The Significance of Peking Man.*

By Prof. G. ELLIOT SMITH, F.R.S.

THE brain-case found by Mr. W. C. Pei at Chou Kou Tien on Dec. 2, 1929, is the most significant and illuminating relic of primitive man ever recovered. Prof. H. Fairfield Osborn, writing in *Science* of Feb. 22, 1929, raises the possibility that Piltown man may be so old as the Pliocene. He claims that the dark-coloured fragments of the skull of *Eoanthropus* are intermingled with similarly coloured fragments of proboscidean molars of unquestionably Upper Pliocene age, and that it is not certain that *Eoanthropus* belongs to the Lower Pleistocene. In the case of *Sinanthropus*, there is no such uncertainty as to the contemporary fauna, for the human remains were left on the floor of a cave and a vast number of the animals which roamed the region of Chou Kou Tien in these remote times left their bones in the same cave. As all these fossils belong to the same geological epoch, the Lower Pleistocene, there can be no doubt of the age of *Sinanthropus*.

The discovery, at Chou Kou Tien, of fossil teeth of Lower Pleistocene age which were identified as human, had made it evident that at the close of Tertiary or the beginning of Quaternary time man, or a very closely related anthropoid, actually did exist in eastern Asia. This knowledge is of fundamental importance to students of human palaeontology. For in the same geological epoch *Pithecanthropus* was living in Java, *Eoanthropus* was roaming the region around Piltown in England, and at Mauer, very shortly afterwards, the man of Heidelberg, *Palaeanthropus*, represented the human family in Germany.

In November 1928 additional remains of human skulls—further teeth, portions of two lower jaws and fragments of brain-cases—were found. The peculiar features of the chin region of these jaws differed from those of all other known human specimens excepting only the Piltown jaw, to which they present a general resemblance, without being generically identical. There is a similar ape-like obliquity in the slope of the symphysis and traces of the simian shelf in the lingual aspect of the jaw. Not only do these peculiarities emphasise the peculiar features of *Sinanthropus*, but they also afford welcome confirmation to the views of those who regard the Piltown jaw as human.

The skull discovered by Mr. W. C. Pei was successfully freed from travertine after a labour of four months by Dr. Davidson Black, and then disarticulated and reconstructed. It is important not merely because it gives a much fuller idea of the exact form of the skull of an Early Pleistocene man (free from the doubts which arise in the case of a reconstructed specimen), but also because its peculiar features, revealing as they do many points which suggest an affinity with *Pithecanthropus*, associated in the same skull with others such as are known only in the case of the Piltown skull, form a bond

of union between the other two Early Pleistocene skulls, the characters of which hitherto have been supposed to be irreconcilable one with the other.

In addition to this, the skull of *Sinanthropus* reveals many features which are unknown in either of the other types and throws a great deal of light upon the characters of the common ancestor of the human family, from which all these genera had been derived. One of the most striking illustrations of this fact is the peculiar form of the mastoid region of the temporal bone, recalling as it does the condition found in the new-born child and in the adult anthropoid apes. For it lacks that salient character which is so distinctive of the adult human being of other genera.

The brain-case found in 1929 is that of a young adult corresponding in the state of its development with the condition found in modern human skulls at about eighteen years of age. When the skull was first examined, Prof. Davidson Black was impressed by the grace of its contours in comparison with the uncouth outlines of *Pithecanthropus*, and suggested the possibility that it might be female, with the reservation, of course, that the evidence at our disposal regarding this hitherto unknown type of being was altogether inadequate for any definite decision upon this matter.

The discovery of another brain-case was made in July 1930 by recovering from material brought in from the Chou Kou Tien cave (in October 1929) a series of fragments which articulated naturally one with the other to form the greater part of the calvaria. This discovery of a skull of another young adult of approximately the same age revealed a more lightly built skull with smaller eyebrow ridges, a less prominent forehead, and less obtrusive parietal eminences, which both Prof. Davidson Black and I consider to be probably of a different sex from the other skull.

