Mesozoic life has occurred, and we find now a new scene, a new and hardier flora, and a new and hardier fauna in possession of the world.

It is still a bleak and impoverished scene with which this new volume of the book of life begins. The cycads and tropical conifers have given place very largely to trees that shed their leaves to avoid destruction by the snows of winter and to flowering plants and shrubs, and where there was formerly a profusion of reptiles, an increasing variety of birds and mammals is entering into their inheritance.

VIII. The Age of Mammals

THE OPENING of the next great period in the life of the earth, the Cainozoic period, was a period of upheaval and extreme volcanic activity. Now it was that the vast masses of the Alps and Himalayas and the mountain backbone of the Rockies and Andes were thrust up, and that the rude outlines of our present oceans and continents appeared. The map of the world begins to display a first dim resemblance to the map of to−day. It is estimated now that between forty and eighty million years have elapsed from the beginnings of the Cainozoic period to the present time.

At the outset of the Cainozoic period the climate of the world was austere. It grew generally warmer until a fresh phase of great abundance was reached, after which conditions grew hard again and the earth passed into a series of extremely cold cycles, the Glacial Ages, from which apparently it is now slowly emerging.

But we do not know sufficient of the causes of climatic change at present to forecast the possible fluctuations of climatic conditions that lie before us. We may be moving towards increasing sunshine or lapsing towards another glacial age; volcanic activity and the upheaval of mountain masses may be increasing or diminishing; we do not know; we lack sufficient science.

With the opening of this period the grasses appear; for the first time there is pasture in the world; and with the full development of the once obscure mammalian type, appear a number of interesting grazing animals and of carnivorous types which prey upon these.

At first these early mammals seem to differ only in a few characters from the great herbivorous and carnivorous reptiles that ages before had flourished and then vanished from the earth. A careless observer might suppose that in this second long age of warmth and plenty that was now beginning, nature was merely repeating the first, with herbivorous and carnivorous mammals to parallel the herbivorous and carnivorous dinosaurs, with birds replacing pterodactyls and so on. But this would be an altogether superficial comparison. The variety of the universe is infinite and incessant; it progresses eternally; history never repeats itself and no parallels are precisely true. The differences between the life of the Cainozoic and Mesozoic periods are far profounder than the resemblances.

The most fundamental of all these differences lies in the mental life of the two periods. It arises essentially out of the continuing contact of parent and offspring which distinguishes mammalian and in a lesser degree bird life, from the life of the reptile. With very few exceptions the reptile abandons its egg to hatch alone. The young reptile has no knowledge whatever of its parent; its mental life, such as it is, begins and ends with its own experiences. It may tolerate the existence of its fellows but it has no communication with them; it never imitates, never learns from them, is incapable of concerted action with them. Its life is that of an isolated individual. But with the suckling and cherishing of young which was distinctive of the new mammalian and avian strains arose the possibility of learning by imitation, of communication, by warning cries and other concerted action, of mutual control and instruction. A teachable type of life had come into the world.

The earliest mammals of the Cainozoic period are but little superior in brain size to the more active carnivorous dinosaurs, but as we read on through the record towards modern times we find, in every tribe and race of the

mammalian animals, a steady universal increase in brain capacity. For instance we find at a comparatively early stage that rhinoceros−like beasts appear. There is a creature, the Titanotherium, which lived in the earliest division of this period. It was probably very like a modern rhinoceros in its habits and needs. But its brain capacity was not one tenth that of its living successor.

The earlier mammals probably parted from their offspring as soon as suckling was over, but, once the capacity for mutual understanding has arisen, the advantages of continuing the association are very great; and we presently find a number of mammalian species displaying the beginnings of a true social life and keeping together in herds, packs and flocks, watching each other, imitating each other, taking warning from each other's acts and cries. This is something that the world had not seen before among vertebrated animals. Reptiles and fish may no doubt be found in swarms and shoals; they have been hatched in quantities and similar conditions have kept them together, but in the case of the social and gregarious mammals the association arises not simply from a community of external forces, it is sustained by an inner impulse. They are not merely like one another and so found in the same places at the same times; they like one another and so they keep together.

