cut away such portions of food as they wished. It must have been lying on its left side, since the cuts were all made on bones of the right.[66] It is not probable that fishes would have been apt to choose the outside faces of the ribs on the right side for their meals. These cut bones have been carefully examined by many competent men, who have agreed with Capellini that they are the work of men.[67] Mr. Dawkins thinks the cuts were artificial, but he says, "It is not, however, to my mind satisfactorily shown that these were obtained from undisturbed strata."[68] Now these bones have been found in several localities, always in Pliocene deposits, which formed the shores of the Pliocene sea.[69] Knowing how carefully geologists inquire into all the surroundings of a find, surely, if Capellini and others are the competent men they are admitted to be, they would have informed us long ago if they were not found in undisturbed strata.

Mr. Dawkins also objects because fragments of pottery were found in the strata. "Pottery," says he, "was unknown in the Pleistocene Age,[70] and therefore is unlikely to have been found in the Pliocene."[71] Mr. Geikie says this objection is founded on a mistake, as Prof. Capellini told him the pottery was found lying on the surface, and was never for a moment imagined by him as belonging to the same age as the cut bones.[72] There is also the objection, that, inasmuch as all the mammals then alive except one have perished, it is more than likely that, had man been in

existence then, he too would have disappeared.

We considered this point fully when speculating as to the presence of man in the Miocene: so we have nothing further to offer. We might, however, suggest that, if the hippopotamus amongst mammals could survive all the changing time since the Pliocene, as it has done, it seems no more than fair to admit equal power of endurance to the human species. The position then of the scientific world as to the Pliocene Age of man is, on the whole, more decided in its favor than for the Miocene Age. Quite a number of eminent scholars, whose conclusions are worthy of all respect, unhesitatingly affirm the existence of Pliocene man in Europe. Others are not quite ready to admit his existence in Europe, but do think he was in existence elsewhere. Still others, with all due respect for the discoveries of Capellini, think it more prudent to await further discoveries. The reader, who has followed us through this brief outline of the past, can join which of the classes he will, and be sure of finding himself in good company.

This completes our review of past geological ages. With the termination of the Pliocene Age we find ourselves on firmer ground. We only wish to call attention once more to the gradual unfolding of life. We see that the rule has been that everywhere the lower forms of life precede the higher. In the plant world flowerless plants precede the flowering ones. The coal we burn to-day is mainly the remains of the wonderful growth of the flowerless vegetation of the Paleozoic Ace. When flowering plants appear, it is the lower forms of them at first.

It was long ages before trees with deciduous leaves appeared. The growth of animal life is equally instructive. First invertebrate life, then the lowest forms of vertebrate life. The fishes are followed by amphibians—then reptiles, then birds. The first mammal to appear was the lowest organized of all—the marsupials. And we have seen the sudden increase of mammalian life in Tertiary times. We notice, in all the divisions of life, a

beginning, a culmination, and a decline. There has never been such a growth of flowerless plants as in the Paleozoic, and flowering plants probably culminated in the Miocene. The same rule holds good for the animal world also. As man is the most highly organized of all the animals, we can not hope to find any evidence of his presence until we find proofs of the presence of all the lower types of life. Of course future discoveries may change our knowledge when the series is complete; but, from our present stand-point, he could not have lived before the Miocene Age, and we have seen how faint and indecisive are the proofs of his presence even then. But should it finally be proved, beyond all dispute, that man did live in the Miocene Age, we must observe that this is but a small portion, but a minute fraction, of the great lapse of time since life appeared on the globe. We are a creation of but yesterday, even granting all that the most enthusiastic believer in the antiquity of man can claim.

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Haywood's, Heer's, "Primeval World of Switzerland."
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Marsh: "American Assoc. Rep.," 1877.
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Nicholson's "Manual of Zoology," pp. 419 and 504.
When we talk of first appearance, we mean the discovery of remains. All who believe in the doctrine of evolution, know that the class Mammalia must have appeared early in Paleozoic times. Thus, Mr. Wallace says, "Bats and whales—strange modifications of mammals—appear perfectly well developed in the Eocene. What countless ages back must we go for the origin of these groups—the whales from some ancestral carnivorous animal, the bats from the insectivora!" and even then we have to seek for the common origin of these groups at far earlier periods. "So that, on the lowest estimate, we must place the origin of the Mammalia very far back in Paleozoic times." ("Island Life," p. 201.)
This word is also spelled Kainozoic, and Cainozoic. We follow Dana, p. 140.
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Many of these animal forms were common during the early Eocene. (Winchell.)
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Winchell's "Pre-Adamites," Whitney's "Auriferous Gravels of California," Marsh's "Address before American Assoc.," 1879.

"Antiquity of Man," p. 234.

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"Pre-Adamites."
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"Early Man in Britain," p. 92.
Geikie's "Prehistoric Europe," p. 344.
Same as Glacial. See "Outline," p. 41.
"Early Man in Britain," p. 92.
"Prehistoric Europe," p. 345, note 2.

Chapter III

MEN OF THE RIVER DRIFT.[1]

Beginning of the Glacial Age—Inter-glacial Age—Man living in Europe during this age—Map of Europe—Proof of former elevation of land—The animals living in Europe during this age—Conclusions drawn from these different animals—The vegetation of this period—Different climatic conditions of Europe during the Glacial Age—Proofs of a Glacial Age—Extent of the Glacial Ice—Evidence of warm Inter-glacial Age—The primitive state of man—Early English civilization—Views of Horace—Primitive man destitute of metals—Order in which different materials were used by man for weapons—Evidence, from the River Somme—History of Boucher de Perthes's investigations—Discussion of the subject—Antiquity of these remains—Improvement during Paleolithic Age—Description of the flint implements—Other countries where these implements are found—What race of men were these tribes—The Canstadt race—Mr. Dawkins's views—

When did they first appear in Europe—The authorities on this question—Conclusion.

TERTIARY AGE, with its wonderful wealth of animal and plant life, gradually drew to its close. In our "Outline" we have named the period that next ensued the Glacial Age.[2] This was sufficiently exact for our purpose then, but we must remember this is the name[3] for a long series of years. During this period great changes in climate occurred. At its commencement, a genial temperate climate prevailed throughout Europe; and this, as we know, was preceded, during the Miocene Age, by a warm tropical one.[4] This succession, then, shows us that, for some reason or other, the climate had been gradually growing colder. This change went forward uninterruptedly. Doubtless very gradually, from century to century, the seasons grew more and more severe, until, finally, the Summer's sun no longer cleared the mountains of the Winter's snow. This was the beginning of the Glacial Age proper.

The best authorities also suppose that the reign of snow and ice was broken by at least one return (possibly more) of genial climate, when animals and plants from the south again visited the countries of Northern Europe—only, however, to be once more driven forth by a return of arctic cold. But finally, before the increasing warmth of a genial Climate, the glaciers vanished, not to return again, and the Glacial Age became merged in that of the present.

It is no longer a question that man lived in Europe during the largest portion of this age, if not from the beginning. It is necessary, then, to come to a clear understanding of the successive stages of this entire age, and to trace the wonderful cycles of climate—the strange mutation of heat and cold, which must have exerted a powerful influence on the life, both animal and vegetable, of the period—and see when we first find decisive proofs of man's presence, and learn what we can of his condition.

The map of Europe, at the close of Pliocene times and the commencement of the Glacial Age, is of interest to us in several ways. From this it will be seen that it was considerably more elevated than at the present. As this is no fancy sketch, but is based on facts, it is well to outline them. Without the aid of man, land animals can not possibly pass from the mainland of a continent to an island lying some distance off the shore. But it is well known that animals like the rhinoceros, and several others, wandered as well over the surface of the British Islands as on the adjacent coast of Europe. We are therefore compelled to assume, that at that time the English Channel and the Irish Sea were not in existence. This necessitates an elevation of at least four hundred feet, which would also lay bare a large portion of the North Sea.[5] In proof of this latter statement is the fact, that, at a distance from land in the North Sea, fishermen at the present day frequently dredge up bones and teeth of animals that then roamed in Europe.[6]

While there is no necessity for supposing an elevation greater than that required to lay bare a passage for animals back and forth, yet soundings undertaken by the British government have established the fact, that the ocean deepens very gradually away from the shores of the main-land until a depth of six hundred feet is reached, when the shore falls away very suddenly. This is supposed to be the sea-coast of that time. The English Channel would then have existed as the valley of the Seine, and the Rhine have prolonged its flow over the present bed of the North Sea. As the land stood at this height through a large portion of the Glacial Age, it is not at all unreasonable to suppose that primitive tribes hunted back and forth along these valleys, and so doubtless many convincing proofs of their presence at that early day lie buried underneath the waves of the sea. In like manner, at the south, we know that elephants, lions, and hyenas passed freely from Africa to Spain, Italy, and the Island of Crete,[7] and, consequently, the Mediterranean Sea must have been bridged in one or two places at

least.[8]

The change from Pliocene times to early Glacial was so gradual that quite a number of animals lived on from one to the other, and, as we have already stated, one of these species has even survived to our own times.[9]

But we note the arrival in Europe of a great number of new animals, and the diversity of species seems at first an inexplicable riddle. The key, however, is to be found in the great climatic changes, which we have already mentioned as occurring during this age. On the one hand, we find such animals as the musk-sheep, reindeer, and arctic fox, animals whose natural home is in high northern latitudes, where snow and ice prevail most of the year.[10] Yet during this age they lived in Southern France and Italy, which must then have had a far different climate than that at present.

Were we to confine our attention to these alone we would be convinced that the climate of Europe at that time was arctic in its severity. But side by side with the remains of these animals are found others which imply an altogether different climate. The hippopotamus, now frequenting the rivers of Africa, during that period roamed as far north as Yorkshire, England.[11] This animal could not live in a country where the cold was severe enough to form ice on the rivers. The remains of a number of other animals are found whose natural home is in the warm regions of the earth.[12] These two groups of animals, one from the north and one from the south, show how varied was the climate of Europe during the Glacial Age.

In addition to these, there was also a large number of animals whose home is in the temperate regions of the earth—animals that thrive in neither extremes of heat and cold. This includes a great many animals of the deer kind, several varieties of bears and horses; in fact, the majority of those with which we are acquainted.[13]

Now, what conclusion follows from this assemblage of animals? Many theories have been put forward in explanation. It has been suggested that Europe at that time had a climate not unlike that of some portions of the earth at present; that is, a long and severe Winter was followed by a short but warm Summer. During the Winter reindeer and other northern animals would press from the north in search of food, but would retire on the approach of Spring, when their feeding grounds would in turn be occupied by bisons and animals of a southern habitat. In confirmation of this view it is pointed out that a vast collection of bones, from the bottom of a sink-hole or pond in Derbyshire, England, conclusively show that in the summer-time it was visited by bisons with their calves, and in Winter by reindeer.[14] This theory is open to a great many objections. As is well known, some animals make quite extensive migrations annually, but we can scarcely believe that heavy, unwieldy animals like the hippopotamus, were then such industrious travelers as to wander every year from Italy to Northern England and return.[15] But the very ground on which this theory rests, that of strongly contrasted summers and winters, could not be true of Europe or the western portions of it, owing to the presence of the Atlantic Ocean, and the influence which it inevitably exerts on the climate.[16] We see, then, that the presence of these different animals can be explained only by supposing great secular changes in climate. Let us see if we can strengthen this view by an appeal to the vegetation of this period.

We have seen how important a guide as to climate were the remains of the vegetation of the early times. We therefore turn with more confidence to such discoveries as will tell us of the flora of this age. But there are many reasons why remains of plant growth should be few. As we shall soon learn, this was a period of flooded rivers; and in the gravels and loams thus formed is found our principal source of information as to the life of the age. But such a rush of waters would form gravelly banks or great beds of loam, and would sweep any plants which might be washed into its floods

far out to sea; or if by chance they should become buried in such gravel beds, the action of water would speedily cause the decay of the tender portions, such as leaves, bark, and soft wood, in which case no profitable investigation could be made. Occasionally, however, around the shores of old lakes, vegetable beds have been buried, and we know that some mineral springs deposit a sort of protecting sediment on every thing with which they come in contact. By such means, at rare intervals, leaves, seeds, and fruits have been sealed up for future inspection, and from a careful study of all such instances much valuable information has been obtained. At one place in the valley of the Seine was discovered, under a bed of tufa, the remains of a forest growth. It is not doubted that the deposit belongs to the Glacial Age.[17]

Yet the forest growth reminds us of that prevalent during the Miocene Age. The fig-tree, canary, laurel, and box-tree grew in profusion. These are all southern forms. One severe winter would kill them all, and even hard frosts would prevent the ripening of their fruits.

Neither were the Summers hot and dry. This is shown by the presence of numerous plants which can not thrive in hot and dry localities, but live in the shady woods of Northern France and Germany. The evidence of this forest growth surely presents us an inviting picture of Europe during a portion of the Glacial Age.

We are not without evidence, also, of a much more severe climate. In a lignite bed (a species of coal) found in nearly the same latitude as the forest growth just mentioned, we detect the presence of trees that grow only in cold northern climates, such as birch, mountain pine, larch, and spruce.[18] And in some peat-bogs of Southern Europe belonging to this age[19] are found willows now growing only in Spitzbergen, and some species of mosses that only thrive far to the north. It is quite evident that this deposit testifies to an altogether different climate from that indicated by the deposit before mentioned. No theory of migration can explain this

assemblage of plants, unless it be migration taking place very slowly, in consequence of an equally slow change of climate.

From what we have just learned of the animals and plants living in Europe during this age, we can frame some conception of the different climatic conditions of Europe. On the one hand, we have a country with a mild and genial climate. Trees of a warm latitude were then growing as far north as Paris, and we may well suppose Europe to have abounded in shady forests and grassy plains, through which flowed large rivers. It was just such a country as that in which elephants and southern animals would flourish, while vast herds of deer and bovine animals wandered over the entire length and breadth of the land. Where animal life was so abundant there were sure to be carnivorous animals also, and lions, hyenas, tigers, and other animals added to the variety of animal life.

This, however, is but one side of the picture. The other presents us with a very different scene; instead of an abundant forest growth, the land supported only dwarf birch, arctic willows, and stunted mosses. Arctic animals, such as musk-sheep and reindeer, lived all the year around in Southern France. The woolly mammoth lived in Spain and Italy. In short, the climate and conditions of life were vastly different in the two stages.

We must now turn our attention to the proofs of glaciers in Europe, the phenomena from which this age derives its name. Descriptions of Alpine glaciers are common enough, but as glaciers and the Glacial Age have a great deal to do with the antiquity of man, we can not do better than to learn what we can of their formation, and their wonderful extension during this period. The school-boy knows that by pressure he gives his snowball nearly the hardness of ice. He could make it really ice if he possessed sufficient strength. The fact is, then, that snow under the influence of pressure passes into the form of ice. In some cases nature does this on a large scale. Where mountains are sufficiently elevated to raise their heads above the snow line we know they are

white all the year around with snow. What is not blown away, evaporated, or, as an avalanche, precipitated to lower heights, must accumulate from year to year. But the weight pressing on the lower portions of this snow-field must soon be considerable, and at length become so great, that the snow changes to the form of ice. But as ice it is no longer fixed and immovable. We need not stop to explain just how this ice-field moves, but the fact is that, though moving very slowly, it acts like a liquid body. It will steal away over any incline however small, down which water would flow. Like a river it fills the valleys leading down from the mountains. But, of course, the lower down it flows the higher the temperature it meets, and it will sooner or later reach a point where it will melt as fast as it advances. This stream of ice flowing down from snow-clad mountains is called a glacier. Those we are best acquainted with are but puny things compared with those of the polar regions, where in one case a great river of ice sixty miles wide, flowing from an unknown distance, some thousands of feet in depth (or height), pours out into the sea.[20]

We at once perceive that such a mass of ice could not pour down a valley without leaving unmistakable signs of its passage. The sides of the mountains would be deeply scarred and smoothed. Projecting knobs would be worn away. The surface of the valley, exposed to the enormous grinding power of the moving ice, would be crushed, pulverized, and dragged along with it. Pieces of stone, like that here represented, would form part of this moving *débris*, and as they were crowded along they would now and then grate over another piece of stone more firmly seated, and so their surface would be deeply scratched in the direction of their greatest length. There is always more or less water circulating under the Alpine glaciers, and the streams that flow from them are always very muddy, containing, as they do, quantities of crushed rock, sand, and clay.

If, for any reason, this earthy matter was not washed out it would form a bed of hard clay, in places packed with these striated stones. Such beds of clay are known as "till" or bowlder clay.[21]

This is descriptive, though in a very general way, of the glaciers as they exist to-day. Geologists have long been aware of the fact that they have convincing proofs of the former presence of glaciers in Northern Europe, where now the climate is mild. The mountains of Scotland and Wales show as distinct traces of glaciers as do those of the Alps. It is not necessary, in this hasty sketch, to enumerate the many grounds on which this conclusion rests. It is sufficient to state that by the united labors of many investigators in that field we are in possession of many conclusions relating to the great glaciers of this age which almost surpass belief; and yet they are the results of careful deductions. The former presence of this ice sheet itself is shown in a most conclusive manner by the bowlder clay formed underneath the great glacier, containing abundant examples of stone showing by their scratched surface that they have been ground along underneath the glacier. The rocks on the sides of the mountains are scratched exactly as are those in the Alps. By observing how high up on the mountains the striæ are, we know the thickness of the ice-sheet; and the direction in which it moved is shown in several ways.[22]

Briefly, then, the geologist assures us that when the cold of the Glacial Age was at its maximum glaciers streamed down from all the mountains of Scotland, Wales, and Northern England; that the ice was thick enough to overtop all the smaller hills, and on the plains it united in one great sea of ice some thousands of feet in thickness, that it stretched as far south as the latitude of London, England. But that to the west the ice streamed out across, the Irish Sea, the islands to the west of Scotland, and ended far out into what is now the Atlantic.[23] But these glaciers, vast as they were, were very small compared with the glaciers that streamed out from the mountains of Norway and Sweden. These great glaciers

invaded England to the south- west, beat back the glacier ice of Scotland from the floor of the North Sea, overran Denmark, and spread their mantle of bowlder clay far south into Germany.[24]

While such was the condition of things to the north, the glaciers of the Alps were many times greater than at present. All the valleys were filled with glacier ice, and they spread far out on the plains of Southern Germany and westward into France. The mountains of Southern France and the Pyrenees also supported their separate system of glaciers. Ice also descended from the mountains of Asia Minor and North Africa.[25] In America we meet with traces of glaciers on a vast scale; but we can not pause to describe them here.[26]

It need not surprise us, therefore, to learn of reindeer and musk-sheep feeding on stunted herbage in what now constitutes Southern France. When a continuous mantle of snow and ice cloaked all Northern Europe, it is not at all surprising to find evidence of an extremely cold climate prevailing throughout its southern borders. We thus see how one piece of evidence fits into another, and therefore we may, with some confidence, endeavor to find proofs of more genial conditions when the snow and ice disappeared, and a more luxuriant vegetation possessed the land, and animals accustomed to warm and even tropical countries roamed over a large extent of European territory. In Switzerland it was long ago pointed out that after the ancient glaciers had for a long time occupied the low grounds of that country they, for some cause, retreated to the mountain valleys, and allowed streams and rivers to work over the *débris* left behind them. At Wetzikon most interesting conclusions have been drawn. We there learn that, after the retreat of the glaciers, a lake occupied the place, which in course of time became filled with peat, and that subsequently the peat was transformed into lignite. To judge from the remains of animals and plants, the climate must have been at least as warm as that at present; and this condition of things must have prevailed

over a period of some thousands of years to explain the thick deposits of peat, from which originated the lignites.[27]

But we also know that this period came to an end, and that once more the ice descended. This is shown by the fact that directly overlying the lignite beds are alternating layers of sand and gravel, and, resting on these, glacier-born bowlders. The same conclusion follows from the discoveries made at many other places.

In Scotland it is well known that the bowlder clay contains every now and then scattered patches of peat and beds of soil either deposited in lakes or rivers. The only explanation that can be given for their presence is that they represent old land surfaces; that is, when the land was freed from ice, and vegetation had again clothed it in a mantle of green. In this cut is shown one of these beds. Both above and below are the beds of bowlder clay. The peat in the centre varies from an inch to a foot and a half in thickness, and contains many fragments of wood, sticks, roots, etc.; and of animals, numerous beetles were found, one kind of which frequents only places where deer and ruminant animals abound.