One of the most remarkable points of contrast between the brain-case of *Pithecanthropus* and of *Eoanthropus* was the remarkable thickness of the latter, whereas the skull of *Pithecanthropus* was much thinner. In the case of the skull of *Sinanthropus* found on Dec. 2, 1929, the thickness of the bone (Fig. 1) approximates to that of the Piltown skull. Not only does it resemble it in mere thickness, but also the architecture of the cranial vault (which in the case of the Piltown skull has hitherto been regarded as quite distinctive) is almost exactly reproduced in the case of *Sinanthropus*. In all other known human skulls the cranial bones consist of two fairly thick tables united by a comparatively thin layer of diploic tissue consisting of fine trabeculae. In the case of the thick cranial bones of both the Piltown and the Peking skulls, the tables are relatively thinner, and the thicker layer of diploic bone consists of a very robust network of coarse trabeculae. These similarities suggest that in the thickness and peculiar texture of the cranial bones of two Early Pleistocene skulls of different types

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(separated geographically as their habitats were by the whole extent of the continental land mass

FIG. 1.—Photograph of the upper aspect of the Peking skull with part of the roof removed to display the exceptional thickness of the bones and the small size of the brain cavity, which is occupied by a mass of limestone (travertine). The thickness and texture of the skull reveal an unexpected similarity to the conditions found in the Piltdown skull.

between England and China) we are dealing with characters of primitive man for which no close analogy can be found in the apes. This condition in the Piltdown skull was regarded either as pathological or the result of some freakish mutation. But the presence of the same condition in *Sinanthropus* enhances its importance.

Why the skull of primitive man should attain such an enormous thickness is difficult to explain: but the evidence provides an interesting problem for morphologists to endeavour to solve. Did primitive man's skull increase in thickness because the increase in the capacity of the brain-case deprived an increasing area of the protection of the temporal muscles?

For the moment, when there is no clear indication as to the meaning of this peculiar morphological feature, it is of interest as emphatic evidence of the affinity between *Eoanthropus* and *Sinanthropus* and of the enhanced importance of the structural peculiarity itself. The contrast in thickness between the cranial vault in *Pithecanthropus* and *Eoanthropus* acquires a new interest in view of the fact that the three (adult) skulls of *Sinanthropus* (one of the frag-

ments found in 1928 is thin because it is part of a child's skull) reveal a considerable range that is sufficient to bridge the gap which separates Piltdown man from the ape-man of Java.

The discovery of the two jaws in 1928, presenting as they did features hitherto known only in Piltdown man, raised the possibility that there had been discovered in China a type of human being more closely akin to the Pleistocene man of England than that of the ape-man of Java, who was geographically much nearer to the Peking man. When, however, in 1929 the skull was found (and the base was still embedded in the solid mass of travertine) the striking resemblances of the brain-case (Fig. 2) to that of *Pithecanthropus* suggested that, after all, the newly found genus was more nearly akin to his neighbour from Java. The skull revealed great projecting eyebrow ridges like those of *Pithecanthropus*, which provided a marked contrast to the condition found in Piltdown man, in which such ridges were lacking. The front part of the skull was also flattened and ill-filled, and had a prominent median crest such as that of *Pithecanthropus*. There was this difference in the frontal region of the bone, however, that the frontal eminences were definitely more obtrusive than those of *Pithecanthropus*. Turning to the consideration of the parietal bones, one finds a close resemblance to those of the Piltdown man. This resemblance depends both upon the fact that the bones tended to be raised up towards the middle line and are not so flat as those of *Pithecanthropus*, that there is a very definite parietal eminence such as is completely lacking in the Java skull, and that the postero-inferior corners of the parietal bones are everted in that peculiarly distinctive way found in the Piltdown skull. The occipital bone again presents a much closer resemblance to that of *Pithecanthropus*, and when we turn to consider the temporal bones we find a much more primitive condition of the mastoid and of the tympanic bones

FIG. 2.—The left side of a skull of Peking man found in July 1930. It shows the root of the nose and part of the base of the skull which were not present in the specimen found in December 1929, and it reveals certain minor differences from the other skull which have been interpreted as due to a difference in sex.

than that which is revealed in *Eoanthropus*. Unfortunately the temporal bone of *Pithecanthropus* has not yet been discovered, so that we cannot

institute comparisons between *Sinanthropus* and *Pithecanthropus* in this respect.

One of the most interesting features of the specimen found in 1929, a feature which Dr. Davidson Black inferred from the nature of the wear of the teeth long before the skull was found, is the fact that the condyloid fossa for articulation with the mandible presents a very close resemblance to the condition found in modern man, in size, depth, and direction. This fact is all the more remarkable because in other extinct members of the human family, in particular Rhodesian man and Neanderthal man, there are much more profound differences in the under-surface of the temporal bone. The attainment of the condition which became a permanent factor in *Homo sapiens* suggests that *Sinanthropus* is a primitive generalised type, and that modern man has retained many of these primitive characters.