This difference between the reptile world and the world of our human minds is one our sympathies seem unable to pass. We cannot conceive in ourselves the swift uncomplicated urgency of a reptile's instinctive motives, its appetites, fears and hates. We cannot understand them in their simplicity because all our motives are complicated; ours are balances and resultants and not simple urgencies. But the mammals and birds have self−restraint and consideration for other individuals, a social appeal, a self−control that is, at its lower level, after our own fashion. We can in consequence establish relations with almost all sorts of them. When they suffer they utter cries and make movements that rouse our feelings. We can make understanding pets of them with a mutual recognition. They can be tamed to self−restraint towards us, domesticated and taught.

That unusual growth of brain which is the central fact of Cainozoic times marks a new communication and interdependence of individuals. It foreshadows the development of human societies of which we shall soon be telling.

As the Cainozoic period unrolled, the resemblance of its flora and fauna to the plants and animals that inhabit the world to−day increased. The big clumsy Uintatheres and Titanotheres, the Entelodonts and Hyracodons, big clumsy brutes like nothing living, disappeared. On the other hand a series of forms led up by steady degrees from grotesque and clumsy predecessors to the giraffes, camels, horses, elephants, deer, dogs and lions and tigers of the existing world. The evolution of the horse is particularly legible upon the geological record. We have a fairly complete series of forms from a small tapir−like ancestor in the early Cainozoic. Another line of development that has now been pieced together with some precision is that of the llamas and camels.

IX. Monkeys, Apes and Sub−men

NATURALISTS divide the class Mammalia into a number of orders. At the head of these is the order Primates, which includes the lemurs, the monkeys, apes and man. Their classification was based originally upon anatomical resemblances and took no account of any mental qualities.

Now the past history of the Primates is one very difficult to decipher in the geological record. They are for the most part animals which live in forests like the lemurs and monkeys or in bare rocky places like the baboons. They are rarely drowned and covered up by sediment, nor are most of them very numerous species, and so they do not figure so largely among the fossils as the ancestors of the horses, camels and so forth do. But we know that quite early in the Cainozoic period, that is to say some forty million years ago or so, primitive monkeys and lemuroid creatures had appeared, poorer in brain and not so specialized as their later successors.

The great world summer of the middle Cainozoic period drew at last to an end. It was to follow those other two

great summers in the history of life, the summer of the Coal Swamps and the vast summer of the Age of Reptiles. Once more the earth spun towards an ice age. The world chilled, grew milder for a time and chilled again. In the warm past hippopotami had wallowed through a lush sub−tropical vegetation, and a tremendous tiger with fangs like sabres, the sabre−toothed tiger, had hunted its prey where now the journalists of Fleet Street go to and fro. Now came a bleaker age and still bleaker ages. A great weeding and extinction of species occurred. A woolly rhinoceros, adapted to a cold climate, and the mammoth, a big woolly cousin of the elephants, the Arctic musk ox and the reindeer passed across the scene. Then century by century the Arctic ice cap, the wintry death of the great Ice Age, crept southward. In England it came almost down to the Thames, in America it reached Ohio. There would be warmer spells of a few thousand years and relapses towards a bitterer cold.

Geologists talk of these wintry phases as the First, Second, Third and Fourth Glacial Ages, and of the interludes as Interglacial periods. We live to−day in a world that is still impoverished and scarred by that terrible winter. The First Glacial Age was coming on 600,000 years ago; the Fourth Glacial Age reached its bitterest some fifty thousand years ago. And it was amidst the snows of this long universal winter that the first man−like beings lived upon our planet.

