Current events

Did they also make stone tools?

F. Sémah
U.R.A. 184 au C.N.R.S., Muséum National d'Histoire Naturelle, IPH, 1, rue René Panhard F-75013 Paris, France and Laboratoire de Géomagnétisme, 94107 St-Maur-des-Fossés, France

A.-M. Sémah
ORSTOM, Laboratoire d'Archéologie, BP.A5 NOUMÉA Cedex, Nouvelle-Calédonie, France and Muséum National d'Histoire Naturelle, U.R.A. 184 du C.N.R.S., France

T. Djubiantono
Pusat Penelitian Arkeologi Nasional, Jl. Raya Condet Pejaten 4, Jakarta Selatan, Indonesia

H. T. Simanjuntak
Pusat Penelitian Arkeologi Nasional, Jl. Raya Condet Pejaten 4, Jakarta Selatan, Indonesia

Journal of Human Evolution (1992) **23,** 439–446

Introduction

Over a century ago, the discovery of a fossil hominid in Java, *Pithecanthropus erectus*, now recognised as the Southeast Asian form of *Homo erectus* (Wood, 1984), opened the era of human paleontology research. Despite strong efforts made to find the cultural remains of *Pithecanthropus*, all palaeolithic artefacts discovered until now on Java have been assigned by researchers to more recent human populations, with the exception of two isolated pieces from Sambungmacan, probably made by Solo man. Following on R. P. Soejono's palaeolithic research in Sangiran (Soejono, 1982), we carried out survey and subsequent excavation in Ngebung, which lies in the northwestern part of the Sangiran dome, Central Java, which has led to the discovery of archaeological layers within the middle Pleistocene Kabuh beds. The site, presently studied by an Indonesian–French team, has already provided us with several stone tools, including larger flake artefacts and bolas. Such a find adds important data to a never ending debate "did *Pithecanthropus* use stone tools?" (Bartstra, 1989; Sémah *et al.*, 1990; Pope, 1989; Bellwood, 1985) and opens a new field to prehistoric research in Java.

Did *Pithecanthropus* use stone tools?

Up to now, only three artefact-bearing sites have been related to the Javanese *Pithecanthropus*, two of which have been much discussed (Figure 1a).

0047–2484/92/110439+08 $08.00/0

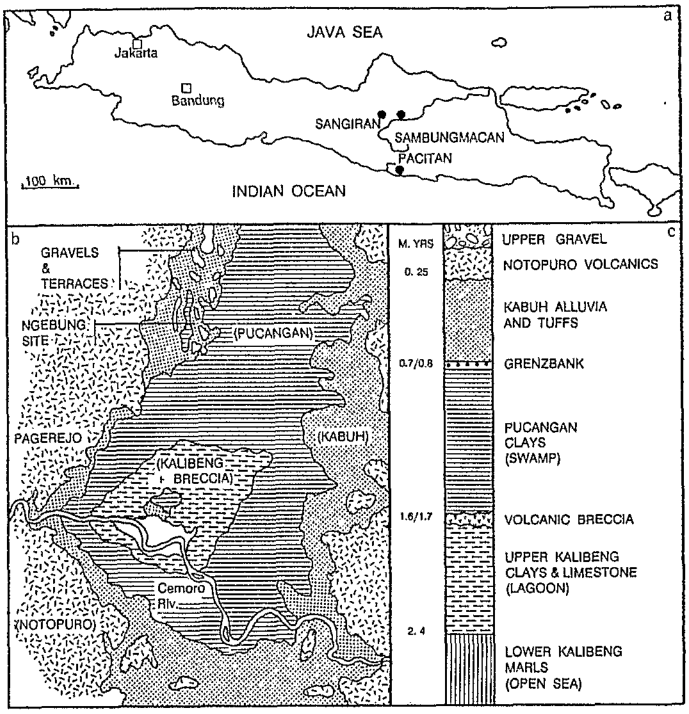

Figure 1. (a) Localities mentioned in the text on Java Island. (b) Simplified geological map of the Sangiran dome, location of the Ngebung site. (The map is simplified from Watanabe & Kadar, 1985.) (c) Synthetic geological section (not for scale) of the Sangiran area series.