From a large number of such discoveries it is conclusively shown that, after all, Scotland was smothered under one enormous glacier, a change of climate occurred, and the ice melted away. Then Scotland enjoyed a climate capable of nourishing sufficient vegetation to induce mammoths, Irish deer, horses, and great oxen to occupy the land. But the upper bowlder clay no less conclusively shows that once more the climate became cold, and ice overflowed all the lowlands and buried under a new accumulation of bowlder clay such parts of the old land surface as it did not erode. Substantially the same set of changes are observed in English and German geology.[28]

Having thus given an outline of the climatic changes which took place in Europe during the Glacial Age, and the grounds on which

these strange conclusions rest, we must now turn our attention to the appearance of man.

The uncertainties which hung over his presence in the earlier periods, spoken of in the former chapter, do not apply to the proofs of his presence during this age, though it is far from settled at what particular portion of the Glacial Age he came into Europe. We must remember we are to investigate the past, and to awaken an interest in the history of a people who trod this earth in ages long ago. The evidence on which we establish a history of the early tribes of Europe is necessarily fragmentary, but still a portion here and a piece there are found to form one whole, and enable us to form quite a vivid conception of manners and times now very far remote.

It is not claimed that we have surmounted every difficulty—on the contrary, there is yet much to be deciphered; but, in some respects, we are now better acquainted with these shadowy tribes of early times than with those whose history has been recorded by the historian's facile pen. He has given us a record of blood. He acquaints us with the march of vast armies, tells us of pillaged cities, and gives us the names of a long roll of titled kings; but, unfortunately, we know little of the home life, the occupation, or of those little things which make up the culture of a people. But the knowledge of primitive tribes, gathered from the scanty remains of their implements, from a thorough exploration of their cavern homes, has made us acquainted with much of their home life and surroundings: and we are not entirely ignorant as to such topics as their trade, government, and religion. We must not forget that this is a knowledge of tribes and peoples who lived here in times immeasurably ancient as compared with those in existence at the very dawn of history.

We must try and form a mental picture of what was probably the primitive state of man; and a little judicious reasoning from known facts will do much for us in this direction. Some writers have

contended that the first condition of man was that of pleasing innocence, combined with a high degree of enlightenment, which, owing to the wickedness of mankind, he gradually lost. This ideal picture, however consonant with our wishes, must not only give way before the mass of information now at our command, but has really no foundation in reason; "or, at any rate, if this primitive condition of innocence and enlightenment ever existed, it must have disappeared at a period preceding the present archæological investigations."[29] Nothing is plainer than that our present civilization has been developed from barbarism, as that was from savagism.[30] We need go back but a few centuries in the history of any nation, before we find them emerging from a state of barbarism. The energy and intelligence of the Anglo-Saxon has spread his language to the four corners of the globe; he has converted the wilderness into fruitful fields, and reared cities in desert lands: yet his history strikingly illustrates our point. A century back, and we are already in a strange land. The prominent points of present civilization were yet unthought of. No bands of iron united distant cities; no nerves of wire flashed electric speech. The wealth of that day could not buy many articles conducive of comfort, such as now grace the homes of the poor. The contrast is still more apparent when we recall another of the countless centuries of the past. England, with Europe, was but just awakening to modern life. Printing had but just been invented. Great discoveries had been made, and mankind was but just beginning those first feeble efforts which were to bring to us our modern comforts. But a millennium of years ago, and the foundation of English civilization had but just been laid by the union of the rude Germanic tribes of the Saxons and the Angles. Similar results attend the ultimate analysis of any civilization. It was but yesterday that wandering hordes, bound together by the loose cohesion of tribal organization, and possessing but the germ of modern enlightenment, held sway in what is now the fairest portion of the world: and we, the descendants of these rude people, must reflect that the end is not yet—that the onward march of

progress is one of ever hastening steps—and that, in all human probability, the sun of a thousand years hence will shine on a people whose civilization will be as superior to ours as the light of day exceeds the mellow glow of a moon-lit night.

If such are the changes of but a few centuries, what must we not consider the changes to have been during the countless ages that have sped away since man first appeared on the scene! The early Greek and Roman writers were much nearer right when they considered primitive man to have been but a slight degree removed from the brute world. Horace thus expresses himself: "When animals first crept forth from the newly formed earth, a dumb and filthy herd, they fought for acorns and lurking places —with their nails, and with fists—then with clubs—and at last with arms, which, taught by experience, they had forged. They then invented names for things, and words to express their thoughts; after which they began to desist from war, to fortify cities, and enact laws." The learning of modern times leads to much the same conclusion.

It is evident that primitive man must have been destitute of metals; for it requires a great deal of knowledge and experience to extract metals from their ores. In the eyes of savages, the various metallic ores are simply so many varieties of stone— much less valuable for his purposes than flint, or some other varieties. We know it to be historically true, that a great many nations have been discovered utterly destitute of any knowledge of metals.

When we reflect how much of our present enlightenment is due to the use of metals, we can readily see that their discovery marks a most important epoch in the history of man. There is, then, every reason to suppose that stone was a most important article for primitive man. It was the material with which he fought his battle for existence, and we need not be surprised that its use extended through an enormously long period of time. Not only was primitive man thus low down in the scale, but of necessity his progress must have been very slow.

The time during which men were utterly destitute of a knowledge of metals, far exceeds the interval that has elapsed since that important discovery.[31] Scholars divide the stone age into two parts. In the first, the stone implements, are very few, of simple shapes, and in the main formed of but one variety of stone—generally flint~-and they were never polished. In the second division, we meet with a great many different implements, each adapted to a different purpose. Different varieties of stone were employed, and they also made use of bone, shell, and wood, which were often beautifully polished.

From what we have learned of the development of primitive society, it will not surprise us to learn that the first division of the age of stone comprises a vastly greater portion of time, and is far more ancient, than the second. We will give an outline showing the order of use of different materials; but it is here necessary to remark that Bronze was the first metal that man learned to use, and Iron the second.

ORDER IN WHICH DIFFERENT MATERIALS WERE USED FOR WEAPONS AND IMPLEMENTS BY PRIMITIVE MAN.

Age of Stone.	Rough, or Old Stone Age	Paleolithic
	Polished, or New Stone Age	Neolithic
Age of Metals.	Bronze Age. Iron Age.	

In this outline the words Paleolithic and Neolithic are the scientific terms for the two divisions of the Stone Age, and will be so used in these pages.

The only races of men that we could expect to find in Europe during the Glacial Age would be Paleolithic tribes, and it is equally manifest that we must find traces of them in beds of this age, or in association with animals that are characteristic of this age, or else we can not assert the existence of man at this time. The valley of the river Somme, in Northern France, has become classical ground to the student of Archæology, since it was there that such investigations as we have just mentioned were first and most

abundantly made. It is now well known that the surface features of a country—that is, its hills and dales, its uplands and lowlands—are mainly due to the erosive power of running water. Our rivers have dug for themselves broad valleys, undermined and carried away hills, and in general carved the surface of a country, until the present appearance is the result. It must be confessed that when we perceive the slow apparent change from year to year, and from that attempt to estimate the time required to produce the effects we see before us, we are apt to shrink from the lapse of time demanded for its accomplishment. Let us not forget that "Time is long," and that causes, however trifling, work stupendous results in the course of ages.

But a river which is thus digging down its channel in one place, deposits the materials so dug away at other and lower levels, as beds of sand and gravel. In the course of time, as the river gradually lowers its channel, it will leave behind, at varying heights along its banks, scattered patches of such beds. Wherever we find them, no matter how far removed, or how high above the present river, we are sure that at some time the river flowed at that height; and standing there, we may try and imagine how different the country must have looked before the present deep valley was eroded.

In the case of the river Somme, we have a wide and deep valley, a large part of which has been excavated in chalk rock, through which the river now winds its way in a sinuous course to the English Channel. Yet we feel sure that at some time in the past it was a mighty stream, and that its waters surged along over a bed at least two hundred feet higher than now. In proof of this fact we still find, at different places along the chalky bluff, stretches of old gravel banks, laid down there by the river, "reaching sometimes as high as two hundred feet above the present water level, although their usual elevation does not exceed forty feet."[32]

The history of the investigation of the ancient gravel beds of the Somme is briefly this: More than one instance had been noted of the finding of flint implements, apparently the work of men, in association with bones of various animals, such as hyenas, mammoths, musk-sheep, and others, which, as we have just seen, lived in Europe during the Glacial Age. In a number of cases such finds had been made in caves. But for a long time no one attributed any especial value to these discoveries, and various were the explanations given to account for such commingling. A French geologist, by the name of Boucher DePerthes, had noted the occurrence of similar flint implements, and bones of these extinct animals, in a gravel pit on the banks of the Somme, near Abbeville, France. He was convinced that they proved the existence of man at the time these ancient animals lived in Europe. But no one paid any attention to his opinions on this subject, and a collection of these implements, which he took to Paris in 1839, was scarcely noticed by the scientific world. They were certainly very rude, and presented but indistinct traces of chipping, and perhaps it is not strange that he failed to convince any one of their importance. He therefore determined to make a thorough and systematic exploration of these beds at Abbeville. In 1847 he published his great work on this subject, giving over sixteen hundred cuts of the various articles he had found, claiming that they were proof positive of the presence of man when the gravels were depositing.

Now there are several questions to be answered before the conclusions of the French geologist can be accepted. In the first place, are these so-called flint implements of human workmanship? From our illustrations, we see that they are of an oval shape, tending to a cutting edge all around, and generally more or less pointed at one end. The testimony of all competent persons who have examined them is, that however rude they may be, they were undoubtedly fashioned by man. Dr. C. C. Abbott has made some remarks on implements found in another locality,

equally applicable to the ones in question. He says: "We find, on comparing a specimen of these chipped stones with an accidentally fractured pebble, that the chipped surfaces of the former all tend toward the production of a cutting edge, and there is no portion of the stone detached which does not add to the availability of the supposed implement as such; while in the case of a pebble that has been accidentally broken, there is necessarily all absence of design in the fracturing."[33]

Like the watch found on the moor, they show such manifest evidence of design, that we can not doubt that they were produced by the hand of man. But it is not enough to know that they are artificial, we must also know that they are of the same age as the beds in which they are found.

This cut represents a section of a gravel pit at St. Acheul, on the Somme. The implements are nearly always found in the lowest strata, which is a bed of gravel from ten to fourteen feet thick. Overlying this are beds of marl, loam, and surface soil, comprising in all a depth of fourteen feet. It has been suggested that the implements are comparatively recent, and have sunk down from above by their own weight, or perhaps have been buried in artificial excavations. The beds are however too compact to admit of any supposition that they may have been sunk there; and if buried in any excavation, evident traces of such excavation would have remained. We can account for their presence there in no other way than, that when the river rolled along at that high elevation, and deposited great beds of sand, these implements were someway lost in its waters, and became buried in the gravel deposits.

Finally, we have to consider the age of the deposits. This is a question that can be answered only by geologists, and we may be sure that more than ordinary attention has been bestowed upon them. The remains of many animals characteristic of the Glacial Age were found in the beds at Abbeville. These include those of

the elephants, rhinoceros, hyenas, cave-bear, and cave-lion.[34]

In the formation of these gravel beds, ice has undoubtedly played quite an important part. Bowlders that could have got there only by the aid of ice, are found in several localities. Evidence gathered from a great many different sources all establish the fact that these gravels date as far back as the close of the Glacial Age at least, and there are some reasons for supposing them to be interglacial.

We can easily see that the melting away of the immense glaciers that we have been describing would produce vast floods in the rivers, and it is perhaps owing to the presence of such swollen rivers that are due the great beds of surface soil, called loam or loess, found in all the river valleys of France and Germany.[35] These deposits frequently overlie the gravel beds. They are then of a later date than the beds in which are found such convincing proofs of the presence of man, and if they themselves date from the close of the Glacial Age, it is no longer a question whether the gravel beds themselves belong to that age. Thus we see that we can no longer escape the conclusions of Boucher DePerthes. The discovery of rudely worked flints in the drift of the Somme River thus establishes the fact that some time during the Glacial Age, man in a Paleolithic state lived in France.

Geological terms convey to us no definite ideas as to the lapse of time, and we have an instinctive desire to substitute for them some term of years. In most cases this is impossible, as we have no means to measure the flight of past time, nor are we yet prepared to discuss the question of time, since to do so we must learn a great deal more about the cause of the Glacial Age. We might, however, cite statements which can not fail to impress us with the fact that a great extent of time has passed.

In the case of the river Somme we have a valley in some places a mile or more in width, and about two hundred feet in depth. This

has mostly been excavated in chalk rock. Taking our present large rivers as a basis, it would require from one to two hundred thousand years for the Somme to perform this work.[36] It will not do, however, to take the present action of our rivers as a guide, since we have every reason to suppose this work went forward much more rapidly in past times. But we can not escape the conclusion that it demands a very long time indeed to explain it. The valley has remained in its present shape long enough to admit the formation of great beds of peat in some portions. Peat is formed by the decomposition of vegetable growth. Its growth is in all cases slow, depending entirely upon local circumstances. European scholars who have made peat formation a special study assure us that to form such immense beds as occur near Abbeville, several thousand years are required, even under the most favorable conditions.

Yet we would be scarcely willing to rest such important conclusions as the foregoing on the researches of one individual, or in one locality. As already stated, DePerthes made his discoveries public in 1847. Yet they were so opposed to all that had been believed previously, that but few took the pains to investigate for themselves. In 1853, Dr. Rigollot, of Amiens, who had been skeptical as to DePerthes, commenced to look for himself in the gravel beds at St. Acheul, about nine miles below Abbeville. As might be expected, he was soon convinced.

It may be said that the scientific world formally accepted the new theory when such English scientists as Evans, Falconer, Lyell, and Prestwich reported in its favor. Since that time, many discoveries of ancient implements have been made at various places in France and England under circumstances similar to those in the valley of the Somme. In England they have been found along almost all the rivers in the southern and south- eastern part. One class of discoveries there gives us new ideas as to the extent

of time that has passed since they were deposited. That is where they occur in gravel beds having no connection with the present system of rivers. In one case the gravel forms a hill fifteen feet high, situated in the midst of a swampy district, surrounded on all sides by low, flat surfaces. Several such instances could be given; but, in all such cases, we can not doubt that, somewhere near, there once rolled the waters of an ancient river, that man once hunted along its banks, and that, owing to some natural cause, the waters forsook their ancient bed—and that since then, in the slow course of ages, the action of running water has removed so much of the surface of the land near there, that we can not guess at its ancient configuration: we only know, from scattered patches of gravel, that we are standing on the banks of an ancient water-course.

One instance, illustrative of the great change that has come over the surface features of the country, demanding for their accomplishment a great lapse of time, is furnished by the Isle of Wight. That island is now separated from the mainland by a narrow channel, called the South Hampton Water, or the Solent Sea.

It is now known that this is nothing but an old river channel, in which the sea has usurped the place of the river. The coast is a river embankment, with the usual accompaniments of gravel beds, flint implements, and fresh water shells. On the shores of the island we find the opposite bank of the old river. A very great change must have taken place in the surface features before the sea could have rolled in and cut off the Isle of Wight from the mainland.

In speaking of the length of time demanded for this change, Dr. Evans says: "Who can fully understand how immeasurably remote was the epoch when what is now that vast bay was high and dry land, and a long range of chalk downs, six hundred feet above the sea, bounded the horizon on the South? And yet that must have been the sight that met the eye of primitive man who frequented the banks of that ancient river, which buried their handiwork in

gravels that now cap the cliffs—and of the course of which so strange and indubitable a memorial subsists in what has now become the Solent Sea?"[37]

The illustrations scattered through this essay are representations of the stone implements found in the drift of European rivers. During all the long course of time supposed to be covered by the Paleolithic Age, there are but very few evidences of any improvement, as far as we can judge from the implements themselves. This is in itself a melancholy proof of the low condition of man. He had made so little advance in the scale of wisdom, he possessed so little knowledge, he was so much a creature of instinct, that, during the thousands of years demanded for this age, he made no appreciable progress. The advance of the last century was many times greater than that of the entire Paleolithic Age. A blow struck on one end of a piece of flint will, owing to the peculiar cleavage of flint, split off pieces called flakes. This is the simplest form of implement used by man. It is impossible to say with certainty how they were used; but, from the evidence observed on them, they were probably used as scrapers. The men of that day doubtless knew some simple method of preparing clothing from the skins of the animals they had killed, and probably many of these sharp-rimmed flakes were used to assist in this primitive process of tanning.

When the piece of flint itself was chipped into form, it was one whose shape would indicate a spear-head or hatchet. We present illustrations of each. Forms intermediate between these two are found. Some have such a thick heavy base that it is believed they were used in the hand, and had no handle or haft.

Others, with a cutting edge all round, may have been provided with a handle. M. Mortillet, of France, who has had excellent opportunities of studying this question very thoroughly, thinks that the hatchet was the only type of implement they possessed, and

that it was used for every conceivable purpose—but that their weapon was a club, all traces of which have, of course, long since vanished away.[38]

These few implements imply that their possessors were savages like the native Australians. In this stage of culture, man lived by hunting, and had not yet learned to till the ground, or to seek the materials out of which his implements were made by mining. Re merely fashioned the stones which happened to be within reach in the shallows of rivers as they were wanted, throwing them away after they had been used. In this manner the large numbers which have been met with in certain spots may be accounted for. Man at this time appears before us as a nomad hunter, poorly equipped for the struggle of life, without knowledge of metals, and ignorant of the art of grinding his stone tools to a sharp edge.[39] Of course we can not hope to learn much of their social condition other than that just set forth.

DePerthes found some flints which show evidence of their human origin, and yet it would be very difficult to say what was their use. He thinks they may have a religious significance, and has set forth a great variety of eloquent surmises respecting them. It only need be said that such theorizing is worse than useless. That while it is very probable these tribes had some system of belief, yet there is no good reason for supposing these flints had any connection with it. It has been supposed, from another series of wrought flints, that the men of this epoch were possessed of some sentiments of art, as pieces have been found thought to represent the forms of animals, men's faces, birds, and fishes; but as very few have been able to detect such resemblances, it is safe to say they do not exist.

As the love of adornment is almost as old as human nature itself, we may not be surprised to find traces of its sway then. Dr. Rigollot found little bunches of shells with holes through either

end. The supposition is that these were used as beads; which is not at all strange, considering how instinctively savage men delight in such ornaments. These ancient hunters made use of beads partially prepared by nature.

Europe is not the only country where the remains of this savage race are found. They are found in the countries bordering the Mediterranean in Northern Africa, and in Egypt. In this latter country they are doubtless largely buried under the immense deposits of Nile mud; yet in 1878 Professor Haynes discovered in Upper Egypt scrapers and hatchets, pronounced by archæologists to be exactly similar to those of the river Somme. We are not informed as to their geological age, but there can be no question that they are much older than any monument of Egyptian civilization hitherto known.[40]

Paleolithic implements have also been found in Palestine and in India. In the latter country the beds are so situated that they present the same *indicia,* of age as do those of the Somme Valley. A great portion of the formation has been removed, and deep valleys cut in them by running water.[41] They have also been found in at least one locality in the United States; that is in the glacial gravel of the valley of the Delaware at Trenton, New Jersey. We must not confound these remains with those of the Indian tribes found scattered over a large extent of surface. Those at Trenton also are not only in all respects, except materials, similar to those of the Somme, but are found imbedded in a formation of gravel that was deposited at least as far back as the close of the Glacial Age, thus requiring the passage of the same long series of years since they were used, as do the implements of European rivers.[42] We must also bear in mind that no country has been so carefully explored for these implements as has Europe, and that the very country, Asia, where, for many reasons, we might hope to find not only unequivocal proofs of man's presence but from our discoveries be able to clear up many dark points, as to the race, origin, and fate of

these primitive tribes, is yet almost a sealed book.

But the scattered discoveries we have instanced show us that the people whose implements have been described in this chapter were very widely dispersed over the earth, and everything indicates that they were far removed from us in time. The similarity in type of implements shows that, wherever found, they were the same people, in the same low savage state of culture—"Alike in the somber forests of oak and pine in Great Britain, and when surrounded by the luxuriant vegetation of the Indian jungle."[43]

We have yet two important points to consider. The first is, what race of men were these river tribes? and second, when did they arrive in Europe? Did they precede the glacial cold? did they make their appearance during a warm interglacial period? or was it not until the final retreat of the glaciers that they first wandered into Europe? These questions are far from settled; yet they have been the object of a great amount of painstaking research.

