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Restoration of Head and Face in Javanese *Homo erectus* Sangiran 17

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Abstract The Javanese *Homo erectus* Sangiran 17 skull was reconstructed. Then, its head and face were restored based upon the reconstructed skull, arranging the muscles and other organs. The restored head and face show tangible images of typical features of Asian Lower/Middle Pleistocene *Homo erectus*.
Key words: *Homo erectus*, Sangiran 17, Java, Restoration, Face.

Introduction

So far as we know, the Sangiran 17 skull is the best preserved skull of Asian *Homo erectus*, because it has a face (Fig. 1). The Sangiran 17 skull was found in 1969 from Pucung site in Sangiran, Central Java, by Mr. Tukimin, a local farmer (Sartono, 1972). The skull is believed to be derived from the Kabuh (Bapang) Formation and dates to 0.7 to 0.8 million yr. BP (Matsu'ura, 1982; Itihara *et al.*, 1985). The original Sangiran 17 skull is kept in the Geological Research and Development Centre, Bandung, under the care of the second author (FA).

The skull had partly been reconstructed and studied by several authors (Sartono, 1975; Jacob, 1975; Thorne and Wolpoff, 1981; Santa Luca, 1980; Rightmire, 1990, 1998). Recently the skull was reconstructed by us, using casts with reference to the original (Aziz *et al.*, 1996). By this reconstruction, we could obtain the presumed initial shape of the whole skull, including the face, without the mandible (Fig. 1). After that, the face of the original skull was re-arranged and stabilized by us (Fig. 2). However, the face remains distorted considerably.

In order to get a tangible image of ancient humans, reconstruction of skull/skeleton and restoration of face/body are important not only for the general public but also for scientists. Thus, using the previously reconstructed skull cast without mandible, we reconstruct the whole skull cast of the Sangiran 17 and restore the head and face of this individual.

Fig. 1. Original (upper) and reconstructed cast (lower) of the Sangiran 17 skull.

Skull of Sangiran 17

Basic Description of the Skull

The Sangiran 17 skull provides an almost complete skull vault (Fig. 2). But its face is more or less damaged, the mandible is missing, and the left one third of the upper face is broken off. The remaining portions of the face are also distorted considerably (Thorne & Wolpoff, 1981; Aziz *et al.*, 1996).

The skull shows typical characteristics of Asian *Homo erectus* from Lower/Middle Pleistocene. The vault is long, wide and low, with remarkable development of the superstructures. The vault is large, but the endocranial volume (1,004 m*l*, Holloway, 1981) is moderate due to thickness of the bones (10 mm at the bregma). It provides a thick brow ridge, a robust occipital torus, a clear bregmatic eminence, bulged supramastoid crests, and distinct temporal crests, which makes the vault outline rhombic in

