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Hominid Skull Fragments found in 1979 from Sangiran, Central Java

By

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Abstract Two hominid skull fragments (S 37a,b) were recovered in 1979 from Sangiran, Central Java. These two occupy left lateral and right posterior parts of the same skull vault. They show typical *Homo erectus* characteristics, that is, the inferior temporal line is low, an angular torus is present, angulation of the external surface above asterion is marked, etc. In overall size and shape, the reconstructed vault is intermediate between those of Sangiran 17 and Sangiran 2.

Introduction

It is well known that the Sangiran area in Central Java has yielded rich vertebrate fossils, including those of hominids (JACOB 1972, SARTONO 1975, de VOS 1985, AZIZ *et al.* 1989). In this area the bed, about 3 by 6 km wide, was elevated by a mud volcano to form a dome-like structure and layers of Pliocene and Pleistocene were exposed and cut away horizontally by erosion, like the cross-section of an onion (Fig. 1). The stratigrahy has been divided into four formations, from the lowest (center of the dome) to the highest (periphery), upper Pliocene Kalibeng, lower Pleistocene Pucangan, lower to middle Pleistocene Kabuh, and middle Pleistocene Notopuro (Matsu'ura 1982, 1991). Specimens of Javanese *Homo erectus* (*Pithecanthropus*) have been recovered mainly from the Kabuh formations.

Since 1976 extensive field research has been carried on in this area by the Indonesian-Japanese cooperation team (CTA-41), which receives support from the Japan International Cooperation Agency (WATANABE and KADAR 1985). As a result of this research, several fossil hominid bones were recovered and stored in the Quaternary Geology Laboratory, Geological Research and Development Centre, Bandung. Some of these hominid bones were reported previously (AZIZ 1981, 1983). We describe here two skull fragments recovered in 1979. They were found at the same time by our local collector from the surface at Sendangbusik, on the Eastern part of the Sangiran dome (Fig. 1). The specimens were tentatively designated as Sb 7904, that is, found at Sendangbusik in April, 1979. Later they were serially designated as Sangiran 37a, b (S 37a,b).

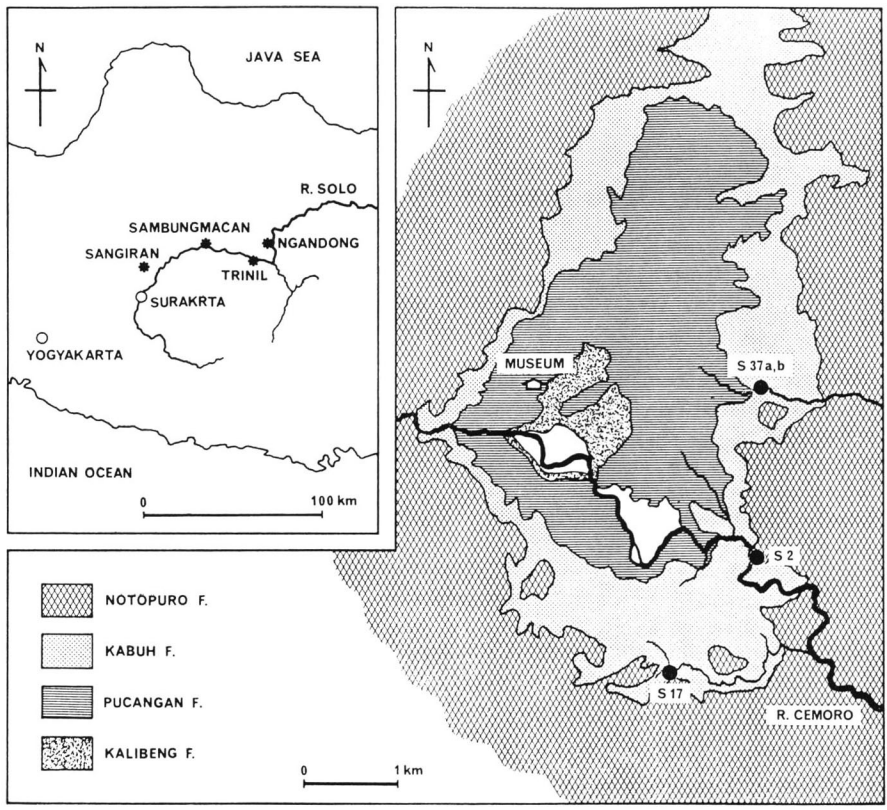

Fig. 1. Map of main hominid fossil sites in Central Java and geology of the Sangiran dome area. Find spots of Sangiran 37a and b in question, sangiran 2, and Sangiran 17 are shown as S 37a,b, S 2, and S 17, respectively.

