

The Hall of the Age of Man in the American Museum.¹

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AN important event in the American Museum of Natural History is the approaching completion of the Hall of the Age of Man. This hall has been planned as a climax to the series of collections in invertebrate and vertebrate palæontology, arranged so that the student or visitor will begin with the Hall of Invertebrates, dating back to the Cambrian, and pass in geologic and palæontologic sequence through a series of five halls surrounding the south-east court, to be devoted to the Age of Fishes; the Age of Amphibians, of Permian and Triassic Reptiles; the Age of Jurassic Reptiles, including the giant Sauropoda; to the Cretaceous Reptiles; into the Age of Mammals; and finally into the Hall of the Age of Man. This will afford effective exhibition of the collections in vertebrate palæontology which

arranged in ascending order from an introductory genealogical tree of the Primates to the races which overran Europe in Neolithic times. On the floor space surrounding these central cases are shown some of the chief types of mammals of the four continents, Africa, Eurasia, North and South America, which was also the great theatre of human evolution during late Pliocene and Pleistocene times.

Around the walls, above the cases, is a series of four large mural paintings which present the mammalian life of these continents during the final period of maximum glaciation and the close of the immediately preceding Third Glaciation period. This is the reindeer and mammoth period in Central Europe, of the late loess period of northern France, of the loess deposition of the

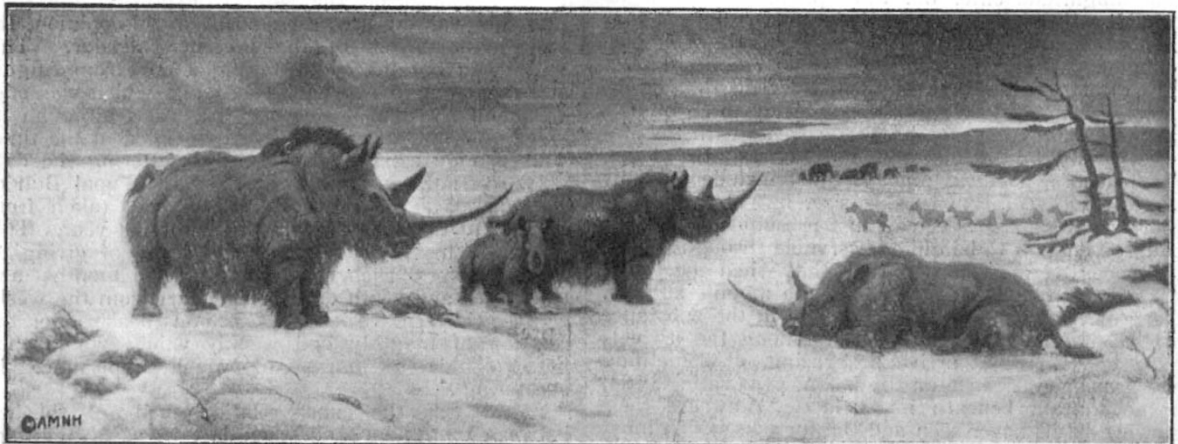


FIG. 1.—The most common of the many extinct rhinoceroses is the *Rhinoceros antiquitatis* or woolly rhinoceros of Europe and Siberia. This species was most like the square-mouthed or white rhinoceros of Africa nearly extinct to-day. It was protected from the wintry blasts by a heavy coat of long hair and a thick undercoat of fine wool. This brown wool was found in a good state of preservation on the side of the face of one specimen discovered in the ice-fields of Siberia, and is now in the Museum of Petrograd. In the distance can be seen a group of mammoths and a line of saigas—an extinct species of antelope. The rhinoceros kept closely to the ice-sheet and never wandered so far south as did the mammoth. It was a plains-dweller, living on grass and small herbs.

began in 1891 and extend from the first appearance of vertebrate life to the very close of the Pleistocene of North America. These collections now include about 25,000 catalogued specimens, chiefly from North and South America, but there are also specimens from Eurasia, Africa, and Australia, obtained either by museum expeditions or by exchange.