By the middle Cainozoic period there have appeared various apes with many quasi−human attributes of the jaws and leg bones, but it is only as we approach these Glacial Ages that we find traces of creatures that we can speak of as "almost human." These traces are not bones but implements. In Europe, in deposits of this period, between half a million and a million years old, we find flints and stones that have evidently been chipped intentionally by some handy creature desirous of hammering, scraping or fighting with the sharpened edge. These things have been called "Eoliths" (dawn stones). In Europe there are no bones nor other remains of the creature which made these objects, simply the objects themselves. For all the certainty we have it may have been some entirely unhuman but intelligent monkey. But at Trinil in Java, in accumulations of this age, a piece of a skull and various teeth and bones have been found of a sort of ape man, with a brain case bigger than that of any living apes, which seems to have walked erect. This creature is now called Pithecanthropus erectus, the walking ape man, and the little trayful of its bones is the only help our imaginations have as yet in figuring to ourselves the makers of the Eoliths.

It is not until we come to sands that are almost a quarter of a million years old that we find any other particle of a sub−human being. But there are plenty of implements, and they are steadily improving in quality as we read on through the record. They are no longer clumsy Eoliths; they are now shapely instruments made with considerable skill. And they are much bigger than the similar implements afterwards made by true man. Then, in a sandpit at Heidelberg, appears a single quasi−human jaw−bone, a clumsy jaw−bone, absolutely chinless, far heavier than a true human jaw−bone and narrower, so that it is improbable the creature's tongue could have moved about for articulate speech. On the strength of this jaw−bone, scientific men suppose this creature to have been a heavy, almost human monster, possibly with huge limbs and hands, possibly with a thick felt of hair, and they call it the Heidelberg Man.

This jaw−bone is, I think, one of the most tormenting objects in the world to our human curiosity. To see it is like looking through a defective glass into the past and catching just one blurred and tantalizing glimpse of this Thing, shambling through the bleak wilderness, clambering to avoid the sabre−toothed tiger, watching the woolly rhinoceros in the woods. Then before we can scrutinize the monster, he vanishes. Yet the soil is littered abundantly with the indestructible implements he chipped out for his uses.

Still more fascinatingly enigmatical are the remains of a creature found at Piltdown in Sussex in a deposit that may indicate an age between a hundred and a hundred and fifty thousand years ago, though some authorities would put these particular remains back in time to before the Heidelberg jaw−bone. Here there are the remains of a thick sub−human skull much larger than any existing ape's, and a chimpanzee−like jaw−bone which may or may not belong to it, and, in addition, a bat−shaped piece of elephant bone evidently carefully manufactured, through which a hole had apparently been bored. There is also the thigh−bone of a deer with cuts upon it like a tally. That

is all.

What sort of beast was this creature which sat and bored holes in bones?

Scientific men have named him Eoanthropus, the Dawn Man. He stands apart from his kindred; a very different being either from the Heidelberg creature or from any living ape. No other vestige like him is known. But the gravels and deposits of from one hundred thousand years onward are increasingly rich in implements of flint and similar stone. And these implements are no longer rude "Eoliths." The archaeologists are presently able to distinguish scrapers, borers, knives, darts, throwing stones and hand axes$f$.

We are drawing very near to man. In our next section we shall have to describe the strangest of all these precursors of humanity, the Neanderthalers, the men who were almost, but not quite, true men.

But it may be well perhaps to state quite clearly here that no scientific man supposes either of these creatures, the Heidelberg Man or Eoanthropus, to be direct ancestors of the men of to−day. These are, at the closest, related forms.

X. The Neanderthaler and the Rhodesian Man

ABOUT fifty or sixty thousand years ago, before the climax of the Fourth Glacial Age, there lived a creature on earth so like a man that until a few years ago its remains were considered to be altogether human. We have skulls and bones of it and a great accumulation of the large implements it made and used. It made fires. It sheltered in caves from the cold. It probably dressed skins roughly and wore them. It was right−handed as men are.

Yet now the ethnologists tell us these creatures were not true men. They were of a different species of the same genus. They had heavy protruding jaws and great brow ridges above the eyes and very low foreheads. Their thumbs were not opposable to the fingers as men's are; their necks were so poised that they could not turn back their heads and look up to the sky. They probably slouched along, head down and forward. Their chinless jaw−bones resemble the Heidelberg jaw−bone and are markedly unlike human jaw−bones. And there were great differences from the human pattern in their teeth. Their cheek teeth were more complicated in structure than ours, more complicated and not less so; they had not the long fangs of our cheek teeth; and also these quasi−men had not the marked canines (dog teeth) of an ordinary human being. The capacity of their skulls was quite human, but the brain was bigger behind and lower in front than the human brain. Their intellectual faculties were differently arranged. They were not ancestral to the human line. Mentally and physically they were upon a different line from the human line.