Sangiran–Ngebung

The first famous Sangiran flakes were discovered by G. H. R. von Koenigswald in 1934 (von Koenigswald & Gosh, 1973). His excavations on the top of a hill at Ngebung (Figure 1b) yielded many other pieces. The artefacts are small, sometimes heavily rolled, and mainly made of siliceous material like calcedony and jasper—such raw material probably deriving from the Southern Mountains of Java. Von Koenigswald first gave a Middle Pleistocene-Kabuh age (Figure 1c) to his finds. However, other researchers have considered, on geomorphological and sedimentological grounds, that the Ngebung gravels are much younger, perhaps even younger than the Notopuro lahars, and might represent older alluvial deposits formed just before the Sangiran dome was cut down by the erosion (possibly Upper Pleistocene; see for instance, G. J. Bartstra, 1985).

More recently, a chopper made of metamorphic rock has been found at Ngebung by R. P. Soejono (1982, 1991) during his 1979 excavations. It was found 150 cm from the highest point of the ground level and it has been correlated by this author to the Kabuh layers. Bartstra (1985) described the discovery of several artefacts in a lower terrace level at Ngebung, among these finds was a chopper (ibid., Plate 2). Also found in the area are the somewhat common reworked bolas (like those from Ngandong and Sambungmacan, see S. Sartono, 1979). These kinds of larger stone tools found at Sangiran have been given by G. J. Bartstra (1989) an Upper Pleistocene/Lower Holocene age.

Patjitan

Noting the southern origin of the "Sangiran flakes" lithic raw materials, von Koenigswald oriented his research for the habitat of *Pithecanthropus* toward the Southern Mountains of Java, an important source of sedimentation into the former Solo basin. There, in October 1935, in the Gunung Sewu karstified area near the town of Pacitan, he found typical palaeolithic tools along the course of the Baksoko river, in river terraces, the uppermost situated approximately 20 m above the present riverbed (von Koenigswald, 1936; Teilhard de Chardin, 1937; Movius, 1944; Bartstra, 1976). Until now, no one has succeeded in ascertaining the age of those alluvial formations. Taking into account the geomorphological situation, G. J. Bartstra (1984) suggests an Upper Pleistocene age to the Patjitan assemblage.

Sambungmacan

Hitherto, the only hint offered of *Pithecanthropus* cultural remains was the discovery, in 1975, of two stone artefacts at Sambungmacan (Jacob *et al.*, 1978). The tools, a chopper made on a big flake and a smaller retouched flake, were reportly found *in situ* in the lower fossil-bearing conglomerate of the Sambungmacan section. Though the exact layer which yielded the Sambungmacan skull is not known, those two artefacts seem to be at least as old as the human fossil cranium. Nevertheless, the Sambungmacan cranium is related to a derived, Solo type *H. erectus*, and not to the classical form of *Pithecanthropus* which is documented at Trinil and Sangiran.

Searching for stones and palaeosurfaces

The search for *Pithecanthropus* occupation places in the Solo area faces a major problem: the fossils have been deposited in a depression, after substantial transport from the mammals' and hominids' original habitat. For example, the Kabuh layers mainly consist in fluviatile sequences, each one truncating the underlying one. On the other hand, the search for stone tools, according to us, did not so far take into account an obvious fact, i.e., the overall lack of stones in the fossil-bearing layers. For instance, the small mean dimension of the rolled Sangiran flakes, matching the dimension of the gravels in the sediment, might well not be due to "cultural" factors, but to "granulometric" circumstances. The discovery of the Ngebung archaeological layer was guided by those basic geological considerations: one must search for palaeosurfaces—like older riverbanks—and for layers showing a high pebble content.