The Hall of the Age of Man is of especial interest because it affords the first opportunity of working out in palæontology the general theory of exhibition which prevails throughout the American Museum—namely, to present animals, extinct as well as living, in their environment. In this hall what is actually known of the history of man is presented in a series of ten central cases

Pampean region of South America, and of the loess deposition on the Missouri River in the latitude of Kansas, where the native American horse appeared for the last time on the American continent. These murals represent the four seasons of the year in mid-Glacial time. Thus the woolly rhinoceros, the saiga antelope, and the woolly mammoth are shown (Fig. 1) in a midwinter steppe scene of northern France. The succeeding mural (Fig. 2) represents early spring, herds of mammoth and of reindeer migrating northward. This is the most authentic of the murals, because it is based upon the painting, drawing, and sculpture of the contemporary Crô-Magnon race (Fig. 4). Midsummer is depicted on the Missouri River in the latitude of Kansas (Fig. 3); the least-known animal in this stage is *Bison regius*, which is represented in the American Museum by a gigantic head and horns, the only

¹ The present article was prepared at the request of the Editor as an abstract from an article with the same title which appeared in the popular journal of the American Museum, *Natural History*, vol. xx., May-June, 1920, No. 3.



FIG. 2.—Early spring.—“The Reindeer and Mammoth on the River Somme, France.”—It is thought not improbable that herds of mammoth, rhinoceroses, and reindeer migrated northward and southward with the seasonal changes. This mural represents a northward march in the spring. As the mammoth was faithfully depicted by the Crô-Magnon artists—especially in the cavern at Font-de-Gaume—and as mammoth skeletons have been well preserved, there can be little doubt that the present representation by Knight is a close likeness of this huge proboscidean. The woolly mammoth resembled greatly an Indian elephant, but was somewhat larger, was covered with coarser hair, and had larger and differently curved tusks. Whole carcasses of these beasts have been found frozen in the ice-fields of Siberia, where they probably survived later than in Europe.

type of this species thus far found. The autumn scene of this series is in northern New Jersey, the place of discovery of the deer-moose, or *Cervales*, of the northerly range of the tapir, and of the North American coypu type of rodents known as *Castoroides*.

On the opposite side of the hall, facing the four seasonal series, are other murals, which represent the life of the Pampean region, the ground sloths, glyptodonts, toxodonts, and macrauchenias, in a series of groups. Very careful studies of the superb fauna of southern California are now being made for murals, which will depict the life discovered in the tarpools in the vicinity of Los Angeles, where occurs the most remarkable collection of extinct mammals so far found in the whole history of palæontology, since the entire fauna of early and middle Pleistocene times is represented, including the three types of mammoth—the imperial, the Columbian, and the woolly—the bison, the horse, the camel, the sabretoothed tiger, and the giant lion, *Felis atrox*. It is intended to show here the entire mammalian and avian fauna of the period. Studies upon the animals in these murals now extend over eight years, and other years of additional study will be needed. The restorations themselves are preceded by models. The naturalness of the scenes is aided by kinema reproductions secured by recent museum expeditions of similar scenes among existing large mammals of Africa and from drawings made in early days in Africa, when the mammals were still in their primitive number and variety.

Materials in the central cases devoted to human prehistory are placed in ascending order, beginning with replicas of the Trinil man of Dubois, the Piltdown man of Smith Woodward, and the Heidelberg man of Schoetensack. In the final arrangement each will occupy an entire case showing the geologic position of the find, replicas of the original materials, the author's restorations, and museum restorations by Prof. McGregor. It is noteworthy that a hundred years of fossil hunting in various parts of the world have yielded only these three individual types of human and prehuman ancestors. As soon as the period of human burial begins, in the closing centuries of the long period when the Neanderthal race covered western Europe, skeletal remains become very abundant, and it will require two large cases to exhibit replicas and restorations of the Neanderthal species of man successively discovered near Gibraltar, Neanderthal, Spy, Krapina, at many points in the Dordogne Valley, and most recently in Spain. The masterly work of Boule on this race is supplemented by the exhaustive anatomical studies of McGregor and other anatomists which form the materials on which the first of the murals depicting life in the Old Stone age is founded; this is the beginning of the Cave period, and a group of Neanderthals is represented in a flint quarry in front of the Grotto Le Moustier, which gives its name to the whole period of Mousterian culture.