To determine the first point, it is necessary that anatomists have skeletons of the men of this age, to make a careful study of them. But for a great many reasons, portions of the human skeleton are very rarely found in such circumstances that we are sure they date back to the Paleolithic Age, and especially is this true of the men of the River Drift. In a few instances fragmentary portions have been found.

M. Quatrefages, of France, who is certainly a very high authority on these points, thinks that the hunter tribes of the River Drift belonged to the Canstadt race—"so named from the village of Canstadt, in Germany, near which a fossil skull was discovered in 1700, and which appears to be closely allied to the Neanderthal skull, discovered near Dusseldorf in 1857, and about which so much has been written."[44] Quatrefages supposes that this type of man is still to be found in certain Australian tribes. These are not mere guesses, but are conclusions drawn from careful study by

eminent European scholars.[45]

It is well known that a competent naturalist needs but a single fossil bone to describe the animal itself, and tell us its habits. So also anthropologists need but fragments of the human skeleton, especially of the skull, to describe characteristics of the race to which the individual belonged.

This cut, though an ideal restoration, is a restoration made in accordance with the results of careful study of fragmentary skulls found in various localities in Europe. The head and the face present a savage aspect; the body harmonized with the head; the height was not more than five feet and a half; yet the bones are very thick in proportion to their length, and were evidently supplied with a powerful set of muscles, since the little protuberances and depressions where the muscles are attached are remarkably well developed.[46] Huxley and Quatrefages have both pointed out that representatives of this race are to be found among some Australian tribes. Among the races of this great island there is one, distributed particularly in the province of Victoria, in the neighborhood of Port Western, which reproduces in a remarkable manner, the characters of the Canstadt race."[47] Not the least interesting result of this discovery is the similarity of weapons and implements. "With Mr. Lartet, we see in the obsidian lances of New Caledonia the flint heads of the lower alluvium of the Somme. The hatchet of certain Australians reminds us, as it did Sir Charles Lyell, of the Abbeville hatchet.[48]

Yet some hesitate about accepting these interesting inferences, thinking that the portions of the human skeleton thus far recovered, which are beyond a doubt referable to this period, are too fragmentary to base such important conclusions upon. This is the view of Boyd Dawkins, who thinks "we can not refer them to any branch of the human race now alive."[49] "We are without a clew," continues he, "to the ethnology of the River Drift man, who most

probably is as completely extinct as the woolly rhinoceros or the cave bear."[50] Future discoveries will probably settle this point.

It is yet a much disputed point to what particular portion of the Glacial Age we can trace the appearance of man. We can profitably note the tendency of scientific thought in this direction. But a short time has elapsed since a few scholars here and there began to urge an antiquity for man extending back beyond the commonly accepted period of six thousand years. Though it is now well known and admitted that there are no good grounds for this estimate, yet such was its hold, such its sway over scientific as well as popular thought, that an appeal to this chronology was deemed sufficient answer to the discoveries of DePerthes, Schmerling, and others. It was but yesterday that this popular belief was overthrown and due weight given the discoveries of careful explorers in many branches, and the antiquity of man referred, on indisputable grounds, to a point of time at least as far back as the close of the preceding geological age.[51]

It seems as if here a halt had been called, and all possible objections are urged against a further extension of time. It is, of course, well to be careful in this matter, and to accept only such results as inevitably follow from well authenticated discoveries. But it also seems to us there is no longer any doubt that man dates back to the beginning of that long extended time we have named the Glacial Age.[52]

In the first place, we must recall the animals that suddenly made their appearance in Europe at the beginning of this age. Though there were a number of species, since become extinct, the majority of animal forms were those still living.[53]

These are the animals with which man has always been associated. There is therefore no longer any reason to suppose the evolution of animal life had not reached that stage where man was to appear. We need only recall how strongly this point was urged

in reference to the preceding geological epoch, to see its important bearings here. Mr. Boyd Dawkins has shown that the great majority of animals which invaded Europe at the commencement of this age, can be traced to Northern and Central Asia, whence, owing to climatic changes, they migrated into Europe.[54]

Inasmuch as man seems to have been intimately associated with these animals, it seems to us very likely that he came with them from their home in Asia. We think the tendency of modern discoveries is to establish the fact that man arrived in Europe along with the great invasion of species now living.[55]

Turning now to the authorities, we find this to be the accepted theory of many of those competent to form an opinion.

In England Mr. Geikie has strongly urged the theory that the Glacial Age includes not only periods of great cold, but also epochs of exceptional mildness; and he strongly argues that all the evidence of the River Drift tribes can be referred to these warm interglacial epochs; in other words, that they were living in Europe during the Glacial Age.[56]

In answer to this it has been stated that the relics of River Drift tribes in Southern England overlie bowlder clay, and must therefore be later in origin than the Glacial Age.[57]

But, Mr. Geikie and others have shown that the ice of the last great cold did not overflow Southern England,[58] so that this evidence, rightly read, was really an argument in favor of their interglacial age.[59] The committee appointed by the British Association to explore the Victoria Cave, near Settle, urge this point very strongly in their final report of 1878.[60] To this report Mr. Dawkins, a member of the committee, records his dissent, but in his last great work he freely admits that man was living in England during the Glacial Age, if he did not, in fact, precede it.[61]

Mr. Skertchley, of the British coast survey, in 1879,[62] announced

the discovery in East Anglia of Paleolithic, implements underlying the bowlder clay of that section. Mr. Geikie justly regards this as a most important discovery.[63]

Finally Mr. Dawkins, in his address as President of the Anthropological section of the British Association, in 1882, goes over the entire ground. After alluding to the discovery of paleolithic implements in Egypt, India, and America, he continues: "The identity of implements of the River Drift hunter proves that he was in the same rude state of civilization, if it can be called civilization, in the Old and the New World, when the hand of the geological clock struck the same hour. It is not a little strange that this mode of life should have been the same in the forests of the North, and south of the Mediterranean, in Palestine, in the tropical forests of India, and on the western shores of the Atlantic." This, however, is not taken as proving the identity of race, but as proving that in this morning-time of man's existence he had nowhere advanced beyond a low state of savagism. Mr. Dawkins then continues: "It must be inferred from his wide-spread range that he must have inhabited the earth for a long time, and that his dispersal took place before the Glacial epoch in Europe and America. I therefore feel inclined to view the River Drift hunter as having invaded Europe in preglacial times, along with other living species which then appeared." He also points out that the evidence is that he lived in Europe during all the changes of that prolonged period known as the Glacial Age.[64]

Sir John Lubbock also records his assent to these views. He says on this point: "It is, I think, more than probable that the advent of the Glacial Period found man already in possession of Europe."[65]

In our own country Prof. Powell says: "It is now an established fact that man was widely scattered over the earth at least as early as the beginning of the Quaternary period, and perhaps in Pliocene times."[66]

This completes our investigation of the men of the River Drift. We see how, by researches of careful scholars, our knowledge of the past has been enlarged. Though there are many points which are as yet hidden in darkness, we are enabled to form quite a clear mental picture of this early race. Out of the darkness which still enshrouds the continent of Asia we see these bands of savages wandering forth; some to Europe, Africa, and the west; others to America and the east.

This was at a time when slowly falling temperature but dimly prophesied a reign of arctic cold, still far in the future. This race does not seem to have had much capacity for advancement, since ages came and went leaving him in the same low state. During the climax of glacial cold he doubtless sought the southern coasts of Europe along with the temperate species of animals. But whenever the climatic conditions were such that these animals could find subsistence as far north as England he accompanied them there, and so his remains are found constantly associated with theirs throughout Europe. Though doubtless very low in the scale, and at the very foot of the ladder of human progress, we are acquainted with no facts connecting them with the higher orders of animals. If such exists, we must search for them further back in geological time. The men of the River Drift were distinctively human beings, and as such possessed those qualities which, developing throughout the countless ages that have elapsed, have advanced man to his present high position.

REFERENCES

This chapter was submitted to Prof. G. F. Wright, of Oberlin, for criticism.

Lyell's "Antiquity of Man;" Geikie's "Prehistoric Europe," p. 332.

It is, however, applicable to only a portion of the Quaternary, or Post-tertiary period. (Wright.)

Chapter II.

Geikie's "Prehistoric Europe," p. 339.

Dawkins's "Cave Hunting," p. 365.

Dawkins's "Early Man in Britain," p. 112.

Geikie's "Prehistoric Europe," p. 337.

The majority of the Pliocene animals disappeared from Europe at the close of the period in question. This includes such animals as the mastodon, hipparion, and many kinds of deer (Geikie's "Prehistoric Europe," p. 334). The following animals survived into the Glacial Age, and some even into Inter-glacial periods: African hippopotamus (still living), saber-toothed lion, bear of Auvergne, big-nosed rhinoceros, Etruskan rhinoceros, Sedgwick's deer, deer of Polignac, Southern elephant. ("Prehistoric Europe," p. 95.)

The northern animals include the following: Alpine hare, musk-sheep, glutton, reindeer, arctic fox, lemming, tailless hare, marmot, spermophile, ibex, snowy vole, chamois. (Geikie's "Prehistoric Europe," p. 32.)

Geikie's "Prehistoric Europe," p. 28.

The following animals are given as southern species: Hippopotamus, African elephant, spotted hyena, striped hyena, serval, caffer cat, lion, leopard. In addition to the above there were also four or five species of elephants and three species of rhinoceros, which have since become extinct. (Geikie's "Prehistoric Europe," p. 32.)

It is scarcely necessary to give a list of these animals. Prof. Dawkins enumerates thirty-three species. The following are some of the most important: Urus, bison, horse, stag, roe, beaver, rabbit, otter, weasel, martin, wildcat, fox, wolf, wild boar, brown bear, grizzly bear. (Geikie's "Prehistoric Europe," p, 32.)

Dawkins's "Early Man in Britain," p. 191.

Lubbock's "Prehistoric Times," p. 316.

Geikie's "Prehistoric Europe," p. 87.

Geikie's "Prehistoric Europe," p. 50.

Geikie's "Prehistoric Europe," p. 54.

Ibid., p. 55.

Kane's "Arctic Exploration," Vol. I, p. 225.

Geikie's "Prehistoric Europe," p. 180.

Wallace's "Island Life," p. 104.

Geikie's "Prehistoric Europe," p. 189.

Ibid., p. 192, *et seq*.

Dawkins's "Early Man in Britain."

For fuller information on this topic see James Geikie's "The Great Ice Age;" also, by the same author, "Prehistoric Europe." In Appendix "B" of this latter work the author gives a map of Europe at the climax of the Glacial Age, showing the great extension of the glaciers. This map embodies the results of the labors of a great many eminent scholars. See also Croll's "Climate and Time;" also Wallace's "Island Life," pp. 102-202. We are not aware that the statements as set forth above are seriously questioned by any geologist of note. Some consider it quite possible that the bowlder clays of Southern England and Central Germany were deposited during a period of

submergence from melting icebergs. (Dawkins's "Early Man in Britain," p. 116.) But even this demands vast glaciers to the north of this supposed submergence to produce the icebergs. The weight of authority, however, is in favor of the glaciers. (Geikie's "Prehistoric Europe," p. 175.)

Haywood's Heer's "Primeval World of Switzerland," p. 200.

"Prehistoric Europe," p. 261. It is no longer a question that there was at least one mild period separating two periods of cold in Europe. See Lubbock's "Prehistoric Times," p. 316; Dawkins's "Early Man in Britain," pp. 115-120; Lyell's "Antiquity of Man," pp. 282-285., Dana's "Manual of Geology," first edition, p. 561; Haywood's Heer's "Primeval World of Switzerland," Vol. II, p. 203; Wallace's "Island Life," p. 114; Croll's "Climate and Time." Mr. Geikie, in his works, "The Great Ice Age" and "Prehistoric Europe," maintains there were several warm interglacial epochs.

Wright.

Morgan's "Ancient Society," p. 29.

Geikie's "Prehistoric Europe," p. 365. Morgan's "Ancient Society," p. 39.

Rau's "Early Man in Europe," p. 14.

"Primitive Industry," p. 485.

Lubbock's "Prehistoric Times," 384.

Geikie's "Prehistoric Europe," chap. ix. Most geologists suppose there was a general depression of the region below the sea level, or so as to form inland lakes, and that the loess was thus deposited, as perhaps it is depositing at the present time in the lakes of Switzerland. (Wright.)

Lubbock's "Prehistoric Times," p. 423.

Evans's "Ancient Stone Implements," p. 621.

Pop. Science Monthly, Oct., 1883.

Dawkins's "Ear. Man in Brit.," p. 163.

Wright's "Studies in Science and Religion," p. 278. See also British Association Report, 1882, p. 602.

Lubbock's "Prehistoric Times," p. 356.

Abbott's "Primitive Industry."

Dawkins's "Early Man in Britain," p. 172.

Wright.

Quatrefages's "Human Species," p. 307.

"Human Species," p. 305.

Ibid., p. 307.

Quatrefage's "Human Species," p. 306.

"Early Man in Britain," p. 173.

Ibid., p. 233.

We do not give any estimate in years as to this antiquity in this chapter.

We must remember that this age is also variously called the Quaternary, Pleistocene, and Post Tertiary. We do not now refer to the evidence of

man's existence in the Miocene and Pliocene, treated of in the preceding chapter.

Mr. Dawkins finds that fifty-five out of seventy-seven species are yet living. "Early Man in Britain," p, 109.

"Early Man in Britain," p. 110.

Those who reject the proofs of the existence of man in Pliocene times because the evolution of life had not then reached a stage where we could hope to find man, are here confronted with a difficulty. If Mr. Dawkins be right (as stated above) then the various animals in question must have been living in Asia during the preceding Pliocene Age. There is no reason to suppose man was not associated with them, since he belongs to the same stage of evolution (Le Conte's "Elements of Geology," p. 568), and though, owing to climatic and geographical causes, the animals themselves might have been confined to Asia, there is surely no good reason why man may not, in small bands, and at various times, have wandered into Europe.

"Prehistoric Europe," "The Great Ice Age."

Dawkins's "Early Man in Britain," p. 170.

"Prehistoric Europe," p. 268.

Ibid., 360.

British Assoc. Rep., 1878.

"Early Man in Britain," pp. 137, 141, and 169, with note.

British Assoc. Rep., 1879.

Prehistoric Europe, p. 263.

British Assoc. Rep., 1882.

Preface to Kains-Jackson's "Our Ancient Monuments."

"First Annual Report, Bureau of Ethnology," p. 73.

Chapter IV
CAVE-MEN.[1]

Other sources of Information—History of Cave Exploration—The formation of Caves—Exploration in Kent's Cavern—Evidence of two different races—The higher culture of the later race—Evidence of prolonged time—Exploration of Robin Hood Cave—Explorations in Valley of the River Meuse—M. Dupont's conclusions—Explorations in the Valley of the Dordogne—The

Station at Schussenreid—Cavemen not found south of the Alps—Habitations of the Cave-men—Cave-men were Hunters—Methods of Cooking—Destitute of the Potter's art—Their Weapons—Clothing—Their skill in Drawing—Evidence of a Government—Of Religious belief—Race of the Cave-men—Distinct from the men of the Drift—Probable Connection with the Eskimos.

HAVE been delving, among the sands of ancient river bottoms for a proof of man's existence in far remote times. Slight and unsatisfactory as they may be to some, they are the materials with which we reconstruct a wondrous story of life and times removed from us by many a cycle of years.

Men have frequently resorted to the caverns of the earth for protection. In places we find caves that served this purpose during the Paleolithic Age. The men of the Drift, however, do not appear to have used them, save as temporary places of refuge, perhaps as a protection from bands of savage enemies, or from unusually inclement weather. But yet most surprising results have attended the exploration of caves in England, France, and Belgium. We find in those gloomy places that the men of the Drift were not the only tribes of men inhabiting Europe during the Glacial Age. In fact, living at later date than the Drift tribes, but still belonging to the Paleolithic Age, were tribes of people who appear to have utilized caverns and grottoes as places of permanent resort, and, judging from their remains, they had made considerable advance in the arts of living as compared with the tribes of the Drift.

But before pointing out the grounds upon which these conclusions rest, it may be well to give a slight review of the history of cave research. The dread and awe which kept people away from caves during the Middle Ages preserved their contents for later discoverers. In the seventeenth century, some adventurous spirits began to search in them for what they called Unicorn horns, which were deemed a most efficacious remedy for various

diseases. This search served the good purpose of bringing to light various fossil bones of animals, and calling the attention of scientific men to the same.

The cave of Gailenreuth, in Bavaria, was explored by Dr. Goldfuss in 1810. He came to the conclusion that the bones of bears and other extinct animals were proofs of the former presence of the animals themselves. Dr. Buckland, a celebrated English writer, visited the cave in 1816, and became much interested in the work; so much so that when Kirkdale Cavern, in England, was discovered in 1821, he at once repaired to the spot and made a careful exploration. The results satisfied him that hyenas and other extinct animals had once lived in England. He followed up his explorations in a number of cases, and published a work on this subject in 1822, which marks the commencement of a new era in cave research.

In 1825 Kent's Cavern, near Torquay, was discovered, and Rev. J. McEnry made partial explorations in it. He discovered flint implements and perceived they might be a proof of the presence of man with these extinct animals. Dr. Buckland had not found these relics, or else had passed them by as of no importance, for he refused to entertain the theory that man and the extinct animals had been contemporaneous. Explorations made in France in 1827-8 had furnished such strong evidence on this point that it was deemed established by some scholars, but being opposed to the prevailing belief, nothing came of it.

In 1829 Schmerling commenced his investigations in the caves of the valley of the Meuse. For years he continued his work under many difficulties. Sir Charles Lyell tells us he was let down day after day to the opening of the Engis Cave by a rope tied to a tree. Arriving there he crawled on all fours through a narrow passage way to the enlarged chamber, where, standing in mud and water, he superintended the investigations. He examined over forty of

those caves, and published his results in 1833. He clearly showed that man must have been living along with various animals now extinct in Belgium. But, as before remarked, it was deemed sufficient answer to this careful explorer to point out that his results were opposed to the accepted chronology, and so they were passed by. When the time at last came, and their true worth was recognized, Schmerling himself had passed away.

We have already seen what great results followed the exploration of DePerthes in the river gravels. When it had been clearly established that man and extinct animals hid coexisted in Europe, the results of cave explorations were eagerly recalled, and governments vied with royal societies and private individuals in continuing the researches. The results are that a rich store of facts has been gathered from those gloomy resorts, illustrative of the later stages of Paleolithic art.

A word as to the formation of caves, grottoes, caverns, and rock shelters. These vary greatly in size, some being so small as to furnish protection to but few individuals; others, especially caves, so large that whole tribes might have found a place of resort within their chambers. They are found in all limestone countries. The formation of caves is now recognized as due to natural causes acting slowly through many years. Limestone rock is very hard and durable, but chemistry teaches us that water charged with carbonic acid gas will readily dissolve it. Rain-water falling from the clouds is sure to come in contact with masses of decaying vegetable matter, which we know is constantly giving off quantities of this gas. Laden with this the water sinks into the ground, and, if it comes in contact with limestone, readily washes some of it away in solution. But beds of limestone rock are noted for containing great fissures through which subterranean waters penetrate far into the ground. We can readily see how this percolating water would dissolve and wear away the surface of the rocks along such a fissure, and in process of time we would have the phenomenon of a

stream of water flowing under ground.

Owing to a great many causes—such, for instance, as the meeting of another fissure—we would expect that portions of this underground way would become enlarged to spacious halls. In some such a way as this it is now understood that all caves have originated.

Owing to many natural causes the river may, after a while, cease to flow, leaving enlarged portions of its channel behind as a succession of chambers in a cave. But water would still come trickling in from the tops and sides, and be continuously dripping to the floor, where it speedily evaporates. When such is the case it leaves behind it the limestone it held in solution. So, in process of time, if the deposition is undisturbed, there will be formed over the floor of the cave a more or less continuous layer of limestone matter known as stalagmite. The same formations on the top and sides of the cave are called stalactites. In places where the drip is continuous the stalactite gradually assumes the shape of an immense icicle; while the stalagmite on the floor of the cave, underneath the drip, rises in a columnar mass to meet the descending stalactite. A union of these is not uncommon, and, we have pillars and columns presenting the strange, fantastic appearance on which tourists delight to dwell in their notes of travel.