The Ngebung site

Overview

The Ngebung hills (Figure 1b) are capped by the artefact-bearing gravels discussed above. Underlying layers show volcano-sedimentary facies and are attributed either to the Kabuh beds (Watanabe & Kadar, 1985; sections S32, S35 and S36) or to the Kabuh-Notopuro complex (Bartstra, 1985, 1989). According to Bartstra's schematic profile, the upper part of these fluviatile sequences could be the sedimentary equivalent of the Notopuro lahars (which are conspicuous at Pagerejo), but the Kabuh–Notopuro lithostratigraphical boundary is not obvious at Ngebung. In the bottom of the valley separating the two Ngebung hills we find outcrops of the Grenzbank transition layer and then the uppermost part of the Lower Pleistocene Pucangan beds. Along the slopes, one can find the remains of terraces related to a younger drainage pattern (Bartstra, 1985).

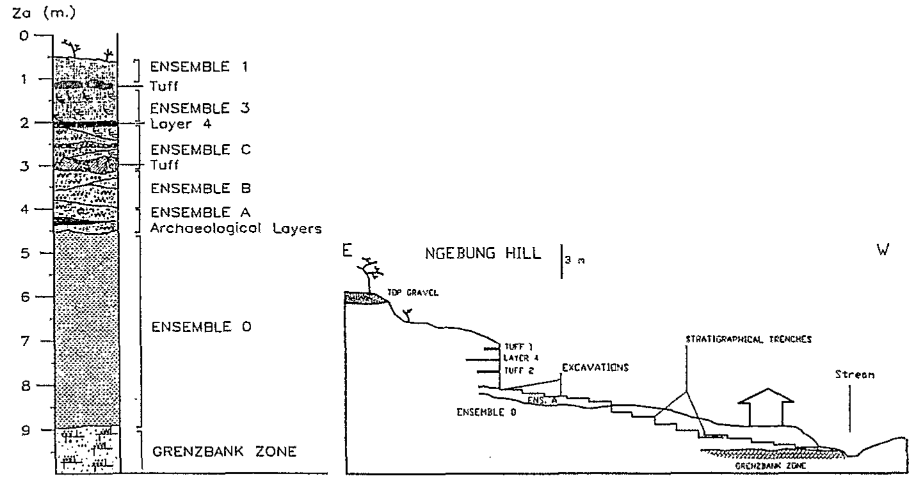

Figure 2. Synthetic profile of the Ngebung site. Stratigraphical section of the excavated part.

Stratigraphy

The synthetic section and the profile shown in Figure 2 give the stratigraphical succession of the site. Above a well-developed Grenzbank zone, where continental and marine elements are mixed—the Grenzbank reflects the filling up of the Solo lagoon (see for instance, Sémah, 1986; Djubiantono, 1992)—there was deposited a thick clayey unit, Ensemble O, originating from weathered volcanic ashes. According to our stratigraphical trenches, it appears that no pedogenetic phase has occurred during this sedimentation phase, which seems to have comformably followed the Grenzbank deposition. The top of Ensemble O has been eroded and covered by gravels, sands and tuffaceous layers (Ensembles B, C, etc.).

The section drawn on Figure 2 does not represent the whole of the hill slope at the spot: it is limited upwards to the excavated part. There are still several meters of sands and tuffs above, before matching the top of the Ngebung hill and the gravels (see profile on Figure 2).

Characteristic of the site is that the erosion zone of Ensemble O can show in places a notable thickness, up to 1 m thick sands and gravels containing a lot of clayey grains—soft gravels—reworked from the underlying clays. This erosion zone, called Ensemble A, contains a lot of large clastics which granulometrically contrast with the sediment matrix: andesitic pebbles, artefacts (including bolas), bigger and smaller broken bones. Moreover, careful excavation shows in places prints of leaves and tree bark. The scarcity of the pebbles, which are very often partly embedded in the underlying fine-grained clayey Ensemble O, suggests that their deposition is not natural.

It appears that the erosional surface of Ensemble O is not simply the result of the truncation of the clayey sequence by the younger fluviatile layers. Ensemble A represents the sedimentation which took place when the erosional surface acted as the bank of a river and/or swamp. We are presently undertaking the study of the vertical and horizontal distribution of the objects within Ensemble A in order to ascertain to what extent the remains we find have been disturbed by water flow and whether there are in fact several archaeological layers within Ensemble A.

