

Homo erectus : an old species with new problems

by

M.H. DAY

Summary

The history of the discovery of *Homo erectus* goes back for almost 100 years to the work of Dubois in Java. Subsequent finds in China and North Africa expanded the sample. Recent finds from East Africa (KNM-ER 3733, 3883; WT15000), Europe (Arago, Bilzingsleben) and India (Hathnora) have prompted a reappraisal of the species *Homo erectus* and new work on the Trinil remains from Java has questioned the antiquity of the Trinil I femur. The question raised by these new finds in relation to the origin, the distribution and the fate of *Homo erectus* are reviewed.

Résumé

L'histoire de la découverte de l'*Homo erectus* remonte à presque cent ans avec les travaux de Dubois dans l'île de Java. Les trouvailles qui ont suivi, en Chine et en Afrique du Nord, ont étendu l'échantillon. Les découvertes récentes en Afrique orientale (KNM-ER 3733, 3883; WT15000), en Europe (Arago, Bilzingsleben) et en Inde (Hathnora) ont incité à faire une réévaluation de l'espèce *Homo erectus* tandis que les nouveaux travaux sur les restes de Trinil provenant de Java, mettent en doute l'antiquité du fémur I de Trinil. Les questions soulevées par ces nouvelles découvertes et relatives à l'origine, l'extension et le devenir des *Homo erectus* sont passées en revue.

The beginning of the story of the discovery of what is now known as *Homo erectus* took place in Java in 1890-1891 when Eugene Dubois, the anatomist turned soldier/physician recovered the Trinil calotte and Trinil Femur I from the deposits of the Solo river. He later named the creature *Pithecanthropus erectus* (Dubois 1894) from his conviction that the calotte showed features intermediate between ape and man and that the functional anatomy of the femur was indicative of bipedalism. This latter point has been confirmed time and time again by anatomists (Manouvrier 1895; Hepburn 1897; Weinert 1928; Weidenreich 1941; Le Gros Clark 1964; Day and Molleson 1973; Lamy 1984). Later descriptions of the finds from China (Zhoukoudian) by Black (1931) and Weidenreich (1936, 1937 and 1943) confirmed the cranial features of *P. erectus* but did not confirm the postcranial features as exemplified by the Trinil femur (Weidenreich 1941).

