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Homo erectus erectus: The Search for His Artifacts

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Where are the artifacts of Java Man? This is the question that arises now that almost four years of research and fieldwork in Indonesia (1977–81) have provisionally been completed.[1] One of the aims of this work was to shed light on the material culture of the early hominids of Java. Accordingly, most of the known sites with stone tools and fossil hominid remains were visited and surveyed, and several new ones were discovered. River terraces in many places in Central and East Java were mapped and investigated for the presence of artifacts. Much attention was devoted to regions in which the geological history indicates that Upper Pleistocene and (Sub-)Holocene disturbances have been minimal. Many artifacts (including handaxes and unifacial and bifacial choppers) were found, collected, and studied, but nowhere were we able to demonstrate that these artifacts came from Lower or Middle Pleistocene deposits and therefore could have been made by Java Man.

The story of the discovery of Java Man has become legendary. In 1887 the Dutch army surgeon Dubois arrived in the former Dutch East Indies with the aim of finding the "missing link," and in October 1891, in the course of excavations at Trinil, a village in Central Java (fig. 1), he did indeed find the heavily fossilized braincase of a primitive hominid. Almost a year later, in August 1892, the same fossil horizon yielded a femur with a remarkable resemblance to that of modern man. Dubois (1894) described these remains as belonging to *Pithecanthropus erectus*, thus honouring Ernst Haeckel, who had used this generic name hypothetically in his writings. There was not much further clarification concerning Java Man until 1937, when the calvarium of a second, fully grown individual was found at Bapang, near Sangiran, also in Central Java.[2] Java Man could then be accepted with more certainty as a precursor of modern man—unfortunately, however, no longer with the approval of Dubois, who came to stress the apelike features of the Trinil skullcap more and more. *Pithecanthropus erectus* is now classified as *Homo erectus erectus*, although some of those who are closely involved with palaeoanthropological research on Java still use the name *Pithecanthropus*. *H. erectus erectus* (of which the remains of about 30 individuals are now known) differs subspecifically from *H. erectus modjokertensis*, remains of which have been found in older deposits, and from *H. erectus soloensis* (Solo Man), known from younger sediments. In Africa and in Europe representatives of the species *H. erectus* lived in the Lower Pleistocene (from 1,800,000 to 700,000 years B.P.) and in the Middle Pleistocene (from 700,000 to 130,000 years B.P.). Java Man probably lived in the same time span.[3]

In the literature dealing with early man in Java, claims have often been made of the discovery of artifacts of *H. erectus erectus*. The first such claim appears in the reports of the Selenka expedition, where it is stated that some fossil remains of vertebrates were found at Trinil with traces of working by man (Carthaus 1911). The Selenka expedition carried out excavations (in 1906–8) close to Dubois's former pits, and the alleged bone implements came from the same fossil horizon as the braincase of the first *H. erectus erectus*. Subsequently, in the 1930s, von Koenigswald reported the find of small stone tools at Sangiran, the most prolific site of fossil hominid remains in Java, and attributed them to *Pithecanthropus* (e.g., von Koenigswald 1936*a*: 41), a connection that he still maintains (e.g., von Koenigswald 1978). These implements from Sangiran must be clearly distinguished from the larger and more pronounced artifacts of the Patjitan[4] culture in South Java, also found for the first time in the 1930s (von Koenigswald 1936*b*). The finds from the older phases of this "Patjitanian" have also been ascribed to *Pithecanthropus*, for example, by Movius (1949:408) and van Heekeren (1972:43). Finally, Jacob et al. (1978) mention "stone tools from mid-Pleistocene sediments" near the village of Sambungmacan (also in Central Java, between Sangiran and Trinil) and suggest a correlation with a Middle Pleistocene hominid.

All these claims for the association of artifacts with a Lower

[1] The research and fieldwork, carried out in cooperation with staff members and students of the National Research Centre of Archaeology in Jakarta, were made possible by a grant from WOTRO, the Netherlands Foundation for the Advancement of Tropical Research.

[2] In fact, a new skull of a *Pithecanthropus* had already been found a year earlier (in 1936) near Mojokerto in East Java. This, however, was an infant calvarium, so no satisfactory comparison could be made with the Trinil vault.