While these accumulations are in all cases very slow, still we can not measure the time since it commenced by the rate of present growth, because this rate varies greatly at different times and places even in the same cave. And we must also remark that this complete series of changes only occur in a few localities, the majority of caves being insignificant in size.[2]

From what has been said as to the formation of caves, we would expect them to occur in river valleys, and this is the case, though in some instances there have been such immense changes in the

surface level of the country that we can now find no trace of rivers near them. This is exactly similar to some gravel deposits, which, as we have seen, are occasionally found where is now no running water. The most noted caverns, however, are found high up on the banks of existing rivers. We can not doubt that the rivers were the cause of the caves. But having excavated their beds below the level of the then existing caves, they ceased to flow in them, and left them to be occupied by savage animals and the scarcely less savage men. But at times, swollen by floods, the river would again assert its supremacy and roll its waters through its old channels.

These floods would not only tear up and rearrange whatever *débris* had already accumulated, but would introduce quantities of sediment and animal remains. In some such a manner as is here pointed out (though exactly how geologists are not agreed) caves were invaded, after being long occupied by men or animals, by floods of water. In many cases the evidence would seem to indicate that after such a visitation by water the cave and its water-rolled and water-arranged contents were left to silence, visited by neither man nor beast. In such instances stalagmitic coverings would gradually form over the confused *débris,* and in some places acquire a thickness of several feet. In some instances several such floors are found one above the other, pointing to a prolonged period of usage, and then a quiet stage, in which the drip of falling water alone broke the silence, and nature sealed up another chapter of cave biography beneath the layer of stalagmite.

One of the most important caves of England is Kent's Cavern, before mentioned. This cave was carefully explored under the direction of a committee appointed by the British Association, and to show the care and thoroughness of the work we need only state that this work occupied the greater portion of sixteen years, and hence the results obtained may be regarded as, in a general way, illustrative of the life of the cave dwellers. "This cave is about a mile east of Torquay harbor, and is of a sinuous character, running

deeply into a hill of Devonian limestone, about half a mile distant from the sea. In places it expands into large chambers, to which various distinctive names have been given."[3]

Let us see what general results have been reached by this committee. The investigation disclosed several different beds of stalagmite, cave earth, and breccia. The lowest layer is a breccia.[4] The matrix is sand of a reddish color, containing many pieces of rock known as red-grit and some pieces of quartz. This implies the presence of running water, which at times washed in pieces of red-grit. The surface features must have been quite different from the present, since now this rock does not form any part of the hill into which this cave opens.[5] And this change in drainage took place before this lowest layer was completed, since not only bears, but men, commenced to visit the cave. The presence of bears is shown by numerous bones, and that of man by his implements.

We must notice that all the implements found in the breccia are similar to those of the Drift, being rudely formed and massive. No doubt these are the remains of Drift men, who, for some cause or other, temporarily visited the cave, perhaps contending with the cave bear for its possession. But a time at length arrived when for some reason neither animals nor man visited the cave. The slow accumulation of stalagmite went forward until in some places it had obtained a thickness of twelve feet. Freely admitting that we can not determine the length of time demanded for this deposition, yet none can doubt that it requires a very long time indeed. Says Mr. Geikie: "How many centuries rolled past while that old pavement was slowly accreting, no one can say; but that it represents a lapse of ages compared to which the time embraced by all tradition and written history is but as a few months, who that is competent to form an opinion can doubt?" But after this long period of quiet, from some source great torrents of water came rolling through the cave. We know this to be so, because in places

it broke up this layer of stalagmite and washed it away, as well as large portions of the breccia below, and after the floods had ceased, occasionally inundations still threw down layers of mud and silt. This accumulation is known as cave earth, and is the layer containing the numerous remains of the Cave-men. Here the explorers were not only struck with the large number of implements, but at once noticed that they were of a higher form and better made. Instead of the rude and massive implements of the Drift tribes, we have more delicate forms chipped all around. And we also meet with those that from their form may have been used as the heads of spears or arrows. Flakes were also utilized for various purposes. We also find implements, weapons, and ornaments of bone—a step in advance of Drift culture. They had "harpoons for spearing fish, eyed needles or bodkins for stitching skins together, awls perhaps to facilitate the passage of the slender needle through the tough, thick hides; pins for fastening the skins they wore, and perforated badgers' teeth for necklaces or bracelets."[6] Nothing of this kind has yet been shown as belonging to the men of the Drift.

The bones of a large number of animals are also found in the cave earth. The most abundant is the hyena, and no doubt they dragged in a great many others; but the agency of man is equally apparent, as the bones have often been split for the extraction of marrow. Besides bones of the hyena, we have also those of the lion, tiger, bear, and reindeer.[7]

With these animals man, from time to time, disputed possession of the cave. At one place on the surface of the cave earth is found what is known as the "black band." This is nothing more or less than the fire-place of these old tribes. Here we find fragments of partially consumed wood, bones showing the action of fire—in short, every thing indicating a prolonged occupancy by man.

No one can doubt but that this deposit of cave earth itself requires a prolonged time for its accumulation.[8] But this period, however prolonged, at length comes to an end. From some cause, both animals and man again abandoned the cave. Another vast cycle of years rolls away—a time expressed in thousands of years—during which nature again spread over the entombed remains a layer of stalagmite, in some places equal in thickness to the first formation. Above this layer we come to a bed of mold containing remains of the later Stone Age, of the Bronze, and even of the Iron Age. Below the first layer of stalagmite—the completed biography of Paleolithic times; above, the unfinished book of the present. Such are the eloquent results obtained by the thorough exploration of one cave. The results of all the other explorations, in a general way, confirm these. Mr. Dawkins explored a group of caverns in Derbyshire, England. These caverns and fissures are situated in what is known as Cresswell Crags, the precipitous sides of a ravine through which flows a stream of water dividing the counties of Derby and Nottingham.

This cut represents the different strata in Robin Hood cave. It will be seen that, at one place, the stalactite has united with the stalagmite below. It is not necessary to go into the details of this exploration. All the relics of man found in *d*, *c*, and the lower portions of *b*, are the rude and massive forms peculiar to the River Drift tribes. But the relics found in the breccia *a*, and the upper portion of the cave earth *b*, denote a sudden advance in culture. The rude tools of the lower strata are replaced by more highly finished ones of flint.

The most important discovery was that of a small fragment of rib, with its polished surface ornamented with the incised figure of a horse. The peculiar value of this discovery is, that it serves to connect the Cave-men of England with those of the continent who, as we shall afterward see, excelled in artistic work of this kind.

In another cave of this series, in association with similar flints, were found the following bone implements. We can only conjecture the use of the notched bone. The pieces of reindeer horn, terminating in a scoop, may have served as a spoon to extract marrow.

We must not fail to notice that the more highly finished relics of the Cave-men are found in strata overlying those of the River Drift; and, in the case of Kent's Cavern, these two sets of implements are separated by a layer of stalagmite requiring a very prolonged time for its formation. This would imply that the Cave-men came into England long after the tribes of the River Drift; and, judging from the relics themselves, they must have been a distinct people. We must recall how completely the climate and animals in England varied during the Glacial Age. We have also seen how closely connected the River Drift tribes were with the animals of the warm temperate regions. Coming at a later date, totally distinct from them in culture are those Cave-men—perhaps they may prove to be associated with the Arctic animals. But, before speculating on this point, we must learn the results attending the exploration of the caves of Belgium, France, and other countries on the continent of Europe.

In the valley of the river Meuse (Belgium), and its tributaries, have been found a number of caves and rock-shelters. It was in the caves of the Meuse that Schmerling made his explorations. When the real value of his work was recognized, the Belgian government had a thorough exploration made by M. Dupont, director of the Royal Museum in Brussels. This gentleman scientifically examined forty-three of these resorts. His opinions, therefore, are deserving of great weight; but, unfortunately, they are not accepted by all. These caves vary greatly in size—many being mere rock-shelters. From their position, we are at once struck with the

prolonged period of time necessary to explain their formation. They are found at very different heights along the river's bank. In one case two caves are so situated that the river must have sunk its bed nearly two hundred feet between the time of their formation.[9]

M. Dupont thinks the evidence very clearly points to the presence of two distinct stages in cave life—one of which he calls the Mammoth period, and the other, which is more recent, the Reindeer. It is, however, known that the mammoth lived all through the Reindeer epoch, if not to later times; so the names bestowed on these periods do not seem very appropriate. We can readily see, however, that, while the names might be wrong, the two periods might be reality. In many cases, the same cave contained remains of both stages, separated by layers of cave earth, and it is noticed that, in such cases, those of the Reindeer stage are invariably of a later date. In general terms, M. Dupont finds that the implements of the Mammoth period are of a rude make, consisting of a poor kind of flint, and poorly finished. But, in beds of the Reindeer epoch, the flint implements consist, principally, of well-shaped blades and flakes—with numerous bodkins, or awls—javelins, or arrow-heads —besides articles of bone and horn such as harpoons, and teeth of various animals drilled as if suspended for ornaments. Their workmanship indicates decidedly more skill than that of the implements obtained from the lower levels. But the most remarkable finds of the Reindeer epoch consist of portions of reindeer horn, showing etchings or engravings which have been traced by some sharp point, no doubt by a flint implement. One small bit of horn has been cut or scraped so as to present the rude outline of a human figure.

So far the evidence seems to bear out the same conclusions as do those of the British caves, though it also shows that the men of the Drift inhabited caves quite extensively. We must remember, however, that the greatest wealth of cave relics belongs to the so-called Cave-men, but that savage tribes have always resorted to

caves as a place for occasional habitation.[10]

It is in France that we find the greatest wealth of relics of Cave-men. Sir John Lubbock has left us a description of the valley of the Vezère, where these caverns occur. The Vezère is a small tributary of the Dordogne. "The rivers of the Dordogne run in deep valleys cut through calcareous strata: and while the sides of the valley in chalk districts are generally sloping, in this case, owing probably to the hardness of the rock, they are frequently vertical. Small caves and grottoes frequently occur: besides which, as the different strata possess unequal power of resistance against atmospheric influence, the face of the rock is, as it were, scooped out in many places, and thus 'rock- shelters' are produced. In very ancient times these caves and rock-shelters were inhabited by men, who have left behind them abundant evidence of their presence.

"But as civilization advanced, man, no longer content with the natural but inconvenient abode thus offered to him, excavated chambers for himself, and in places the whole face of the rock is honey-combed with doors and windows, leading into suits of rooms, often in tiers one over the other, so as to suggest the idea of a French Petra. Down to a comparatively recent period, as, for instance, in the troublous times of the Middle Ages, many of these, no doubt, served as very efficient fortifications, and even now some of them are in use as store- houses, and for other purposes, as, for instance, at Brantome, where there is an old chapel cut in solid rock.

"Apart from the scientific interest, it was impossible not to enjoy the beauty of the scene which passed before our eyes, as we dropped down the Vezère. As the river visited sometimes one side of the valley, sometimes the other, so we had at one moment rich meadow lands on each side, or found ourselves close to the perpendicular and almost overhanging cliff. Here and there we came upon some picturesque old castle, and though the trees were not in full leaf, the rocks were, in many places, green with box and

ivy and evergreen oak, which harmonized well with the rich yellow brown of the stone itself."[11]

Thus it will be seen this valley has been a favorite resort for people at widely different times, and amongst others, the cave dwellers of the Paleolithic Age. As in the caves of Belgium, some of them are at a considerable height above the stream, while others are but little above the present flood line. Mr. Dawkins refers us to the results of the exploration of a French scientist in one of the grottoes of this section, which seem to be exactly similar to the results obtained from the caves of Cresswell Crags and Kent's Cavern. The implements obtained from the two lower strata are rough choppers and rude flakes of jasper and other simple forms. Above these beds was a stratum of black earth, underneath a sheet of stalagmite. Here were found implements of a far higher type: those of flints, consisting of flakes, saws, and scrapers, with finely chipped heads and arrow-heads, and awls and arrow-heads of bone and antler.[12] Now these results can only be interpreted as were those in the English caverns. The lower and ruder implements belong to the men of the Drift; the later and more polished ones to the Cave-men.

Most of the relics obtained from these caverns belong to the Cave-men proper. However, the implements from one of them, known as Le Moustier, are of a rude type, and may belong to those of the Drift. But most of them are of superior make and finish. These specimens are all from caves in this vicinity.[13]

We have seen that the men of the Drift were very widely scattered over the earth. We find, however, that the Cave-men had a much more limited range. Dr. Fraas has shown their presence in Germany. At Schussenreid, in Bavaria, was found an open air station of these people. It was evidently a camping- ground, one of the few places where proofs of their presence have been discovered outside of caves. Here we found the usual *débris,* consisting of

broken bones, charcoal, blackened hearth-stone, and implements of flint and horn. We must stop a minute to notice a bit of unexpected proof as to the severity of climate then prevailing in Europe. This deposit was covered up with sand, and on this sand were the remains of moss, sufficiently perfect to determine the kind. We are assured that it is composed of species now found only in Alpine regions, near or above the snow-line, and in such northern countries as Greenland and Spitzbergen.[14] Dr. Fraas also proved their presence in several caves in Suabia. One known as the Hohlefels Cave was very rich in these relics. They have been found in Switzerland, as at Thayengen; but are not found south of the Alps or the Pyrenees. Men, indeed, inhabited caves in Italy, but they did not use the implements characteristic of the Cave-men.[15] Mr. Dawkins points out that this range corresponds very nearly to that of the northern group of animals, thus differing widely from the men of the River Drift. In this connection we must notice that the reindeer is the animal whose remains are most commonly met with in the *débris* they have left in the caves. This animal surely testifies to a cold climate. We are thus justified in concluding that the Cave-men are associated with the Arctic group of animals.[16]

We must now turn our attention to the culture of the Cave-men. We must reflect that long ages, with great changes of climate and life, both animal and vegetable, have rolled away since the remains of these early races were sealed by the stalagmite formation in caves. The relics at their best are but scanty memorials of a people long since passed, and we can not expect, can not hope, to recover more than a general outline. But this will be found full of interest, for it is a picture of Paleolithic life and times existing in Europe long ages before the pyramids of Egypt were uplifted.

With respect to habitations, we have already seen that he took up his abode in caves, at least where they were suitable. According to their depth and the light penetrating them, he either occupied the whole extent of them, or established himself in the outlet only.

About the center of the cave some slabs of stone, selected from the hardest rock such as sandstone or slate, were bedded down in the ground, and formed the hearth for cooking his food. But in no country are such resorts sufficiently numerous to shelter a large population; besides, they, are generally at some distance from the fertile plains, where game would be most abundant. In such cases they doubtless constructed rude huts of boughs, skins, or other materials. Such an out-door settlement was the station at Solutré, France, where has been found an immense number of bones of horses, reindeers, also, though in less abundance, those of elephants, aurochs, and great lions.[17]

Where no cave presented itself, these people made for themselves convenient sheltering places under the cover of some great overhanging rock. In various places in France such resorts have been discovered. The name of "rock shelters" has been given to such resorts. In such places, where we may suppose they built rude huts, are found rich deposits of the bones of mammals, birds, and fishes, as well implements of bone and horn.

We have frequently referred to the presence of hearths, showing that they used fire. Like other rude races, it is probable that they obtained fire by the friction of one piece of wood upon another. M. Dupont found in one of the Belgium caves a piece of iron pyrites, from which, with a flint, sparks could be struck.

Speculations have been indulged as to the probable condition of man before he obtained a knowledge of fire. If the acquisition of fire be regarded as one of the results of human endeavor, it must surely be classed as one of the most valuable discoveries which mankind has made. We do not believe, however, that we shall ever discover relics of races or tribes of men so low in the scale as to be ignorant of the use of fire. Even some of the flints which M. Bourgeois would refer to the Miocene Age show evidence of its action.[18]

The men of the Caves supported life by hunting. But a very small part of their food supplies could have been drawn from the vegetable kingdom. When the climate was so severe that Alpine mosses grew at Schussenreid, acorns and like nuts would be about all they could procure from that source. The animals hunted by the Cave-men were principally reindeer, horses, bisons, and, occasionally mammoths and woolly rhinoceros. But they were not very choice in this matter, as they readily accepted as food any animal they could obtain by force or cunning. Wolves and foxes were not rejected, and in one cave large numbers of the bones of the common water rat were obtained. We know what animals were used as food, because we find their bones split for the purpose of procuring the marrow they contained. This was evidently to them a nutritious article of diet, since they were careful to open all the bones containing it, and bones so split are frequently the only means of detecting the former presence of man in some bone caves.

We must not forget that at that time the shore of the Atlantic Ocean, during a large part of the Paleolithic Age, was situated much farther west than it is now, and so in all probability many refuse heaps are now underneath the waves. From certain drawings that are found in some French caves, we know they were used for hunting both seals and whales.

We can not doubt that the capture of a whale afforded as much enjoyment to them as it does to a tribe of Eskimos now. Bones of birds and fishes are found in many instances. The salmon appears to have been a favorite among fishes. Among the birds are found some species now only living in cold countries, such as the snowy owl, willow grouse, and flamingo. This is but another proof that the climate of Europe was then very cold.

The Cave-men were not afraid to attack animals greatly superior to them in strength. In the Hohlefels Cave in Germany were found

great quantities of the broken and split bones of cave bears, an animal very similar to the grizzly, and probably its equal in strength. The reindeer was the main reliance of these tribes. Its bones are found in great abundance, and it doubtless was to them all it is to the Lapps of Europe to-day, except, of course, that it was not domesticated.

Though fire would naturally suggest some rude method of cooking, we can scarcely find a trace of such operations, and it has been a matter of conjecture how they proceeded. Sir John Lubbock thinks they boiled their food, and in the absence of pottery used wooden or skin vessels, bringing the water to a boiling point by means of stones heated red hot and thrown into the water. He points out the presence of peculiarly shaped stones found in some caves, which he thinks were used for this purpose.[19] It is not supposed they had any articles of pottery during this epoch. This is quite an important point, because a knowledge of pottery marks an important epoch in the culture of a people.

A people possessed of this knowledge have passed from Savagism into the lower status of Barbarism.[20] A piece of pottery is as little liable to destruction as a piece of bone, and so, had those people possessed pottery, there is no reason why pieces of it should not be found in every refuse heap, and amongst the *débris* of all caves. But such is not the case; no fragments of pottery have yet been found which can be referred with confidence to the epoch of the Cave-men.[21]

Some speculations have been indulged in as to whether the men of this age were cannibals or not. It need occasion no surprise if they were, since ancient writers assert that even during historical times this practice prevailed in Europe.[22] Though not definitely proven there are many facts difficult of explanation, except on this supposition. However, it may well be that this, after all, only amounted to the custom of eating parts of an enemy killed in

battle, as certain modern savages do that we would not call cannibals.[23]

It is not necessary to speak at much length of the methods of hunting. They had bows and arrows, daggers of reindeer horn, spears tipped with flint or bone, and harpoons. Besides, they made a formidable club of the lower jaw-bone of the cave-bear with its canine tooth still left in its place. Fishing with nets is not supposed to have been known, Harpooning was probably their favorite way. M. G. DeMortillet thinks they fished as follows: They fastened a cord to the middle of a small splinter of bone. This was then baited, and when swallowed by the fish, was very certain to get caught in the body.[24]

We know that rude tribes of to-day have many means of snaring animals. Doubtless similar scenes were enacted on their primeval hunting-grounds. French books contain illustrations of the men of this period driving game over precipitous sides. They had no dogs to assist them in the hunt, and though reindeer were around them in great abundance, it is not supposed that they thought of domesticating them.

Man is the only animal which seeks to protect his body from the Summer's heat or the cold of Winter by the use of clothing. We are, unfortunately, not able to present many details of the dress of man during the early Stone Age. We are, however, quite certain that when the climate was severe enough to permit such animals as the musk-sheep and the reindeer to inhabit South- western Europe, man must have been provided with an abundance of warm clothing, though doubtless rudely made and fashioned. Many reindeer horns found in France are cut and hacked at the base in such a way as to indicate that it was done when removing the skins. We also know that the rudest of savage tribes are never at a loss for some process of tanning hides and rendering them fit for use. From the immense number and variety of scrapers found among the cave *débris.* we are sure the preparation of clothing

occupied no inconsiderable portion of their time. We also find numerous awls and splinters of flint and bone, which they doubtless used in exactly the same manner as similar tools are used by the Lapps to-day in Europe, that is, to pierce holes in the hides, through which to pass their rude needle and thread. The needles are made of reindeer horn, and they were not only smoothly polished, but the eyes are of such a minute size, and withal so regularly made, that many at first could not believe they were drilled by the use of flint alone. This, however, has been shown to be the case by actual experiments. The thread employed was reindeer tendons, for bones of these animals are found cut just where they would he cut in removing these tendons. This cut shows that they protected their hands by means of long gloves of three or four fingers.[25]

We have thus far been considering those arts which pertain more directly to living. We have presented some sketches found engraved on pieces of bone. We first noticed this among the relics found in one of the Creswell caves in England. It was also noticed in Belgium. It was among the Cave-men of Southern France that this artistic trait became highly developed. Among the reindeer hunters of the Dordogne were artists of no mean ability. We must pause a minute and mark the bearing of this taste for art. We have seen many reasons for supposing the men of the caves much farther advanced in the scale of culture than those of the Drift, but we have also seen that we can not rank them higher than the highest grade of savages.

