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Recent Work on the Pleistocene and the Palaeolithic of Java[1]

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In a 1982 report in this journal on the till-then unsuccessful search for artifacts of *Homo erectus erectus* on Java (Bartstra 1982), we suggested that, rather than continue to look for cores of the chopper/chopping-tool complex (a very late development on Java), it might be profitable to focus on the small irregular cores and crude flakes collected by von Koenigswald at Sangiran. These artifacts, while not Middle Pleistocene as he contended, seemed to us to point in the direction of a solution to the problem. Since von Koenigswald's explorations stone implements have repeatedly been reported from Pleistocene strata at Sangiran, and therefore Sangiran assumed a central position in our research. This work has since identified small stone tools—flakes and cores—in deposits of Pleistocene age that may be correlated with *H. erectus soloensis* and, further, documented the occurrence of large andesite core tools in deposits dated to the Upper Pleistocene/Lower Holocene.

From the geological viewpoint,[2] the Sangiran area can be described as a dome (fig. 1). Erosion has exposed a sequence of Upper Neogene and Quaternary deposits, and fossil fragments of vertebrates can be collected in many places from the clayey centre of the dome towards the sandy rim. The bulk of the latter consists of fine-grained tuffaceous sands, but in the upper part coarse gravels occur locally. It is from some of these gravel sheets that stone implements can be collected.

An important site for these implements is that of the two Ngebung hills, which form the highest point of the northwestern rim of Sangiran, around 180 m above sea level. Like the rest of the rim, they mainly consist of tuffaceous sands known as the Kabuh[3] deposits (fig. 2). These deposits are fluviatile: cross-bedding is conspicuous, and locally seams of small rounded pebbles can be traced. Being more or less congruent with the Brunhes normal epoch (715,000–125,000 years B.P. [Sémah 1986]), they are of Middle Pleistocene age. Almost all the *H. erectus* remains from the Sangiran area come from the Kabuh stream sediments.

The upper part of the Ngebung hills consists of coarser clastics. It is not yet clear whether the deposits immediately below the top gravel should still be assigned to the Kabuh beds or distinguished from them as Notopuro. Traditionally, the Notopuro deposits have been understood to include the agglomerates, volcanic conglomerates, and occasional lahars (volcanic mudflows) that indicate renewed volcanic activity in the upper part of the Sangiran section and for which the Lawu, a volcano to the southwest of Sangiran, is held responsible (van Bemmelen 1949). However, the stratigraphy of Ngebung includes no lahar that could function as a marker bed. This absence of a lahar deposit also forces us to reject the idea that the entire local section (minus the top gravel) is Lower and Middle Kabuh (Itihara et al. 1985*a*); the hypothetical absence of Upper Kabuh deposits at Ngebung cannot be explained by the eroding power of a lahar.

The very top gravel of the Ngebung hills, typically fluviatile, has been labeled the Old River Gravel (fig. 2 [Bartstra 1985]). It contains, in addition to pebbles of igneous rock, much chalcedony, chert, jasper, and limestone. We date the Old River Gravel to the beginning of the Upper Pleistocene (Eemian ingression). Occasionally small fossilized fragments of vertebrate bones can be found in it, but these appear to be derived from the underlying Kabuh beds. More important are the small, artificially worked chalcedony flakes and cores, which occur in all stages of rounding and seldom exceed 5 cm in length (von Koenigswald 1939, van Heekeren 1972, Bartstra 1985).

On the slopes of the Ngebung hills can be traced remnants of stream terraces carved into the Kabuh sediments. We call these various thin fills the Young River Gravel (fig. 2). These treads and scarps are the result of a repeatedly interrupted valley "rejuvenation" effected by the uplift of the dome. To what extent the Last Glacial regression contributed to this process is still a matter of debate. We consider the Young River Gravel to be of Upper Pleistocene (High or Brangkal terrace) to Lower Holocene (cemented Low terrace) age. The terrace fills contain fragments of a presumably derived Kabuh fauna. They also contain stone implements, both reworked pieces from the Old River Gravel and autochthonous artifacts (Bartstra 1985).

The Old River Gravel at Ngebung appears to have been the last deposit laid down before the uplift of the area and the entrenching of a young drainage system. If the doming of Sangiran is indeed the result of the gravitational collapse of the first Lawu cone (van Bemmelen 1949, Itihara et al. 1985*b*), then the Old River Gravel dates from a time when the first Lawu ("Old Lawu" in

1. 0011-3204/89/3002-0007$1.00. We are indebted to Hemmo Veenstra and Richard Shutler for critically commenting on the manuscript. Just after finishing the final draft, we learned from Zuraina Majid (Penang, Malaysia) that the implements from her excavations at Kota Tampan can probably be dated around 35,000 years B.P. This may be further evidence for the theory that the large core industries of Southeast Asia should be connected with incoming *H. sapiens* (see Majid n.d.).