The second of the human murals (Fig. 4) is that for which the evidence is most authentic, inasmuch as we have several complete skeletons of Crô-Magnon man, giving us the entire anatomy; also the lamps, the ornaments, the insignia of the chieftains, the materials showing the methods of preparing the paints, and, still more remarkable, the actual painting of the procession of the mammoths, which is taken as the central feature of this restoration. It would appear that the highly evolved Crô-Magnon race entered Europe from the east and drove out the Neanderthals. There is little evidence of inter-marriage between these two widely distinct races, although two of the skeletons of the burial at La Ferrassie show characters which may be so interpreted. The contrast between the Crô-Magnon heads and those of the Neanderthals is as wide as it possibly could be. The Crô-Magnons are people like ourselves in point of evolution, and the characters of the head and cranium reflect their moral and spiritual potentialities, while the body skeleton points to a physically perfect race.

The concluding mural of the human series represents a group of stag-hunters depicted as men of the northern fair-haired race living along the southern shores of the Baltic in the earliest phase of the Neolithic—the stage known as the Campignian from the remains of huts and rudely finished implements found near Campigny, in France. If of Nordic affinity, this race was courageous, warlike, hardy, and probably of lower intelligence than the Crô-Magnons. It is still, however, an open question to what primary branch of European stock this race of Campigny belonged.

In each of the central cases the culture element is associated with the skeleton wherever it has been found to show correlation between the mental development and the industrial or artistic stage. The tests of a museum exhibition series are, first, that it meets the specialist's demand for accuracy; secondly, that the exhibits are arranged in such a way as to attract and arouse the interest of the people; and thirdly, that the aroused interest leads to a more careful examination of materials and to at least a dawning comprehension of what they signify. The central cases and the models and murals which seek to interpret them appear to stand all three tests admirably. They arouse the interest of increasing numbers of visitors,² and it is noticeable that the Old Stone age and the cave man are finding their way into the current intellectual life of the American people, who, in general, are far behind their European contemporaries in their general knowledge of the rudiments of anthropology and archæology. This exhibition series presents the facts of human evolution in a simple and convincing way.

The collections of original fossils brought together in the Hall of the Age of Man are worthy of supplementing the human series found in the

² The annual attendance is now above a million. Sunday attendances during January, 1921, averaged 12,500. By its contract with the City of New York the museum now receives 350,000 dollars annually from the Municipality of New York.



FIG. 3.—Mid-summer.—The Mastodon, Royal Bison, and Horse on the Missouri River, in the Latitude of Kansas. —This mural presents a summer scene in a region of North America south of the farthest advance of the ice-sheet. The great mastodon (left) with flat, elongated head and extremely short, massive legs survived in America to a time contemporary with man in Europe, but no mastodons lived in Europe at such a late period. In the centre of the picture are seen the royal bison (*Bison regius*), the gigantic forerunners of our present bison. On the right is a group of the last species of native American horse (*Equus scottii*), which disappeared before the appearance of man on the North American continent.

central cases. They cover the complete evolution of the Proboscidea, from the early stages in the life of this great order described by Andrews in the genera *Phiomia* and *Palæomastodon* from the Fayûm region of northern Africa. This collection carries us back into an early period in the Age of Mammals, the Oligocene, for it has been deemed wise to present here the entire history of the evolution of the Proboscidea, which, taken altogether, is the most majestic line of evolution thus far discovered. It is possible that the ancestors of man were the companions of the proboscidean race from the beginning, because the *Propliopithecus*, the companion of the *Palæomastodon* in the Fayûm, is at least structurally ancestral to the higher apes and man—in other words, it is a possible prehuman link, for it is conceivable that

the true *Mastodon americanus* of the eastern American forests in the late Pleistocene. This race reaches its climax in the massive *M. americanus*, represented in the famous specimen known as the Warren mastodon, which was presented to the museum by the late J. Pierpont Morgan. Nearby is the complete skeleton of the American woolly mammoth, *Elephas primigenius*, above which towers the partial skeleton of the imperial mammoth, *E. imperator*.