Sir John Lubbock thus speaks of them: "In considering the probable condition of these ancient Cave-men, we must give them full credit for their love of art, such as it was; while, on the other hand, the want of metal, of polished flint implements, and even of pottery, the ignorance of agriculture, and the apparent absence of all domestic animals, including even the dog, certainly imply a very low state of civilization."[26]

They were certainly not as far advanced in civilization as the next race we will describe, yet the Neolithic people had no such skill as was possessed by the cave-men. This need not surprise us, because "an artistic feeling is not always the offspring of civilization, it is rather a gift of nature. It may manifest its existence in the most barbarous ages, and may make its influence more deeply felt in nations which are behind in respect to general progress than in others which are more deeply advanced in civilization."[27]

In regard to the objects themselves, a glance at the illustrations show us that they are quite faithful sketches of the animals at that time common. As might be expected, sketches of the reindeer are numerous. This cut is regarded as the highest example of Paleolithic art, sketched on a piece of horn and found in Switzerland. The animal is grazing, and the grass on which it feeds is seen below. We have on a piece of slate the outlines of a group of reindeer, generally considered as representing a fight, though it may mean a hunt, and that the hunter has succeeded in killing a portion of the herd. Some, as we see, are on the ground.

It would be exceedingly interesting could we but find well executed sketches of the men of this period, but, unfortunately, with one or two exceptions, no representations, however rude, have yet been discovered of the human form. Perhaps an explanation of this fact may be found in the well-known reluctance of savage tribes to have any engravings taken of themselves, and we can well imagine that if any one was known to make drawings of human beings he would be regarded with suspicious distrust, and it would hardly be a safe accomplishment to possess. One very curious group represents a man, long and lean, standing between two horses' heads, and by the side of a long serpent or fish, having the

appearance of an eel. On the reverse side of this piece of horn were represented the heads of two aurochs or bisons. Mr. Dawkins thinks this also represents a hunting sketch, and that the man is in the act of striking one of the horses with a spear.

On, a fragment of spear-head found in France several human hands were engraved, but having only four fingers each. On this point Mr. Lartet assures us that some savage tribes still depict the hand without the thumb.[28] Representations of birds and reptiles are very rare; fishes are more common. On a piece of reindeer's horn was found this representation of the head and chest of an ibex. Of special interest to us is a representation of a mammoth found engraved on a piece of mammoth tusk in one of the Dordogne caves. We have no doubt that the artist who engraved it was perfectly familiar with the animal itself.

Their artistic skill was not confined to the execution of drawings. They frequently carved pieces of reindeer horn into various animal forms. Our next cut shows us a dagger, the handle of which is carved to imitate a reindeer. It will be seen how the artist has adapted the position of the animal to the necessities of the case. Flowers are very seldom represented; but one implement from France has a very nice representation of some flowering plant engraved on it.

Take it all in all, the possession of this artistic instinct is certainly remarkable—the more so when we remember the rudeness of his surroundings, and the few and simple means at his command for work. "A splinter of flint was his sole graving tool; a piece of reindeer horn, or a flake of slate or ivory, was the only plate on which primitive man could stamp his reproduction of animated nature."[29]

Some speculations have been indulged in as to whether we have any traces of a government amongst the Paleolithic people. That they had some chief or leader is more than probable. In the caves of France we find a number of fragments of reindeer horn. Generally speaking, they show evidence of a good deal of care in making them. They are carved and ornamented with sketches of various animals, and invariably have one or more holes bored in the base. The idea has been quite freely advanced, that these are emblems of authority.[30] And some have pointed out, that, though they are too light for use as weapons, yet, their "frequent occurrence, and uniformity of type, show that they possess a conventional significance."[31] Mr. Geikie says that these conjectures "are mere guess-work."[32] And Mr. Dawkins points out that they are very similar in design and ornament with an implement of the Eskimos known as an "arrow-straightener."[33]

Whatever may be our conclusions in regard to these ornamented pieces of reindeer horn, we can not doubt but that their social instincts found expression in some sort of alliance for the common good. This is shown by several facts: such, for instance, as the evidence of trade or barter between localities considerable distances apart. The inhabitants of Belgium must have gone to what is now Southern France to procure the flint they used. They also procured, from the same source, fossil sea- shells, which they valued highly.[34] We also notice the fact, that certain localities appear to have been used as the place of manufacture for certain articles, to the exclusion of others. In other words, the primitive people appear to have learned the great utility of a division of labor. One of the caves in Belgium appears to have been used as a place to make flint implements. Over twenty thousand articles of flint were found in this cave.[35] In France, while in one cave the implements were all of the spear-head type, in a neighboring cave horn was almost the only article used in the manufacture of implements. We must not, however, form an exalted idea of their trade—it was simply barter in a rude state of society.[36]

Various opinions have been held as to whether we have any trace of a religious belief. Theoretically speaking, they had some sort of a religion, though doubtless very vague and indistinct; for we know of no nation as far advanced as they were destitute of it.[37] It has been pointed out, that the bones of some animals, as the horse, were very rare, and their absence explained as the result of superstitious reasons. It has also been conjectured that some of the perforated bones and teeth of animals found in various deposits were amulets worn for religious purposes; and some have gone so far as to infer, that the ornamentations on some of these so-called amulets represent the sun, and that, consequently, sun-worship prevailed among the Cave-men. While these various conjectures are, of course, possible, it is equally certain they are all "mere guess-work."

Early explorers describe with considerable degree of confidence the manner of burial among the Cave-men, and inferred from the remains found buried with the bodies that they had some notion of a life beyond the grave—and, accordingly, placed near the body food and drink to support him on his journey, weapons wherewith to defend himself, and his favorite implements, so that, arrived at the land of spirits, he would be well provided for. These result are not borne out by later investigations. The instance mentioned most prominently, that of the burial cave at Aurignac, France, has been shown to have no bearing on the question, as every thing indicates that the burials were of a much later date.

We have yet a most important question before us—one that is still engaging the attention of scientific men in Europe. That is the question of race. Who were these early tribes? Are they in any way connected with the men of the Drift? Have we any representations

of them now living upon the earth? On these questions there is quite a diversity of opinion. In various caves in France and Belgium, skulls and other bones of the human skeleton have been found. These have been studied with care by the best scholars in Europe; and B. Carfares has set forth the results in his various works, in which he connects them, not only with the men of the River Drift, but with the race of men that inhabited Europe during the succeeding Neolithic Age, and, indeed, with men now living in France and Belgium.

There is no question as to the correctness of these inferences — the only one is, whether the skulls and fragmentary skeletons are really remains of the Cave-men. This must be made perfectly clear and unquestioned before we are to accept them. Mr. Darkens reviews the various cases where skeletons have been found in caves.[38] He points out that, in every instance, very serious doubts can be raised as to whether they are really remains of the Cave-men or not.

Until these objections are met, we do not see how the opinion of B. Carfares (above) can be accepted. But if these instances are not accepted, then, in all other instances where there is no doubt, the remains are in such a fragmentary condition that no conclusion can be made from them. So as far as remains of the human skeleton are concerned, we can form no conclusions as to the race to which the Cave-men belonged.

We have already noted, that the Cave-men came into Europe much later than the men of the Drift, and that their range was very limited, corresponding, in fact, with that of the northern group of animals. When the cold of the Glacial Age passed away, the musk-sheep, reindeer, and other animals, were driven out of Europe. They are found now only in high northern latitudes, such as Greenland. Mr. Darkens thinks that there, also, are to be found the Cave-men of the Paleolithic Age, now known as the Eskimos. Though not accepted by all authorities, yet some of our best

scholars find much to commend in this theory.

We have undoubted proofs that, in America, the Eskimos formerly lived much farther south.[39] And Dr. Abbot thinks the Paleolithic implements discovered in New Jersey, bearing such striking resemblance to those of Europe, are undoubtedly their work.[40] Therefore, there is no absurdity in asserting that they once lived in Western Europe; the more so, when we reflect that the climate, the animals—in fact, all their surroundings— must have been similar to those of their present habitats.

When we come to examine the customs and habits of these Eskimos, we are at once struck with their resemblance to what we have seen was the probable state of life among the Cave-men. At Solute, for instance, we have vast refuse heaps of bones of animals. We find similar heaps around the rude huts of the Eskimos to-day. Captain Parry describes one as follows: "In every direction round the huts were lying innumerable bones of walruses and seals, together with skulls of dogs, bears, and foxes."[41]

Other points of comparison strike us when reading Sir John Lubbock's account of their habits and customs. For instance: "Their food, if cooked at all, is broiled or boiled; their vessels, being of stone or wood, can not, indeed, be put on the fires, but heated stones are thrown in until the water becomes hot enough and the food is cooked." "Their food consists principally of reindeer, musk-ox, walrus, seals, birds, and salmon. They will, however, eat any kind of animal food. They are very fond of fat and marrow, to get at which they pound the bones with a stone." "The clothes of the Eskimos are made from the skins of the reindeer, seals, and birds, sewn together with sinews. For needles they use the bones of either birds or fishes." "The Eskimos have also a great natural ability for drawing. In many cases they have made rude maps for our officers, which have turned out to be substantially correct. Many of their bone implements are covered with sketches."

In this cut we have a bone drill on which are sketched reindeer, geese, a braider or flat-bottomed boat, a tent around which various articles of clothing are hung up to dry, a woman apparently engaged in the preparation of food, and a hunting scene.

Now, we know that savage tribes, widely separated by time and space, will, after all, under the pressure of common necessities, invent much the same implements and live much the same life. But still, where every thing seems to coincide, the climate, the animals, the mode of life proved the same, and especially when both are seen possessed of a common artistic skill, together with the known fact that in the Western Continent the Eskimos did formerly live much farther south; there is surely a strong case made out, and therefore the probabilities are that the Eskimos are the representatives of the Cave-men of Europe.[42] And yet we must be cautious on this point; or rather we remember that the phrase, "predecessors of the Eskimos," does not imply that they were in all respects like them. An examination of the rude sketches of the Cave-men left by themselves seems to indicate that the whole body was covered with hair. "The hunter in the Antler from Duluth Cave has a long, pointed beard, and a high crest of hair on the poll utterly unlike the Eskimo type. The figures are also those of a slim and long-jointed man."[43]

This completes our review of the Paleolithic people, and it only remains to present some general conclusions. The Glacial or Pleistocene Age is seen to have been of immense duration, and characterized by great changes in climate. We have found that two races of men occupied Europe during this time. The men of the River Drift are the most ancient.

We have seen that they can be traced over wide-extended areas. They seem to have invaded Europe, along with the great invasion of animals from Asia, constituting the temperate group of animals; and with those animals they probably shifted back and forth, as the

cold of the Glacial Age increased or waned. These people seem to have completely vanished. At a later date, when the cold of the Glacial Age was once more severe, associated with animals now living only in high northern latitudes, came the Cave-men, whose discussion has formed the subject of this chapter.

It will be seen how much we owe to patient investigators. The results are, indeed, bewildering. They make us acquainted with a people the very existence of whom was not known a few years back. Though the whole life of those ancient races seemed hopelessly lost in the night of time, the gloom is irradiated by the light of modern science, which lays before our astonished vision the remains of arts and industries of the primitive tribes that occupied Europe during the morning-time of human life.

REFERENCES

The manuscript of this chapter was submitted to Prof. B. B. Wright, of Overlain, for criticism.

On the formation of caves consult Geikie's "Prehistoric Europe," p. 71; also Evans's "Ancient Stone Implements," p. 429.

Evans's "Ancient Stone Implements," p. 445.

Pronounced Bret'-chá, a rock composed of fragments of older rock, united by a cement.

Geikie's "Prehistoric Europe," p. 92.

Pengelly, quoted by Geikie, "Prehistoric Europe," p. 93.

Evans's "Ancient Stone Implements," p. 462.

Evans's "Ancient Stone Implement," p. 463.

Geikie's "Prehistoric Europe," p. 102.

Mr. Dawkins ("Early Man in Britain," p. 203) does not consider M. Dupont justified in dividing the remains found in the caverns of Belgium into two epochs. He considers them to be the remains of the same people, some tribes being, perhaps, farther advanced than others. Mr. Dawkins is, of course, high authority, but we think his argument could also be applied to

prove there was no real difference between the men of the River Drift and the so-called Cave-men. This, in fact, is the opinion of many, including Mr. Evans, who is exceptionally well qualified to judge of these remains. We think, however, in view of the evidence adduced by Mr. Pengelly, Mr. Geikie, Mr. Dawkins, and others, few will venture to doubt that there is a wide difference between the men of the River Drift and those of the Caves.

"Prehistoric Times," p. 330.

"Early Man in Britain," p. 198.

French writers make four divisions of these caves, according to the degree of finish, which the specimens show. Mr. Dawkins does not think the difference in the implements sufficient to justify this view. With the possible exception of Le Moustier, as stated above, we think his view correct, which is also the opinion of Mr. Evans. ("Ancient Stone Implements," p. 439.)

Rau's "Early Man in Europe," p. 88.

Dawkins's "Early Man in Britain," p. 205.

Ibid., p.

It is, however, thought that the station was used as a camping-ground by very different people, at widely different times.

Lubbock's "Prehistoric Times," p. 434.

"Prehistoric Times," p. 335.

Morgan's "Ancient Society," p. 12.

Lubbock's "Prehistoric Times," p. 338. J. C. Southall, in his valuable work, "Recent Origin of Man," p. 195, *et seq.*, argues that pottery was known at this time, and cites instances where it is stated to have been found. This is the opinion of Figuier also. ("Primitive Man," p. 54.) But Mr. Dawkins points out that these pieces of pottery are clearly of a Neolithic style, and does not think it proven that they are of Paleolithic age. Mr. Geikie also denies that there is any proof that they were acquainted with the potter's art. ("Prehistoric Europe," p. 18.) So the highest place in the scale of civilization we can assign these people to is that of Upper

Savageism.

Rau's "Early Man in Europe," p. 79;

Geikie's "Prehistoric Europe," p. 22.

Figuier's "Primitive Man," p. 90.

Dawkins's "Early Man in Britain," p. 210.

"Prehistoric Times," p. 341.

Figuier's "Primitive Man," p. 105.

Figuier's "Primitive Man," p. 111.

Figuier's "Primitive Man," p. 105.

Figuier's "Primitive Man," p. 102.

Rau's "Early Man in Europe," p. 73.

"Prehistoric Europe," p. 18.

Dawkins's "Early Man in Britain," p. 237.

Figuier's "Primitive Man," p. 117.

Ibid., p. 118.

Ibid., pp. 94 and 95.

This, as Sir John Lubbock points out, depends on our meaning of the word "religion." ("Prehistoric Times," p. 589.)

"The principal instance are Cro-Magnon, Frontal, and Furforz, in Belgium; Aurignac, Bruniquel, and Mentone, in France." "Cave-Hunting," chap. vii.

"Contributions to N. A. Ethnology," vol. i, p. 102; "U.S. Geographical Survey West of the 100th Meridian," vol. vii, p. 12; Abbott's "Primitive Industry," p. 517.

"Primitive Industry," 518.

Quoted by Lubbock,"Prehistoric Times," p. 507.

Dawkins's "Early Man in Britain," p. 242.

Prof. Grant Allen, *Popular Science Monthly,* November, 1882, p. 99.

Chapter V

ANTIQUITY OF THE PALEOLITHIC

AGE.[1]

Interest in the Antiquity of man—Connected with the Glacial Age—The Subject Difficult—Proofs of a Glacial Age—State of Greenland to-day—The Terminal Moraine—Appearance of the North Atlantic—Interglacial Age—Causes of the Glacial Age—Croll's Theory—Geographical causes—The two theories not Antagonistic—The date of the Glacial Age—Probable length of the Paleolithic Age—Time since the close of the Glacial Age—Summary of results.

WE have already remarked, geological periods give us no insight as to the actual passage of years. To say that man lived in the Glacial Age, and that we have some faint traces of his presence in still earlier periods, after all conveys to our minds only vague ideas of a far-away time. The more a geologist studies the structure of the earth, the more impressed is he with the magnitude of the time that must have passed since "The Beginning." At present, however, there are no means known of accurately measuring the time that has passed. It is just as well that it is so, since, were it known, the human mind would be utterly incapable of comprehending it. But as to the antiquity of man, it is but natural that we should seek more particularly to solve the problem and express our answer in some term of years.

Now, we have seen that the question of the antiquity of man is intimately connected with that of the Glacial Age. That is to say, the relics of man as far as we know them in Europe, are found under such circumstances that we feel confident they are not far removed from the period of cold. For it will be found that those conservative scholars who do not think that man preceded the Glacial Age, or inhabited Europe during the long course of years included in that period, do think he came into Europe as soon as it

passed away. So, in any case, if we can determine the date of the Glacial Age, we shall have made a most important step in advance in solving the problem of the antiquity of man himself. So it seems to us best to go over the subject of the Glacial Age again, and see what conclusions some of our best thinkers have come to as to its cause, when it occurred, and other matters in relation to it.

It is best to state frankly at the outset that this topic is one of the great battle-grounds of science to-day, and that there are as yet but few points well settled in regard to it. One needs but attempt to read the literature on this subject to become quickly impressed with the necessity of making haste slowly in forming any conclusions. He must invoke the aid of the astronomer, geologist, physical-geographer, and physicist. Yet we must not suppose that questions relating to the Glacial Age are so abstruse that they are of interest only to the scholar. On the contrary, all ought to be interested in them. They open up one of the most wonderful chapters in the history of the world. They recall from the past a picture of ice-bound coasts and countries groaning under icy loads, where now are harbors enlivened by the commerce of the world, or ripening fields attesting the vivifying influence of a genial sun. Let us, therefore, follow after the leaders in thought. When we come to where they can not agree we can at least see what both sides have to say.

Somewhat at the risk of repetition, we will try and impress on our readers a sense of the reality and severity of the Glacial Age. There is danger in regarding this as simply a convenient theory that geologists have originated to explain some puzzling facts, that it is not very well founded, and is liable to give way any day to some more ingenious explanation. On the contrary, this whole matter has been worked out by very careful scholars. "There is, perhaps, no great conclusion in any science which rests upon a surer foundation than this, and if we are to be guided by our reason at all in deducting the unknown from the known, the past from the

present, we can not refuse our assent to the reality of the Glacial Age of the Northern Hemisphere in all its more important features.[2] At the present day glaciers do exist in several places on the earth. They are found in the Alps and the mountains of Norway, and the Caucasus, in Europe. The Himalaya mountains support immense glaciers in Asia; and in America a few still linger in the more inaccessible heights of the Sierra Nevada. It is from a study of these glaciers, mainly however, those of the Alps, that geologists have been enabled to explain the true meaning of certain formations they find in both Europe and America, that go by the name of drift.

When in an Alpine valley we come upon a glacier, filling it from side to side, there will be noticed upon both sides a long train of rock, drift, and other *débris* that have fallen down upon its surface from the mountain sides. If two of these ice-rivers unite to form one glacier, two of these trains will then be borne along in the middle of the resulting glacier. As this glacier continues down the valley, it at length reaches a point where a further advance is rendered impossible by the increased temperature melting the ice as fast as it advances. At this point the train of rocks and dirt are dumped, and of course form great mounds, called moraines. The glacier at times shrinks back on its rocky bed and allows explorers to examine it.

In such cases they find the rocks smoothed and polished, but here and there marked with long grooves and striæ. These points are learned from an examination of existing glaciers. Further down the valley, where now the glaciers never extend, are seen very distinctly the same signs. There are the same moraines, striated rocks, and bowlders that have evidently traveled from their home up the valley. The only explanation possible in this case is that once the glaciers extended to that point in the valley.

It required a person who was perfectly familiar with the behavior of Alpine glaciers, and knew exactly what marks they left

behind in their passage, to point out the proofs of their former presence in Northern Europe and America, where it seems almost impossible to believe they existed. Such a man was Louis Agassiz, the eminent naturalist. Born and educated in Switzerland, he spent nine years in researches among the glaciers of the mountains of his native country. He proved the former wide extension of the glaciers of Switzerland. With these results before them, geologists were not long in showing that there had once been glacial ice over a large part of Europe and North America.

