

HOMO ERECTUS/ERGASTER AND OUT OF AFRICA: RECENT DEVELOPMENTS IN PALEOANTHROPOLOGY AND PREHISTORIC ARCHAEOLOGY

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Abstract

The present paper reviews one of the most interesting research issues of Paleoanthropology, the early human migration from their original homeland Africa to Eurasia. We discuss various evidences of human presence outside Africa and we shall seek for the answers for the questions like by whom, when and where the first wave of migration "Out of Africa" happened. Here, we combine both Paleoanthropological and Prehistoric Archaeological evidences for understanding the first "Out of Africa" scenario in a conceptual ground.

Key Words: Out of Africa, Homo erectus / ergaster, Mode 1, Homo habilis, Homo georgicus, Dmanisi.

Introduction

One of the most debatable issues of the present day Paleoanthropological and Prehistoric Archaeological research is the first human settlements outside the African continent. The possible hominids who were responsible for the first movement "Out of Africa" and their possible timescale for the migration is reviewed here in the light of recent developments. There was a general concept that the early homo did not move outside Africa until 1 Ma ago, which has been changed due to various new discoveries coming from different geographical regions of Eurasia.

The earliest archaeological evidence outside of Africa compliments the known fossil evidence and comes from such localities as 'Ubeidiya (Tchernov 1987), Java, Longuppo Cave (Wanpo *et al.* 1995), Riwat and Pabbi Hills (Dennell *et al.* 1988), Dmanisi (Gabunia *et al.*, 2000), and c. 2.0 mya artifacts from the Jordan valley (Tchernov 1987). Interestingly, the earliest lithic assemblages outside the African continent are found in the form of core-chopper (non-biface) artifacts (Mode 1). All bifacial material (Mode 2) known from these regions of the Old World post-dates most Mode 1 assemblages.

The Problem to be Discussed

The earliest hominin fossils are found in Africa, and date to around 7 myr, close to the supposed divergence of humans from chimpanzees. The earliest stone tools are also from Africa. The earliest fossil hominins to be found outside of Africa date to 1.8 myr and are already spread over an area from Dmanisi, Georgia to Java, Indonesia. The first tools in different areas are surprisingly different from each other, which should not be the case if the initial dispersal was at 1.8 myr itself or even associated with the beginning of stone tool manufacture at 2.5 myr.

Acheulian technology did not disperse over the entire hominin range, indicating that it emerged after the dispersal out of Africa. This may indicate that dispersal events were not triggered by technological advances but rather followed migration into new regions. The first tools might have followed after a pre stone tool making dispersal out of Africa, which might be significantly earlier than the current evidence suggests.

From a general point of view, the absence of Acheulian bifaces within early Pleistocene sediments in East and Southeast Asia suggest that Homo must have initially left Africa before the Acheulian stage appeared in East Africa. Furthermore, in recent years, Homo erectus is being viewed as an Asian development rather than an African species (Klein, 1999). In addition to these early sites, a second dispersal from Africa is represented exclusively by Acheulian sites dating to the Middle Pleistocene - signifying the first appearance of Mode 2 in northwest and southern Europe. So, all these problems force us to think about the first "Out of Africa", by whom, when and where?

Long Chronology and Short Chronology

There are various theories about the early human occupation in Eurasia which are based on the fossil or artifactual discoveries. Based on the dates for different discoveries, two chronological frameworks have been postulated: Long Chronology and Short Chronology.

The short chronology is based on the most evidence until last decade, suggested that hominins had been restricted to Africa until about 800,000 years ago (Pope 1983, Klein 1999, Langbroek & Roebroeks 2000). Investigators thought the earliest accepted Far East and Island Southeast Asian hominin sites were between 500 and 800 ka (Pope 1983). 'Ubeidiya, Israel represented the best evidence of 1 Ma or older hominins just outside Africa (Klein 1999) but was widely attributed to, at best, short-term hominin forays outside Africa. Thus, the earliest hominin dispersal from Africa was considered by paleoanthropologists to be relatively late in human evolution with hominins leaving Africa only with the assistance of Acheulean technology. Such a view has been dubbed the "short chronology" (Roebrooks 2001). Given the presumed timing of this dispersal, paleoanthropologists often assumed the dispersing hominin to be a late form of *Homo erectus*.