[3] A good deal of research has been done on Java in recent years with the aim of obtaining reliable absolute datings of Pleistocene strata. Although one would expect the K-Ar method to offer considerable prospects in view of the significant role that vulcanism has played on Java, difficulties arise in the analysis of samples (Stross 1971). Methods currently employed also include fission-track dating (Nishimura, Thio, and Hehuwat 1980), U-series dating on vertebrate bones, and palaeomagnetic dating (Sémah et al. 1981, Sartono et al. 1981).

[4] The new Indonesian spelling for the town which gave its name to the culture is Pacitan (see fig. 1).

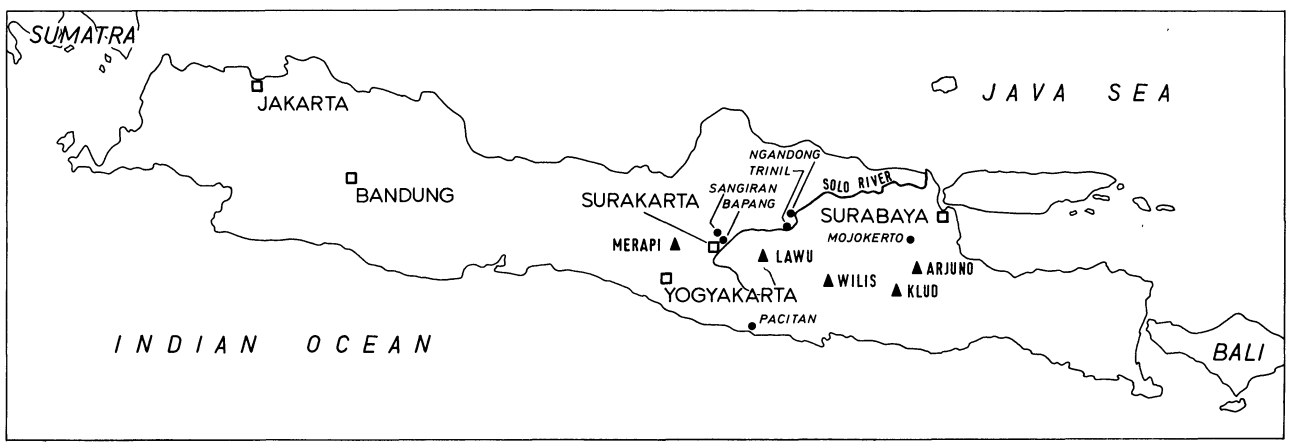

FIG. 1. The island of Java with the principal localities of fossil hominids and prehistoric stone artifacts (●), active volcanoes (▲), and towns (□). Scale: 1:5,000,000.

or Middle Pleistocene hominid can be refuted. To do this in detail is beyond the scope of this account; details must await more extensive reports. However, several points will be emphasized here.

In the case of the Selenka expedition, it is the "implements" themselves that are doubtful. The illustrations that are given of them (it seems that the originals were destroyed in World War II) certainly do not show typical bone tools; in fact, they are reminiscent of the "osteodontokeratic" controversies in South Africa. Their characteristic features and fracture patterns can be explained by, for example, the action of carnivores.[5]

Concerning the small stone tools found at Sangiran by von Koenigswald, it is the deposits in which these artifacts occur that raise doubt as to an association with *H. erectus erectus*. Von Koenigswald calls these deposits Middle Pleistocene on the basis of remains—in lower-lying strata but within the same (Notopuro) formation—of Middle Pleistocene vertebrates (a so-called Trinil fauna, i.e., the fauna that was originally found in the horizon of the skullcap and femur at Trinil). However, these remains are heavily abraded and water-worn and are certainly derived from still older strata. They cannot be used for age determination; among the first to point this out was Teilhard de Chardin (1937:29), after a visit to Java in early January 1936, and others have only been able to confirm his observations (e.g., de Terra 1943:456; Movius 1944:90 n. 58; 1949:354 n. 12; van Heekeren 1972:48; Bartstra 1974:7; 1978:68). From a geological point of view, the artifact-bearing deposits indicated by von Koenigswald cannot be older than Upper Pleistocene (< 130,000 years B.P.).