Figure 3. Ro

The stone artefacts

The first discoverie
limited by the scarci
third clearly appea
andesites, which w
fine-grained rocks
excavations yielde
Sangiran. The item
5). It is worthy to n
of the two chopper
those tools is therefo
the bolas coming fr
documented throug

As yet we have fo
conglomeratic lense
The source area of t
the problems which
transport distance o

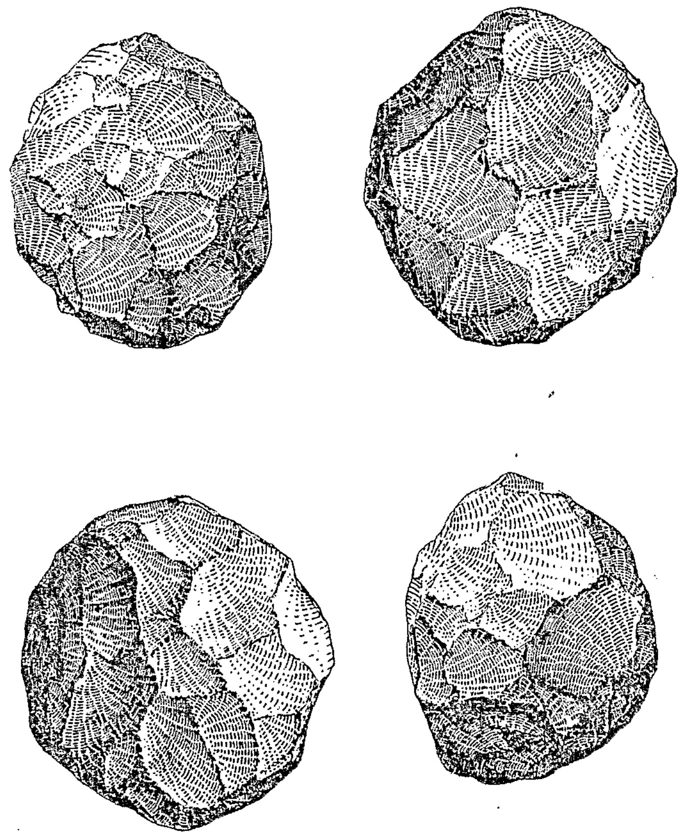

Figure 3. Rough polyedric tool (coarse-grained andesite). Drawing: J. Krzepkowska (50%).

The stone artefacts

The first discoveries seem to confirm that man's activity has been deeply influenced and limited by the scarcity and the poor quality of raw material; among the pebbles, less than one third clearly appear to have been used or worked by man. Those are mainly coarse-grained andesites, which were used to make bolas and rough polyedric tools (Figure 3). The rare fine-grained rocks comprise more sophisticated tools on big flakes (Figure 4). The 1990 excavations yielded a quartz pebble whose size is amazingly rare—if not unique—in Sangiran. The item bears fresh smaller breaks and is interpreted as a hammer stone (Figure 5). It is worthy to note here that the size of the excavated stone tools matches the dimensions of the two choppers mentioned by Soejono (1982) and Bartstra (1985). Comparison with those tools is therefore necessary. We have to be more cautious about the comparison between the bolas coming from Ensemble A and other bolas found in the area, for this kind of tool is documented through the Pleistocene until recent times.

As yet we have found neither workshop remains (andesitic flake or debris), nor any coarse conglomeratic lense in the surrounding Kabuh beds from which the pebbles could originate. The source area of the quartz pebble ought to be in the Southern Mountains of Java. One of the problems which could be solved by further excavations is that of the location and the transport distance of such raw material by man.