In the past decade, a wealth of new data and sites has been offered supporting a “longer chronology” of hominin presence outside of Africa (Swisher *et al.* 1994; Larick *et al.* 2001; Gabunia *et al.* 2000; Vekua *et al.* 2002). Although the precise age of many of these sites remains a controversial matter, the earliest occupation of Europe has increased to at least 800 ka, of Western Asia to 1.7 Ma, and of Indonesia to 1.6 or 1.8 Ma (Swisher *et al.* 1994; Carbonell *et al.* 1999; Gabunia *et al.* 2000). Perhaps the most important, and least contested, of these sites in regard to establishing an age for the earliest African dispersals are the discoveries at Dmanisi, Republic of Georgia, dated to approximately 1.7 Ma; they are least contested both because of the combined radiometric, paleomagnetic, and biostratigraphic age estimates and because of the anatomy of the hominins discovered there.

Out of Africa: Who?

Presently, we have very scanty evidence about the first migrational wave from Africa to the Eurasian landmass specifically who were the first to put steps out of Africa. But as a general assumption in a historical term, *H. ergaster* or *erectus* is believed to be the first migrant out of Africa. The recently discovered 1.7-Myr-old specimens from Dmanisi, Georgia, which have recently been classified as a very early type of *H. ergaster* and/or a new taxon, *H. georgicus*. The specimens attributed to *H. erectus* in as different from the east African *H. ergaster*. The earliest of these is the Mojokerto cranium, which now seems to have been found in context, despite previous misgivings, and is dated to 1.81 ± 0.04 Myr ago; the key specimens from Sangiran have been dated to about 1.6–1.7 Myr ago. So, if *Homo erectus* or *Homo ergaster* were not responsible for the first wave of migration, then who is the best candidate in this regard?

It has always been thought that the first hominid to leave Africa was *Homo erectus* (or *ergaster*), and that this had happened after *erectus* had attained the modern body shape and full adaptation to bipedality shown in the Turkana Boy fossil. The discovery of the Dmanisi skulls, particularly D2700, raises the possibility, suggested by Vekua (Vekua *et al.* 2002) and his colleagues that the Dmanisi hominids might have evolved from *habilis*-like ancestors that had already left Africa. That in turn would cause re-evaluation of theories about why hominids first left Africa.

The evolutionary relation between *ergaster* and *erectus* is unclear: some experts treat them as early and late forms of the same species. We discuss some important characteristic features (Leakey 1994) of *Homo erectus* and *Homo ergaster* and their relationship with some other species.

H. ergaster existed between 1.8 million and 1.3 million years ago, which like *H. habilis*, the face shows:

- protruding jaws with large molars;
- no chin;
- thick brow ridges;
- long low skull, with a brain size varying between 750 and 1225 cc.

Early *H. ergaster* specimens average about 900 cc, while late ones have an average of about 1100 cc. The skeleton is more robust than those of modern humans, implying greater strength.

Homo georgicus specimens recovered recently exhibit characteristic *H. erectus* features like sagittal crest, marked constriction of the skull behind the eyes. But they are also extremely different in several ways, resembling *H. habilis*:

- small brain size (600 cc);
- prominent browridge;
- projection of the face;
- rounded contour of the rear of skull;
- huge canine teeth.

Some researchers propose that these fossils might represent a new species of *Homo* as *H. georgicus*.

The type specimen for *ergaster* is KNM-ER 992 (Klein 1999). Groves and Mazak claimed that the mandible was significantly different from *H. erectus* to deserve its own species designation. However, they did not compare it to *H. habilis*, and the mandible may actually belong to that taxon. The specimen showed some periodontal disease, as seen by absorption of bone around the roots of the teeth. The mandibular symphysis also shows strong markings for the digastric muscle (important for swallowing and vocalization), which some people have interpreted as proof of language by this time.

Some scientists classify some African *erectus* specimens as belonging to a separate species, *Homo ergaster*, which differs from the Asian *H. erectus* fossils in some details of the skull (e.g. the brow ridges differ in shape, and *erectus* would have a larger brain size). Under this scheme, *H. ergaster* would include fossils such as the Turkana boy and ER 3733.

One of the most spectacular and important paleoanthropological finds (Klein 1999) in recent years was the Nariokotome Boy (KNM-WT 15000), by a team of researchers led by Richard Leakey and Alan Walker. This find represents the most complete early hominid ever found, with almost the entire cranium, and most of the postcranial material intact. This specimen has been attributed as a male ergaster by some, though most place it in *H. erectus*. Other specimens that have been attributed to ergaster include KNM-ER 3733, SK 847, and KNM-ER 3883.

