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EARLY HUMAN DISPERSALS: THE UNEXPLORED CONSTRAINT OF AFRICAN DISEASES

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Introductory Remarks

This paper aims to present certain aspects of the dispersal phenomena of hominids migrating out of Africa, a series of episodic events which took place after a long *statis* in early human evolution (Klein, 1999). Currently, most authorities agree that the first 'sorties' from Africa occurred around 1.7/1.5 Ma (*e.g.*, Arribas and Palmqvist, 1999; Bar-Yosef, 1994, 1998; Gabunia and Vekua, 1995; Klein, 1989, 1999; Potts, 1998a, b; Schick and Toth, 1993; Tchernov, 1998, 1999). These dates are derived from a suite of archaeological sites and fossils from Eurasia and are interpreted as evidence for the incipient migrations. Gaps in regional sequences are considered to indicate the extinction of particular hominid lineages (Bar-Yosef, 1994, 1998), supporting the notion that, at least at the beginning, migrations were not incremental or always successful.

We would like herewith to focus on the particular bio-behavioral traits of the hominids involved in these dispersal events from 1.8-1.0 Ma ago that enabled them to accomplish this feat, as well as to discuss apparent advantages of moving out of their African "homeland," which we feel have not been sufficiently emphasized in previous publications.

Before we delve into the more detailed interpretations of the hominid capacities and present a few remarks concerning the archaeological and fossil record, it would be useful to reiterate the terms paleoanthropologists use, which derive from the domain of biogeography. The common usage of these terms has recently been summarized by Tchernov (1992) and Burney (1996), as follows:

(a) Jump dispersal sweepstakes. These are accidental cases of dispersals that do not necessarily lead to successful colonization.

(b) Diffusion gradual movements. These are selective in the number of participating species. When movements across the land are slow, they permit speciation among the taxa involved. Hence, one must define time trajectories along dispersal lines and identify colonizers in their homeland and along their geographic trail.

(c) Immigration mass movement through a geographic corridor. The migrating species will be the same in their homeland and target landing. This can also mean the successful colonization of an entire suite of species.

Hominid Propensities and Capacities

The behavioral repertoire mastered by early *Homo* populations while in Africa, was undoubtedly a prerequisite for their ability to adjust to various environmental circumstances, and facilitated the occupation of Eurasia. Among the bio-behavioral features identified and discussed by various scholars (see Klein, 1999 and references therein), in our view the following are the most crucial in accounting for the success of Eurasian hominid adaptations:

1. Steady and prolonged walking capacity at normal pace (Steudel, 1994).
2. Heat adaptation as reflected in the particular body shape and skull morphology of *Homo erectus*, (Falk, 1992; Walker and Leakey, 1993; Wheeler, 1993).
3. A greater brain capacity than that of the contemporaneous bi-pedal *Australopithecinae*, justifying their being called 'human,' whichever the cause be it related to heat resistance adaptation, or social complexity and learning (Aiello and Dunbar, 1993; Aiello and Wheeler, 1995).
4. A social structure different from that of the Chimpanzee, more human-like, as inferred from the archaeological data directly reflecting hominid behavior such as site patterning (*e.g.*, Kroll, 1994), and exploitation of animal tissues (*e.g.*, Rose and Marshall, 1996 and references therein). The biological studies indicate additional features, such as taking care of sick group members (Walker and Shipman, 1996 as regards KNM-ER 1808 who suffered from vitaminosis A, and see also Walker *et al.*,

1982), reduced sexual dimorphism (McHenry, 1994; McHenry and Berger, 1998), and increasing neocortex size (Dunbar, 1996 and references therein; O'Connell *et al.*, 1999).

5. Behavioral flexibility in subsistence adaptation in the face of climatic fluctuations (for a detailed discussion see Cachel and Harris, 1998). Though we lack a detailed picture of the *Homo erectus* diet, undoubtedly the ratios and importance of its various components such as animal tissues and vegetal sources changed according to their reliability, accessibility, predictability, and the procurement techniques practised.

