A New Hominid Skull Cap from Pleistocene Sangiran

BY TEUKU JACOB

RÉSUMÉ

L'an dernier l'université de Gadjah Mada (Jogjakarta) inaugurait une projet de recherches archéologique avec le support financier du Ministère des Recherches Nationales de l'Indonésie ainsi que des départements d'archéologie et de Géologie. Le projet vise à découvrir des fossils qui pourraient compléter les séries paléanthropologiques indonésiennes en y ajoutant d'autres spécimens. L'auteur fait ici un rapport préliminaire sur la découverte d'un nouveau crane hominidé à Sangiran (Java central).

After two decades of slowing down in paleoanthropological research activities in Indonesia, beginning with the outbreak of the Pacific war, last year saw the setup of a research project on the initiative of Gadjah Mada University in Jogjakarta. It is a joint project sponsored by the University, the Archeological Survey and the Geological Survey, and financially supported by the Ministry for National Research, and takes as its tasks to search for new hominid fossil remains with the rather optimistic hope to fill the existing hiatus in Indonesia's paleoanthropological series, to eventually add new specimens to those species already discovered, and to collect animal and plant fossils and cultural implements associated with human remains.

The first area selected to be surveyed and explored was the Sangiran dome area in Central Java, due to: 1) its proximity to Gadjah Mada University; 2) the richness of the area in vertebrate fossils, as evidenced by the collections of villagers shown and offered to weekend visitors, and the appearance of new materials after every rainy bout with subsequent erosions; 3) the discovery of a *Meganthropus* mandible in 1952 described

by Marks (1953), and of a *Pithecanthropus* mandible in 1960 and described by Sartono (1962), which clearly show that prehominid fossils are not exhausted at all in the Sangiran area; 4) Sangiran is the site left by von Koenigswald in his energetic research stopped by the second world war.

Members of our project are encouraged by Weidenreich's remarks in 1945 (p. 66):

> The discovery of the Java man, first made by Dubois in 1891, shifted the question of the missing link out of the stage of pure speculation into that of facts. The new discoveries solved the Pithecanthropus puzzle but, at the same time, confronted us with new and more specific problems. These, too, can be solved. The only requisites are a spade, a hoe, and a little money. The sites where the relics of the earliest human past can be exhumed — in Java, as well as in China — are well known, almost to the spot where the implements have to be driven into the soil. The chances for rich rewards are much greater here than they ever were in similar cases elsewhere. The spade, the hoe, and the people who are willing to handle them are available; the only thing missing, so far, is the money.

However, many other factors tend to diminish any possibility to find even a minor piece of *Pithecanthropus* bone by way of excavation in so wide an area as Sangiran and with such a changing geological history (von Koenigswald, 1940). And besides, "to deliberately set out to find man's ancestors is a much harder task than the proverbial hunt for a needle in a haystack," said Linton (1936:12). But luck has its own way of striking, and thus, in August 1963, a farmer discovered fragments of a fossil skull in the Sangiran dome area while working in the field. The site of discovery was the very site selected and mapped by our project a week earlier for a small-scale excavation at the end of the month, a fact which brought us to the brink of finding the first remains of *Pithecanthropus erectus in situ*. The site was chosen because of these reasons: 1) it was near the site where *Pithecanthropus* III was found in 1937 (von Koenigswald, 1940); 2) it was the site where in May 1963 a parietal bone, a zygomatic bone, and other cranial fragments were discovered by the same farmer (Sartono, 1963); 3) it was the site where fossil remains of *Buffalus sq.* were dug up in July 1963; 4) it is the fossiliferous upper part of the Kabuh layer (Trinil beds).

Unfortunately, during the excavation in August and September 1963 no other hominid bones were exposed; the materials found were skulls, horns, teeth, ribs, and limb bones of *Buffalus sp.*

The cranial fragments consist of the left parietal bone, the occipital bone, and minor pieces of the left temporal bone. All the bones are remarkably thick and show a high degree of fossilization.

The left parietal bone was broken into five pieces, four of them separated from one another, and the remaining one is held to a portion of the left temporal and occipital bones by means of sandstone endocast. All fragments are white in color, with irregular, yellowish and brownish spots and patches. Of the four margins, the frontal one is completely lacking. Also, the sphenoidal, frontal and occipital angles are not present. The sagittal suture shows well defined serration, is simple in course and structure, with no sign of closure ectocranially, which contributes to the easy separation of individual cranial bones. A slight sagittal torus is evident near the sagittal margin, and is more pronounced toward the anterior end. The bone continues laterally as a flat surface before it suddenly protrudes as a well marked, angular parietal eminence. Thus, in frontal view the bone is strongly curved, while sagittally it is remarkably flat. A slight asteriac process is observable, but temporal lines are not distinct.