Several researchers (Anton 2003) have tried to define the difference between ergaster and erectus, P. Andrews and B. Wood among the more prominent. P. Andrews defined seven autapomorphies that were characteristic of erectus, but which ergaster supposedly lacked. However, G. Bräuer has shown that these are not autapomorphies. For example, some erectus do not possess these features, while some ergaster and some habilis do. Also, some of these autapomorphies are not independent traits, and should not be considered separately (e.g., frontal keel and parietal keel). B. Wood (1992) lists seven traits that link ergaster with *H. sapiens*, and that distinguish ergaster from erectus:

- Increased cranial breadth across the parietal bones.
- Increased occipital bone length.
- Broader nasal bones.
- Broader nasal opening.
- Shorter cranial base.
- Greater development of the mandibular symphysis.
- Narrower M1s and lower canines.

However, these synapomorphies have been convincingly challenged by showing them to be present in erectus populations from Asia. Also, more recent analyses by other researchers seem to indicate that even if ergaster specimens are considered as a different taxon than erectus, the erectus material is still closer to modern humans cladistically.

Stone tools from the Omo valley in Africa are as old as 2.4 million years (Toth & Schick, 1993). At present there is no definite evidence of Australopithecine tool-making or use, so anthropologists usually attribute the oldest tools to *H. habilis*. Another species recently identified, the 2.5 million year old *Australopithecus garhi*, has been found in the vicinity of carefully manufactured stone tools. While no other fossils have been found within this vicinity and period, *A. garhi* remains as the possible link between *Australopithecus afarensis* and Homo species. Animal remains from this region and period have been found with signs of cut marks, chop marks and hammer marks, showing that this species (*A. garhi*) was a meat eater and skillful tool user. Some of the tools are of materials not from the locality, so they had to be carried by the user.

Homo erectus

In Africa, a technological shift in tool design to handaxes, cleavers or picks occurred about 1.5 million years ago. Anthropologists call these Acheulean (Mode II) as opposed to the earlier Oldowan (Mode I) stone technology. This new technology then spread to the Middle East, Europe and parts of the Indian subcontinent (Toth & Schick, 1993). This more sophisticated Acheulean stone technology coincides roughly with the appearance and spread of *H. erectus*. Fossils and tools of this species have been discovered in Indonesia (dated at 1.8 millions years old) and Dmanisi, in the Republic of Georgia (dated at over 1.7 million years old).

H. erectus existed between 1.8 million and 300,000 years ago. Like habilis, the face has protruding jaws with large molars, no chin, thick brow ridges, and a long low skull, with a brain size varying between 750 and 1225 cc. Early erectus specimens average about 900 cc, while late ones have an average of about 1100 cc (Leakey 1994). The skeleton is more robust than those of modern humans, implying greater strength. Body proportions vary; the Turkana Boy is tall and slender (though still extraordinarily strong), like modern humans from the same area, while the few limb bones found of Peking Man indicate a shorter, sturdier build. Study of the Turkana Boy skeleton indicates that erectus may have been more efficient at walking than modern humans, whose skeletons have had to adapt to allow for the birth of larger-brained infants. *Homo habilis* and all the australopithecines are found only in Africa, but erectus was wide-ranging, and has been found in Africa, Asia, and Europe. There is evidence that erectus probably used fire, and their stone tools are more sophisticated than those of habilis.

Homo habilis

H. habilis, "handy man", was so called because of evidence of tools found with its remains. *Habilis* existed between 2.4 and 1.5 million years ago. It is very similar to australopithecines in many ways. The face is still primitive, but it projects less than in *A. africanus*. The back teeth are smaller, but still considerably larger than in modern humans. The average brain size, at 650 cc, is considerably larger than in australopithecines. Brain size varies between 500 and 800 cc, overlapping the australopithecines at the low end and *H. erectus* at the high end. The brain shape is also more humanlike. The bulge of Broca's area, essential for speech, is visible in one *habilis* brain cast, and indicates it was possibly capable of rudimentary speech. *Habilis* is thought to have been about 127 cm (5'0") tall, and about 45 kg (100 lb) in weight, although females may have been smaller.

Habilis has been a controversial species. Originally, some scientists did not accept its validity, believing that all *habilis* specimens should be assigned to either the australopithecines or *Homo erectus*. *H. habilis* is now fully accepted as a species, but it is widely thought that the 'habilis' specimens have too wide a range of variation for a single species, and that some of the specimens should be placed in one or more other species. One suggested species which is accepted by many scientists is *Homo rudolfensis*, which would contain fossils such as ER 1470.