Preservation

Figure 2 shows the two skull vault fragments herein discussed. The one (S 37a) consists of a posterior part of the left parietal bone and mastoid and occipital bones near the left asterion (Fig. 3). Thus we call this specimen the left P-M-O fragment. It is 9.3 cm high and 5.3 cm wide. The other fragment (S 37b) consists of a posterior part of the right parietal bone, a right half of the upper occipital squama and a portion of a mastoid bone near the right asterion (Fig. 3). The portion of the masotid is so small that we may call this specimen the right P-O fragment. It is 7.9 cm high and 8.0 cm wide.

These two fragments were not found in contact with each other, but their color and texture strongly suggest that they belong to the same skull. They are very hard and heavily mineralized over all the surfaces. However, density in the radiograph is

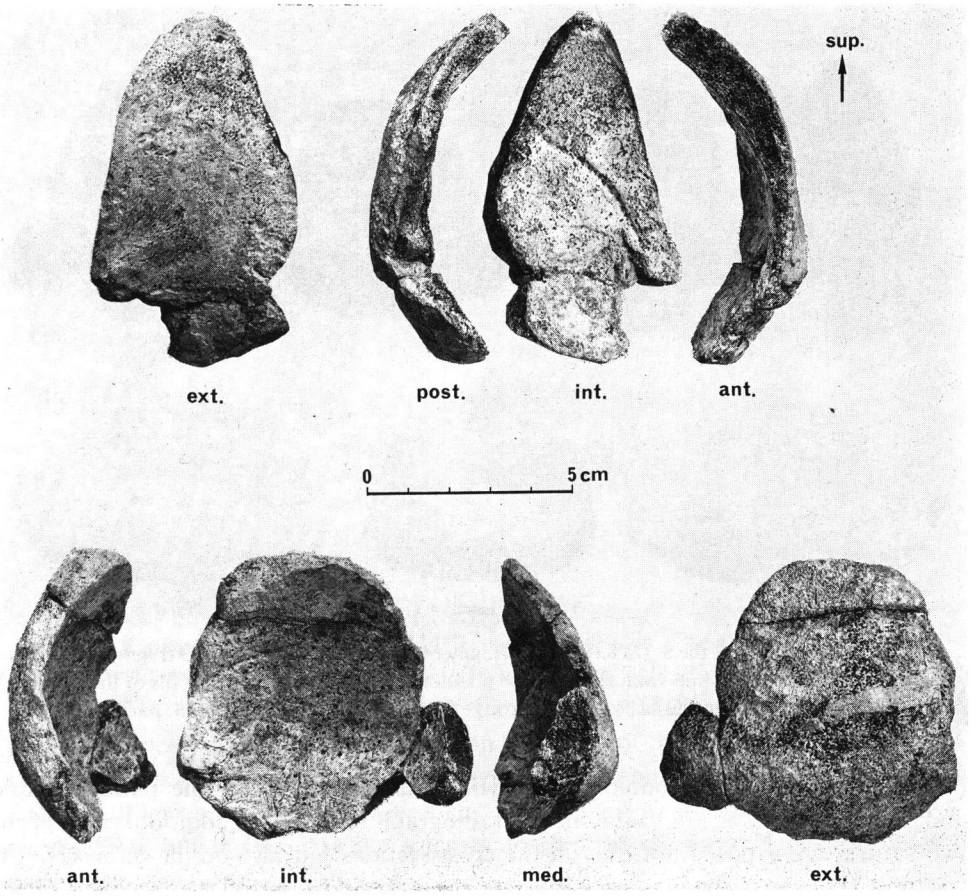

Fig. 2. Sangiran hominid skull fragments recovered in 1979. Upper, S 37a left parietal-mastoid-occipital (P-M-O) fragment; lower, S 37b right parietal-occipital (P-O) fragment.

variable according to the portions and not proportionate to the bone thickness (Fig. 4). This means that the degree of fossilization (mineral content) in the spongy substance is uneven. The bones are mostly light yellowish gray with numerous small black spots and, in some portions, are pinkish. Most of the outer surface is more or less eroded, but all of the inner surface is actually intact, and there are indications that some fractures are new, which means that this skull was destroyed into fragments rather recently.