The cerebral surface is also white with black and yellow patches. Most eye-catching are the wide and deep meningeal grooves, which main arborization appears not to commence from the pterion, as ordinarily in recent man, but more backward, close to the mastoid angle. The endocranial sagittal suture exhibits evidence of closure.

Furthermore, the thickness of the bone is very striking, with corresponding thickness of the diploe. On the sagittal margin the maximum thickness is 10 mm (in the middle), and the minimum thickness is 8 mm (near the occipital angle). But the thickness of the parietal bone ranges from 5.5 mm (near the antero-inferior corner) to 11 mm (in the middle of the parietal eminence). Further variation in thickness is as follows: at the postero-superior and antero-superior corners, 9 mm; at the antero-inferior corner, 8mm; and at the postero-inferior corner, 6 mm.

The occipital bone consists of two fragments, both with brown sandstone endocast, and the left portion connected to the posterior portions of the left parietal and temporal bones. Unfortunately, the basilar and lateral portions, and the foramen magnum are lacking. The external surface is white with black, yellow, reddish and brown patches. The occipital plane is short and low, triangular in shape, but the nuchal plane is large, separated from the former by a rounded occipital torus. This structure is widest in the median line (18.5 mm) and fades laterally before it reaches the lambdoid suture. It projects about 3 mm from the general level of the occipital bone and is separated from the occipital plane by a fairly developed supratoral groove. The upper border of the torus is convex and the lower is concavo-convex.

In regard to the lambdoid suture, it also has well defined but simple serration without evidence of closure ectocranially. The left lambdoid suture is not completely present. No Inca or Wormian bones are found. The parietal eminence continues in the occipital plane as a slight elevation. Opisthocranion is located on the occipital torus and coincides with inion. The external occipital crest is absent.

Removing the endocast is not done piecemeal, but in a block after impregnating the sandstone with polyester. The internal surface of the occipital bone is generally similar in color to that of the parietal. A crack on the internal surface of the posterior fragment of the latter fits perfectly with a fracture line of the more anterior portion. As is the case with the sagittal suture, the endocranial lambdoid suture is already fused.

The occipital bone matches the parietal in thickness, and actually surpasses it at the center of the occipital torus (16 mm). On the other hand, it exhibits minimum thickness, too, in the right lateral area of the nuchal plane (2 mm). At lambda the bone is 11 mm thick and at the level of the internal occipital protuberance 14 mm.

In addition, the most remarkable feature is the strongly angulated appearance of the occipital bone. Since opisthion is not present, we measure the sagittal chord and arc from lambda to the most caudal point of the occipital fragment, to determine

the degree of curvature. The figures obtained are respectively 65 and 77 mm which give an index of 84.4. This means the sagittal occipital chord-arc index is less than that. Lambda-inion chord is 43 mm and its arc is 44 mm, resulting in an index of 97.7. The chord from inion to the most caudal point, taken sagittally, is 32 mm, while the corresponding arc is 33 mm; the index obtained, 97.0, is similar to the lambda-inion chord-arc index, denoting that both the nuchal and the occipital planes are for practical purposes flat.

The length of the lambdoid suture is 85 mm and the angle between both lambdoid sutures is 123°. The biasteriac diameter is 113 mm. Further observation shows that inion is higher than the internal occipital protuberance, indicating the greater development of the nuchal plane relative to the occipital plane, and the smaller size of the cerebellar fossae compared to the cerebral fossae. These features signify strong nuchal muscles and relatively small cerebellum. The sagittal sinus runs left to the midline and the left arm of the cruciate eminence is higher than the right which denote a greater degree of development of the right cerebral hemisphere, but do not necessarily mean left-handedness.

As far as the left temporal bone is concerned, it is not only too fragmentary but the existing portion is also damaged. It runs from the posterior portion of the squamous, the parieto-mastoid and the occipito-mastoid sutures to the petrous bone, where it is broken off at the internal auditory meatus. The external table is absent, so that it is remarkably thin compared with the neighboring occipital and parietal bones. The internal table, however, is present although severely cracked. Of the petrous portion the superior angle is not straight, but makes peculiar undulation. The sigmoid sinus is narrow and moderately deep, and the superior petrous sinus is also well defined. Furthermore, the arcuate eminence is quite prominent.