The south-west quarter of the hall is devoted to the Cope Pampean Collection, chiefly consisting of mounted skeletons of the ground sloth family and the glyptodonts, and of the sabre-toothed tiger of the Pampean region. With these are casts of the skeletons of three other characteristic South American animals, the Macrau-

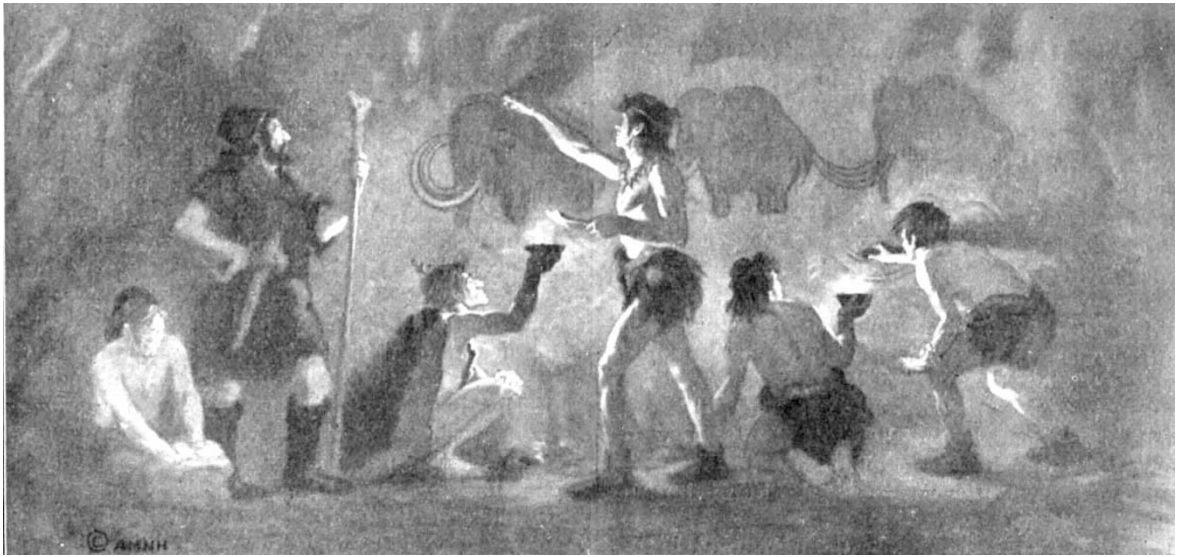


FIG. 4.—Contemporaneously with the disappearance of the last Glacial period in Europe, a highly evolved race in no respect inferior to modern man entered that continent from the east and drove out or exterminated the Neanderthal race, of which they were both the mental and physical superiors. Their cultural capacity is indicated not alone by their physiognomy and the cubic content of their brain, but has also been demonstrated by the handiwork and especially the artistic productions which they have left in the caves of southern Europe. The Palæolithic murals and sculptures in relief found on the walls of limestone grottoes in France and Spain indicate greater artistic sense and ability than have been found among any other uncivilised people. The mural above, painted by Knight for the Hall of the Age of Man, represents four Crê-Magnon artists at work on the famous procession of mammoths as found in the cave of Font-de-Gaume, Dordogne, France. The two half-kneeling figures are holding lamps made of hollowed-out stones. The artist standing half erect is engaged in incising the outlines of a mammoth on the limestone wall with a sharp flint; the other artist is laying on the colours, employing a shoulder-bone for a pallet. The kneeling figure is preparing colours from red or yellow ochre. The clothed man to the left is a chieftain who carries a *bâton de commandement* on his staff as an insignia of his rank.

from such an animal the anthropoids and human lines diverged.

The higher Proboscidea include two complete skeletons and several skulls of the superb race of long-jawed mastodons which have recently been shown by the studies of Dr. Matsumoto to be the true descendants of *Phiomia* of northern Egypt through the classic narrow-toothed mastodon, *M. angustidens*, of Central France in Miocene times. This very vigorous and successful race, starting from Egypt, reached North America at the close of the Miocene, spread all over the present region of the United States during Pliocene times, and then became entirely extinct.

It now appears that the Egyptian form of *Palæomastodon* is, as its happily chosen name indicates, actually an ancient mastodon which gave rise to

chenia, *Toxodon*, and *Hippidium*.³ To demonstrate the American migration of both the sloths and glyptodonts into North America in late Pliocene times, there is also a series of North American ground sloths and glyptodonts, chiefly derived from the explorations of the museum in Texas and Mexico, and from the region of the Rancho La Brea tarpoos of southern California, where the sloths occurred in very great abundance.