Morphology

External surface structure

In the left P-M-O fragment only the external surface features are seen (Figs. 3, 5). Sutures around the left asterion are present on the surface, that is the parietomastoid,

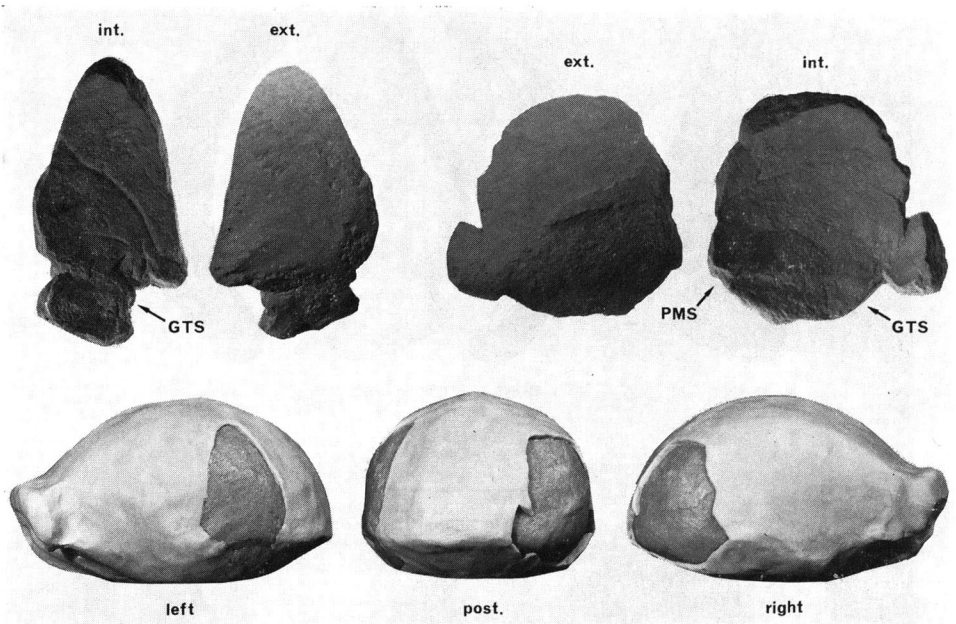

Fig. 3. Plaster casts of the S 37a left P-M-O fragment (left) and S 37b right P-O fragment (right), and reconstructed skull vault showing the positions of the fragments. Details of the surface structure are seen in the casts. GTS, groove for the transverse sinus; PMS, parietomastoid suture.

occipitomastoid, and lambdoid sutures (Fig. 5). Of the three, the parietomastoid and lambdoid sutures are visible in the radiograph (Fig. 4). In addition, parts of the two sutures are exposed not only in the cross-sections but also on the surfaces of the fractures (Fig. 5). These sutures indicate the exact position of the fragment in the skull to which it belongs (Fig. 3).

A supramastoid crest is sharply projected but not as thick as in Sangiran 17 (Figs. 3, 5). The crest runs obliquely from antero-inferior to postero-superior, but it does not turn upward as occurs in Nagndong 11 (WEIDENREICH 1951, SANTA LUCA 1980). Superiorly, it continues to a well-defined inferior temporal line. This line runs in a small circle and turns anteriorly, indicating a probable low course in the parietal bone. Above the supramastoid crest, several striae of the squamosal suture are seen, running parallel to the crest.

A superior temporal line is not clear in this region, but there is a weak eminence about 1 cm behind the inferior temporal line (Figs. 3, 5). So this eminence should be the superior temporal line. Inferiorly it forms a low angular torus just above the left asterion. The torus is not projected as in Sangiran 17 and *Sinanthropus* skulls (WEIDENREICH 1943) but plateau-like as in most Ngandong skulls (WEIDENREICH 1951, SANTA LUCA 1980). The inferior part of this torus extends anteriorly to form a small ridge about 1 cm below the supramastoid crest. Although the remaining part of the