2. On Java Pleistocene archaeology means above all Pleistocene sedimentology and taphonomy, since all relevant artifacts come from stream sediments.

3. We employ the traditional terms for the stream deposits at Sangiran. Recently new names have been suggested (Itihara, Kadar, and Watanabe 1985), but apart from the fact that these have only local significance, we do not think that it is wise to replace a generally accepted system of geological classification with a new one. It is better to adhere to the old terms but clearly formulate what is meant by them.

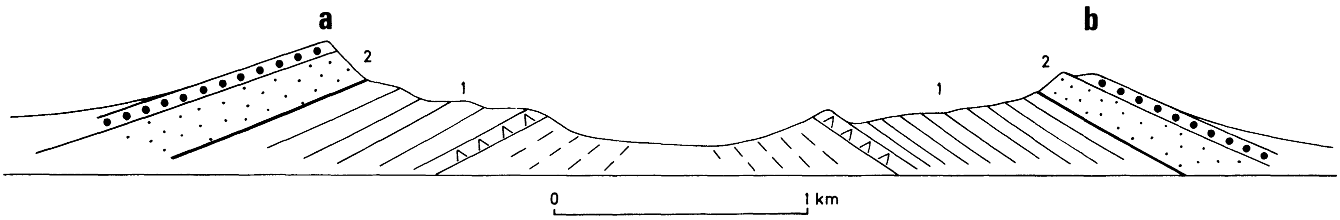

FIG. 1. *Simplified stratigraphy of the hominid site of Sangiran.* 1, *lacustrine clays;* 2, *fluviatile sands (Kabuh beds) and local lahars and volcanic conglomerates (Notopuro beds). Ngebung is situated at the highest point on the northwestern rim* (a), *Grogol and Tapan on the northeastern rim* (b).

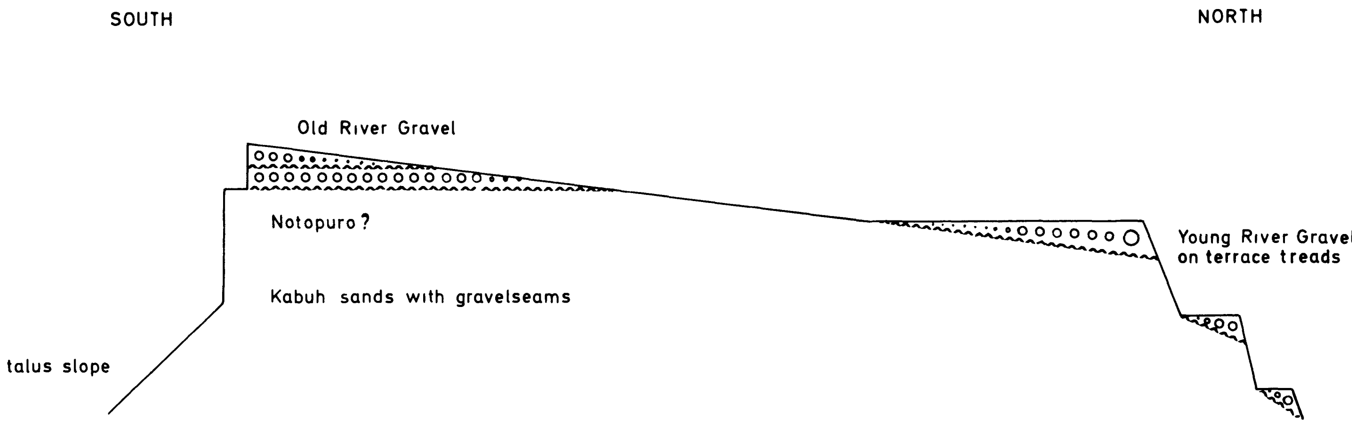

FIG. 2. *Simplified diagram of the Ngebung hills. Total height of section ca. 10 m.*

the literature) was still in existence. Because the activity of the Old Lawu is usually associated with the Notopuro deposits in the Sangiran area, it has to be ascertained whether the Old River Gravel can be described as "fluvial" Notopuro.