Skulls and bones of this extinct species of man were found at Neanderthal among other places, and from that place these strange proto−men have been christened Neanderthal Men, or Neanderthalers. They must have endured in Europe for many hundreds or even thousands of years.

At that time the climate and geography of our world was very different from what they are at the present time. Europe for example was covered with ice reaching as far south as the Thames and into Central Germany and Russia; there was no Channel separating Britain from France; the Mediterranean and the Red Sea were great valleys, with perhaps a chain of lakes in their deeper portions, and a great inland sea spread from the present Black Sea across South Russia and far into Central Asia. Spain and all of Europe not actually under ice consisted of bleak uplands under a harder climate than that of Labrador, and it was only when North Africa was reached that one would have found a temperate climate. Across the cold steppes of Southern Europe with its sparse arctic vegetation, drifted such hardy creatures as the woolly mammoth, and woolly rhinoceros, great oxen and reindeer, no doubt following the vegetation northward in spring and southward in autumn.

Such was the scene through which the Neanderthaler wandered, gathering such subsistence as he could from small game or fruits and berries and roots. Possibly he was mainly a vegetarian, chewing twigs and roots. His level elaborate teeth suggest a largely vegetarian dietary. But we also find the long marrow bones of great animals in his caves, cracked to extract the marrow. His weapons could not have been of much avail in open conflict with great beasts, but it is supposed that he attacked them with spears at difficult river crossings and even constructed pitfalls for them. Possibly he followed the herds and preyed upon any dead that were killed in fights, and perhaps he played the part of jackal to the sabre−toothed tiger which still survived in his day. Possibly in the bitter hardships of the Glacial Ages this creature had taken to attacking animals after long ages of vegetarian adaptation.

We cannot guess what this Neanderthal man looked like. He may have been very hairy and very inhuman−looking indeed. It is even doubtful if he went erect. He may have used his knuckles as well as his feet to hold himself up. Probably he went about alone or in small family groups. It is inferred from the structure of his jaw that he was incapable of speech as we understand it.

For thousands of years these Neanderthalers were the highest animals that the European area had ever seen; and then some thirty or thirty−five thousand years ago as the climate grew warmer a race of kindred beings, more intelligent, knowing more, talking and co−operating together, came drifting into the Neanderthaler's world from the south. They ousted the Neanderthalers from their caves and squatting places; they hunted the same food; they probably made war upon their grisly predecessors and killed them off. These newcomers from the south or the east−for at present we do not know their region of origin−who at last drove the Neanderthalers out of existence altogether, were beings of our own blood and kin, the first True Men. Their brain−cases and thumbs and necks and teeth were anatomically the same as our own. In a cave at Cro−Magnon and in another at Grimaldi, a number of skeletons have been found, the earliest truly human remains that are so far known.

So it is our race comes into the Record of the Rocks, and the story of mankind begins.

The world was growing liker our own in those days though the climate was still austere. The glaciers of the Ice Age were receding in Europe; the reindeer of France and Spain presently gave way to great herds of horses as grass increased upon the steppes, and the mammoth became more and more rare in southern Europe and finally receded northward altogether*f*.

We do not know where the True Men first originated. But in the summer of 1921, an extremely interesting skull was found together with pieces of a skeleton at Broken Hill in South Africa, which seems to be a relic of a third sort of man, intermediate in its characteristics between the Neanderthaler and the human being. The brain−case indicates a brain bigger in front and smaller behind than the Neanderthaler's, and the skull was poised erect upon the backbone in a quite human way. The teeth also and the bones are quite human. But the face must have been ape−like with enormous brow ridges and a ridge along the middle of the skull. The creature was indeed a true man, so to speak, with an ape−like, Neanderthaler face. This Rhodesian Man is evidently still closer to real men than the Neanderthal Man.