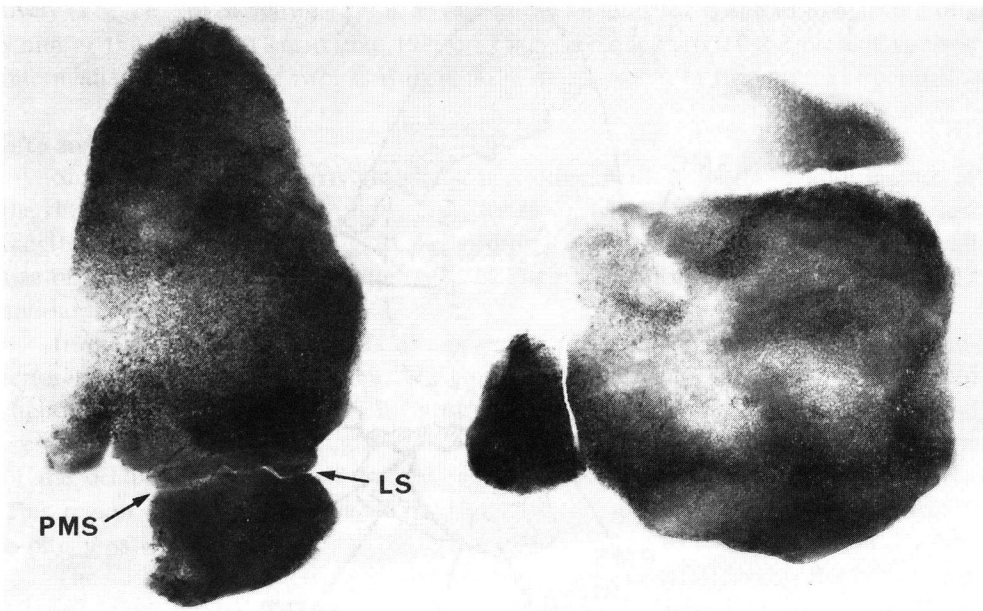

Fig. 4. Radiograph of the S 37a left P-M-O fragment (left) and 37b right P-O fragment (right). Parietomastoid (PMS) and lambdoid (LS) sutures are seen in the left fragment.

ridge is restricted, this ridge is probably an extension of the mastoid crest. There is a shallow sulcus between the two crests (Figs. 3, 5). It must be a supramastoid sulcus. In most *Homo erectus* skulls this sulcus is restricted in the temporal bone (SANTA LUCA 1980), but in this case the sulcus extends onto the parietal bone crossing the parietomastoid suture.

In the lower part of the parietal bone, along the parietomastoid suture there is a fossa of which the upper border is clearly demarcated from the angular torus and the extended part of the mastoid crest (Figs. 3, 5). This fossa should provide an attachment area for the sternocleidomastoid muscle. Before the occipitomastoid suture a rough ridge is seen, which might be an extension of the occipitomastoid crest. Behind this suture is an inferior arm of the occipital torus. It is thin but sharp. Because of breakage it is not clear whether this arm continues anteroinferiorly to the occipitomastoid crest or not.

In the right P-O fragment almost all of the outer surface is strongly eroded and no surface structure is seen (Figs. 2, 3). However, overall shape of the fragment shows that an elevation along the inferior border of the fragment should correspond to the transverse occipital torus. Detail of the torus is not known due to damage.

Internal surface structure

In both fragments, grooves for the posterior (parietal) branches of the meningeal

