

Pithecanthropus Erectus

PART ONE

— A Classic of Science

Anthropology

PITHECANTHROPUS ERECTUS—A Form from the Ancestral Stock of Mankind. By Eugene Dubois. Part of a paper read before the Berlin Anthropological Society on the 14th of December, 1896. Translated from the Anatomischer Anzeiger, Vol. XII. Published in the general appendix to the Smithsonian Report for 1898. Washington, 1899.

THE fossil remains upon which I have founded this new species consist of a calvarium, or skullcap, two upper molars, and a femur. With the exception of one tooth, the second upper molar on the left side, they have already been described by me in a paper published in Batavia in 1894. It now seems desirable to give some special details.

It is well known that a not inconsiderable number of anatomists and zoologists hold diametrically opposite views regarding the significance of these remains. For instance, as to the skull, a few have believed that it is human, although of much more ape-like appearance than hitherto known, while others have considered it the skull of an ape far more human in character than any previously discovered. It is remarkable that only a few have believed in a third possibility, intermediate between these two views, viz, that we have before us here a transition form between apes and men that is neither man nor ape. Recently this intermediate view has made quite significant progress, and a considerable number have accepted it. As to the anthropists and pithecosts, as the upholders of the extreme views may be called, the former find their fossil Java man more ape-like than they at first did, while the latter have placed their most anthropoid of apes still a few steps higher on the ladder of ascent toward man. These views now tend to coincide still more, because in the meantime it has been possible to test them by an exhibition of the objects themselves, and I have been able to give further particulars,

The rocks at Trinil where the pithecanthropus bones were found:—A, area of growing plants; B, soft sandstone; C, lapilli stratum; D, level at which the skeletal remains were found; E, conglomerate; F, argillaceous layer; G, marine breccia; H, wet-season level of the river; I, dry-season level of the river.

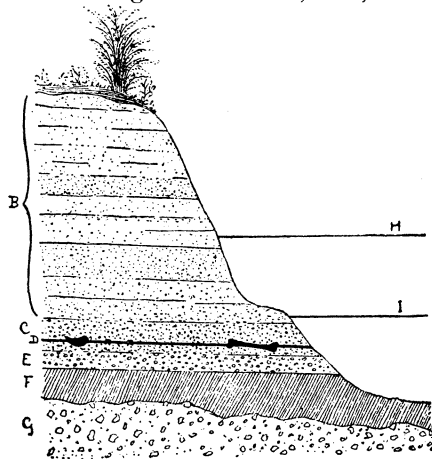
It was a day of startled awakening in the field of biology when Dubois dug up in the wilds of Java the oldest human bones—or the most advanced ape bones—that the understanding human eye had seen. The site of the find is described in the "Classic" for this week, and next week, in part two, the discoverer's description of the bones will be reprinted.

especially as to the circumstances under which the remains were found.

For the proper interpretation of these osseous remains the circumstances under which they were found is quite as important a factor as the anatomical considerations. I will therefore first give some particulars regarding their situation when discovered.

Near the remains that are the subject of this paper I have collected in Java, at Trinil, in the Ngawa district of the Madiun Residency, a great number of fossil skeletal parts of other vertebrate animals belonging to the same species as those found by me during five years of researches at many other places in the same strata, which lie exposed over some hundreds of square kilometers. To judge from the uplifting which these strata have undergone, in the course of which they have all been tilted (at Trinil about 5 degrees south), and also from other geological evidence, they are older than the Pleistocene, apparently older than the early Pliocene. They are of a fluvial character, and lie, more than 350 meters thick, unconformably, upon marine strata, which K. Martin, in Leyden, has determined as Pliocene.

According to the fauna, also, as far



as I have been able to study it up to this time, it is highly probable that the strata are early Pliocene. This fauna is very similar to the fossil vertebrate fauna of western India, but appears to be younger than the Siwalik fauna of the early Miocene or later Pliocene and somewhat older than the fauna of Narbada, which has been placed in the earliest Pleistocene.

At the place where the remains were discovered at Trinil the strata, everywhere composed of volcanic tufa, lie exposed in the cliff-like declivity of the bank of a river of considerable size, the Bengawan, or Solo. They usually consist here of a sandstone of slight consistency which, in its deeper layers, at about the level of the river during the dry season, becomes coarser and coarser as more and more lapilli or volcanic stones form part of its composition. The bones are found throughout the entire thickness of the sandstone strata, being very numerous in the lower half, and most so in the stratum, about 1 meter thick, in which the lapilli are found. In the conglomerate which lies under this I found but few, and none at all in the subjacent argillaceous layer.

The four fragments of the skeleton of Pithecanthropus were found in different years, because, on account of the rise in the river during every rainy season, the excavations were necessarily suspended and could not be resumed until the next dry season. Besides, in the same working season one fragment was found later than the other, because the stone had to be removed cautiously in layers and by marked off areas.