A debatable issue is whether the adaptive flexibility of *Homo erectus* and its immediate predecessors (*Homo habilis* and *Homo rudolfensis*) is indeed reflected in their material culture. Neither the Early Acheulian nor the Developed Oldowan, as defined by M.D. Leakey (Leakey, 1971; and see Leakey and Roe, 1994), demonstrate the presence of a complex operational sequence (*chaîne opératoire*), when compared to the later stages of the Acheulian (*e.g.*, Belfer-Cohen and Goren-Inbar, 1994; Gowlett, 1990; Roche and Texier, 1995) or to the complexity of the Levallois methods (*e.g.*, Boëda, 1995; Meignen, 1995). Certain hominid groups continued to produce Oldowan or core-chopper (also labeled core and flake) industries, whereas contemporaneous groups began to shape the Acheulian bifaces along with various retouched flakes. A variety of the bifaces is present among the Developed Oldowan assemblages (Bar-Yosef and Goren-Inbar, 1993; Leakey and Roe, 1994), often considered as a 'facies' within the Acheulian complex. Thus, *Homo erectus* groups were the bearers of both Acheulian and core-chopper industries. Identifying *Homo erectus* solely with the Acheulian is completely erroneous. The evidence from beyond the "Movius line," in Asia as well as from Eastern and Central Europe, indicates that several *Homo erectus* populations and later archaic *Homo sapiens* held distinct operational sequences for making core-choppers, and never made bifaces. This assertion is supported by experiments aimed at replicating stone chipping techniques and the use of the produced blanks. Studies of operational sequences demonstrate that the dominant artifact forms resulted from different learned behavioral traditions, ignoring in many instances the constraints of the locally available raw materials (*e.g.*, Boëda, 1995; Bordes, 1977; Roche and Texier, 1995; Schick and Zhuan, 1993).

The African Environmental Constraints

The geographic distribution of archaeological sites in Africa dated to 1.8-1.0 Ma is rather limited, if one takes into account the overall surface size of the continent and climatic changes that caused certain areas to open up or close down for human exploitation. We can assume that population growth in the African 'homeland' was constrained not necessarily simply by predation, but particularly by diseases, as is the case for the living pongids. For example, 55 % of chimpanzees die of diseases (Goodall, 1986). It should be remembered that Africa is the home of most zoonotic diseases (caused by organisms that rely primarily on other plants or animals rather than people, *e.g.*, the 'sleeping sickness'). These have a relatively severe impact on the living body. Since the disease-causing organism is not dependent on human transmission, the selection of a strain of the parasite that is less virulent or more compatible with human life is unnecessary. Moreover, many zoonotic diseases attack adults more than they attack children. Indeed, these diseases are different from the more recent common infectious diseases, which are density-dependent, such as 'measles,' 'mumps,' 'rubella,' 'influenza' and the 'common cold' (Cohen, 1989; Karlen, 1995). The latter are self-limiting in isolated populations below a certain threshold size (see below). The worst post-Second World War new diseases appeared in Africa, as "a growing population exploited the environment and invited zoonoses…" (Karlen, 1995:163). In this sense, Africa can be considered as a garden of germs.

Africa's ecology included (and continues to include) a dense array of microparasites that evolved with humanity itself. They are so adjusted to the human presence that any notable increase in human numbers promptly provokes a sharp intensification of infection and infestation. Together with limitations on the availability of food, tropical microparasites sufficed to keep our remote ancestors relatively rare in the balance of nature (McNeill, 1980:11).

Although apes suffer from a variety of worms and other intestinal parasites that affect people, they generally move less rapidly and less widely, and they inhabit moister habitats hence more parasite-tolerant soil regimes. Thus, once humans moved out of the zoonotic infected zones, they were left with fewer parasites altogether (especially if they moved to colder environments).

The Spread into New Habitats

The triggers for the movement of humans out of Africa are not well known. Among the reasons considered are population increase (as every successful species expands beyond its original homeland), or climatic changes that severely reduced and modified the size of the exploitable territories (Larick and Ciochon, 1996). A major climatic change that affected the African environment is currently recognized in the Olduvai subchron, which was accompanied by the desertification of numerous wet and lush environments (Potts, 1998a).