As for the Patjitan culture, "Palaeolithic" types of artifacts, such as handaxes and choppers, are found in terrace fills and in the channel-load of several small rivers on the south coast of Java. These artifacts, however, cannot be the work of *H. erectus erectus*. The oldest river terraces in the region west of Pacitan (where most of the finds have been made) belong to the last phases of the Pleistocene; the younger terrace fills and scarps are Holocene, and the artifacts have not been derived from older sediments. What is even more important is that so-called Palaeolithic types of artifacts occur in surface assemblages away from rivers. In the literature these assemblages are rather vaguely categorized as "Neolithic"; it can be demonstrated geomorphologically that they do indeed belong to the Holocene. It is truly questionable to what extent the various sites of the Patjitan culture represent only different seasonal or occupational activities of a group of (Sub-)Holocene hunter-gatherers. Wajak Man[6] could very well have been the manufacturer of the Patjitan tools, and the very name "Patjitanian" can be cast into the melting-pot of the Hoabinhian. In any case, the label "Lower Palaeolithic" that is always attached to the Patjitan culture is extremely confusing.

Finally, the tools from Sambungmacan amount to no more than a chopper and a flake. The village of Sambungmacan made news in 1973, when a fossilized hominid cranium was found in the course of canal-digging operations to short-circuit a meander of the Solo River. From a morphological viewpoint this cranium shows many more advanced features than the remains of *H. erectus erectus* from Trinil or Sangiran. In fact it is very similar to the skulls found farther east in terrace sediments of the Solo near Ngandong (see fig. 1), known in the literature as Solo Man (Oppenoorth 1932, Weidenreich 1951). This Solo Man is definitely younger than Java Man: in contrast to the deposits that contained the skullcap and femur at Trinil, the fluviatile deposits from which the Ngandong skulls originate can be correlated with an existing river drainage system. If geologically speaking Java Man belongs to the Lower and Middle Pleistocene, then Solo Man must be placed in the Upper Pleistocene. Now, the cranium from Sambungmacan also comes from fluviatile sediments exposed along the Solo River. Making use of Occam's razor, one should then assume that the sediments with a "Solo Man-type" skull at Sambungmacan will also be Upper Pleistocene terrace sediments. However, instead of doing so, some make the situation unnecessarily complicated by calling the Sambungmacan sediments "old," principally on the basis of remains of allegedly Middle Pleistocene vertebrates found therein (Jacob et al. 1978). In the first place, the attribution of these sediments to the Middle Pleistocene is disputable on the basis of the small number of genera excavated and identified at Sambungmacan (Sartono 1979:86). In the second place, it must again be emphasized (after what has already been said about the artifact-bearing deposits at Sangiran) that relative-age determinations of fluviatile sediments on Java on the basis of the fossilized vertebrate remains found in them (according to the "established" Javanese vertebrate stratigraphy) would best be dismissed, for sediments are continually being designated as "old" on the basis of allochthonous fossils. Our observations have made it clear (in complete agreement with Sartono's [1979] conclusions) that in Sambungmacan the fluviatile layers that yielded the cranium are indeed normal Upper Pleistocene terrace deposits. That these immediately overlie the Neogene with a stratigraphic hiatus is not at all unusual, being observable in various places along the Solo River,[7] and that the Solo terraces contain autochthonous and allochthonous components of fossil faunas has already been reported (Bartstra, Basoeki, and Santosa Azis 1976:31–33). As for the stone tools found at Sambungmacan, the chopper and flake, which are not abraded, but very fresh-looking, are contemporaneous with these terrace deposits; they are certainly not Middle Pleistocene.

In conclusion, it must be said that on Java there is still not a single site where artifacts can be associated with *H. erectus erectus*. Since many remains of this fossil hominid have been found, however, a feeling of paradox arises: where are the artifacts of Java Man?

Two paths to a solution lie open. First, it could be assumed that the absence of any association between artifacts and Java Man is the result of the lack of sufficient research. From this it would follow that continuing palaeoanthropological research and fieldwork on Java in the traditional way will ultimately bring to light older Quaternary deposits containing the recognizable and (by Movius) long-established stone-tool types of the Lower Palaeolithic in southern and eastern Asia, which are clearly to be associated with *H. erectus erectus*. This hominid must have been able to manufacture stone tools, even if the use of wooden implements was more the rule. Other Lower and Middle Pleistocene hominids, elsewhere in the world, have been found in association with stone artifacts, among them *H. erectus pekinensis* (Peking Man), *H. erectus mauretanicus* (Ternifine), and *H. erectus leakeyi* (OH 9). And even if one would want to point out that Java Man is morphologically more primitive and probably somewhat earlier than the other subspecies mentioned, it should still be recognized that in East Africa stone implements have been found in channel deposits (Omo Delta) older than the oldest strata containing *H. erectus erectus* in Java.