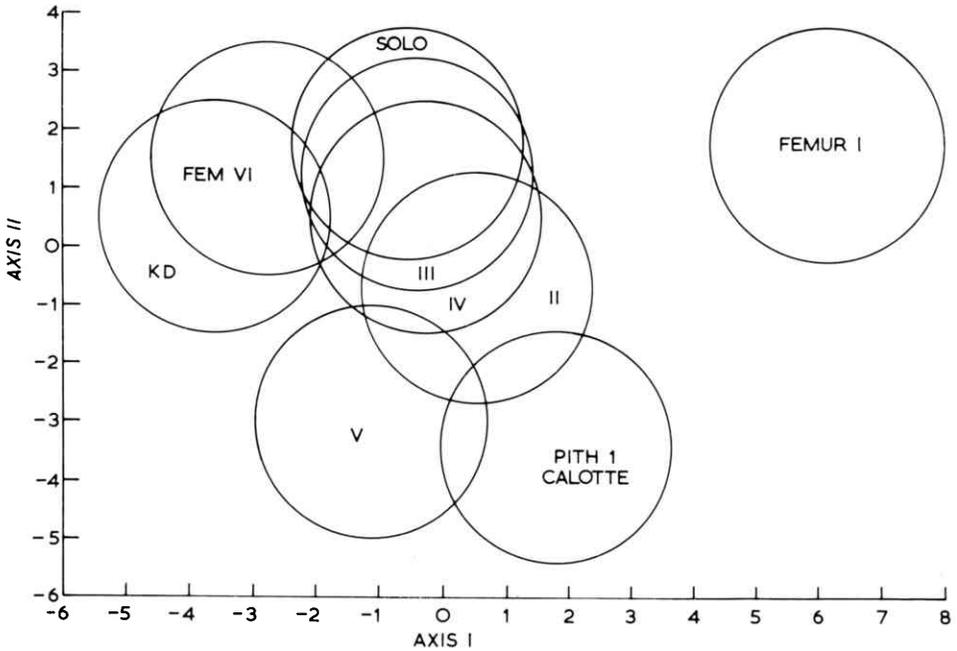


Fig. 1. - Canonical variate plot of the relative quantities of heavy elements detected by X-ray microanalysis in fossil material from Java including the *Pithecanthropus* I calotte, the Trinil femora (I-VI), the Solo remains and a sample of *Elephas* from Kedung Brubus (KD). Trinil femur I is highly significantly different from all of the other material sampled.

Recently the discovery by Bartstra (1982) that the Kabuh deposits in Java that contained the Trinil fauna are overlaid at Trinil by younger Terrace deposits (c. 0.1 m.y. B.P.) provides a plausible explanation for this anatomical confusion. It seems clear now that the Trinil femur on which Dubois depended for his assertion of upright posture and bipedal gait was in fact an intrusive *Homo sapiens* femur from a much more recent period. Analytical studies on the Javan material confirms that the composition of Trinil Femur I is different from that of other Javan remains (Day 1984, 1986) (fig. 1). The description given by Weidenreich for *Homo erectus* femora from China (Weidenreich 1941) has been confirmed from Olduvai (Olduvai Hominid 28) (Day 1971), Koobi Fora (KNM-ER 737, 1472, 1481) (Day 1978; Kennedy 1983) and now from West Turkana (WT 15000). The pelvic features described for O.H. 28 (Day 1971) have also been observed on material from Koobi Fora (KNM-ER 3228) (Rose 1984) and Arago (Arago XLIV) (Day 1982; Sigmon 1982). Together as a femoropelvic complex it may be distinctive of *Homo erectus* or at the

very least typical of a segment of a palaeospecies of that name. It is indeed ironic that the specific name *erectus* given to Dubois' find *Pithecanthropus erectus* should be based on a *Homo sapiens* femur!

After the discoveries of specimens now attributed to *Homo erectus* in Java (Trinil, Sangiran), China (Zhoukoudian) and North Africa (Ternifine), a picture has slowly emerged of a group of Asian and African hominines of the Lower and Middle Middle Pleistocene period whose morphology and temporal ranges seemed to be clearly defined. Since that time the picture has changed radically with new finds attributed to *Homo erectus* from East Africa (Olduvai; Koobi Fora; West Turkana), North Africa (Salé), Europe (Bilzingsleben) and India (Narmada). More controversially other remains, both long known and relatively recent finds, from Mauer, Vértesszöllös, Arago and Petralona have entered the discussion. A detailed review of much of the material has been given by Howells (1980). No longer is *Homo erectus* a clearly defined taxon, temporally, morphologically or even geographically. A brief review of some of the new finds and the new research is given here.

JAVA

Today the picture in Java remains confused chronologically (Pope 1985) and faunally (Groves 1985). It seems likely that all the hominid material from Java is less than 1.3 m.y. old (Pope and Cronin 1984) and that there is no tool culture firmly associated with *Homo erectus* remains (Bartstra 1985). In addition the Ngandong fossils are regarded by some as belonging to *Homo erectus* (Santa Luca 1980). Taxonomically the hominid record of Java seems as confusing as ever (Sartono, 1985) although many would attribute all of the hominid material to one or other form of *Homo erectus*.

CHINA

The recovery from Zhoukoudian in 1966 of new parts of a skull known to Weidenreich is pleasing. The two frontal and parietal fragments fit on to casts made by Weidenreich before the Zhoukoudian remains were lost. This is a complete vindication of the authenticity of the original finds and a confirmation of the reconstruction on to which the new fragments fit perfectly.

In 1980 the recovery of the Hexian skull confirms again the nature of the Chinese form of *Homo erectus* from a site dated at about 150-400000 years B.P.