Another current explanation for early humans (*i.e.*, *Homo erectus*) urge to expand their exploitation grounds lies in the notion that this was the hominid species which evolved into an efficient predator (Walker and Shipman, 1996). Walker and Shipman bring forth evidence for humans becoming a social predator that needed to lower its population density. The options are either to eliminate most of its total population or to spread that population over a much larger geographic range. As Walker and Shipman give a very detailed account of their hypothesis, suffice it to say that they believe humans increased their home range size and thus decreased population densities and the mechanism was migrations out of the *Homo erectus* homeland into the great beyond.

The spread into new habitats in Eurasia, where hominids were previously unknown, meant that they escaped their many biological foes, the insect transmitted diseases such as 'sleeping sickness', 'malaria' and 'elephantiasis,' that decimate primate populations as well as those of other mammals (McNeill, 1976).

Moving away into new environments, especially from the tropics to cooler, drier environments reduces the danger of being exposed to zoonotic diseases. That humans were exposed to them for a long duration of time is indicated by the phenomena of genetic mutations. While in a homozygotic condition these mutations induce illness (as for example 'sickle-cell' anaemia), in heterozygotic conditions they provide a certain immunity to a particular zoonotic disease in this case 'malaria.' It is of interest to note that to date no mutations have been reported that help humans to compete with non-zoonotic infections.

In considering the role of diseases in the past, it is important to stress that the current distribution of diseases and plagues cannot be used as an analogy for the situation during the Lower Pleistocene. In a world without today's rapid transportation, most zoonotic diseases would have had their distribution dramatically limited by the dispersal rates of the wild host and vector species.

In addition, the viral infections 'smallpox,' 'measles,' 'whooping cough,' and the like can exist only among large human populations, which allow the chain of virus generations to continue uninterrupted. In recent times, for example, 'measles' required a community of between 300,000 and 40,000 persons in order to survive (McNeill, 1976:63). Clearly, such a disease could exist on a permanent basis only among civilized societies, where human populations are comparatively dense and communication nets far-flung.

The Eurasian archaeological evidence for early dispersals (fig. 1)

The Javanese *Homo erectus* is currently believed to have arrived in Southeast Asia some 1.8-1.6 Ma ago (Swisher *et al.*, 1994). This date is still debated in the literature by Southeast Asia archaeologists (*e.g.*, Keates, 1998). An age earlier than 1.0 Ma has already been suggested by several geochronological observations in Southwestern Asia: (a) the presence of early stone industries on the Israeli coastal plain, the Lebanese shorelines, and the Syrian fluvial deposits (Horowitz, 1979; Hours, 1975, 1981; Sanlaville *et al.*, 1993); (b) the detailed analysis and Eurasian correlations of faunal collections from 'Ubeidiya (Tchernov, 1986, 1987, 1992, 1999; Aziz *et al.*, 1999; De Vos *et al.*, 1999; Sondaar *et al.*, 1999; Van Den Bergh *et al.*, 1999); (c) the recent discovery at Dmanisi in Georgia (Dzaparidze *et al.*, 1989), where a *Homo erectus* jaw was found (Gabunia and Vekua, 1995). The Dmanisi mandible was retrieved from a deposit that seems to have been a large burrow (bearing a reverse magnetic signal), which lies within layers of normal polarity immediately above a 1.8 Ma K/Ar dated lava flow (Dzaparidze *et al.*, 1989; Ferring and Swisher, pers. comm.).

When taken together, the distribution of Lower Paleolithic sites in Western Asia, including the Caucasus presents several potential routes of *Homo erectus* into Eurasia.

Within the Mediterranean basin, archaeological evidence from the Lower Paleolithic of the Iberian peninsula (Freeman, 1975; Gibert, 1992; Raposo and Santonja, 1995; Roe, 1995; Turq *et al.*, 1996), for a date around 1.5-1.0 Ma, may indicate that