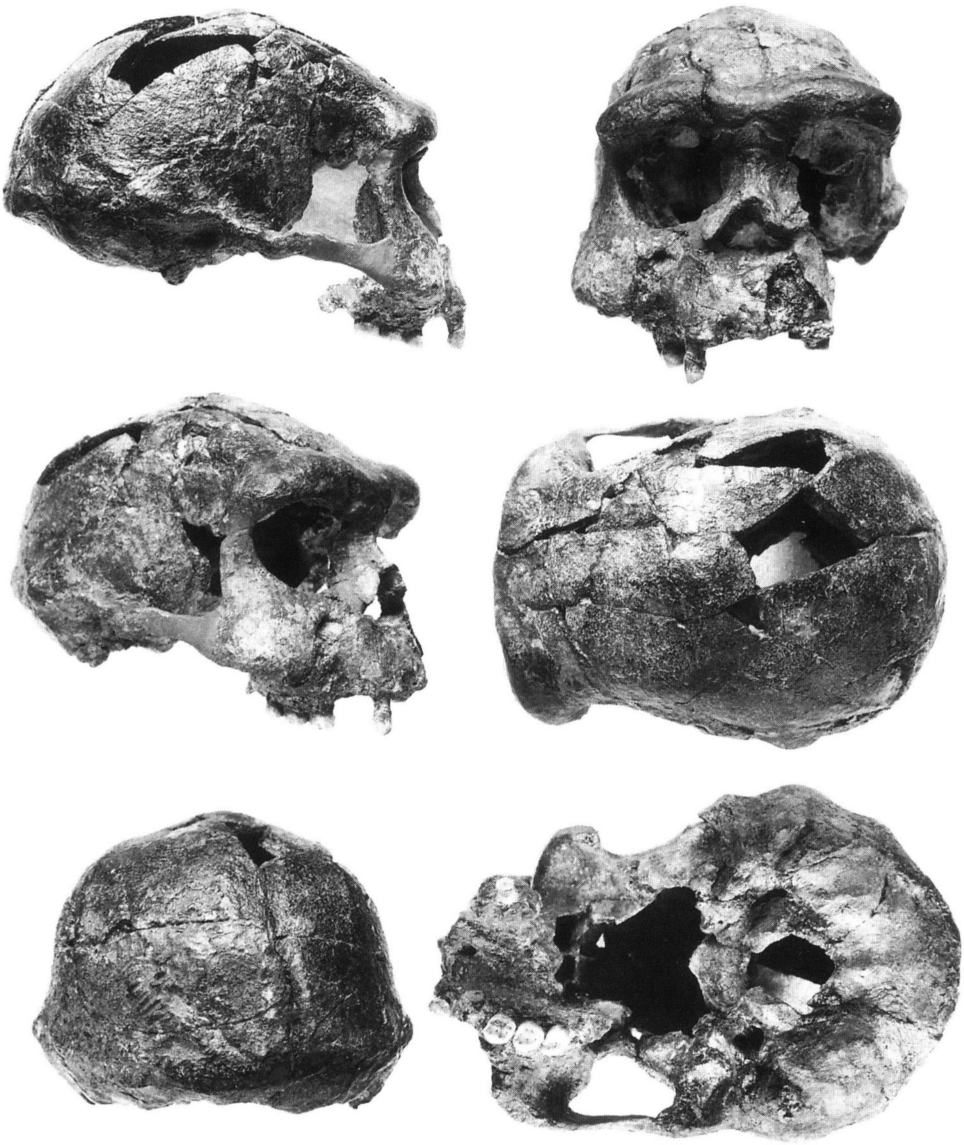

Fig. 2. Six aspects of the re-arranged original skull of Sangiran 17.

the lateral aspect and heptagonal in the occipital aspect (Fig. 3). The frontal sinus is well developed in the medial half of the brow ridge.

The Sangiran17 face is wide and low. It exhibits large orbital openings, a low nasal bridge, a small nasal aperture, a swollen and flared right zygomatic bone (left one is missing), a considerably projected palate, and moderately sized teeth (Baba,

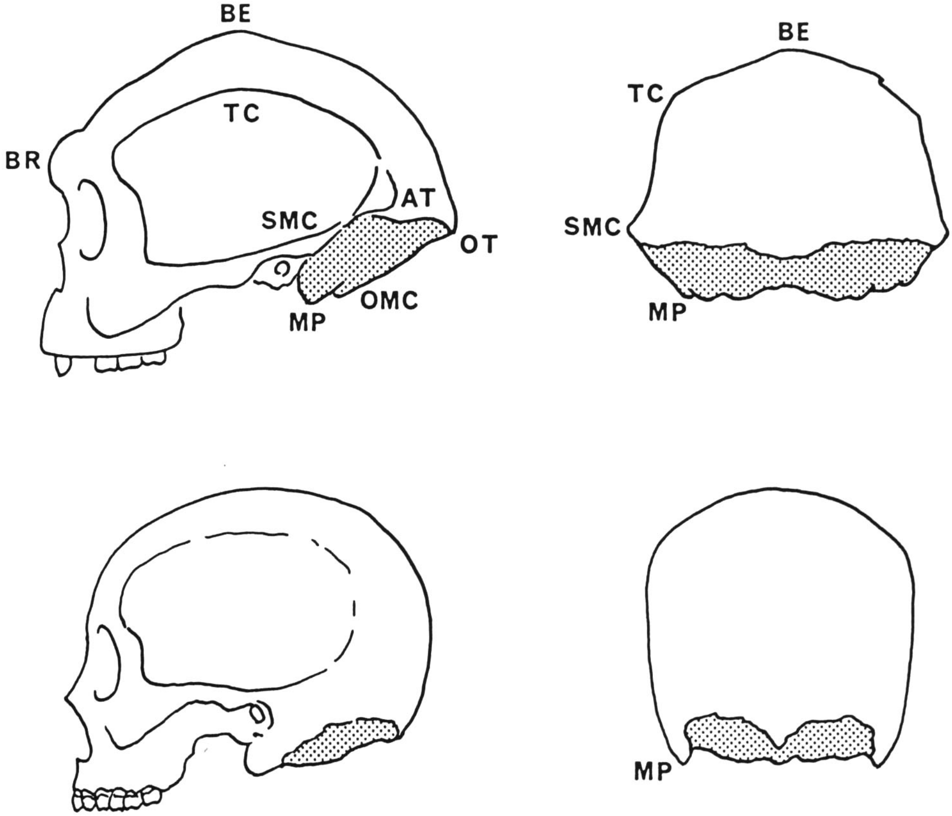

Fig. 3. Scheme of the development of main superstructures and nuchal muscle attachment area in Sangiran 17 (upper) and a recent human (lower). BR: brow ridge, BE: bregmatic eminence, OT: occipital torus, TC: temporal crest, AT: angular torus, SMC: supramastoid crest, MP: mastoid process, OMC: occipitomastoid crest.