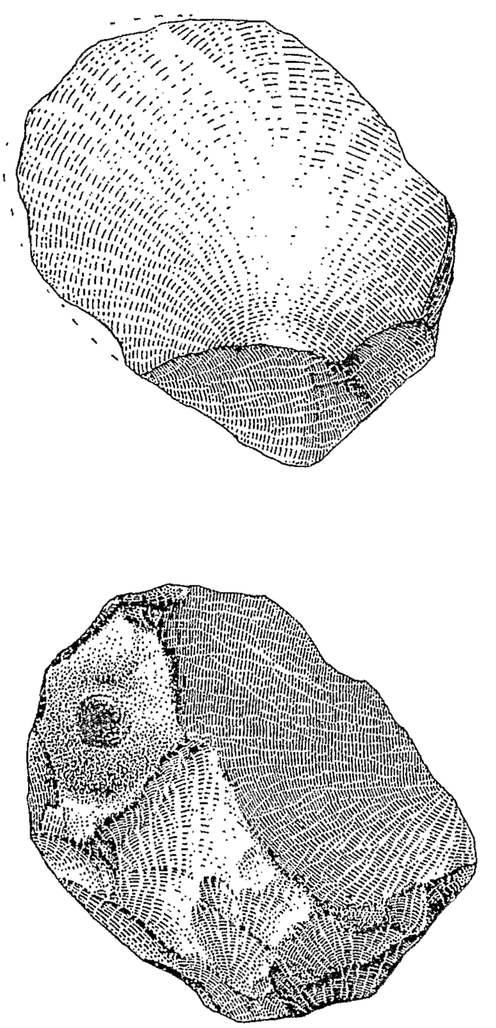

Figure 4. Large flake tool (fine-grained andesite). Drawing: J. Krzepkowska (50%).

A new field of prehistoric research in Java

The Ngebung site has not yet yielded all the information it contains. Its greatest interest is that it is the first apparently undisturbed, living-floor-like site found in the Sangiran dome.

We do not know yet the precise age of the Ensemble A layers. In fact, the minimal age of the Kabuh layers is still under discussion (Sémah, 1986). The absolute range to be taken into account for the moment is from ca. 0·75 Ma (for the Grenzbank, see Sémah, 1986) to ca. 0·25 Ma (Notopuro pumices, Suzuki *et al.*, 1985).

The stratigraphical observations suggest that the archaeological layers are not far from the lower part of the Kabuh beds at Ngebung. Such a position would imply an early Middle Pleistocene age and would also directly relate the archaeological remains with the *H. erectus* fossils found in Sangiran.

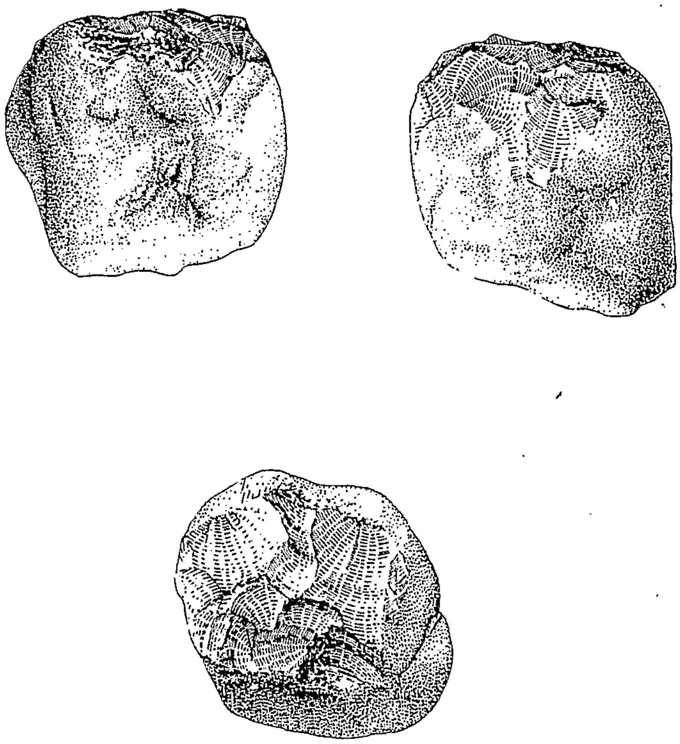

Figure 5. Quartz hammer stone. Drawing: J. Krzepkowska (50%).

The first data collected on the Ngebung site indicate that whenever the older Sangiran inhabitants found stones suitable to make tools, they exploited them for that purpose. In such a case, no fundamental cultural difference would have existed between those Southeast Asian hominids and occurrences of *H. erectus* elsewhere in the Old World.