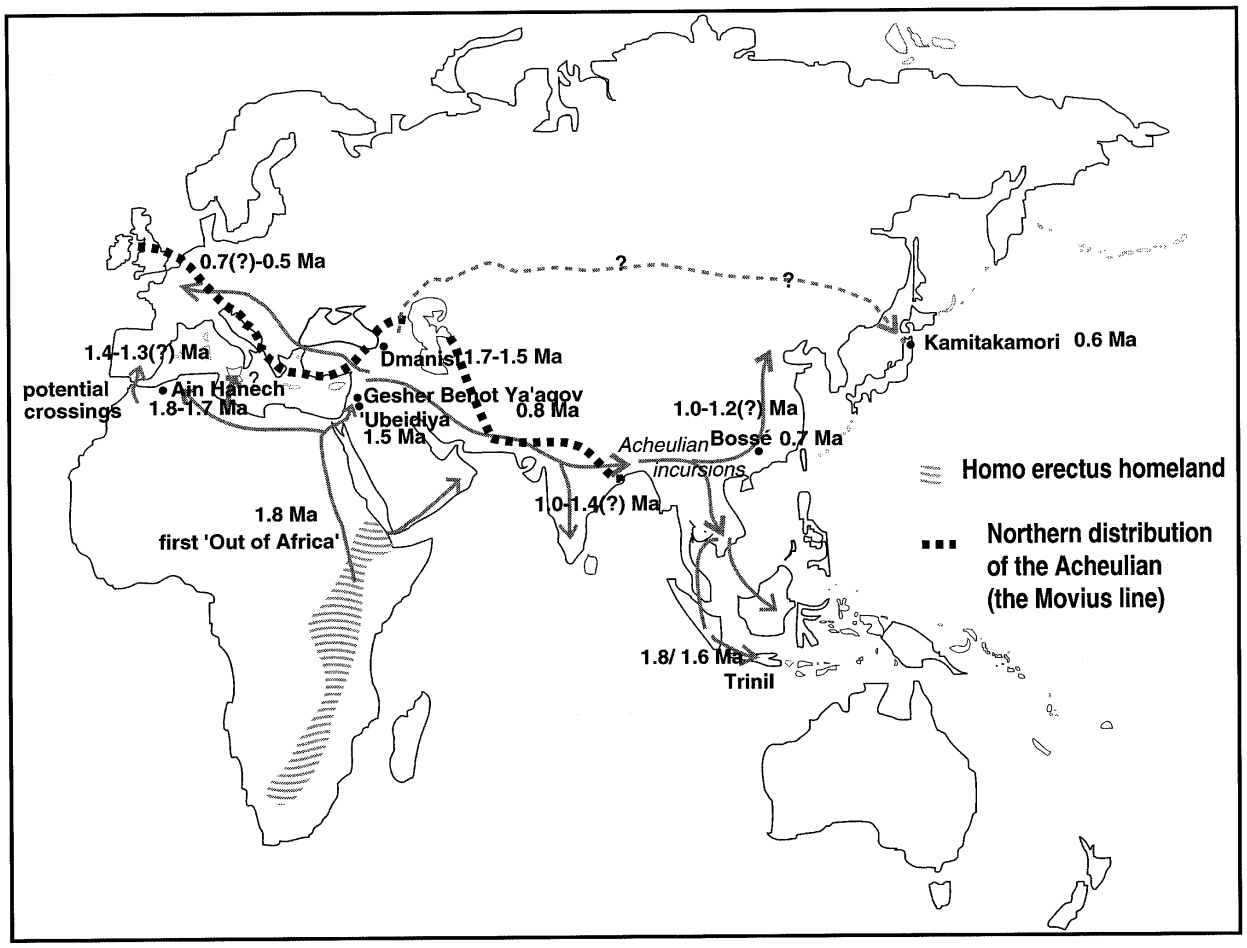


Figure 1.

early crossings from Africa to Mediterranean Europe could have taken place through the Gibraltar Straits (Arribas and Palmqvist, 1999). Another potential pathway across the Mediterranean could have been by way of Sicily (Alimen, 1979), as indicated by the spread of the Acheulian in Italy and the presence of core-chopper assemblages in localities such as Monte Poggiolo and Isernia (*e.g.*, Mussi, 1995; Peretto, 1991, 1994). However, there is as yet no positive archaeological evidence in support of this hypothetical route.

The presence of these variable industries and sites indicate, in our view, that there was more than one "out of Africa" event. One such example from Western Asia is the basalt cleaver/biface Acheulian industry of Gesher Benot Ya'aqov. Despite the fact that large portions of Western Asia are covered with lava flows, no similar industry has yet been reported. In lava plateaux such as the Golan, Upper Acheulian assemblages are generally made of flint (*e.g.*, Goren-Inbar, 1985). It was therefore suggested that the assemblages of Gesher Benot Ya'aqov, represent the migration of a group of people out of Africa (Bar-Yosef, 1987; Goren-Inbar and Saragusti, 1996) at about 0.78 Ma (Verosub *et al.*, 1998). Another assemblage conveying the same impression, produced from andesite, was uncovered in Saffaqah near the Red Sea (Whalen *et al.*, 1984), but unfortunately, no absolute dates are currently available.