1995; Aziz *et al*., 1996).

Development of the Neck and Back Muscles

In the Sangiran 17 skull, the nuchal area (attachment area for the neck and back muscles, e.g., the trapezius, splenius capitis, longissimus capitis, etc) extends onto the whole surface of the middle and posterior cranial base, forming a thick occipital torus on the posterior margin (Figs. 2, 3). Moreover, the area expands far laterally across the occipitomastoid crest and the mastoid process which is small and obliquely oriented. Consequently, there is a flat attachment area for the sternocleidomastoid muscle between the occipitomastoid crest and the supramastoid crest. This flat area is placed obliquely both to the cranial base and to the lateral wall of the vault, which makes the vault outline heptagonal in the occipital aspect, as mentioned above (Fig.

3). This feature is commonly seen in various degrees in *Homo erectus* and archaic *Homo sapiens*.

On the contrary, in recent *Homo sapiens* the mastoid process projects inferiorly (vertically), forming a distinct border which separates the cranial base from the lateral wall of the vault (Fig. 3). Thus, the nuchal area does not extend across the mastoid process.

The nuchal area in the Sangiran 17 skull is somewhat wider than those of the Ngandong (Weidenreich, 1951; Santa Luca, 1980), and Zhoukoudian *Homo erectus* skulls (Weidenreich, 1943) and much wider than those of the OH 9 *Homo erectus* skull (Leakey, 1961) and Kabwe archaic *Homo sapiens* (*Homo heidelbergensis*) skull (Baba, unpublished data). So far as we know, the area in the Sangiran 17 skull is the widest among those of fossil human skulls ever recovered.

Development of the Masticatory Muscles

In the Sangiran 17 skull, the temporal fossae are deep in both anterior and posterior portions, the temporal crests are well ridged, and the supramastoid crests are thick and projected (about 8 mm high from the temporal fossa), (Fig. 3). This indicates marked development of the temporalis muscles.

The right zygomatic bone (left one is missing) of the Sangiran 17 skull is located anteriorly and flares laterally. It is extremely large and bulged so that the inferior border, from which the masseter muscle arises, is wide and situated low, near to the alveolar surface. These features mean that the masseter muscle had to be thick and located low, which implies that the region around the mandibular angle, to which the masseter inserts, might be well developed and located low.

Reconstruction and Restoration of Sangiran 17

Cast Making and Reconstruction of the Skull

Negative molds of the Sangiran 17 skull were made divided into six separated portions by Mr. Shokichi Miyamoto during joint research supported by the Japanese International Cooperation Agency (JICA) and stored in the Geological Research and Development Centre, Bandung.

The original Sangiran 17 skull was distorted and crushed considerably. However, since the skull is too hard and brittle to modify, we had to give up to use the original skull and decided to make up the precise cast in a supposed original shape, in the following procedure. At first, we made positive casts using these molds. Then, in order to correct displacements and distortions, we cut casts into several pieces and adjusted the position, referring to the original specimen, according to our knowledge of *Homo erectus* morphology (Fig. 1). Thirdly, we restored missing portions of the left face based on the shape of the right face (Fig. 4).