NORTH AFRICA

An important new skull was recovered from Salé in North Africa from deposits dated at about 400000 years B.P. (Jaeger 1975, 1981). Many of its features indicate

that it belongs to *Homo erectus* but it has a peculiarity of its occipital region that probably precludes this important area from consideration in terms of its taxonomic diagnosis.

EUROPE

In Europe remains of *Homo erectus* have been reported from several sites, some of them relatively new. A thick skull with an angulated occiput was recovered from Bilzingsleben in Germany and is dated at about 228 000 years B.P.: it has been attributed to *Homo erectus* (Vlček 1983 a and b). The Arago remains from southern France, perhaps 400 000 years old, show both *Homo erectus* and Neandertal features as does the Petralona skull from Greece of much the same age.

EAST AFRICA

East Africa has produced at 1-1.5 m.y. B.P., Olduvai Hominid 9, a clear example of *Homo erectus*; and also from Koobi Fora KNM-ER 3733 and 3883, two older skulls at 1.8 m.y. B.P. also claimed to represent *Homo erectus*. An interesting skeleton KNM-ER 1808 from 1.4-1.6 m.y. B.P., also from Koobi Fora, shows hypertrophic periostitis, which when stripped from the femur reveals the *Homo erectus* morphology underlying the disease (Walker, pers. comm.).

The pelvic remains of *Homo erectus* from East Africa range in time from > 1.9 m.y. B.P. (KNM-ER 3228) to c. 1.6 m.y. B.P. (WT 15000) and to c. 0.6-0.8 m.y. B.P. (O.H. 28).

The new skeleton from West Turkana (WT 15000 : fig. 2) is a remarkable find at 1.6 m.y. B.P.: a skull reconstructed from 70 pieces, all the teeth present and a virtually complete postcranial skeleton. From a brief examination of the casts of the pelvis and femora it seems clear that the distinctive group of femoropelvic features outlined elsewhere for *Homo erectus* are present in this find, although not as well developed as they would have been had he reached maturity.

INDIA

On December 5th 1982, Arun Sonakia recovered the first example of *Homo erectus* from the Indian sub-continent. The skull was found at Hathnora in the Narmada valley, Madhya Pradesh. The well preserved calvaria shows numerous features of *Homo erectus* as well as some that are advanced such as a tall cranial vault and a cranial capacity that may lie between 1155-1421 cc. (de Lumley and Sonakia 1985). It is associated with an Upper Acheulian industry with hand axes and cleavers.

What are the morphological characteristics of *Homo erectus* that can provide some basis upon which to make a differential diagnosis? The early descriptions of what is now widely known as *Homo erectus* were based on the material known from Java (*Pithecanthropus*), China (*Sinanthropus*) and North Africa (*Atlanthropus*).