From the description of morphological features it is apparent that the weight of evidence is strongly toward the diagnosis of *Pithecanthropus*. The total morphological patterns characteristic of the genus *Pithecanthropus* and present in our specimen are: the strongly angulated parietal bone with a pronounced parietal

eminence and a sagittal torus showing the tendency to end anteriorly as a bregmatic eminence; a depressed area between the parietal eminence and the sagittal torus; a low cranial vault reflected by the flattened parietal bone in the sagittal plane; the angulated occipital bone, consisting of a short and low occipital plane and a large nuchal plane, separated by a characteristic occipital torus with a supratoral groove; the absence of the external occipital crest. Besides, the small cerebellum, as deduced from the position of the internal occipital protuberance, gives additional weight to the diagnosis. And these facts are supported by the thickness of the cranial bones, and their being discovered at a known *Pithecanthropus* site in the Kabuh layer of Middle Pleistocene. Also, undulation of the superior angle of the temporal pyramid is observed in other *Pithecanthropus skulls.*

Comparison of the thickness of the skull with *Pithecanthropus* II and III is shown in Table 1 (von Koenigswald, 1940):

TABLE 1.—COMPARISON OF BONE THICKNESS OF SEVERAL PITHECANTHROPUS SKULLS

Bone	Measured at	Present Specimen	P II	P III
Occipital	Lambda	11 mm	13 mm	7 mm
	Maximum	16	21	9
Parietal	Lambda	9	7.5	7
	Eminence	11	12	7
	Squamous suture	8	9	–

The find resembles *Pithecanthropus* III in the extent of preserved fragments and in the age of the individual. Von Koenigswald (1940) mentioned that *Pithecanthropus* III is a young male specimen, because all cranial sutures are open. In our specimen, endocranial sutures show closure, but the contrary is true for ectocranial sutures. The sagittal suture starts to close in recent man usually around 22 years of age and the lambdoid suture around 26, simultaneously on the endocranial and ectocranial aspects (Cobb, 1952). Suture closure is not a reliable age indicator, however. In the absence of other evidence for age identification, and assuming the closure of vault sutures in *Pithecanthropus* is comparable to that in modern man, we could roughly estimate the age of our specimen as being in early

twenties. Sex diagnosis is harder to make on the basis of the preserved fragments.

We strongly suspect that skull fragments found earlier *(vide supra)* and reported by Sartono (1963) belong to the same individual. It is a very small chance indeed that different bones of two skulls are to be found at the same locality without duplicity.

The find described provides additional comparative data on the morphology of *Pithecanthropus erectus*. For Indonesian workers it is of special importance owing to the fact that it is the first skull of the species to be kept in the country where it is discovered, and thus, it gives ample opportunity for the convenient study of both site and original find, and for the comparison of eventual future discoveries in the area. And this benefit will be enjoyed by international anthropologists as well.

ACKNOWLEDGEMENT

This report is a portion of an investigation supported by the Ministry for National Research of the Republic of Indonesia. The author wishes to express his appreciation to Dr. Lawrence Oschinsky, University of Toronto Department of Anthropology, Toronto, Canada, for reading the manuscript, and to M. Soejono, Archeological Survey of Indonesia, Prambanan, for the accompanying photographs.

National Paleoanthropological Research Project
Gadjah Mada University College of Medicine
Jogjakarta, Indonesia.

REFERENCES

BOULE, MARCELLIN and HENRI V. VALOIS
1957 Fossil Men. New York, The Dryden Press.

COBB, W. MONTAGUE
1952 Skeleton, *in* Cowdry's Problems of Ageing, by A.I. Lansing. 3rd ed. Baltimore, The Williams and Wilkins Co.

LEGROS CLARK, W.E.
1955 The Fossil Evidence for Human Evolution. Chicago, The University of Chicago Press.

LINTON, RALPH
1936 The Study of Man. New York, Appleton-Century-Crofts, Inc.

MARKS, P.
1953 Preliminary Note on the Discovery of a New Jaw of Meganthropus von Koenigswald in the Lower Middle Pleistocene of Sangiran, Central Java. Indonesian Journal for Natural Science 1-3:26-33.

MCKERN, THOMAS W. and T.D. STEWART
1957 Skeletal Age Changes in Young American Males. Natick, Mass., Headquarters Quartermaster Research and Development Command.

SARTONO, S.
1962 Sebuah Rahang Bawah Baru Pithecanthropus, Jogjakarta. Kongres Ilmu Pengetahuan Nasional II.
1963 A New Pithecanthropus Skull: An Announcement. Publikasi Keilmuan (in press).

TOBIAS, PHILLIP V.
1959 Studies on the Occipital Bone in Africa. V. The Occipital Curvature in Fossil Man and the Light It Throws on the Morphogenesis of the Bushman. Am. J. Phys. Anthrop. 17, 1:1-12.
1960 Studies on the Occipital Bone in Africa. VI. The Relative Usefulness of Pearson's Occipital Index and the Occipital Chord-Arc Index. Man 29:1-3.

KOENIGSWALD, G.H.R., VON
1940 Neue Pithecanthropus-Funde 1936-1938, Wetenschappelijke Mededeelingen, 28, Dienst van den Mijnbouw in Nederlandsch-Indië.

WEIDENREICH, FRANZ
1945 Apes, Giants, and Man. Chicago, The University of Chicago Press.