Looking at the skull as a whole, one can say that its general form is intermediate between the conditions found in *Pithecanthropus* and *Eoanthropus*. It enables us to unite into a solid foundation the characters of the three most primitive members of the human family at present known. In giving coherence to this knowledge it also enables us to picture the nature of the common ancestor of all three, the as yet hypothetical Pliocene man.

The suggestion has been made that the Peking

man's distinctive features are not sufficiently pronounced to exclude him from the genus *Pithecanthropus*. The whole configuration of the skull, the texture of the cranial bones, the morphology of the frontal, parietal, and occipital bones, as well as the distinctive features of the teeth and mandible, clearly differentiate Peking man from the ape-man of Java, and present a contrast which is so profound as to compel us to accord it generic distinction. In many respects it differs from *Pithecanthropus* and resembles *Eoanthropus*, but the contrast to the latter is even more obtrusive. It occupies an intermediate position between the two, but is more primitive and generalised than either.

It is a very significant phenomenon that at Chou Kou Tien, in spite of the most careful search in the caves during the last three years, no trace whatever of implements of any sort has been found. It must not be forgotten, however, that Dr. Andersson in 1921 found pieces of quartz in association with the fossil bones, and that in the later stages of the excavation Mr. Pei found further examples of this alien material. Those who have been searching in vain for evidence of human craftsmanship on this site are being forced to the conclusion that the Peking man was in such an early phase of development as not yet to have begun to shape implements of stone for the ordinary needs of his daily life.

Vitamin B.

DISTRIBUTION AND PHYSIOLOGY.

THE general distribution of vitamin B is now fairly well defined, but the adequacy of different food substances in this respect for different species and the distribution of the various factors in the B complex are still subjects for investigation. R. H. A. Plimmer, with W. H. Raymond, J. Lowndes, and J. L. Rosedale, has examined the comparative vitamin B value of cereals, pulses, and nuts (*Biochem. Jour.*, vol. 21, p. 1141, 1927; vol. 23, p. 545; 1929). The preventive method was employed, using pigeons, and the criterion was maintenance for at least 26 weeks. All the vitamins required by the pigeon were therefore included in the estimation; symptoms of deficiency were paralysis and loss of weight. The diets used contained 5 per cent fish meal, white flour or white rice, and the substance under test in varying proportions. Dried yeast contained most vitamin: of the other foodstuffs, wheat germ was about half as good as the yeast, whole wheat, bran, and middlings contained about a tenth of the amount present in yeast, and other cereals about a twentieth. The majority of the pulses and nuts examined contained between a fifth and a tenth of the quantity present in yeast. More vitamin B is required for hatching and rearing young than for maintenance. Chickens require half as much again as pigeons, rats only about half; the requirements of human beings may be intermediate between those of the pigeon and the rat.

A. L. Bacharach and E. Allchorne (*ibid.*, vol. 22, p. 313; 1928) found that the vitamin B content of

malted flour was the same as that of the original unmalted flour, but that the malt extract appeared to contain more: the experiments were carried out on rats and the effect is attributed to the improvement in appetite brought about by the extract.

The content of vitamin B in seeds has been shown to be markedly influenced by the manure applied to the plant, by M. J. Rowlands and B. Wilkinson (*ibid.*, vol. 24, p. 199; 1930). Two similar plots of grass and clover were manured with an artificial manure and pigs' dung respectively: the pigs were fed on barley meal, middlings, and a small amount of a mixture of meat meal, rye and wheat embryo, bone meal, and cod liver oil. The manured patch produced a heavier crop, containing more clover, but the growth on the dunged patch was bigger. By preventive and curative growth tests on rats, it was shown that the vitamin B content of the seeds from the manured patch was much less than that of those from the dunged patch. In further experiments vitamin B was extracted from pigs' dung by means of alcohol.

There is evidence that lower organisms can synthesise vitamin B or similar growth factors, and that this synthesis may occur also in the intestinal tract in higher animals. Thus, Reader has found that the meningococcus can synthesise a growth factor for a streptothrix, all the vitamin B₁ being previously removed from the medium; and G. L. Peskett (*ibid.*, vol. 21, p. 1102; 1927) has shown that yeast can synthesise vitamin B₁. Intra-