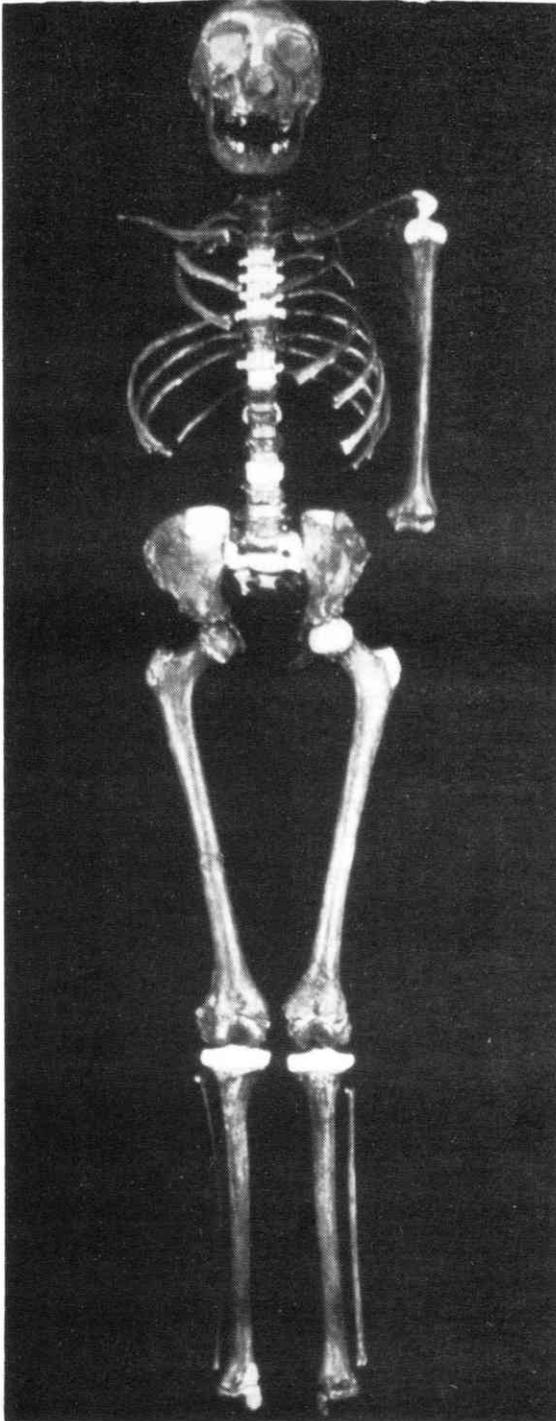


Fig. 2. - The skeleton of a *Homo erectus* boy of 12 years of age found at Nariokotome, West of Lake Turkana, Kenya (WT 15000). Photograph by courtesy of Richard Leakey, Director of the National Museums of Kenya.

These descriptions and others of later material from East Africa include the following features that epitomise a *Homo erectus* skeleton : a low and long cranial vault with flattened frontal and parietal bones, an angulated occiput, a strongly marked and continuous supraorbital torus, a small mastoid process with a marked supra-mastoid crest and a *torus angularis* on the parietal bone. The vault also shows a frontal and parietal sagittal keel with parasagittal flattenings, a «tent-shaped» coronal section, a low maximum skull breadth between the supramastoid crests as well as a low triangular squamous portion of the temporal bone. The vault bones are thick, there is pronounced postorbital constriction and the inion and the opisthocranium coincide. The cranial capacity is between 700-1225 cc.

The face of *Homo erectus* is less well known but it is prognathic with a large interorbital breadth and broad nasal bones. The mandible has no chin, a narrow but rounded dental arcade, thickening of the mandibular body, a large bicondylar breadth and in many cases multiple mental foramina. The teeth are of variable size but are in general robust with shovel-shaped incisors and basal tubercles. Molars and premolars have a cingulum and the molars have a dryopithecine cusp pattern that has a tendency to transformation to the «plus» pattern by metaconid reduction. The third molar is often reduced in size while the permanent molars, premolars and milk molars show some degree of taurodontism.

The postcranial bones were poorly represented at first but later finds have improved the sample. The femora are unusual in the great thickness of the cortical bone, they are platymeric, have a low narrow point and a prominent convexity of the medial border of the shaft. The pelvic morphology is also distinctive in having a large acetabulum, a stout acetabulocrystal buttress and laterally rotated ischial tuberosities. The recognition of this femoropelvic complex of features (Weidenreich, 1941; Day, 1971) has disposed of the view held earlier that *Homo erectus* was essentially *sapiens* in its postcranial features.

This general description includes many features referred to by others who have attempted a definition of the species *Homo erectus* (Weidenreich 1943; Le Gros Clark 1964; Howell 1978; Howells 1980; Day and Stringer 1982; Rightmire 1984; Stringer 1984; Wood 1984) but no attempt has been made here to distinguish between characters of common inheritance and new or derived features unique to *Homo erectus*. Those who have sought such unique features have not been too successful (Wood 1984; Andrews 1984; Hublin 1986; Bilsborough and Wood 1986). The derived features that are usable for a diagnosis of the taxon are very few and their apparent concentration in the Asian specimens has led to doubts about the existence of *Homo erectus* from African sites (Andrews 1984); these doubts are not entirely shared by Bilsborough and Wood (1986). Hublin goes even further and suggests that from a purely cladistic point of view *Homo erectus* does not exist as a taxon, but as a grade it can be defined by features primitive to *Homo sapiens* particularly if evolutionary stasis has occurred. This agrees (perhaps for different reasons) with the view taken earlier by Jelinek (1978, 1981) and Thoma (1973) who argue that *Homo erectus* should be sunk as a taxon into *Homo sapiens*.