The proofs in this case are almost exactly the same as those used to show that the ancient glaciers of Switzerland were once larger than now. But as the great glaciers of the glacial age were many times larger than any thing we know of at the present day, there were of course different results produced.

For instance, the water circulating under Alpine glaciers is enabled to wash out and carry away the mass of pulverized rock and dirt ground along underneath the ice. But when the glaciers covered such an enormous extent of country as they did in the Glacial Age, the water could not sweep away this detritus, and so great beds of gravel, sand, and clay would be formed over a large extent of country. But to go over the entire ground would require volumes; it is sufficient to give the results.

The interior of Greenland to-day is covered by one vast sea of ice. Explorers have traversed its surface for many miles; not a plant, or stone, or patch of earth is to be seen. In the Winter it is a snow-swept waste. In the Summer streams of ice-cold water flow over its surface, penetrating here and there by crevasses to unknown depths. This great glacier is some twelve hundred miles long, by four hundred in width.[3] Vast as it is, it is utterly insignificant as compared with the great continental glacier that geologists assure us once held in its grasp the larger portion of North America.

The conclusions of some of our best scholars on this subject are so opposed to all that we would think possible, according to the present climate and surroundings, that they seem at first incredible, and yet they have been worked out with such care that there is no doubt of the substantial truth of the results.

The terminal moraine of the great glacier has been carefully traced through several States. We now know that one vast sea of ice covered the eastern part of North America, down to about the thirty-ninth parallel of latitude. We have every reason to think that the great glacier, extending many miles out in the Atlantic, terminated in a great sea of ice, rising several hundred feet perpendicularly above the surface of the water. Long Island marks the southern extension of this glacier. From there its temporal moraine has been traced west, across New Jersey and Pennsylvania, diagonally across Ohio, crossing the river near Cincinnati, and thence west across Indiana and Illinois. West of the Mississippi it bears off to the north- west, and finally passes into British America.[4]

All of North America, to the north and northeast of this line, must have been covered by one vast sea of ice.[5] Doubtless, as in Greenland to-day, there was no hill or patch of earth to be seen, simply one great field of ice. The ice was thick enough to cover from sight Mt. Washington, in New Hampshire, and must have been at least a mile thick over a large portion of this area,[6] and even at its southern border it must in places have been from two hundred to two thousand feet thick.[7] This, as we have seen, is a picture very similar to what must have been presented by Europe at this time.[8]

The Northern Atlantic Ocean must have presented a dreary aspect. Its shores were walls of ice, from which ever and anon great masses sailed away as icebergs. These are startling

conclusions. Yet, in the Southern Hemisphere to-day is to be seen nearly the same state of things. It is well-known that all the lands around the South Pole are covered by a layer of ice of enormous thickness. Sir J. A. Ross, in attempting to reach high southern latitudes, while yet one thousand four hundred miles from the pole, found his further progress impeded by a perpendicular wall of ice one hundred and eighty feet thick. He sailed along that barrier four hundred and fifty miles, and then gave up the attempt. Only at one point in all that distance did the ice wall sink low enough to allow of its upper surface being seen from the mast-head. He describes the upper surface as an immense plain shining like frosted silver, and stretching away as far as eye could reach into the illimitable distance.[9]

The foregoing makes plain to us one phase of the Glacial Age. Though it may not be quite clear what this has to do with the antiquity of man, yet we will see, in the sequel, that it has considerable. As to the periods of mild climate that are thought by some to have broken up the reign of cold, we do not feel that we can say any thing in addition to what has been said in a former chapter.[10]

We might, however, say, that the sequences of mild and cold climate are not as well made out in America as they seem to be in Europe; or at least our geologists are more cautious as to accepting the evidence as sufficient. And yet such evidences are not wanting: as in Europe, at various places, are found layers of land surfaces with remains of animals and plants, but both above and below such surface soil are found beds of bowlder clay. These offer undeniable evidence that animals and plants occupied the land during temperate inter-glacial epochs, preceded and followed by an Arctic climate, and ice-sheets like those now covering the interior of Greenland, and the Antarctic Continent.[11]

We have thus, though somewhat at length, gone over the evidence as to the reality and severity of the Glacial Age. It was

during the continuance of such climate that Paleolithic man arrived in Europe, though it was not perhaps until its close. We must not lose sight of the fact that our principal object at present is to determine, if we can, a date for either the beginning or ending of this extraordinary season of cold, and thereby achieve an important step in determining the antiquity of man.

A moment's consideration will show us that a period of cold sufficient to produce over a large portion of the Northern Hemisphere the results we have just set forth must have a cause that is strange and far-reaching. It can not be some local cause, affecting but one continent, since the effect produced is observed as well in Europe as in America.

Every year we pass through considerable changes in climate. The four seasons of the year seem to be but an annual repetition, on a very small scale of course, of the great changes in the climate of the earth that culminated in the Glacial Age; though we do not mean to say, that periods of glacial cold come and go with the regularity of our Winter. The changes in the seasons of the year are caused by the earth's position in its orbit, and its annual revolution around the sun. It may be that the cause of the Glacial Age itself is of a similar nature; in which case it is an astronomical problem, and we ought, by calculation, to determine, with considerable accuracy, dates for the beginning and ending of this epoch.

Nothing is clearer than that great fluctuations of climate have occurred in the past. Many theories have been put forth in explanation. It has been suggested that it was caused by loss of heat from the earth itself. That the earth was once a ball of incandescent matter, like the sun, and has since cooled down, is of course admitted. More than that, this process still continues; and the time must come when the earth, having yielded up its internal heat, will cease to be an inhabitable globe. But the climate of the surface of the earth is not dependent upon the heat of the interior. This now depends "according to the proportion of heat received

either directly or indirectly from the sun; and so it must have been during all the ages of which any records have come down to us."[12] Some have supposed that the sun, traveling as it does through space, carrying the earth and the other planets with him, might, in the course of ages, pass through portions of space either warmer or colder than that in which it now moves. When we come to a warm region of space, a genial climate would prevail over the earth; but, when we struck a cold belt, eternal Winter would mantle a large part of the globe with snow and ice. This, of course, is simply guess-work. No less than seven distinct causes have been urged; most of them either purely conjectural, like the last, or manifestly incompetent to produce the great results which we have seen must be accounted for. But, amongst these, two causes have been advanced—the one astronomical, the other geographical; and, to the one or the other, the majority of scholars have given their consent.

It will be no harm to see what can be said in favor of both theories. So, we will ask the reader's attention, as it is our earnest desire to make as plain as possible a question that has so much to do with our present inquiry. In the course of our investigations, we can not fail to catch glimpses of wonderful changes in far away times; and can not help seeing what labor is involved in the solution of all questions relating to the same.[13]

The earth revolves around the sun in an orbit called an ellipse. This is not a fixed form, but slowly varies from year to year. It is now gradually becoming circular. It will, however, not become an exact circle. Astronomers assure us that, after a long lapse of time, it will commence to elongate as an ellipse again. Thus, it will continually change from an ellipse to an approximate circle, and back again. In scientific language, the eccentricity of, the earth's orbit is said to increase and decrease.

In common language we would state that the shape of the path

of the earth around the sun was sometimes much more elongated and elliptical than at others. The line drawn through the longest part of an ellipse is called the major axis. Now the sun does not occupy the center of this line, but is placed to one side of it; or, in other words, occupies one focus of the ellipse. It will thus be seen that the earth, at one time during its yearly journey, is considerably nearer to the sun than at others. The point where it approaches nearest the sun is called *Perihelion,* and the point where it reaches the greatest distance from the sun is called its *Aphelion.* It will be readily seen that the more elliptical its orbit becomes the greater will be the difference between the perihelion and aphelion distance of the sun. At present the earth is about three millions of miles nearer the sun in perihelion than in aphelion. But we must remember the orbit of the earth is now nearly circular. There have been times in the past when the difference was about thirteen millions of miles. We must not forget to add, that the change in the shape of the earth's orbit is not a regular increase and decrease between well-known extremes. It is caused by the attraction of the other planets. It has been calculated at intervals of ten thousand years for the last million years. In this way it has been found that "the intervals between connective turning points are very unequal in length, and the actual maximum and minimum values of the eccentricity are themselves variable. In this way it comes about that some periods of high eccentricity have lasted much longer than others, and that the orbit has been more elliptical at some epochs of high eccentricity than at others."[14] We have just seen that the earth is nearer the sun at one time of the year than at another. At present the earth passes its perihelion point in the Winter of the Northern Hemisphere, and its aphelion point in the Summer. We will for the present suppose that it always reaches the points at the same season of the year. Let us see if the diminished distance from the sun in Winter has any thing to do with the climate.

If so, this effect will be greatly magnified during a period of high eccentricity, such as the earth has certainly passed through in

the past. We will state first, that the more elliptical the orbit becomes, the longer Summer we have, and the shorter Winter. Astronomically, Spring begins the 20th of March, and Fall the 22d of September. By counting the days between the epochs it will be found that the Spring and Summer part of the year is seven days longer than the Fall and Winter part. But if the earth's orbit becomes as highly eccentrical as in the past, this difference would be thirty-six days.[15]

This would give us a long Spring and Summer, but a short Fall and Winter. This in itself would make a great difference. We must beer in mind, however, that at such a time as we are here considering, the earth would be ten millions of miles nearer the sun in Winter than at present. It would certainly then receive more heat in a given time during Winter than at present.[16] Mr. Croll estimates that whereas the difference in heat received during a given time is now one-fifteenth,[17] at the time we are considering it would be one-fifth. Hence we see that at such a time the Winter would not only be much shorter than now, but at the same time would be much milder.

These are not all the results that would follow an increase of eccentricity. The climate of Europe and North America is largely modified by those great ocean currents—the Gulf Stream and the Japan current. Owing to causes we will not here consider, these currents would be greatly increased at such a time. As a result of these combined causes, Mr. Croll estimates that during a period of high eccentricity the difference between Winter and Summer in the Northern Hemisphere would be practically obliterate. The Winter would not only be short, but very mild, and but little snow would form, while the sun of the long Summers, though not shining as intense as at present, would not have to melt off a great layer of snow and ice, but the ground became quickly heated, and so warmed the air. Hence, if Mr. Croll be correct, a period of high eccentricity would certainly produce a climate in the Northern

Hemisphere such as characterized many of the mild interglacial epochs as long as the earth passed its perihelion point in Winter.

We have so far only considered the Northern Hemisphere. As every one knows, while we have Winter, the Southern Hemisphere has Summer. So at the very time we would enjoy the mild short Winters, the Southern Hemisphere would be doomed to experience Winters of greatly increased length and severity. As a consequence, immense fields of snow would be formed, which, by pressure, would be changed to ice, and creep away as a desolating glacier. It is quite true that the short Summer sun would shine with increased warmth, but owing to many causes it would not avail to free the land from snow and ice.

As Mr. Geikie points out, "An increased amount of evaporation would certainly take place, but the moisture-laden air would be chilled by coming into contact with the vast sheets of snow, and hence the vapor would condense into thick fogs and cloud the sky. In this way the sun's rays would be, to a large extent, cut off, and unable to reach the earth, and consequently the Winter's snow would not be all melted away." Hence it follows that at the very time the Northern Hemisphere would enjoy a mild interglacial climate, universal Spring, so to speak, the Southern Hemisphere would be encased in the ice and snow of an eternal Winter.

But the earth has not always reached its perihelion point during the Winter season of the Northern Hemisphere. Owing to causes that we need not here consider, the earth reaches its perihelion point about twenty minutes earlier each year, so if it now passes its perihelion in Winter of the Northern Hemisphere, in about ten thousand years from now it will reach it in Summer, and in twenty-one thousand, years it will again be at perihelion in Winter. But see what important consequences follow from this. If during a period of high eccentricity we are in the enjoyment of short mild Winters and long pleasant Summers, in ten thousand years this would certainly be changed. Our Summer season would become short and

heated; our Winters long and intensely cold. Year by year it would be later in the season before the sun could free the land from snow, and at length in deep ravines and on hill-tops the snow would linger through the brief Summer, and the mild interglacial age will have passed away, and again the Northern Hemisphere will be visited by snow and ice of a truly. Glacial Age. If, therefore, a period of high eccentricity lasts through the many thousand years, we must expect more than one return of glacial cold interspersed by mild interglacial climates.

We have tried in these last few pages to give a clear statement of what is known as Croll's theory of the Glacial Age. There is no question but what the earth does thus vary in its position with regard to the sun, and beyond a doubt this must produce some effect on the climate, and we can truthfully state that the more the complicated question of the climate of the earth is studied, the more grounds do scholars find for affirming that indirectly this effect must have been very great. And yet we can not say that this theory is accepted as a satisfactory one even by the majority of scholars. Many of those who do not reject it think it not proven. Therefore, before interrogating the astronomer as to the data of the Glacial Age, according to the terms of this theory, let us see what other causes are, adduced; then we can more readily accept or reject the conclusions as to the antiquity of man which this theory would necessitate us to adopt.

The only other cause to which we can assign the glacial cold, that is considered with any favor by geologists, is geographical; that is to say, depending on the distribution of land and water. Glaciers depend on the amount of snow-fall. In any country where the amount of snow-fall is so great that it is not all evaporated or melted by the Summer's sun, and consequently increases from year to year, glaciers must soon appear, and these icy rivers would ere-long, flow away to lower levels. If we suppose, with Sir Charles Lyell, that the lands of the globe were all to be gathered around the

equator, and the waters were gathered around the poles, it is manifest that there would be no such a thing as extremes of temperature, and it is, perhaps, doubtful whether ice would form, even in polar areas.[18] At any rate, no glaciers could be formed, as there would be no land on which snow could gather in great quantities.

If, however, we reverse this picture, and conceive of the land gathered in a compact mass around the poles, shutting out the water, but consider the equatorial region of the earth to be occupied by the waters of the ocean, we would manifestly have a very different scene. From the ocean moisture-laden winds would flow over the polar lands. The snowfall would necessarily be great. In short, we can not doubt but what all the land of the earth would be covered with glaciers.[19]

Although these last conceptions are purely hypothetical, they will serve the good purpose of showing the great influence that the geographical distribution of land and water have on the climate of a country. Of one thing, however, geologists have become more and more impressed of late years. That is, that continents and oceans have always had the same relative position as now; that is to say, the continents have followed a definite plan in their development. The very first part of North America to appear above the waters of the primal sea clearly outlined the shape of the future continent. Mr. Dana assures us that our continent developed with almost the regularity of a flower. Prof. Hitchcock also points out that the surface area of the very first period outlined the shape of the continent. "The work of later geological periods seems to have been the filling up of the bays and sounds between the great islands, elevating the consolidated mass into a continental area."[20] So it is not at all probable that the lands of the globe were ever grouped, as we have here supposed them.

This last statement is liable, however, to leave us under a wrong impression; for although, as a whole, continental areas have been

permanent, yet in detail they have been subject to wonderful and repeated changes. "Every square mile of their surface has been again and again under water, sometimes a few hundred feet deep—sometimes, perhaps, several thousand. Lakes and inland seas have been formed and been filled up with sediment, and been subsequently raised into hills, or even mountains. Arms of the sea have existed, crossing the continent in various directions, and thus completely isolating the divided portions for varying intervals. Seas have become changed into deserts and deserts into seas."[21]

It has been shown beyond all question that North-western Europe owes its present mild climate to the influence of the Gulf Stream.[22] Ocean currents, then, are a most important element in determining the climate of a country. If we would take the case of our hypothetical polar continent again, and, instead of presenting a continuous coast line, imagine it penetrated by long straits and fiords, possessing numerous bays, large inland seas, and in general allowing a free communication with the ocean, we are very sure the effect would be widely different.

Under these circumstances, says Mr. Geikie, the "much wider extent of sea being exposed to the blaze of the tropical sun, the temperature of the ocean in equatorial regions would rise above what it is at present. This warm water, sweeping in broad currents, would enter the polar fiords and seas, and everywhere, beating the air, would cause warm, moist winds to blow athwart the land to a much greater extent than they do at present; and these winds thus distributing warmth and moisture, might render even the high latitude of North Greenland habitable by civilized man." So we see that it is necessary to look for such geographical changes as will interfere with the movements of marine currents.

Now, it is easy to see that comparatively small geographical changes would not only greatly interfere with these currents, but might even cause them to entirely change their course. An elevation of the northern part of North America, no greater in

amount than is supposed to have taken place at the commencement of the Glacial Age, would bring the wide area of the banks of Newfoundland far above the water, causing the American coast to stretch out in an immense curve to a point more than six hundred miles east of Halifax, and this would divert much of the Gulf Stream straight across to the coast of Spain.[23]

Such an elevation certainly took place, and if continued westward, Behring's Strait would also have been closed. It is to such northern elevations, shutting out the warm ocean currents, that a great many geologists look for a sufficient explanation of the glacial cold.

Prof. Dana says: "Increase in the extent and height of high latitude lands may well stand as one cause of the Glacial Age." Then he points out how the rising of the land of Northern Canada and adjacent territory, which almost certainly took place, "all a sequel to the majestic uplift of the Tertiary, would have made a glacial period for North America, whatever the position of the ecliptic, or whatever the eccentricity of the earth's orbit, though more readily, of course, if other circumstances favored it."[24]

It may occur to some that if high northern lands be all that is necessary for a period of cold, we ought to have had it in the Miocene Age, when there was a continuous land connection between the lands of high polar areas and both Europe and America, since we know that an abundant vegetation spread from there, as a center, to both these countries. But at that epoch circumstances were different. The great North Temperate lands were in a "comparatively fragmentary and insular condition."[25] There were great inland seas in both Europe and Asia, through which powerful currents would have flowed from the Indian Ocean to Arctic regions.

Somewhat similar conditions prevailed in North America. The western part was in an insular condition. A great sea extended over

this part of the country, joining the Arctic probably on the north, through which heated water would pour into the polar sea. And so, instead of a Glacial Age, we find evidence of a mild and genial climate, with an abundant vegetation.

We thus see that there are two theories as to the cause of the Glacial Age presented for our consideration. Both of them have received the sanction of scholars eminent for their scientific attainments. On inspection we see they are not antagonistic theories. They may both be true for that matter, and all would admit that whatever effect they would produce singly would be greatly enhanced if acting together. Indeed, there are very good reasons for supposing both must have acted in unison.

There seem to be very good reasons for not believing that the eccentricity of the earth's orbit, acting alone, produced the glacial cold. If that were the case, then whenever the eccentricity was great we should have a Glacial Age. Now, at some period of time during the long-extended Tertiary Age we are certain the eccentricity of the earth's orbit became very great, much more so, in fact, than that which is supposed to have produced the cold of the Quaternary Age. But we are equally certain there was no glacial epoch during this age.[26] What other explanation can we give for its non-appearance except that geographical conditions were not favorable?

But, on the other hand, there are certain features connected with the phenomena of the Glacial Age that seem very difficult of explanation, if we suppose that geographical changes alone produced them. We must remember that evidences of the former presence of glaciers are found widely scattered over the earth. We shall, therefore, have to assume an elevation not only for America and Europe, but extend it over into Asia, and take in the Lebanon Mountains, for they also show distinct traces of glaciers. And this movement of elevation must also have affected the Southern Hemisphere, the evidence being equally plain that at the same

comparatively late date glaciers crushed over Southern Africa and South America.[27] This is seen to prove too much. Again, how can we explain the fact that some time during the Glacial Age we had a submergence, the land standing several hundred feet lower than now, but still remained covered with ice, and over the submerged part there sailed icebergs and ice-rafts, freighted with their usual *débris*? That such was the state of things in Europe we are assured by some very good authorities.[28]

Neither do geographical causes afford an adequate explanation of those changes of temperature that surely took place during the Glacial Age. These last considerations show us how difficult it is to believe that geographical causes could have produced the Glacial Age.

We are assured that all through the geological ages the continents had been increasing in size and compactness, and that just at the close of the Tertiary Age they received a considerable addition of land to the north. The astronomer also informs us that at a comparatively recent epoch the eccentricity of the earth's orbit became very great. The conditions being favorable, it is not strange that a Glacial Age supervened.

We have been to considerable length in thus explaining the position of the scientific world in regard to the cause of the Glacial Age. Our reason for so doing is that this age is, we think, so connected with the Paleolithic Age of man, that it seems advisable to have a clear understanding in regard to it. What we have to say is neither new nor original. It is simply an earnest endeavor to represent clearly the conclusions of some of our best scholars on this subject, and we have tried to give to each theory its due weight. Our conclusions may be wrong, but, if so, we have the consolation of erring in very good company.