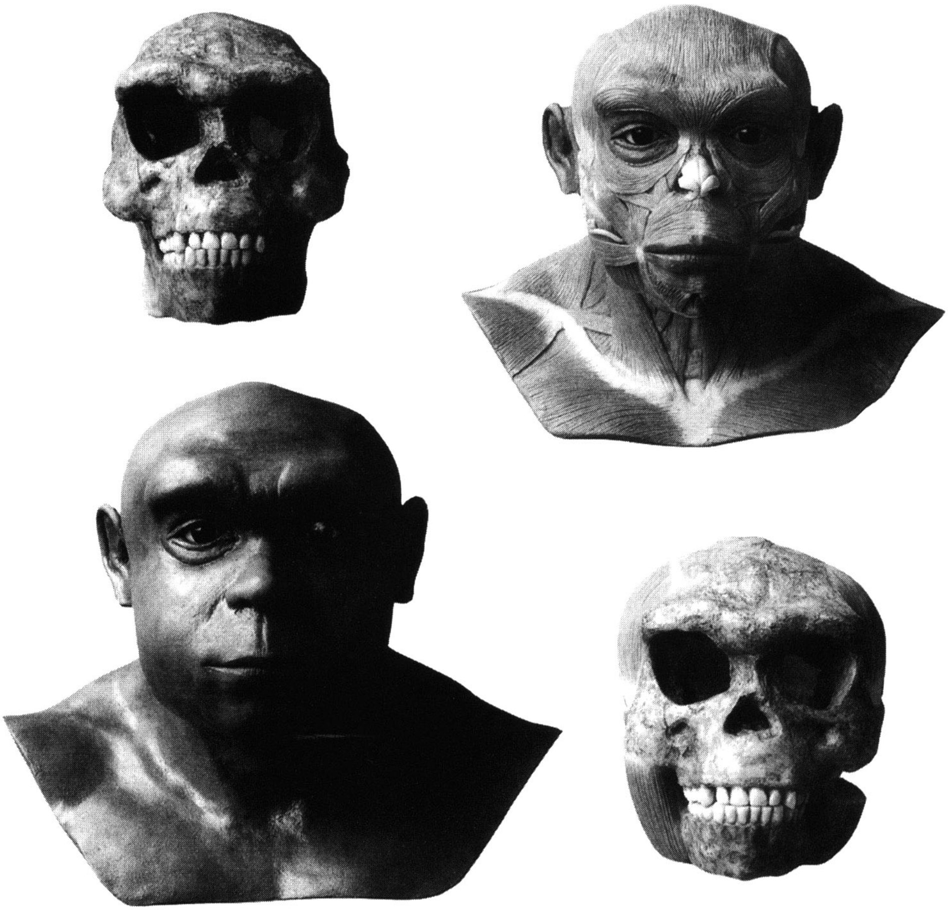

Fig. 4. Process of reconstruction and restoration of Sangiran 17 from the reconstructed skull (upper left), through masticatory muscle attachment (lower right) and facial muscle restoration (upper right), to a live face (lower left).

Restoration of the Head and Face

Then we asked Mr. Yoichi Yazawa, who has been working on reconstruction and restoration under our supervision for these ten years, to carry out further restoration with us. At first, we restored a mandible of Sangiran 17 using the Sinanthropus mandible (XII, Weidenreich, 1936). That is, we made the dental arcade wider and the mandibular ramus a little higher. Thus we obtained a whole restored skull of Sangiran 17 (Fig. 4).

Second, using clay, we attached the temporalis and masseter muscles to the skull, of which area and thicknesses were determined based upon the muscle markings on the skull and upon our knowledge of human and ape anatomy. The attachment area and thickness of the muscles are much larger in the Sangiran 17 skull than in recent humans and more or less larger than in other fossil hominids, as discussed above.

Third, we attached facial muscles to the skull, using wax sheets of various thicknesses. There are no significant difference in the structure of facial muscles between apes and humans, as might be true in *Homo erectus*. Thus, we restored the facial muscles according to our knowledge of human anatomy (Fig. 4).

Fourth, we attached ears using wax sheets and salivary glands using clay to the face. We set eye balls in the orbital cavities, using ready made eye balls for mannequins, which are a little larger than those of actual humans and fit well with the large orbital cavities in the Sangiran17 skull (Fig. 4).

Fifth, we restored the skin, using wax sheets covering all of the head and face (Fig. 4). The thickness of the skin including subcutaneous fat varies from portion to portion, e.g. it is thin (2–3 mm) in the nasal region, medium (5–10 mm) over the skull, and thick (15–30 mm) in the cheek.

Finally, we colored the skin dark brown, as is seen in recent humans in low latitudes. We did not reconstruct the hair and beard, because they conceal the details of shape in the head and face.

Restored Head and Face

The Sangiran 17 head, of which shape directly reflects the skull vault shape, is low, long and wide with its maximum width at the lower part of the vault (Fig. 4). In the lateral view, there are three projections (the brow ridge, occipital torus and bregmatic eminence), which make the vault outline rhombic in shape. All these characteristics should have been more or less shared in other *Homo erectus* in Asia and Africa. The forehead is flat and strongly receded, showing Javanese *Homo erectus* features.

The Sangiran 17 face is wide and moderately high, with a rounded rectangular outline, which might represent presumed common features shared in *Homo erectus* (Fig. 4). The mouth is, however, moderately projected compared with those of other *Homo erectus*. In addition, the cheeks are much swollen, and the nose is small. Consequently, the face looks very flat (Baba, 1995). These features in Sangiran 17 show the uniqueness of this specimen, and curiously resemble those of recent Northeast Asians, which imply some similarity in masticatory adaptation rather than direct phylogenetic relationship between them.

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