Recent geological research in the area has shown that what has always been called Notopuro in fact consists of a sequence of deposits reminiscent of active volcanism and quieter periods (Itihara et al. 1985*a*). Such a sequence can be studied in the Pohjajar Valley (some 6 km to the south of Ngebung) and in the local section is referred to as the Pohjajar beds. At least two lahars (upper and uppermost) and several pumice horizons can be distinguished. In between are gravelly deposits of fluviatile origin that outcrop on the slopes in cemented banks and locally as loose lag gravels. It is in these places that a distinction from the Old River Gravel at Ngebung becomes apparent. The Ngebung deposit is varied and multicoloured and contains fossils and artifacts, whereas the fluviatile Notopuro gravels of the Pohjajar Valley contain only small, soft grey volcanic pebbles. For the sake of clarity we assume that the Notopuro sequence and the Old River Gravel are sequential in time (fig. 3). A fission-track analysis of Notopuro pumice pebbles collected in the southern part of Sangiran (north valley slope, middle course of the Pohjajar River) has yielded an age of 250,000 ± 70,000 years B.P. (Suzuki et al. 1985). As these pebbles originate from fluvial strata and are thus probably reworked, it is safe to assume that this date more or less marks the onset of Old Lawu activity in the Sangiran area. The Old River Gravel is certainly younger.

We have suggested that the Old River Gravel may be part of the Solo High terrace system (Bartstra 1985). The terraces of the Solo, the most important river in Central Java, have often been studied (see, among others, de Terra 1943, Sartono 1976, Bartstra 1977). In the generally accepted Quaternary stratigraphy of Java, the Solo High terrace deposits are superimposed on the Notopuro volcanics. Recently attempts have been made to uranium-series-date the Solo High terrace fills (Bartstra, Soegondho, and van der Wijk 1988). Fossil vertebrate bones from the hominid site of Ngandong, which has yielded the skulls of Solo or Ngandong man (Oppernoorth 1932), have produced relatively young ages (between 31,000 ± 3,000/2,000 and 101,000 ± 12,000/10,000 years B.P.). However, a few bone fragments from a High terrace deposit at Matar, on the other side of the river, have produced an age of 165,000 ± 30,000/23,000 years B.P. At the moment it is uncertain whether this difference in age of various fossil High terrace constituents is the result of a laboratory procedure or of a real difference between an autochthonous and an allochthonous terrace fauna.

Lestrel (1975) has given a date of 310,000 years B.P. for the Solo High terrace deposits. This date is based on a potassium-argon analysis (by G. H. Curtis, Berkeley) and has a standard error of 100%. No details are known

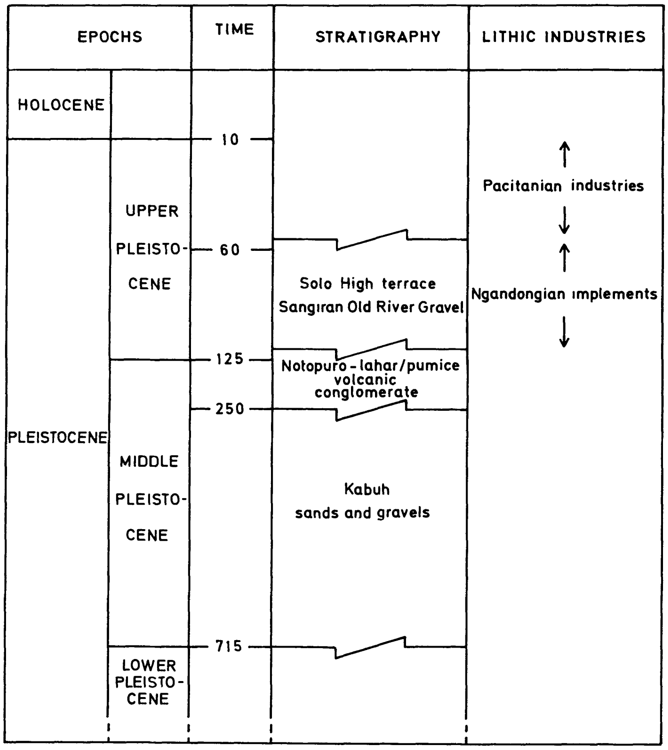

FIG. 3. *Simplified stratigraphic framework of the Pleistocene and the Palaeolithic of Central Java (time in thousands of years* B.P.).

about the sample, not even where it was collected. The date seems improbably early, and, although they are certainly not final, we are inclined to consider the uranium-series dates more reliable. The geomorphological evidence also points to an Upper Pleistocene (Eemian ingression) age for the Solo High terrace. Lestrel indicates that the Solo-man remains must have been reworked, and this reworking hypothesis is explicitly advanced by Santa Luca (1980). But for anyone who is familiar with the field situation around Ngandong, the question is where the hypothetical parent sediments of the Ngandong skulls might be situated. It is only far to the south of Ngandong that Middle and Lower Pleistocene strata outcrop; Ngandong itself lies amidst Upper Neogene marl and limestone deposits. It can hardly be assumed that 11 skulls (and 2 tibiae) were transported together by stream action along a meandering river course for more than 30 km. There is still good reason to consider the Ngandong hominid remains contemporary with the Solo High terrace fill.