This scheme of arrangement whereby interest is centred in the fauna fits in with that of the remainder of the hall showing the wonderful climax in the Age of Mammals, when a similar mammalian fauna covered the tem-

³ The valuable collections obtained from the Miocene of Patagonia and certain early Tertiary North American fossil mammals are also assembled here as affording light on the origin and early history of this marvellous Pampean fauna of South America.

perate regions of the entire northern hemisphere as far south as North Africa and Mexico, which appear to have been the southern limit of the great waves of migration of the various types of mammoths from Central Asia. This is, in fact, the climax in the history of such diverse families as the proboscideans, camels, horses, bison, and the great carnivora that preyed upon them. The impression created by the collection in a single hall of all these various types is that the period just preceding the final great glaciation of the northern hemisphere witnessed the assemblage of the most superb land mammals that the earth has produced. It is virtually the climax of the Age of Mammals, and marks the beginning of what

has since proved to be the close of the Age of Mammals, because the elimination which began from natural causes during the early stages of human evolution, and reached the dimensions of a cataclysm as the Ice age progressed, has now been accelerated by the introduction of firearms. By the middle of the present century man will be alone amid the ruins of the mammalian world he has destroyed. The period of the Age of Mammals will have entirely closed, and the Age of Man will have reached a numerical climax, from which some statisticians believe it will probably recede, because we are approaching the point of the over-population of the earth in three of the five great continents.

The Rise and Development of the Sussex Iron Industry.

A PAPER of considerable interest on this subject was recently read before the Newcomen Society (formed two years ago for the study of the history of engineering and technology) by Mr. Rhys Jenkins. He pointed out that although the industry in Sussex has been extinct for a hundred years, the district is historically one of great importance, for it was here that the blast-furnace was first used in England, and afterwards spread to what are now the chief iron-making districts in the Midlands, the North, and South Wales. Although it is customary to speak of the district as Sussex, it embraces parts of Kent, Surrey, and Hampshire; in fact, it is the Weald between the North and South Downs. Sites of old iron works exist from a little beyond Haslemere on the west to Sissinghurst on the east.

It appears that iron was manufactured in the Weald in early times, and there are clear indications of the existence of the industry during the Roman occupation. It is supposed to have waned with the coming of the Anglo-Saxons, and the indications of its existence are very scanty until Norman times are reached. Down to about the fifteenth century the iron was made by a direct process—*i.e.* the ore was reduced directly to malleable iron. Its production must have been on quite a small scale. At some period in the latter half of the fifteenth century, however, the blast-furnace was introduced into Sussex, and proved to be the forerunner of the modern process in which the ore is first smelted with the production of fluid pig-iron, and afterwards converted either into wrought iron or into one of the many varieties of steel. It was the blast-furnace which started the Wealden iron industry on its career of prosperity, and soon Sussex became the premier iron-producing district of England. It must not be imagined that there was ever anything in the nature of a "black country," for, although there were a great many works, they were scattered over a wide area, and they were small. The only fuel employed was charcoal, and the power was derived from the streams.

Mr. Jenkins reviewed at some length the evidence available, and came to the conclusion that the blast-furnace, together with the finery process for converting cast iron into malleable iron, had been introduced into England before the year 1500; by that date there were certainly three furnaces at work—namely, at Buxted, Hartfield, and Newbridge. The iron workers were of French origin, and this points to the method of manufacture having been borrowed from France. No doubt the old direct method of manufacture did not disappear at once, but it is probable that by the middle of the sixteenth century it had been entirely displaced. By that time a number of native workmen had been trained in the new process, and the total number of works in the district, according to a return made in the year 1548, was fifty-three, of which about half were furnaces. The new works were established as near as possible to the sea-coast; clearly the object was to reduce, so far as possible, the expensive land transport. Every reduction in the cost of carriage placed the Sussex maker on a more favourable footing, as against the foreigner, in the London market.

The direct process had been carried out on a small scale, and produced a bloom weighing from 100 lb. to 200 lb. at a time. The manufacture could be carried on with few appliances and inexpensive erections, and entirely by human labour. It needed only a small capital outlay; obviously it was the industry of the small man. All this was changed with the coming of the blast-furnace. The furnaces, with the finery, chafery, and hammer, were comparatively expensive structures. The furnace bellows and the hammer called for more power than could be conveniently applied by workmen, so water-power was pressed into service. This meant the acquisition of an existing mill, possibly of a number of water rights, and the construction of dams or bays to form the furnace and hammer ponds, once so common a feature in Sussex. All this required an outlay of capital, probably in many cases the ownership of land, etc.; in short, iron-making was transformed