Acknowledgements

Fieldwork supported by French Ministère des Affaires Etrangères and Muséum National d'Histoire Naturelle, BQR-M13. Thanks are due to Francis Clark Howell and Henry de Lumley who kindly corrected the manuscript and to Gert-Jan Bartstra for constructive suggestions.

References

Bartstra, G. J. (1976). *Contributions to the study of the Palaeolithic Patjitan culture, Java, Indonesia—Part I.* Leiden: E. J. Brill.

Bartstra, G. J. (1984). Dating the Patjitanian. *Cour. Forsch. Inst. Senckenberg* **69,** 253–258.

Bartstra, G. J. (1985). Sangiran, the stone implements of Ngebung, and the Palaeolithic of Java. *Mod. Qual. Res. S-E Asia* **9,** 99–113.

Bartstra, G. J. (1989). Recent work on the Pleistocene and the Palaeolithic of Java. *Curr. Anthrop.* **30**(2), 241–244.

Bellwood, P. (1985). *Prehistory of the Indo-Malaysian Archipelago.* Sydney: Academic Press.

Djubiantono, T. (1992). Les derniers dépôts marins de la dépression de Solo (Java Central, Indonésie)—Chronostratigraphie et Paléogéographie. *Mém. Semenanjung* **1.**

Jacob, T., Soejono, R. P., Freeman, L. G. & Brown, F. H. (1978). Stone tools from mid-Pleistocene sediments in Java. *Science* **202,** 885–887.

Koenigswald, G. H. R. von (1936). Early Palaeolithic stone implements from Java. *Bull. Raffles Mus. Sing.* **1,** 52–60.

Koenigswald, G. H. R. von & Gosh, A. K. (1973). Stone implements from the Trinil beds of Sangiran, Central Java. *Proc. Kon. Ned. Akad. v. Wetensch.*, B, **76**(1), 1–34.

Movius, H. L. (1944). Early Man and Pleistocene statigraphy in Southern and Eastern Asia. Pap. Peabody Mus. Am. Arch. Ethnol., XIX, **3,** 1–128.

Pope, G. G. (1989). Hominid palaeoenvironments in the Far East. In *Hominidae.* Proc. 2nd Int. Congr. of Human Paleontology, pp. 231–235. Milan: Editoriale Jaca Book.

Sartono, S. (1979). The stratigraphy of the Sambungmacan site, Central Java. *Mod. Quat. Res. S-E Asia* **5,** 83–88.

Sémah, F. (1986). Le peuplement ancien de Java. Ebauche d'un cadre chronologique. *L'Anthropologie* **90**(3), 359–400.

Sémah, F., Sémah, A.-M. & Djubiantono, T. (1990). *They Discovered Java.* Jakarta: Puslit Arkenas and Museum National d'Histoire Naturelle.

Soejono, R. P. (1982). *New Data on the Palaeolithic Industry in Indonesia.* Colloque international C.N.R.S. L'*Homo erectus* et la place de l'Homme de Tautavel parmi les hominidés fossiles, Nice, II, pp. 578–590. Nice: CNRS.

Soejono, R. P. (1991). *Paleolitik di Indonesia.* Seminar Peringatan 100 tahun penemuan *Pithecanthropus.* Puslit Arkenas, Muséum Nat. d'Histoire Naturelle, Museum Nasional, Cedust, Jakarta, August 1991, pp. 20–52.

Suzuki, M., Wikarno, Budisantoso, Saefudin, I. & Itihara, M. (1985). Fisson-track ages of pumice tuff, tuff layers, and javites of hominid fossil-bearing formations in Sangiran area, Central Java. In (N. Watanabe & D. Kadar, Eds), Quaternary geology of the hominid fossil-bearing formations in Java, pp. 309–331. Bandung: Geological Research and Development Centre.

Teilhard de Chardin, P. (1937). Notes sur la paléontologie humaine en Asie méridionale. *L'Anthropologie* **47,** 23–33.

Watanabe, N. & Kadar, D. (1985). Quaternary Geology of the Hominid Fossil Bearing Formations in Java. Bandung: Geological Research and Development Centre.

Wood, B. (1984). The origin of Homo erectus. *Cour. Forsch. inst. Senckenberg* **69,** 99–112.