WOO, JU-KANG
1956 Human Fossils Found in China and Their Significance in Human Evolution. Scientia Sinica 5, 2:389-397.
1960 The Unbalanced Development of the Physical Features of Sinanthropus Pekinensis and Its Interpretation. Vertebrata Palasiatica 4, 1:17-26.
1960a New Discoveries of Palaeoanthropology in China. Science Record n.s. 4, 2:120-125.

PLATE I

Occipital fragments with sandstone endocast, showing the remarkable thickness of the bone. The lambdoid suture (on the right side) exhibits closure endocranially and distinct serration ectocranially.

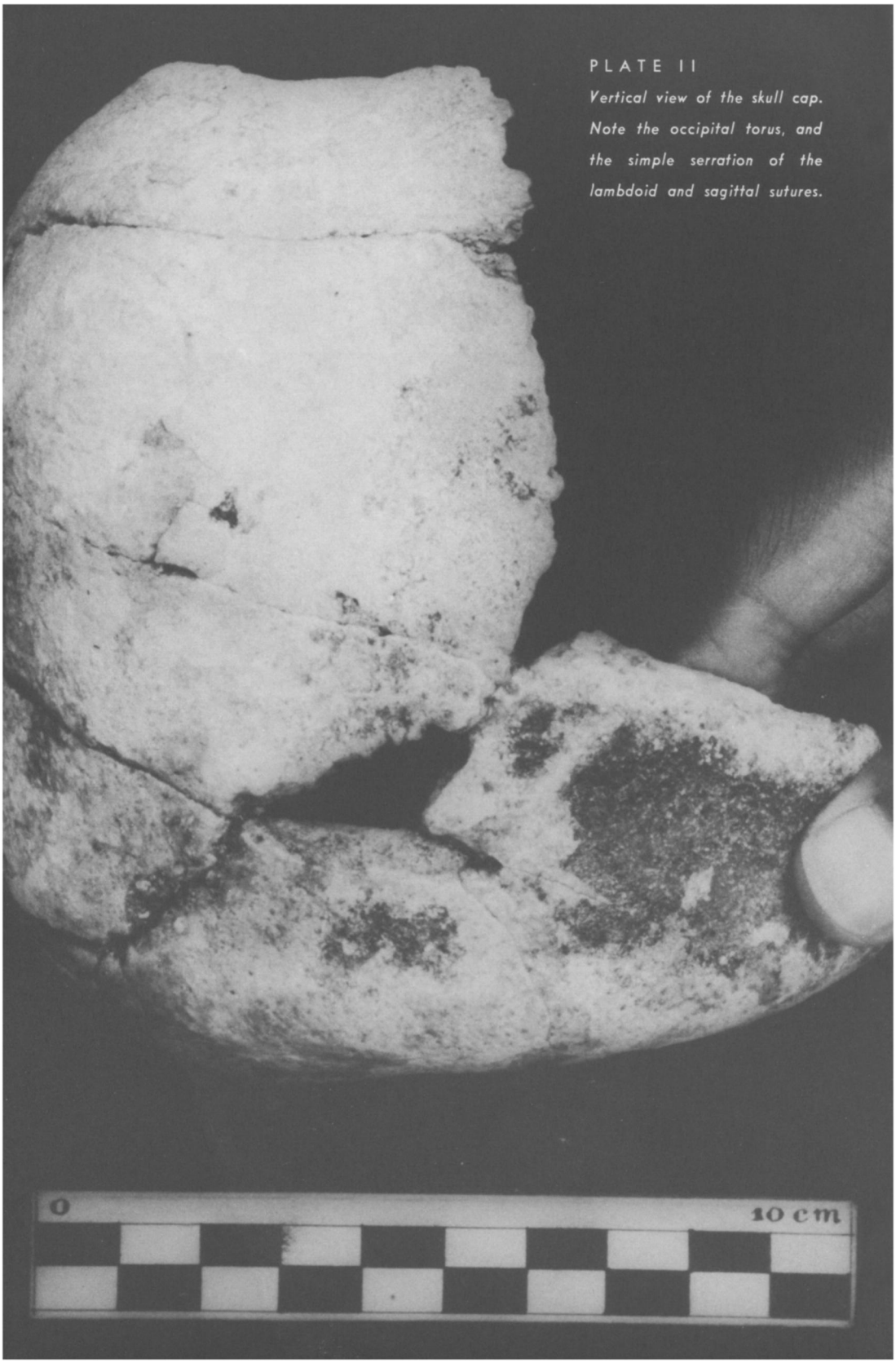

PLATE II

Vertical view of the skull cap. Note the occipital torus, and the simple serration of the lambdoid and sagittal sutures.

PLATE III

Occipital view of Homo Soloensis, Pithecanthropus II *and the present specimen. The lower border of the occipital torus is clearly shown. Compare the parietal contour and the sagittal torus.*