This Rhodesian skull is probably only the second of what in the end may prove to be a long list of finds of sub−human species which lived on the earth in the vast interval of time between the beginnings of the Ice Age and the appearance of their common heir, and perhaps their common exterminator, the True Man. The Rhodesian skull itself may not be very ancient. Up to the time of publishing this book there has been no exact determination of its probable age. It may be that this sub−human creature survived in South Africa until quite recent times.

XI. The First True Men

THE EARLIEST signs and traces at present known to science, of a humanity which is indisputably kindred with ourselves, have been found in western Europe and particularly in France and Spain. Bones, weapons, scratchings

upon bone and rock, carved fragments of bone, and paintings in caves and upon rock surfaces dating, it is supposed, from 30,000 years ago or more, have been discovered in both these countries. Spain is at present the richest country in the world in these first relics of our real human ancestors.

Of course our present collections of these things are the merest beginnings of the accumulations we may hope for in the future, when there are searchers enough to make a thorough examination of all possible sources and when other countries in the world, now inaccessible to archaeologists, have been explored in some detail. The greater part of Africa and Asia has never even been traversed yet by a trained observer interested in these matters and free to explore, and we must be very careful therefore not to conclude that the early true men were distinctively inhabitants of western Europe or that they first appeared in that region.

In Asia or Africa or submerged beneath the sea of to−day there may be richer and much earlier deposits of real human remains than anything that has yet come to light. I write in Asia or Africa, and I do not mention America because so far there have been no finds at all of any of the higher Primates, either of great apes, sub−men, Neanderthalers nor early true men. This development of life seems to have been an exclusively old world development, and it was only apparently at the end of the Old Stone Age that human beings first made their way across the land connexion that is now cut by Behring Straits, into the American continent.

These first real human beings we know of in Europe appear already to have belonged to one or other of at least two very distinct races. One of these races was of a very high type indeed; it was tall and big brained. One of the women's skulls found exceeds in capacity that of the average man of to−day. One of the men's skeletons is over six feet in height. The physical type resembled that of the North American Indian. From the Cro−Magnon cave in which the first skeletons were found these people have been called Cro−Magnards. They were savages, but savages of a high order. The second race, the race of the Grimaldi cave remains, was distinctly negroid in its characters. Its nearest living affinities are the Bushmen and Hottentots of South Africa. It is interesting to find at the very outset of the known human story, that mankind was already racially divided into at least two main varieties; and one is tempted to such unwarrantable guesses as that the former race was probably brownish rather than black and that it came from the East or North, and that the latter was blackish rather than brown and came from the equatorial south.

And these savages of perhaps forty thousand years ago were so human that they pierced shells to make necklaces, painted themselves, carved images of bone and stone, scratched figures on rocks and bones, and painted rude but often very able sketches of beasts and the like upon the smooth walls of caves and upon inviting rock surfaces. They made a great variety of implements, much smaller in scale and finer than those of the Neanderthal men. We have now in our museums great quantities of their implements, their statuettes, their rock drawings and the like.

The earliest of them were hunters. Their chief pursuit was the wild horse, the little bearded pony of that time. They followed it as it moved after pasture. And also they followed the bison. They knew the mammoth, because they have left us strikingly effective pictures of that creature. To judge by one rather ambiguous drawing they trapped and killed it.

They hunted with spears and throwing stones. They do not seem to have had the bow, and it is doubtful if they had yet learnt to tame any animals. They had no dogs. There is one carving of a horse's head and one or two drawings that suggest a bridled horse, with a twisted skin or tendon round it. But the little horses of that age and region could not have carried a man, and if the horse was domesticated it was used as a led horse. It is doubtful and improbable that they had yet learnt the rather unnatural use of animal's milk as food.

They do not seem to have erected any buildings though they may have had tents of skins, and though they made clay figures they never rose to the making of pottery. Since they had no cooking implements their cookery must have been rudimentary or nonexistent. They knew nothing of cultivation and nothing of any sort of basket work or woven cloth. Except for their robes of skin or fur they were naked painted savages.