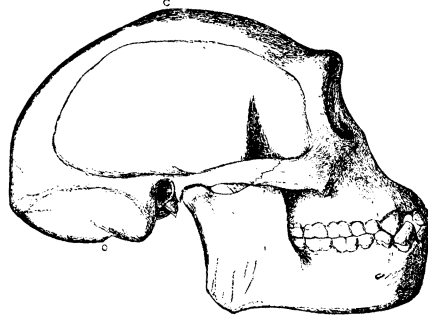
The four fragments, were, however, found at exactly the same level in the entirely untouched lapilli stratum (fig. 1). They were therefore deposited at the same time; that is to say, they are of the same age. The teeth were distant from the skull from 1 to, at most, 3 meters; the femur was 15 meters away. The quite sharp relief of their surface does not support the theory that they have been washed out from some older layer and then embedded for a second time. They were found at the place of their original deposit. Besides they all show exactly the same state of preservation

and of petrefaction as do all other bones that have been taken from this particular stratum at Trinil. Their specific gravity (sp. gr. of compact tissue = 2.456) is much greater than that of unpetrified bones (sp. gr. of compact tissue = 1.930). The femur weighs 1 kilogram, therefore considerably more than double the weight of a recent human femur of the same size; the medullary cavity is partly filled with a stony mass. The eroded upper surface which the skullcap and not the femur shows occurred in the bed where it was found, appearing on many bones excavated near the skullcap, and is caused by infiltration of water through the cliff at that place.

Associated with these bones I also found very numerous remains of a small axis-like species of *Cervus*, frequently, also, the remains of *Stegodon*. Farther away were found *Bubalus*, apparently identical with the Siwalik species, *Leptobos*, *Boselaphus*, *Rhinoceros*, *Felis*, *Sus*, *Hyæna*, that all appear to be of new species. Of species found in other situations of the same stratum I will mention a gigantic *Manis*, more than three times the length of the existing Javanese species; a *Hippopotamus*, belonging to the same subspecies, *Hexaprotodon*, as the forms from the Siwalik and Narbada strata of western India.

Upon the evidence of these remains I determined that the four skeletal fragments were of exactly the same age, and very probably early Pliocene. Further, these remains, in connection with the anatomical investigation of the skeletal fragments, have firmly convinced me that these fragments are all parts of one and the same skeleton. The total result of the discussion of these fragments that has been carried on by many eminent anatomists in no way contradicts this conclusion; on the contrary, it raises the presumption that it is highly improbable that they do not belong together.

A few anatomists hold that the fragments are parts of a human skeleton; according to others there is no doubt but that they belonged to individuals of the same race. Others, again, consider the femur to be quite human, while they think that the skullcap and teeth must have belonged to the most anthropoid of all anthropoid apes. A few anatomists, however, agree with me in the opinion that a femur entirely human in character might nevertheless belong to the same individual as this ape-like skull, because a similar function would entail a similar form. Besides, this femur



has certain peculiarities that I have not been able to find in a single one of some hundreds of thigh bones, so that it is not human in the usual sense of the word.

If we adopt the view that the skullcap is that of an ape, and, indeed, as must be acknowledged, that of the most man-like of all, but that the femur is that of a man, then both of these fragments must have been deposited at the same time in what was very probably an early Tertiary bed. We would then have in this case two specially important, but wholly unknown, closely related forms found together. Now, on the one hand, human bones have never been recognized below the Middle Pleistocene, much less as low as the Tertiary, and, on the other, but few remains of apes have been found, and these are much smaller, more significant, and by no means as human in character as the skullcap in question. There is therefore little probability that this view is correct. The view that these fragments were derived from different individuals of one and the same race has also very little to support it. After explorations which have been extended for five years over hundreds of square kilometers of exposed strata more than 350 meters thick and containing everywhere a numerous and homogeneous fauna, I have found, with but one possible exception, nothing which could be referred to this or any similar race.

According to all paleontological experience, the parts must have belonged to a single skeleton in case their anatomical configuration does not contradict such unity of origin. This is, however, not the case. The considerations advanced by many anatomists on this subject lead, when taken together, really to no other conclusion than that the fragments were derived from one individual. The more I myself have studied these fragments the more firmly I have been convinced of this unity of origin; and at the same time it has become ever clearer to me that they are really parts of a form

Dubois, who discovered the pithecanthropus bones, made this restoration of the probable shape of the entire skull. He finds the part of the skull extant very similar to the corresponding part of a gibbon's skull, but twice as large. He therefore followed the cranial architecture of that primitive ape in filling in the missing features.

intermediate between men and apes, which was the ancestral stock from which man was derived. They all show, though in somewhat different degree, intermingled human and ape-like characters.

I.—THE SKULLCAP

In the form of the skullcap similitude to that of the ape is undoubtedly predominant. Never yet has there been seen so flat and low a human skull, never yet, outside of the true apes, has so strong a projection of the orbital region been found. The skulls of Neanderthal and Spy and all microcephalic skulls are more highly vaulted, especially in the parietal region; the ratio between the central portion of the skull and the orbital part lying in front of the temporal fossa is quite the same as in the apes, differing widely from that of the lowest human skull, even that of Neanderthal and those of microcephali. Virchow has referred especially to this. It can be seen only on the left side, the right having suffered a notable loss of substance. The part of the wall of the orbit that lies in front of the deepest portion of the temporal fossa and belongs to the zygomatic process (external angular process) of the frontal bone is, in its antero-posterior dimension, about twice as large as that of the most ape-like human skulls. Further, it would be difficult to find in a human skull so strongly developed a *torus occipitalis transversus* as that of the Javanese skull, and the lower part of the *squama temporalis* of that specimen retreats outwardly, as it does in the apes.

Those who have followed the history of the Neanderthal skull are aware that there has never existed regarding it such divergence of opinion as to its man or ape-like qualities as has arisen concerning the Pithecanthropus. The two opposed views in that case were: Ape-like man or diseased man; the native of the Neanderthal has from the very first always been considered as an undoubted, real man. The human character of the Pithecanthropus is, however, very questionable. The skull of the gibbon almost doubled in size would not be very different from it in external appearance.