The Solo High terrace fills have yielded not only the cranial remains and tibiae of *H. erectus soloensis* but also small stone artifacts, the so-called Ngandongian (Movius 1949, van Heekeren 1972). In our opinion these artifacts are the work of *H. erectus soloensis* (Bartstra, Soegondho, and van der Wijk 1988). If the Old River Gravel at Sangiran is part of the Solo High terrace, then the artifacts from the upper stratum at Ngebung can also be ascribed to *H. erectus soloensis.*

The inconspicuous small chalcedony flakes and cores of Ngebung and of the Solo High terrace differ considerably from the chopper/chopping-tool Palaeolithic traditionally associated with early man in the Far East. Large core tools, made of silicified tuff and limestone, do occur on Java, for example, along the south coast, where they are known as the Pacitanian (formerly Patjitanian). Successive researchers have made this Pacitanian increasingly younger (von Koenigswald 1936; Houbolt 1940; Movius 1944, 1949; Soejono 1961, 1962; Mulvaney 1970; van Heekeren 1972, 1975). We ourselves have repeatedly stressed that the large core industries near Pacitan should be assigned to the later phases of the Upper Pleistocene and associated with the appearance of *H. sapiens* on Java (Bartstra 1983, 1984; Bartstra, Soegondho, and van der Wijk 1988). The Pacitanian core tools represent a distinct break with preceding lithic industries such as those found in the Solo High terrace and the Old River Gravel. In our view this break marks the succession of two hominid species that invaded Java during the Pleistocene: *H. erectus* and *H. sapiens.* On Java we can therefore distinguish an Early (Solo High terrace/Old River Gravel [*H. erectus*] and a Late (Pacitanian chopper/chopping-tool [*H. sapiens*]) Palaeolithic (fig. 3).

The evidence of a break in the stone tool tradition on Java may contribute to the discussion of late *H. erectus* and the emergence of *H. sapiens* in the Far East (Pope 1983, 1984; Shutler 1984; Hutterer 1985; Gowlett 1987). Our experience in Central Java leads us to believe that the chopper/chopping-tool complex of Southeast Asia is considerably younger than is usually thought, most of the large core industries there belonging to the second half of the Upper Pleistocene and in some cases even to the Lower Holocene. On Java itself new evidence has been found in the form of large core tools in the Sangiran area. These tools are made of andesitic rock, and as this material is readily rounded by chemical erosion and fluvial action these artifacts were long overlooked in the field. The stream deposits with which these artifacts can be correlated are of decisive importance for dating. At Ngebung it is clear that the large andesitic core tools are to be associated with the Young River Gravel (Bartstra 1985). Subsequent research on the eastern rim of Sangiran, near Tapan and Grogol, has confirmed this picture. The large core types date from a time when the Notopuro lahars and the Old River Gravel were already subject to erosion. It was *H. sapiens* who then roamed the area, collecting suitable cobbles from the eroding lahars to manufacture his heavy-duty implements. By then *H. erectus* had long since disappeared from Java.

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Human Behavioural Evolution: A Physiomorphic Model[1]

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6 X 88

The precise nature of human uniqueness, if any, has been contentious ever since Darwin's *Descent of Man* (1871). The superficially obvious candidates have now been eliminated as either present (if in rudimentary form) in other species or less than universal among humans. Language remains a strong candidate but is better construed as itself an expression of the more fundamentally unique factor which, among its other consequences, facilitated linguistic evolution. Most authorities would, however, agree that there is something unique about us as self-evident as it is difficult to specify. Current explanations of human uniqueness fall into two broad categories: those that deny that it is anything but quantitative (see, e.g., the arguments of many sociobiologists) and those that invoke a qualitative jump to a capacity for symbolism (see, e.g., White 1949, Fluehr-Lobban 1986, Kitahara-Frisch 1980) or the adoption of a life-style based on labour (see, e.g., Engels 1972 [1876]). The problem with accounts of the second type is that they generally do not explain how or why the transition was achieved. In more recent accounts (e.g., Tobias 1983, Blumenberg 1983), this gap is somewhat obscured by the ubiquitous invocation of "feedback loops" of some kind—a strategy which may prevent us from exploring alternative modes of theoretical analysis. In this paper a model (at this stage rather formal) of hominisation is outlined which accepts that modern humans are unique but has no substantial gaps. An additional feature of this account is that it provides an alternative basis for conceptualising the origin

1. This is a considerably revised and expanded version of the full-length paper originally prepared for the 2d International Congress for Human Paleontology, Turin, Italy, September 28–October 3, 1987. Dean Falk made helpful comments on an earlier draft.