Out of Africa: When?

A warning note from Dennell & Roebroeks (2005)

- If we get the early evidence of different hominid fossils as early as 1.8 myr ago, how much earlier could this dispersal have been?
- If a hominin at the same grade as *H. habilis* was able to exist outside Africa, why not others?
- If the hominids from Dmanisi could colonize southwest Asia by 1.7Myr ago, why not at 2.6Myr ago?
- Or why not even earlier, by, for example, 3.0–3.5Myr ago, when the Saharan–Arabian desert barriers did not yet exist?
- If *A. bahrelghazali*, 2,500 km west of the Rift Valley, implies that by 3.5Myr ago "hominids were distributed throughout the woodland and savannah belt from the Atlantic Ocean across the Sahel through eastern Africa to the Cape of Good Hope", why could they not have done the same across the grasslands of western, southern and central Asia?

Homo erectus may have been seriously over-rated, and that even if hominids did occupy parts of North Africa, southern Europe and southern Asia shortly after 2 Ma, there is little evidence of colonisation. Whilst further fieldwork will doubtless slowly fill many gaps in a poorly documented Lower Pleistocene hominid record, it appears premature to conclude that the appearance of hominids in North Africa, Europe and Asia was automatically followed by permanent settlement.

Carbonell *et al.* 2007, supporting the hypothesis on the emergence of the technical behaviour as a long period of emergence and consolidation before it began to spread, suggests that the hominid project started around 3 Myr ago, with a 'biofunctional' stage. Later than 2.5 Myr, the 'biomorphotechnical' stage began (Mode 1), and, at around 1.7 Myr, another stage emerged and developed: the 'biopotential' stage (Mode 2). All these stages consist of a two-part process: innovation/emergence, and socialization/generalization of a technical mode. They consider the biomorphotechnical stage where the socialization of lithic tools among hominids was very rapid, which accelerated slightly after 2.5 Myr ago and all latitudes of the African continent may have contained lithic tools around that time. They support the possibilities of occurring archaeological record as early as 2.5 and 2 Myr at the Southern areas of Asia.

The Scenario in Europe

Roebroeks and Kolschoten, (1994) suggested that all the evidence for human presence in Europe prior to half a million years was dubious and essentially Europe was not occupied until around half a million years. This is the "short chronology". Almost immediately however, the excavation of the limestone fissure at Atapuerca in Spain, showed not only artefacts but also human fossils in levels below the Bruhnes Matuyama Boundary (800 kyr) in the TD6 and TD 4 levels (Carbonell *et al.* 1999). In Spain, the Fuente Neve 3 and the Barranco Leon 5 assemblages, from the Orce basin (Gibert *et al.* 1998) belong to the Matuyama epoch. The ongoing excavations of the Atapeurca locality have given incontrovertible evidence for man dating to the Matuyama epoch (Carbonell *et al.* 1999). The most recent discovery has been the finding of a flake assemblage in the Cromer Forest Beds of Britain, after more than a century of searching. At Pakefield new exposures uncovered a small lithic assemblage, in good context (Parfitt *et al.* 2005).

The three well excavated and studied early sites in Italy are Monte Poggiolo (800 kyr to 1 myr) (Peretto et al 1998), Isernia (700,000) (Peretto 2006), and Notarchirico (650-450 kyr) in the Venosa basin (Piperno 1999). Recently 3 cores and 6 flakes have been reported from a new site in Southern Italy, at Pirro Nord by Arzarello, M. *et al* (2007), a already well known for its faunal assemblages. The associated fauna implies an early Pleistocene date, perhaps between 1.6 to 1.3, making it significantly older than the sites of Isernia, Monte Poggiolo and Notarchirico and bridging the gap between them and Dmanisi.

Dmanisi: Some Assumptions

The most spectacular and unexpected evidence to be obtained in the last decade is the amazing site of Dmanisi which is well dated to 1.8 myr. Dmanisi is in Georgia, at the "gateway" to Europe (Lordkipanidze *et al* 2005). At this site 4 skulls and mandibles and some postcranial bones have been found. Although initially attributed to *H. ergaster*, they have now been designated as *Homo georgicus*.