We have now gone over the ground and are ready to see what dates can be given. Though the numbers we use seem to be very

large indeed, they are so only in comparison with our brief span of life. They are insignificant as compared with the extent of time that has surely rolled by since life appeared on the globe. Let us, therefore, not be dismayed at the figures the astronomer sets before us.[29]

About two hundred and fifty thousand years ago the earth's path around the sun was much the same as that of the present. No great changes in climate were liable to take place at that time. During the next fifty thousand years the eccentricity steadily increased. Towards the end of that time all that was necessary to produce a glacial epoch in the Northern Hemisphere was favorable geographical causes, and that our earth should reach its point nearest the sun in Summer. This it must have done when about half that time had elapsed.

We can in imagination see what a slow deterioration of climate took place. Thousands of years would come and go before the change would be decisive. But a time must have at length arrived when the vegetation covering the ground was such as was suited only for high northern latitudes. The animals suited for warm and temperate regions must have wandered farther south; others from the north had arrived to take their place. We can see how well this agrees with the changes of climate at the close of the Pliocene Age. The snows of the commencing Glacial Age would soon begin to fall, finally the sun would not melt them off of the high lands, and mountain peaks, and so a Glacial Age would be ushered in.

We have referred to the fact that the earth reaches its perihelion point a little earlier each year, and, as a consequence, we would have periods of mild climate alternating the cold. This extended period of time, equal to twenty-one thousand of our ordinary years, has been named the Great Year of our globe. Mr. Wallace has pointed out some very good reasons for thinking Mr. Croll's theory must be modified on this point. He thinks that when once a Glacial Age was fairly fastened on a hemisphere, it would retain its grasp

as long as the eccentricity remained high, but whenever the Summer of the Great Year came to that hemisphere, it would melt back the glacial ice for some distance, but this area would be recovered by the ice when the Winter of the Great Year supervened. These effects would be different when the eccentricity itself became low. Then we would expect the glacial conditions to vanish entirely when the Summer of a Great Year comes on.[30]

As we have made the theoretical part of this chapter already too long, we must hurry on. We can only say that this view is founded on the fact that when a country was covered with snow and ice, it had so to speak, a great amount of cold stored up in it, so much, in fact, that it would not be removed by the sun of a new geological Summer. This ought to be acceptable to such geologists as are willing to admit the advance and retreat of the great glacier, but yet doubt the fact of the interglacial mild climate.

But now to return to the question of time about two hundred and twenty thousand years ago. Then the Northern Hemisphere, according to this theory, was in the grasp of a Glacial Age. According to Mr. Wallace, as long as the eccentricity remained high, there could be no great amelioration of climate, except along the southern border of the ice sheet, which might, for causes named, vary some distance during the Great Year. Two hundred thousand years ago the eccentricity, then very high, reached a turning point. It then steadily, though gradually, diminished for fifty thousand years; at that time the eccentricity was so small, though considerably larger than at present, that it is doubtful if it was of any service in producing a change of climate.[31] At that time, also, the Northern Hemisphere was passing through the Summer season of the Great Year. We ought, therefore, to have had a mild interglacial season. Except in high northern latitudes the ice should have disappeared. This change we would expect to find more marked in Europe than in America.

We need only recall how strong are the evidences on this point.

Nearly all European writers admit at least one such mild interval, and though not wanting evidence of such a period in America, our geologists are much less confident of its occurrence.

But from that point the eccentricity again increased. So when the long flight of years again brought secular Winter to the Northern Hemisphere, the glaciers would speedily appear, and as eccentricity was again high, they would again hold the country in their grasp. Fifty thousand years later, or one hundred thousand years ago, it passed its turning point again; eighty thousand years ago, it became so small that it probably ceased to effect the climate. Since then it has not been very large. Twenty-five thousand years ago it was less than it is now, but it is again growing smaller. According to this theory, then, the Glacial Age commenced about two hundred and twenty thousand years ago. It continued, with one interruption of mild climate, for one hundred and forty thousand years, and finally passed away eighty thousand years ago.

What shall we say to these results? If true, what a wonderful antiquity is here unfolded for the human race, and what a wonderful lapse of time is included in what is known as the Paleolithic Age! How strikingly does it impress upon our minds the slow development of man! Is such an antiquity for man in itself absurd? We know no reason for such a conclusion. Our most eminent scholars nowhere set a limit to the time of man's first appearance. It is true, many of them do not think the evidence strong enough to affirm such an antiquity, but there are no bounds given beyond which we may not pass.

Without investigation some might reject the idea that man could have lived on the earth one hundred thousand years in a state of Savagism. If endowed with the attributes of humanity, it may seem to them that he would long before that time have achieved civilization. Such persons do not consider the lowliness of his first condition and the extreme slowness with which progress must have

gone forward. On this point the geologists and the sociologists agree. Says Mr. Geikie: "The time which has elapsed from the close of the Paleolithic Age, even up to the present day, can not for a moment compare with the aeons during which the men of the old stone period occupied Europe." And on this subject Mr. Morgan says: "It is a conclusion of deep importance in ethnology that the experience of mankind in Savagery was longer in duration than all their subsequent experience, and that the period of Civilization covers but a fragment of the life of the race."[32] The time itself, which seems to us so long, is but a brief space as compared with the ages nature has manifestly required to work out some of the results we see before us every day. We are sure, but few of our scholars think this too liberal an estimate. All endeavor to impress on our minds that the Glacial Age is an expression covering a very long period of time.

As to the time that has elapsed since the close of the Glacial Age there is some dispute, and it may be that we will be forced to the conclusion that the close of the Glacial Age was but a few thousand years ago. Mr. Wallace assures us, however, that the time mentioned agrees well "with physical evidence of the time that has elapsed since the cold has passed away."[33]

Difficulties are, however, urged by other writers. We can see at once that as quick as the glaciers are removed the denuding forces of nature, which are constantly at work, would begin to rearrange the *débris* left behind on the surface, and in the course of a few thousand years must effect great changes. Now, in some cases the amount of such change is so small that geologists are reluctant to believe a vast lapse of time has occurred since the glaciers withdrew. Mr. Geikie tells us of some moraines in Scotland that they are so fresh and beautiful "that it is difficult to believe they can date back to a period so vastly removed as the Ice Age is believed to be."[34] In our own country this same sort of evidence is brought forward, and we are given some special calculations going

to show that the disappearance of the glaciers was a comparatively recent thing.[35]

It will be seen that these conclusions are somewhat opposed to the results previously arrived at. In explanation Mr. Geikie thinks the cases spoken of in Scotland were not the moraines of the great glaciers, but of a local glacier of a far later date. He thinks that the climate, while not severe enough to produce the enormous glaciers of early times, was severe enough to produce local glaciers still in Scotland.[36] It is possible that a similar explanation may be given for the evidence adduced in the United States. We can only state that, according to the difference in climate between the eastern and western sides of the Atlantic Ocean, when the climate was severe enough to produce local glaciers in Scotland, it would produce the same effect over a large part of eastern United States down to the latitude of New York City.[37] And while it is true there would not be as much difference in climate on the two sides of the Atlantic in Glacial times as at present, since the Gulf Stream, on which such difference depends would then have less force, still it was not entirely lacking, and the difference must have been considerable.[38]

Prof. Hitchcock has made a suggestion that whereas we know a period of several months elapses after the sun crosses the equator before Summer fairly comes on, so it is but reasonable to suppose that a proportionate length of time would go by after the eccentricity of the earth's orbit became small, before the Glacial Age would really pass away. He accordingly suggests it may have been only about forty thousand years since the glaciers disappeared.[39]

At the close of the Glacial Age Paleolithic man vanished from Europe. This, therefore, brings us to the conclusion of our researches into what is probably the most mysterious chapter of man's existence on the earth.

It may not come amiss to briefly notice the main points thus far

made in our investigation of the past. As to the epoch of man's first appearance, we found he could not be expected to appear until all the animals lower than he had made their appearance. This is so because the Creator of all has apparently chosen that method of procedure in the development of life on the globe. According to our present knowledge, man might have been living in the Miocene Age, and with a higher degree of probability in the Pliocene. But we can not say that the evidence adduced in favor of his existence at these early times is satisfactory to the majority of our best thinkers. All agree that he was living in Europe at the close of the Glacial Age, and we think the evidence sufficient to show that he preceded the glaciers, and that as a rude savage he lived in Europe throughout the long extended portion of time known as the Glacial Age.

We also found evidence of either two distinct races of men inhabiting Europe in the Paleolithic Age, or else tribes of the same race, widely different in time and in culture. The one people known as the men of the River Drift apparently invaded Europe from Asia, along with the species of temperate animals now living there. This people seem to have been widely scattered over the earth. The race has probably vanished away, though certain Australian tribes may be descendants of them. They were doubtless very low in the scale of humanity, having apparently never reached a higher state than that of Lower Savagism. The second race of men inhabiting Europe during the Paleolithic Age were the Cave-dwellers. They seem to have been allied to the Eskimos of the North. They were evidently further advanced than the Drift men, but were still savages.

The Paleolithic Age in Europe seems to have terminated with the Glacial Age. But we are not to suppose it came to an end all over the earth at that time. On the contrary, some tribes of men never passed beyond that stage. When the light of civilization fell upon them they were still in the culture of the old Stone Age. We

are to notice that in such cases the tribes thus discovered were very low in the scale. The probable data for the Paleolithic Age have formed the subject of this chapter. While claiming in support of them the opinions of some eminent scholars, we freely admit that it is not a settled question, but open to very grave objections, especially the date of the close of the Glacial Age, which seems to have been comparatively recent, at least in America. We think, however, that these objections will yet be harmonized with the general results. Neither is this claimed to be an exhaustive presentation of the matter. It is an outline only—the better to enable us to understand the mystery connected with the data of Paleolithic man.

In these few chapters we have been dealing with people, manners, arid times, of which the world fifty years ago was ignorant. Many little discoveries, at first apparently disconnected, are suddenly brought into new relation, and behold, ages ago, when the great continents were but just completed, races of men, with the stamp of humanity upon them, are seen filling the earth. With them were many great animals long since passed away. The age of animals was at an end. That of man had just begun.

The child requires the schooling of adversity and trial to make a complete man of himself, and it is even so with races of men. Who can doubt that struggling up from dense ignorance, contending against adverse circumstances, compelled to wage war against fierce animals, sustaining life in the midst of the low temperature which had loaded the Northern Hemisphere with snow and ice, had much to do in developing those qualities which rendered civilization possible.

As to the antiquity of man disclosed in these chapters, the only question that need concern us is whether it is true or not. Evidence tending to prove its substantial accuracy should be as acceptable as that disproving it. No great principle is here at stake. The truth of Divine Revelation is in no wise concerned. There is nothing in its

truth or falsity which should in any way affect man's belief in an overruling Providence, or in an immortality beyond the grave, or which should render any less desirable a life of purity and honor. On the contrary, we think one of the greatest causes of thanksgiving mortals have is the possession of intellectual powers, which enable us to here and there catch a glimpse of the greatness of God's universe, which the astronomer at times unfolds to us; or, to dimly comprehend the flight of time since "The Beginning," which the geologist finds necessary to account for the stupendous results wrought by slow-acting causes.

It seems to us eminently fitting that God should place man here, granting to him a capacity for improvement, but bestowing on him no gift or accomplishment, which by exertion and experience he could acquire; for labor is, and ever has been, the price of material good. So we see how necessary it is that a very extended time be given us to account for man's present advancement. Supposing an angel of light was to come to the aid of our feeble understanding, and unroll before us the pages of the past, a past of which, with all our endeavors, we as yet know but little. Can we doubt that, from such a review, we would arise with higher ideas of man's worth? Our sense of the depths from which he has ascended is equated only by our appreciation of the future opening before him. Individually we shall soon have passed away. Our nation may disappear. But we believe our race has yet but fairly started in its line of progress; time only is wanted. We can but think that that view which limits man to an existence extending over but a few thousand years of the past, is a belittling one. Rather let us think of him as existing from a past separated from us by these many thousand years; winning his present position by the exercise of God-given powers.

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The manuscript of this chapter was submitted to Prof. G. F. Wright, of Oberlin, for criticism.

Wallace's "Island Life," p. 113.

Nordenskiold's "American Journal of Science," vol. 110, p. 58.

Wright's "Studies in Science and Religion," p. 307, where a map of this moraine is given.

There is, however, a small area in the south-west part of Wisconsin where, for some reason, the ice passed by.

Dane's "Manual of Geology," p. 538.

Wright's "Studies in Science and Religion," p. 308.

"Men of the Drift," p. 71.

Geikie's "Great Ice Age," p. 93.

"Men of the River Drift."

Abbott's "Primitive Industry," p. 545; Quoted from "Geology of Minnesota." Report, 1877, p. 37.

Geikie's "Great Ice Age," p. 97.

The astronomical theory, which we will first examine, was first enunciated by Mr. Croll, following a suggestion of the astronomer Adhemer. Mr. Croll's views were set forth in many able papers, and finally gathered into a volume entitled "Climate and Time in their Geological Relation." The ablest defense of these views is that by Mr. James Geikie, in his works "The Great Ice Age," and "Prehistoric Europe."

Geikie's "Great Ice Age," p. 114.

Lubbock's "Prehistoric Times," p. 420, Table 4.

Ibid., Table 5.

Geikie's "Great Ice Age," p. 123.

Wallace's "Island Life," p. 143.

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"Geology of New Hampshire," Vol. II, p. 5.

Wallace's "Island Life," p. 99.

Geikie's "Great Ice Age," p. 103.

Wallace's "Island Life," p. 149. Hitchcock's "Geology of New Hampshire," Vol. II, p. 7, gives a map showing what immense areas in that section would be raised to the surface by a raise of three hundred feet.

American Journal of Science, 1871, p. 329.

Wallace's "Island Life," p. 184.

Wallace's "Island Life," p. 182.

Ibid., p. 157 and note. Prof. Wright thinks this statement doubtful. He refers to the date of the Glacial Age in the Southern Hemisphere.

Wallace's "Island Life," p. 200; Dawkins's "Early Man in Britain," p. 119; Geikie's "Great Ice Age," p. 256; Quatrefages's "Human Species," p. 288.

For these results, see McFarland's Calculations in "American Journal of Science," 1880, p. 105.

"Island Life," p. 153.

See chart, p. 124, Wallace's "Island Life."

"Ancient Society," p. 39.

"Island Life," p. 201.

"Prehistoric Europe," p. 312.

On this point consult Wright's "Studies in Science and Religion," pp. 232-347; also Prof. Lewis in "Primitive Industry," pp. 547-551.

"Prehistoric Europe," p. 560.

See any isothermal map.

Wallace's "Island Life," p. 154, note.

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Chapter VI

THE NEOLITHIC AGE IN EUROPE.[1]

Close of the first cycle—Neolithic culture connected with the present—No links between the two ages—Long lapse of time between the two ages—Swiss lake villages—This form of villages widely scattered—Irish cranogs—Fortified villages—Implements and weapons of Neolithic times—Possessed of pottery—Neolithic agriculture—Possessed of domestic animals—Danish shell-

heaps— Importance of flint—The art of navigation—Neolithic clothing— Their modes of burial—The question of race—Possible remnants— Connection with the Turanian race—Arrival of the Celts.

THE preceding chapters we have sought to learn what we could of the Paleolithic Age. We have seen what strange people and animals occupied the land, and have caught some glimpses of a past that has been recovered to us out of the very night of time. From under the ashes of Vesuvius archæologists have brought to light an ancient city. We gaze on it with great interest, for we there see illustrated the state of society two thousand years ago. But other cities of that time are still in existence, and not only by the aid of tradition and song, but from the pages of history, we can learn of the civilization of the Roman people at the time of the destruction of Pompei; so that, in this case, our knowledge of the past is not confined to one source of information. But no voice of history or tradition, or of existing institutions, speaks to us of the Paleolithic Age. Of that remote time, the morning time of human life, we learn only from the labors of geologists and archæologists. We are virtually dealing with a past geological age. The long term of years thus defined drew to its close amidst scenes of almost Arctic sterility. In all probability, glaciers reflected the sun's rays from all the considerable hills and mountains of Central and Northern Europe, though forming, perhaps, but a remnant of the great glaciers of the Ice Age. The neighboring seas must have been whitened by the glistening sails of numerous icebergs. Such was the closing scene of Paleolithic life.

The first great cycle of human life, as far as we know it now, was concluded in Europe. We do not mean to say that it terminated all over the world. In other regions it survived to far later times. But, in Europe, Paleolithic animals and men had worked out their mission, and we have now to record the arrival and spread of a new

race, bringing with them domestic animals, a knowledge of rude husbandry, and many simple arts and industries of which their Paleolithic predecessors were ignorant.

We recall, that the men of the Paleolithic Age seemed incapable of advancement;[2] or their progress was so slow that we scarcely notice it. But we can trace the lines of advancement from the Neolithic culture to that of the present. We have, however, to deal with people and times far removed from the light of history.

We have before us, then, a new culture and a new people. On the one hand is Paleolithic man, with his rude stone implements, merely chipped into shape—surrounded by many animals which have since vanished from the theater of life—inhabiting a country which, at its close at least, was more like Greenland of to-day than England or France. The scene completely changes, when the misty curtain of the past again rises and allows us to continue our investigations into primitive times.

We would naturally expect to find everywhere, connecting links between these two ages—the culture of the one gradually changing into the culture of the other. This, however, is not the case. The line of demarkation between the ages is everywhere plainly drawn; and, furthermore, we are learning that a very long time elapsed between the departure, or disappearance, of the Paleolithic tribes, and the arrival of their Neolithic successors. This is shown in a great many ways, and we will notice some of them. We learn that Neolithic man occasionally used caves as a place of habitation. In such cases there is nearly always a thick layer of stalagmite between the strata containing the Paleolithic implements and the Neolithic strata —though this stalagmite is unmistakable evidence of the lapse of many years, we can not determine how many, as we do not know the rate of formation.

This lapse of time is shown very plainly when we come to consider the changes wrought in the surface features of the country

by the action of running water. We know that rain, running water, and frost, constituting what we call denuding forces, are constantly at work changing the surface of a country. We know that, in general, this change is slow. But great changes have been wrought between these two ages.

In the British Islands, we know that the rivers had time to very materially change the surface features of the land. The important rivers of Scotland had carved out channels one hundred feet deep in places; and along their courses, especially near their mouths, had plowed out and removed great quantities of glacial material—forming broad flats which became densely wooded before Neolithic man made his appearance on the scene. In some cases the entire surface of the land had been removed, leaving only knolls and hills of the old land surface. Examples of this occur on the east coast of England, and in what is known as the Fen-lands. The final retreat of the glaciers must have left the country covered with *débris.* After this had been largely denuded, the country became densely wooded. It was not until these changes had taken place, that Neolithic man wandered into Europe.[3]

But still another ground exists for claiming a long interval between these two ages, namely, the great changes that took place in the animal world of Europe during these two epochs. Many different species of animals characteristic of the Paleolithic Age vanished as completely from Europe as the rude tribes that hunted them, before the appearance of Neolithic tribes. But little change in the fauna of England has taken place in the last two thousand years. So it is obvious that the great change above-mentioned demands many centuries for its accomplishment. Huge animals of the elephant kind, such as the mammoth, no longer crashed through the underbrush, or wallowed in the lakes. The roars of lions and tigers, that haunted the caves of early Europe, were no longer heard.[4] In short, there had disappeared forever from Europe the distinctly southern animals that diversified the fauna of

Paleolithic times. Even the Arctic animals were banished to northern latitudes, or mountain heights.

We have dwelt to some length on the proofs of a long-extended time between these two ages. The more we reflect on these instances the more impressed are we with a sense of duration vast and profound, in which the great forests and grassy plains of Europe supported herds of wild animals all unvexed by the presence of man. We will only mention one more point and then pass on.

We have seen that the highest rank we can assign to Paleolithic man in the scale of civilization is Upper Savagism. But when Neolithic man appeared, he was in the middle status of Barbarism. The time, therefore, between the disappearance of Paleolithic man and the arrival of Neolithic man was long enough to enable primitive man to pass one entire ethnical period, that of Lower Barbarism. But this requires a very long period of time, probably several times as long as the entire series of years since Civilization first appeared, which is supposed to be in the neighborhood of five thousand years ago.[5]

We must now turn our attention to Neolithic man himself and learn what we can of his culture, and discover, if possible, what race it was that spread over Europe after it had been for so long a time an uninhabitable country. A few remarks by way of introduction will not be considered amiss.