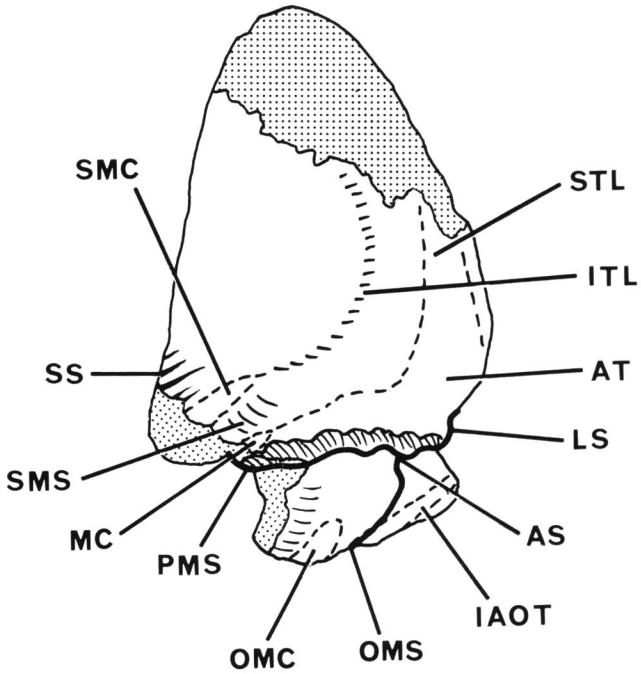

Fig. 5. Diagram of the external surface structure seen in the S 37a left P-M-O fragment. Stippled areas are eroded. A fossa is seen along the parietomastoid suture. AS, asterion; AT, angular torus; IAOT, inferior arm of occipital torus; ITL, inferior temporal line; LS, lambdoid suture; MC, mastoid crest; OMC, occipitomastoid crest; OMS, occipitomastoid suture; PMS, parietomastoid suture; SMC, supramastoid crest; SMS, supramastoid sulcus; SS, squamosal suture; STL, superior temporal line.

media vessels are seen, stretching onto the whole remaining inner surface (Figs. 2, 3). The sutures are almost obliterated in the inner surface except for the small region near the asterion. In addition, the parietomastoid suture is exposed in the fracture near the asterion (Fig. 3).

In the posteromedial corner of the fragment, at the occipital torus, there is a deep round fossa, in which a right occipital polar of the cerebrum locates.

The horizontal groove for the transverse sinus is seen in both fragments (Figs. 2, 3). Its upper border is sharp forming a ridge for the attachment of the tentorium but its lower border is rather dull. In the left P-M-O fragment the groove is seen only at the asterion, and its extension to the groove for the sigmoid sinus is not clear because of damage. In the right P-O fragment the groove runs from the asterion posteromedially to the point about 1 cm below the top of the occipital torus.

Thickness of the bone

The thickness is 14 mm and 12 mm at the left angular torus and asterion, respec-

tively (Fig. 2). In Sangiran 17 it is 20 mm at the angular torus and in Sangiran 2 it is 9 mm at the asterion (RIGHTMIRE 1990). Thus, the thickness of the present vault is intermediate between the two, as is true in the development of the surface structures.

Size and Shape of the vault

Since the remaining parts are small, it is difficult to know the overall faeture of the skull vault. Thus, using plastic clay, we reconstructed a vault to get more or less tangible image of the vault (Fig. 3). According to this reconstructed vault, the overall size of the posterior part is estimated to be slightly smaller than that of Sangiran 17 and larger than that of Sangiran 2.

In most *Homo erectus* valuts, the posterior temporal region, confined by the inferior temporal line and supramastoid crest, is considerably flat facing laterally and slightly superiorly. Inferiorly, the postmastoid region demarcated by the mastoid crest, supramastoid crest, angular torus (if present), and superior and inferior arms of the occipital torus is well defined facing inferolaterally and slightly posteriorly. This region might be the area of insertion for the splenius capitis and longissimus capitis muscles.

The postmastoid region is very flat in *Sinanthropus* 12, considerably flat in Sangiran 17, and more or less flat in other *Homo erectus* and Neandertal skulls. In *Homo sapiens* this region is convex and not well defined because of poor development of the surface structures. In occipital (slightly medial) view, the outline of these two regions makes a sharp angle just above the asterion. This angulation is one of the most significant characteristics of *Homo erectus* skulls.

In the present left P-M-O fragment, the posterior temporal region is flat and is set in the same direction as that of Sangiran 17. The postmastoid region is also flat facing inferolaterally and makes a sharp angle between the posterior temporal region as in other *Homo erectus* skulls.

Although surface erosion obscures the detail, curvature of the occipital bone seen in the right P-O fragment corresponds to that between the larger Sangiran 17 skull and smaller Sangiran 2 skull.

Sex and Age

If we compare Sangiran 17 and Sangiran 2, the former looks like a male and the latter a female. However, RIGHTMIRE (1990) suggested it is impossible to designate Sangiran 2 as female with any certainty. In any event, the overall size and development of the superstructures in the present specimens are intermediate between the two, so the sex is still unknown. The age of the specimen must be rather young because the sutures are almost obliterated in the internal surface but are vissible in the external and fracture surfaces near the asterion, and the grooves for the vessels are shallow (Fig. 3).

Conclusions

The present skull fragments (S 37a,b) exhibit typical *Homo erectus* characteristics, that is, thick vault bones, strong curvature of the occipital, sharp angulation of the outer surface just above the asterion, low course of the inferior temporal line, presence of the angular torus, etc. However, further detailed comparisons with other hominid skulls are difficult since the fragments are small and the provenance is not clear.

Acknowledgments

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