[5] Carthaus was in fact the only member of the expedition who accepted them as "implements" (Blanckenhorn 1977:259). In this connection it is interesting to note that Dubois (1908:1251) remarked that despite meticulous searching at various sites he had never succeeded in finding any artifacts. Concerning the vertebrate fossils of Trinil he says that many bones were broken by crocodiles, in some cases showing (fossil) tooth marks of these animals, and that the fauna included vast numbers of crocodile teeth (Dubois 1908:1242).

[6] Formerly written Wadjak Man. The skulls of this prehistoric hominid were found in caves east of Pacitan at the end of the last century (see review by Jacob 1967).

[7] In the transverse Solo Valley north of Ngawi, Upper Pleistocene terrace sediments immediately overlie Neogene marls and limestones, but this stratification can also be observed in the Trinil area, along the Solo River north of the village of Gajah and west of the village of Glaman.

It is my opinion, however, that a second path should be followed. To find the tools of Java Man the search strategy must be altered. We should stop searching for the established core types of the "chopper/chopping-tool complex," because these constitute a very late development on Java, the roots of which extend at most into the Upper Pleistocene. The Patjitanian is not the work of *H. erectus erectus*. Instead, we should look at the small irregular cores and crude flakes collected by von Koenigswald at Sangiran, which, while not Middle Pleistocene as he contended, are up until now the oldest tools in all of Java. These artifacts point in the direction in which we must search to find the stone tools of Java Man: assemblages of mostly small, indistinct flakes.

Unfortunately, however, this second road is full of pitfalls. The question is whether it will be possible to recognize these amorphous, indistinct, simple, small stone artifacts as such in the synorogenic river sediments and lahar deposits of the Middle and Lower Pleistocene of Java, which were formed "during this very turbulent time that the *Pithecanthropus* lived here, threatened by waterfloods, landslides, and frequent earthquakes" (van Bemmelen 1949:591). In fact, in recent years some finds have been reported of alleged stone implements from Middle Pleistocene strata at Sangiran,[8] but when one sees these objects, made of chalcedony, silicified limestone and claystone, and similar materials, one can only be reminded of the disputes concerning eoliths at the beginning of this century. At Sangiran, too, these "implements" come from deposits in which their raw materials are abundant. Horizontally and vertically they have a remarkably wide distribution, and what is clear is the absence of distinct forms and types: they consist for the most part of small crude flakes, sometimes with irregular retouch and an occasional cone of percussion. Are these the work of Java Man, or are they just stones?

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[8] These Middle Pleistocene strata are jointly known as the Kabuh formation. This formation underlies the Upper Pleistocene Notopuro formation, in which von Koenigswald found his small stone implements. Kabuh and Notopuro are regarded by some as one formation, but this is not to be recommended, as they certainly do not represent uniform conditions of deposition.

Coxa Vara in a Chalcolithic Population from the Sinai[1]

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The normal cervico-diaphyseal (neck-to-shaft) angle of the femur varies with age (Pavlov, Goldman, and Freiberger 1980) and sex (Martin and Saller 1959). In various adult populations from different geographical zones, the average neck-to-shaft angle varies from 120° to 128° (Martin and Saller 1959), whereas in an individual homogeneous population it has been shown to vary from 115° to 137° (Kobyliansky, Weissman, and Nathan 1979). Coxa vara refers to a significant reduction of the cervico-diaphyseal angle, to less than 115°, accompanied by outward rotation of the shaft against the neck, and so reversal to retrotorsion may also be expected (Steindler 1977). Acquired coxa vara is a common deformity and may result from a variety of factors, among them epiphysiolysis, sequelae of septic hip, and Perthes disease (Crenshaw 1971). Congenital coxa vara is relatively infrequent and of unknown etiology, although possible causes have been suggested (Nilsonne 1924).

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