We are learning that tribal organization, implying communism in living, is characteristic of prehistoric people.[6] Tribal organization sufficed to advance man to the very confines of civilization. We have no doubt but that this was the state of society amongst the Neolithic people. But this implies living in communities or villages. We need not picture to ourselves a country dotted with houses, the abodes of single families; such did not exist, but here and there were fortified villages.

Still another consequence follows from this tribal state of society. There was no such thing as a strong central government. Each tribe obeyed its own chief, and a state of war nearly always existed between different tribes. Such we know was the state of things among the Indian tribes of America. Travelers tell us that it is so to-day in Africa. Each tribe stood ready to defend itself or to make war on its neighbors. One great point, therefore, in constructing a village, was to secure a place that could be easily defended.

Bearing these principles in mind, let us see what we can learn of their habitations. Owing to a protracted drouth, the water in the Swiss lakes was unusually low in the Winter of 1854, and the inhabitants of Meilen, on the Lake Zürich, took advantage of this state of affairs to throw up embankments some distance out from the old shore, and thus gain a strip of land along the coast. In carrying out this design, they found in the mud at the bottom of the lake a number of piles, some thrown down and others upright, fragments of rough pottery, bone and stone instruments, and various other relics.

Dr. Keller, president of the Zürich Antiquarian Society, was apprised of this discovery, and proceeded at once to examine the collection made and the place of discovery. He was not long in determining the prehistoric nature of the relics, and the true intent of the pile remains. He proved them to be supports for platforms, on which were erected rude dwellings, the platforms being above the surface of the water, and at some distance from the shore, with which they were connected by a narrow bridge.

This was the first of a series of many interesting discoveries from which we have learned many facts as to Neolithic, times. The out we have introduced is an ideal restoration of one of these Swiss lake villages. It needs but a glance to show how admirably placed

it was for purposes of defense. Unless an enemy was provided with boats, the only way of approach was over the bridge. But the very fact that they resorted to lakes, where at the expense of great labor they erected their villages, is a striking illustration of the insecurity of the times.

This discovery once made, it is surprising what numbers of these ancient lake villages have been discovered. Switzerland abounds in large and small lakes, and in former times they must have been still more numerous, but in the course of years they have become filled up, and now exist only as peat bogs. But we now know that during the Neolithic Age the country was quite thickly inhabited, and these lakes were the sites of villages. Over two hundred have been found in Switzerland alone. Fishermen had known of the existence of these piles long before their meaning was understood. Lake Geneva is one of the most famous of the Swiss lakes. Though in the main it is deep, yet around the shore there is a fringe of shallow water.

It was in this shallow belt that the villages were built. The sites of twenty-four settlements are known. We are told that on "calm days, when the surface of the water is unruffled, the piles are plainly visible. Few of them now project more than two feet from the bottom, eaten away by the incessant action of the water. Lying among them are objects of bone, horn, pottery, and frequently even of bronze. So fresh are they, and so unaltered, they look as if they were only things of yesterday, and it seems hard to believe that they can have remained there for centuries."[7]

A lake settlement represents an immense amount of work for a people destitute of metallic tools. After settling on the locality, the first step would be to obtain the timbers. The piles were generally composed of the trunks of small-sized trees at that time flourishing in Switzerland. But to cut down a tree with a stone hatchet is no slight undertaking. They probably used fire to help them. After the tree was felled it had to be cut off again at the right length, the

branches lopped off, and one end rudely sharpened. It was then taken to the place and driven into the mud of the lake bottom. For this purpose they used heavy wooden mallets. It has been estimated that one of the settlements on Lake Constance required forty thousand piles in its construction.[8]

The platform which rested on these piles was elevated several feet above the surface of the water, so as to allow for the swash of the waves. It was composed of branches and trunks of trees banded together, the whole covered with clay. Sometimes they split the trees with wedges so as to make thick slabs. In some instances wooden pegs were used to fasten portions of the platform to the pilework.

As to the houses which were erected on these platforms, though they have utterly vanished, yet from a few remains we can judge something as to the mode of construction. They seem to have been formed of trunks of trees placed upright, one by the side of the other, and bound together by interwoven branches. This was then covered on both sides with two or three inches of clay. A plaster of clay and gravel formed the floor, and a few slabs of sandstone did duty for a fire-place. The roof was of bark, straw, or rushes. There does not seem to have been much of a plan used in laying out a settlement. As population increased other piles were added, and thus the village gradually extended. No one village would be likely to contain a great number of inhabitants. Calculations based on the area of one of the largest settlements in Lake Geneva, gives as a result a population of thirteen hundred, but manifestly nothing definite is known.

This brief description gives us an idea of a method of constructing villages which, as we shall soon see, extended all over Europe, though varied somewhat in detail. The condition of the remains indicate that these settlements were often destroyed by fire. At such times quantities of arms, implements, and household industries would have been lost in the water, and so preserved for

our inspection.

This mode of building found such favor among the early inhabitants of Europe that it continued in use through the Neolithic Age, that of Bronze, and even into the age of Iron. Passages here and there in ancient histories evidently refer to them. Though they have long since passed away in Switzerland, the Spaniards found them in Mexico, and they are still to be seen in some of the isles of the Pacific. Remembering this, we need not be surprised if we find in one small lake settlements belonging to widely different ages. Here one of the Stone Age, there one of the Bronze, or even a confused mingling of what seems to be several ages in one settlement.[9]

There is scarcely a country in Europe that does not contain examples of lake villages. From their wide distribution we infer that a common race spread over the land. We will now mention some differences in construction discovered at some places, where, from the rocky nature of the bed of the lake, it was impossible to drive piles so as to form a firm foundation. They sometimes packed quantities of stone around the piles to serve as supports in a manner as here indicated. "In all probability the stones used were conveyed to the required spot by means of canoes, made of hollowed out trunks of trees. Several of these canoes may still be seen at the bottom of Lake Bienne, and one, indeed, laden with pebbles, which leads us to think it must have foundered with its cargo."[10]

In some cases these heaps of stone and sticks rise to the surface of the water or even above it, the piles in such cases serving more to hold the mass together than as a support to the platform on which the huts were erected. This mode of construction could only be employed in small lakes. This makes in reality an artificial island, and seems to have been the favorite method of procedure in the British Islands. In Ireland and Scotland immense numbers of

these structures are known. They are called crannogs. This cut represents a section of one in Ireland. Though they date back to the Neolithic Age, yet they so exactly meet the wants of a rude people that they were occupied down to historic times.

The advantage of forming settlements where they could only be approached on one side were so great that other places than lakes were resorted to. Peat-bogs furnished nearly as secure a place of retreat as do lakes. These have been well studied in Northern Italy. They do not present many new features. They were constructed like the lake villages, only they were surrounded by a marsh, and not by a lake. In some of the Irish bogs they first covered the surface of the bog with a layer of hazel bushes, and that by a layer of sand, and thus secured a firm surface.[11] In this case the villages were still further defended by a breastwork of rough spars, about five feet high. One of the houses of this group was found still in position, though it had been completely buried in peat. No metal had been used in its construction. The timbers had been cut with a stone ax, and the explorer was even so fortunate as to find an ax, which exactly fitted many of the cuts observed on the timbers.

But we are not to suppose that lakes and bogs afforded the only sites of villages. They are found scattered all over the surface of the country, and, as we shall soon see, they show the same painstaking care to secure strong, easily defended positions. They have been generally spoken of as forts, to which the inhabitants resorted only in times of danger. We think, however, they were locations of villages, the customary places of abode. For this is in strict accordance with what we find to be the early condition of savage life in every part of the world.

Traces of these settlements on the main-land have been mostly obliterated by the cultivation of the soil during the many years that have elapsed since their Neolithic founders occupied them. In Switzerland the location of five of these villages are known. In all

instances they occupied places very difficult of approach—generally precipitous sides on all but one or two. On the accessible sides ramparts defended them. The relics obtained are in all respects similar to those from the lake villages.[12]

Fortified inclosures have been described in Belgium. We are told, "They are generally established on points overhanging valleys, on a mass of rocks forming a kind of headland, which is united to the rest of the country by a narrow neck of land. A wide ditch was dug across this narrow tongue of land, and the whole camp was surrounded by a thick wall of stone, simply piled one upon another, without either mortar or cement." "One of these walls, when described, was ten feet thick, and the same in height." These intrenched positions were so well chosen that most of them continued to be occupied during the ages which followed. The Romans occasionally utilized them for their camps. Over the whole inclosure of these ancient camps worked flints and remains of pottery have been found.[13] These fortified places have been well studied in the south of England.

What is known as the South-Downs in Sussex is a range of hills of a general height of seven hundred feet. This section is about five miles wide and fifty miles long. Four rivers flow through these downs to the sea. In olden times their lower courses must have been deep inlets of the sea, thus dividing those hills into five groups, each separated from the other by a wide extent of water and marsh land. To the north of these hills was a vast expanse of densely wooded country. It is not strange, then, to find traces of numerous settlements among these hills. As the surface soil is very thin, old embankments can still be traced. The cut given is a representation of Cissbury, one of the largest of these camps. It incloses nearly sixty acres. The rampart varies according to the slope of the hill. Where the ascent was at all easy it was made double. Fortified camps are very numerous throughout the hill

country. They vary, of course, in size, but the situation was always well chosen.[14]

As for the buildings themselves, or huts of the Neolithic people, we know but little. They were probably built much the same as the houses in the lake settlements. We meet with some strange modifications in England. Frequently within these ramparts we find circular pits or depressions in the ground. They are regarded as vestiges of habitations, and they must have been mainly under ground. "They occur singly and in groups, and are carried down to a depth of from seven to ten feet through the superficial gravel into the chalk, each pit, or cluster of pits, having a circular shaft for an entrance. At the bottom they vary from five to seven feet in diameter, and gradually narrow to two and a half or three feet in diameter in the upper part. The floors were of chalk, sometimes raised in the center, and the roof had been formed of interlaced sticks, coated with clay imperfectly burned."[15]

In the north of Scotland, instead of putting them under ground, they built them on the natural surface, and then built a mound over them all. In appearance this was scarcely distinguishable from a mound, but on digging in we discover a series of large chambers, built generally with stones of considerable size, and converging toward the center, where an opening appears to have been left for light and ventilation. In some instances the mound was omitted, and we have simply a cluster of joining huts, with dry, thick walls. These have been appropriately named "Bee-hive Houses."[16]

We can form a very good idea of Neolithic Europe from what we have learned as to their habitations. A well-wooded country, abounding in lakes and marshes, quite thickly settled, but by a savage people, divided into many tribes, independent of and hostile to each other. The lakes were fringed with their peculiar settlements; they are to be noticed in the marshes, and on commanding heights are still others. The people were largely hunters and fishers, but, as we shall soon see, they practised a rude

husbandry and had a few domestic animals. Such was the condition of Europe long before the Greek and Latin tribes lit the beacon fires of civilization in the south.

It is evident that the builders of the lake settlements and the fortified villages were an intelligent and industrious people, though their scale in civilization was yet low. Their various implements of bone, horn, and stone display considerable advance over the rude articles of the Drift.

One of the most important implements was the ax. The Paleolithic hatchet, we remember, was rude, massive, and only roughly chipped into shape, and was intended to be held in the hand. The Neolithic ax was a much better made one, and was furnished with a handle. They were enabled to accomplish a great deal with such axes. "Before it, aided by fire, the trees of the forest fell to make room for the tiller of the ground, and by its sharp edge wood became useful for the manufacture of various articles and implements indispensable for the advancement of mankind in culture."[17] These axes vary in size and finish. As a general thing they are ground to a sharp, smooth edge, but not always, nor were they always furnished with a handle.

Some axes are found with a hole bored in them, through which to pass a handle. These perforated axes are found in considerable numbers, and some have denied that they could be produced without the aid of metal. It is almost self-evident that the perforated axes are later in date than the solid ones, and probably many of them are no earlier in time than the Age of Metals. There is, however, nothing to show that all belong to so late a time. Besides, experiments have amply shown that even the hardest kind of flint can be drilled without the aid of metals.[18]

Warlike implements are, of course, quite common. Many of the axes found are probably war axes. Then besides we have

arrowheads, spears, and daggers. These are considered to be "marvels of skill in flint chipping."[19] Stone was used for a great many other purposes, such as scrapers, sling-stones, hammers, saws, and so on. Flint was generally the kind of stone used. Our civilization owes a great deal to this variety of stone. It is not only hard, but its cleavage is such that it was of the greatest use to primitive man. In a general way the Neolithic stone implements are seen to be better adapted to the object in view than the Paleolithic specimens. They are also generally polished.

Wood was largely used in their common household implements. But it is only in exceptional cases that it has been preserved to us. They have been recovered, however, in peat-bogs and in the remains of lake settlements. These wooden utensils consist of bowls, ladles, knives, tubs, etc. They used fire to hollow them out, and the blows of the flint hatchet used to remove the charred portions, are still to be observed in some specimens.

The Neolithic people had learned how to manufacture pottery, though not of a very superior quality. It is all hand-made: so the potter's wheel had not yet been introduced. The material is clay mixed with gravel or pounded shells. Very often they ornamented their clay vessels with lines and dots. The bowls or jars were evidently suspended by cords, for the bottom was made too rounding for them to stand erect. Besides, we find the holes for the cords, and in some places handles.

No notice of Neolithic tools would be complete without mentioning the use made of horn and bone. One peculiar use for which they employed horn was as a socket for holding other implements. Thus this figure shows us an ax in a socket of horn. The middle of the socket is generally perforated with a round or oval hole, intended to receive a handle of oak, birch, or some other kind of wood adapted for such a use. The cut below represents a

hatchet of this kind. A number of these sockets have been found, which were provided at the end opposite to the stone hatchet with a strong and pointed tooth. These are boars' tusks, firmly buried in the stag's horn. These instruments, therefore, fulfilled double purposes: they cut or crushed with one end and pierced with the other. Sockets are also found which are not only provided with the boars' tusks, but are hollowed out at each end, so as to hold two flint hatchets at once, as is seen in our next figure. Chisels and gouges were also sometimes placed in bone handles. Portions of horn probably at times did duty as hoes. We give a representation of such an implement.[20] We must now seek some information as to how the men of the Neolithic Age supported life.

From the remains of fish at all the lake settlements it is evident they formed no inconsiderable portion of their food. Fishing nets and hooks have been discovered. They were successful hunters as well. But the men of this age were no longer dependent on the chase for a livelihood. We have mentioned several times that they were acquainted with agriculture. This implies a great advance over the primitive hunters of the early Stone Age.

On the shores of the lakes which furnished them with a place of habitation they raised many of our present species of grain. Owing to a cause of which we have already spoken—that is, destruction of the lake settlements by fire—the carbonized remains of these cereals have been preserved to us. There were four varieties of wheat raised, none exactly like our common wheat. In addition to this they raised barley and millet, several varieties of each. Nor were the fruits neglected. Apples and pears were dried and laid away for use in the Winter. Seeds of the common berries were found in abundance, showing that these primitive people were fully alive to their value.

From this it follows that the Neolithic people were not only tillers of the soil, but horticulturists as well. According to Dr.

Keller, the vegetable kingdom furnished their principal supply of food. Hazelnuts, beechnuts, and chestnuts were found in such quantities as to show they had been gathered for use. Neither hemp, oats, nor rye were known. Not only do we find the remains of the grains, fruits, seeds, etc., from which the above conclusions are drawn, but, farther than this, pieces of bread have been found in a carbonized state, and thus as effectually preserved as the bread of a far later date found in the ovens of Pompeii. According to Figuier, the peasant classes of Tuscany now bake bread, after merely bruising the grain, by pouring the batter on glowing stones and then covering it with ashes. As this ancient prehistoric bread is of similar shape, it was probably baked in an equally primitive fashion.[21]

Aside from the natural interest we feel in these evidences as to ancient industry, a study of the remains of plants cultivated by the Neolithic people reveals to us two curious and suggestive facts. It has been found that the wild plants then growing in Switzerland are in all respects like the wild plants now growing there. But the cultivated plants—wheat, millet, etc.—differ from all existing varieties, and invariably have smaller seeds or fruits.[22] This shows us that man has evidently been able to effect considerable change by cultivation, in the common grains, during the course of the many centuries which separate the Neolithic times from our own age. But if this rate of change be adopted as a measure of time, what shall we say is to the antiquity demanded to explain the origin of cultivated grain from the wild grasses of their first form?

We learn, in the second place, that the cultivated plants are all immigrants from the south-east—their native home being in South-eastern Europe and Asia Minor. We shall afterward see that this is true of the domestic animals also. There can be but one explanation for this. The ancient inhabitants of Europe must have come from that direction, and brought with them the plants they had cultivated in their eastern homes, and the animals they had reduced to their

service. The traces of agriculture thus found in Switzerland are by no means confined to that country. In other countries of Europe, such as England and France, we also find proofs that men cultivated the earth. In localities where we do not find the grain itself, we find their rude mills, or mealing stones, which as plainly indicate a knowledge of the agricultural art as the presence of the cereals themselves.[23]

As we have stated, Neolithic man in Europe possessed domestic animals. He was not only a cultivator of the soil, but he was a herdsman as well; and he kept herds of oxen, sheep, and goats. Droves of hogs fattened on the nuts of the forest, and the dog associated with man in keeping and protecting these domestic animals. We know that the Swiss Lake inhabitants built little stalls by the sides of their houses, in which they kept their cattle at night. But these domestic animals were not descendants of the wild animals that roamed the forests of Europe. Like the plants, they are immigrants from the south-east. Our best authorities consider they were brought into Europe by the invading Neolithic tribes.

The knowledge of husbandry, though rude, and the possession of domestic animals, though of a few species only, strikingly indicate the advance over the Paleolithic tribes. They also had fixed places of living. This culture spread all over Europe. That it was substantially the same everywhere there is no doubt. Certain refuse heaps in Denmark, Scotland, and indeed in all the sea-coast countries, have been thought to support a different conclusion. Those of Denmark have been very carefully studied, and so we will refer to them. All along the Baltic coast, but especially in Denmark, have been discovered great numbers of mounds, which were found to consist "almost entirely of shells, especially of the oyster, broken bones of animals, remains of birds and fishes, and, lastly, some wrought flints." The first supposition in regard to those shell-heaps was that they were of marine formation, accumulated beneath the sea, and elevated to the surface along

with the gradual rise of the land. But they are now known to be nothing more or less than the sites of ancient settlements. The location of the rude cabins can still be traced. The ancient hearths are still in place. "Tribes once existed here who subsisted on the products of hunting and fishing, and threw out around their cabins the remains of their meals, consisting especially of the *débris* of shell- fish." These heaps gradually accumulated around their rude dwellings, and now constitute the refuse heaps in question.[24]

The careful investigation of their contents has failed to disclose any evidence of a knowledge of agriculture, and the only domestic animal found is the dog. The implements are altogether of stone and horn. No trace of metal has yet been obtained. As a rule, they are rudely made and finished. Though of the Neolithic type, they are not polished except in a few instances. The principal interest turns on the question of age of these refuse heaps. Some think they were accumulated at the very beginning of the Neolithic Age—that these tribes preceded by many years the men of the Swiss Lakes. Others think they were tribes of the same great people, living at the same time. On such a point as this, only those who have carefully studied the deposits are entitled to speak.

Some few facts stand out quite prominently. The size of the mounds[25] indicate long-continued residence—showing that these people had permanent places of abode. As they are not confined to Denmark, but are found generally throughout Europe, it would seem to imply that the Neolithic people preferred to live as fishers and hunters wherever the surroundings were such that they could by these means obtain an abundant supply of food. Some shell-heaps in Scotland were still forming at the commencement of the Bronze Age; and Mr. Geikie, on geological grounds, assigns the shell-heaps of Denmark to a late epoch of the Stone Age.

It seems to us quite natural that isolated tribes, living where game was abundant, and where fishing met with a rich reward, should turn in disgust from the agricultural life of their brother

tribes, and, resuming the life of mere hunters and fishers, speedily lose somewhat of their hardly won culture—for civilization is the product of labor. Whenever a people from necessity or choice abandon one form of labor for another demanding less skill to triumph over nature, a retrogression in culture is inevitable.[26]

From what we have stated as to the use of flint we can readily see that it was a valuable material. Sections where it was found in abundance would as certainly become thickly populated as the iron and gold regions of our own day. In Paleolithic times the supply of flint was mostly obtained from the surface and in the gravel of rivers. In Neolithic times men had learned to mine for flint. Flint occurs in nodules in the chalk. Near Brandon, England, was discovered a series of these workings. They consist of shafts connected