Producers of core-choppers could have colonized the Maghreb if the sequence established by Biberson (1961) is supported by further fieldwork (Raynal *et al.*, 1995; Sahnouni *et al.*, 1997). Similar groups could have been among the first to colonize western and eastern Asia (Schick and Zhuan, 1993) or among those who ventured to colonize Mediterranean Western Europe (Roe, 1995). However, claims for dated sites around 2.0 Ma or isolated, supposedly human-made stone tools in Pakistan (Dennell *et al.*, 1988) and China (Wanpo *et al.*, 1995) cannot be accepted without additional, well established evidence. Although the earliest dates for the colonization of temperate Europe are also debatable (Dennell and Roebroeks, 1996), the Middle Pleistocene inhabitants of central and eastern Europe who made core-

choppers could have been late migrants from Africa or from a region where such a core-chopper tradition lasted longer, such as East Asia. On the other hand, Acheulian bearers could have ventured into East Asia. Isolated occurrences of bifaces have been reported from China, in sites such as Bosse, currently dated to ca. 0.7 Ma (Huang and Wang, 1995; Schick and Zhuan, 1993), but most of them are of unknown age. The distribution of long-lasting core-chopper assemblages beyond the Eurasian "Movius line" (fig. 1) stands in contrast to Western Europe and Western Asia, where Acheulian occurrences dominate. The stratigraphical interspersal of Acheulian and core-chopper industries (known by various labels such as Clactonian, Tayacian, etc.) in several sub regions seems to be an established phenomenon, although it has been interpreted by Ohel (1977) and Ashton (Ashton *et al.*, 1994) as two 'facies' of the same cultural phenomenon.

The Nature of the Dispersals

From all of the above it becomes clear that the dispersals of early hominids from the late Pliocene or early Pleistocene into Eurasia were essentially sporadic. Little geographic and temporal continuity is observed between the various dated archaeological contexts. The archaeological assemblages do not demonstrate a techno-morphological continuity, as already observed by Movius (1944). The presence of a boundary between the Acheulian and the core-choppers assemblages has been noted by various scholars (*e.g.*, Rolland, 1998 and references therein). The archaeological evidence from 1.8 to 1.0 Ma indicates at least two waves of early migrations, but there were probably more than two. The earliest was of bearers of core-chopper industries while the following was by producers of the Early Acheulian. During the late Lower Pleistocene regional continuities in the production of artifacts are discernible. Within the Acheulian territories the general production of bifaces continues, while beyond the "Movius line," core-chopper assemblages (or core and flake industries) were dominant.

While dietary constraints are of great importance in human evolution, most of the vegetal food consumed by early hominids such as the *Habilines*, was probably similar to that of the Australopithecines, namely, sedges and grasses (*e.g.*, Sponheimer and Lee-Thorpe, 1999). Underground resources, known as USOs, were presumably discovered by *Homo erectus*, but even if the cooking or parching of these tubers is considered as triggering a major breakthrough from the old, primate-like social structure (Wrangham *et al.*, in press), the scarcity of tubers in the Mediterranean basin or Western Asia means that they were not an essential element in the course of the successful colonization of these regions.

Conclusions

The sum reasons for why early humans dispersed from Africa into Eurasia includes the 'push' of environmental change and demographic pressure, as well as the opening of new niches. Whether humans gained their meat supplies from carcasses following carnivores or became themselves active predators (*e.g.*, Arribas and Palmqvist, 1999; Bar-Yosef, 1994; Rolland, 1998; Turner, 1992) is yet unresolved. Even if the trigger for the initial dispersal of *Homo erectus* remains unknown, the success of the hominid occupation of the Eurasian habitats was not necessarily facilitated by the availability of food, or the human flexibility in food procuring techniques, but by the absence of the zoonotic diseases that plagued and constrained hominids in their 'cradle of evolution', East Africa.

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