As reported in the July, 2002 issue of Science, the Dmanisi skull has a number of similarities to early *H. erectus*: an exceptionally small cranium, with a rounded occiput with its face much like KNM-ER 1813. The Dmanisi hominids are among the most primitive individuals so far attributed to *H. erectus* or to any species that is indisputably *Homo*, and it can be argued that this population is closely related to *Homo habilis* as known from Oldavai Gorge in Tanzania, Koobi Fora in northern Kenya, and possibly Hadar in Ethiopia. The presence at Dmanisi of individuals like D2700 calls into question the view that only hominids with brains equivalent in size to those of mid-Pleistocene *H. erectus* were able to migrate from Africa northward through the Levantine corridor into Asia. It now seems more likely that the first humans to disperse from African homeland were similar in grade to *H. habilis* (*sensu stricto*)."

D2700, *Homo georgicus*, discovered in 2001 at Dmanisi in Georgia, estimated age is 1.8 million years. D2700 consisted of a mostly complete skull in exceptionally good condition, including a lower jaw (D2735) found about a meter away and thought to belong to the same individual (Vekua *et al.* 2002). At around 600 cc, this is the smallest and most primitive hominid skull ever discovered outside of Africa.

Two other skulls had earlier been found at the same site in 1999. D2280 was an almost complete braincase with a brain size of 780 cc. D2282 was a cranium which included many of the facial and upper jaw bones, with a brain size of about 650 cc. A lower jaw, D211, had also been discovered in 1991, and another lower jaw, D2600, in 2000 (Gabunia *et al.* 2000). Although the brain size of D2282 (650 cc) was smaller than any *H. erectus* fossil then known, and close to the average *H. habilis* brain size, Gabunia *et al.* (2000) pointed out the many similarities of D2280 and D2282 to *H. erectus* fossils such as WT 15000 and ER 3733:

Despite their relatively small cranial capacities, both Dmanisi fossils differ from *H. rudolfensis* and *H. habilis* and display a number of essential similarities with the crania of *H. erectus sensu lato* and particularly with its early African forms, attributed by some to *H. ergaster* (Gabunia *et al.* 2000). At 600 cc, the new discovery D2700 is even smaller than D2282, and appears more primitive. Vekua *et al.* (2002) list many characteristics in which it resembles *H. ergaster* (or *erectus*), and also a number in which it resembles the *H. habilis* skull ER 1813. However, the differences between the three Dmanisi skulls were not considered great enough to justify placing them in different species: In overall shape, D2700 is similar to D2280 and D2282, and D2735 resembles D211.

Out of Africa: Where?

Present day global Prehistoric scenarios show the possibility of the Early Human Dispersal from Africa to Southeast Asia through South Asia, taking the geographical and environmental conditions into account. One possible route of this East-West connection can be Northeast India, due to the fact that it is situated in the middle of South Asia, East Asia and Southeast Asia. The early human dispersal from Africa can be traced right from the site of Dmanisi in Georgia, Geshar Benot Ya'aqov of Israel, Riwat in Pakistan, Isampur in India, Longgupo in China up to Sangiran and Modjokerto of Indonesia at early Pleistocene time, indirectly shows the importance of Northeast India as a possible dispersal route. Again, recent genetics and archaeological research shows that Northeast India can be the one possible route for the major dispersal pattern of modern human *Homo sapiens* which are yet to be analysed and proved due to the lack of proper archaeological and prehistoric investigations taking the global prehistoric problems.

Concluding Remarks

Homo erectus in Asia would be as old as *Homo ergaster* in Africa. Do the new dates from Dmanisi and Java falsify the hypothesis of an African origin for *Homo erectus*? If the species evolved just slightly earlier than the oldest African fossils (2.0-1.9 million years ago) and then immediately began its geographic spread, it could have reached Europe and Asia fairly quickly.

But the "Out-of-Africa 1" migration is more complex. Conventional paleoanthropological wisdom holds that the first human to leave Africa were tall, large-brained hominids (*Homo ergaster/erectus*). New fossils discovered in Georgia (Dmanisi) are forcing scholars to rethink that scenario completely. These Georgian hominids are far smaller and more primitive in both anatomy and technology than expected, leaving experts wondering not only why early humans first ventured out of Africa, but also how.

To come to a concrete conclusion is a difficult task about the early human migration "Out of Africa". Presently, we see a scenario of hominid migration to Eurasia at about 2 Ma or even earlier, but we can not limit ourself to think about a very early migration as early as 2.5 Ma in to Eurasia. An, we should always look forward to receive any kind of new surprice from the great landmass from Eurasia

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