A more widely held view sees *Homo erectus* as a palaeospecies or chronospecies that will show evidence of evolution through time from a more primitive ancestor, such as *Homo habilis*, to a more advanced successor such as *Homo sapiens* (Le Gros Clark 1964; Campbell 1972; Wolpoff 1980, 1984; Howells 1981; Day 1984).

The question of evolutionary rates, of the punctualist versus the gradualist models, in the hominine fossil record has been raised in relation to *Homo erectus* by those who support the punctuational model (Gould and Eldredge 1977; Stanley 1979, 1981; Eldredge and Tattersall 1982). *Homo erectus* is seen by these authors as a «true» taxon that did not vary greatly in form during its existence. Some evidence has also been presented for this view from the postcranial skeleton (Kennedy 1983, but see Trinkaus 1984; Day 1982). Wolpoff (1980, 1984) contends that significant evolution within the taxon can be determined by the examination of cranial, dental and mandibular features. The full description and analysis of the new find from West Turkana will do much to underpin, or otherwise, the contention that *Homo erectus* was in existence from as early as 1.6 m.y. B.P. at that site and lasted until perhaps as recently as 0.3 m.y. B.P. at other sites in both Africa and Asia — a span of more than 1.0 m.y.

The *erectus/sapiens* transition has also been examined in relation to the Omo I and Omo II skulls from Ethiopia by Day and Stringer (1982) who conclude that these two, supposedly contemporaneous skulls can be aligned with modern *Homo sapiens* and *Homo erectus* respectively, or Omo II included in an «archaic» *Homo sapiens* group that displays a suite of mosaic or intermediate characters.

The existence of a «true» example of *Homo erectus* in Europe is also questioned : denied by Howell (1981, 1982) and not accepted by Stringer (1981), it is accepted by Wolpoff (1975, 1977), Vlček (1978-1983a-1983b), Jaeger (1975) for fossils such as those from Mauer, Vértesszöllös, Petralona, Bilzingsleben and Salé. Rightmire (1980, 1984), however, also holds the view that *Homo erectus* is a «real» species morphologically distinct from modern humans and that there is no need to define this extinct species of man arbitrarily by reference to chronology or gaps in the fossil record.

Debate centers around almost all of the following topics. Does *Homo erectus* exist as a true taxon or should it be sunk into *Homo sapiens*? Is it a palaeospecies that exists, in classical form, as a segment of the line that emerged from *Homo habilis* and gave rise to *Homo sapiens*? Is *Homo erectus* an extinct form that had no part to play in the evolution of *Homo sapiens*? Is *Homo erectus* a good example of a «stasis event» in hominine evolution with little or no evolutionary change in its form during its existence? Is there a clear cut example of *Homo erectus* in the European fossil record of man? Finally are the Asian forms so far removed from the evolution of *Homo sapiens* in Africa to call into question the existence of *Homo erectus sensu stricto* in Africa at all? In addition there are the usual problems that relate to the accuracy of the dating of the sites involved both in relation to each other and to the time scale of the Pleistocene period. All these are profound questions that are answered in differing ways by various authors.

It is clear, therefore, that the taxon *Homo erectus* is under intense inquiry in terms of its geographic range, its temporal range, its origin and its evolutionary fate. It is also the subject of discussion in relation to the evolutionary models of punctuation and gradualism as well as the taxonomic approaches of the cladists and the gradists. As in most debates that are pursued with great vigour and determination it is possible, indeed probable, that the truth will lie in part with all the contenders. Only time and research will provide the answers.

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Adresse de l'auteur : Prof. M.H. Day
Department of Anatomy
St. Thomas's Hospital medical School
Lambeth Palace Road
LONDON SE1 7EH
GREAT BRITAIN