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MICROENVIRONMENT AND THE INITIAL HOMINID SETTLEMENT IN WESTERN ASIA

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Abstract

The initial settlement of tool-making hominids 'out of Africa' 2.0 - 1.8 Ma. ago proceeded in an environment of climatic cooling and aridity. The spreading groups of hominids followed a similar environmental pattern which was largely defined by the tectonics: the junction of African, Arabian and Eurasian plates. In these conditions special types of landscapes have developed, which included lacustrine basins with the diversity of savannah-like grassland, open and closed woodland. These landscapes became particularly attractive for hominids. From the very beginning the subsistence of tool-making hominids was based on scavenging with the wide use of aquatic resources and plant life. These habitats provided the hominids with comparatively stable food resources, yet they did not preclude competition with other predators and scavengers.

Introduction

Two major events have marked the beginning of the Human era: the conscious and systematic tool-making acknowledgeable in archaeologically-identifiable artefacts, and the proliferation of tool-making hominids (apparently *Homo erectus)* in the wider area of the Old World. In light of recently available evidence, it becomes increasingly likely that these two events have occurred very closely in time: 2.0 - 1.8 Ma, or earlier.

Two elements became apparent when these events are set in a wide palaeoenvironmental context. First, the spatial orientation of the sites along the global tectonic structures, and secondly, their temporal coincidence with major climatic changes.

Tectonics

According to the theory of plate tectonics, the surface layers of the Earth are composed of a set of large and small plates, which together constitute the rigid lithosphere. These plates are massive, irregularly shaped slabs of solid rock, generally consisting of both continental and oceanic segments. The plates are in constant movement which normally takes the form of collisions and subduction resulting in raised mountain ranges and the formation of marine basins.

In the wider area where the earlier evidence of tool-making activities are acknowledgeable, two 'southern' plates were impacted against the huge 'Eurasian' plate. As the result of this collision, several minor plates emerged: Aegean, Turkish and Iranian. Dramatic development has occurred in the eastern Mediterranean area, where the tectonic uplift (approximately 1 km) in the Early Miocene was followed by shallow-water carbonate deposition and the ensuing 'Messinian desiccation crisis'. During the Early Pliocene the platform subsided to abyssal depths. Subsidence accelerated in the Late Pliocene-Early Pleistocene, reaching a present-day maximum depth of ca. 2500 m (Robertson, 1998). At the same time, the surrounding areas have experienced a large-scale uplifting, where impressive folded mountains were formed. During the Neogene the Hellenic mountains were subjected to clockwise rotations in the west and counterclockwise rotations in the east, while post-early Messinian clockwise rotations have occurred on Crete (Duermeijer *et al.*, 1998).

In eastern Africa the straight coastlines of Eritrea and northern Somalia were created by the drifting away of the Arabian Peninsula, which opened up the Red Sea and the Gulf of Aden. Extensive faulting has raised and lowered vast blocks of land; the flows of lava from numerous volcanoes have formed elevated plateaux. This has led to the development of the African Rift System which includes the Great Rift Valley. Its southern end is found in the coastal area of the Indian Ocean, in Mozambique; it continues northward through the Shire River valley and Mozambique Plain. It extends further north to the Lake Nyasa (Lake Malawi) and forms a great arc that includes the Lakes Rukwa, Tanganyika, Kivu, Edward, and Albert (Mobutu Sese Seko), stretching on to Lakes Rudolf (Turkana), Naivasha, and Magadi in

Kenya. It continues into the Ethiopian Denakil and further north along the Red Sea, the Gulf of Aqaba. In the north the rift corresponds to the Jordan River valley and the Beqaa. Further north the Rift is lost beneath the tectonic structures of the eastern Mediterranean area, the Taurus and Anatolides. The northern end of the axis forms the impressive tectonic structure of the Lesser Caucasus, where the folded and faulted sedimentary strata were intruded with volcanic rocks (Dumitrashko *et al.*, 1977).

Climatic change

The northward drift of Australia and South America during the middle Cenozoic created a new circumglobal seaway around Antarctica that remained centred on the South Pole. A vigorous circum-Antarctic current developed, isolating the southern continent from the warmer waters to the north. At the same time, the equatorial current system became blocked, first in the Indo-Pacific region, next in the Middle East and eastern Mediterranean, then at Gibraltar, and finally, about 5 million years ago, by the emergence of the Isthmus of Panama. As a result, the equatorial waters were heated less and the mid-latitude ocean gyres were not as effective in keeping the high latitudes warm. Because of this, an ice cap began to form on Antarctica some 20 million years ago and grew to roughly its present size about 5 million years later. This ice cap cooled the waters of the adjacent ocean to such a low temperature that the waters sank and initiated the north-directed abyssal flow that marks the present deep circulation (Margolis *et al.*, 1977).

Marine oxygen-isotopic signals show several cool stages, one of the most significant occurring ca 3.2-3.2 Ma. Yet a more important episode of cooling coincided with the Gauss/Matuyama magnetic reversal at 2.6-2.5 MA. The latter episode marked a substantial modification of the environmental setting on the global scale: first major ice-sheet started emerging in the temperate latitudes of the Northern Hemisphere. Glacial marine ice-rafted debris became abundant in the sediments of polar oceans at 2.7-2.6 Ma (Jansen and Sjohølm, 1991). A high-resolution magnetic chronostratigraphy indicates the massive discharge events of non pelagic deposits in the North Atlantic that has occurred between 2.5 and 2.0 Ma and was probably related to fluctuations of the major (Laurentide) ice sheet (Barthes *et al.*, 1999).

At this stage the cool water penetrated the Mediterranean basin. This cooling was accompanied by the general aridisation of climate: the steppe increasingly supplanted tropical and sub-tropical forest; the hordes of hipparions roving the prairies of southern Europe (Kukla, 1989).

Oxygen-isotopic and pollen records suggest that considerable changes in the climate and vegetation of tropical Africa became pronounced by 2.8 Ma; short-term yet significant shifts occurred also later, at 1.8 and 1.6 Ma. These changes took form of the climate becoming periodically cooler and drier and the vegetation shifting from 'closed canopy' to 'open savannah' (de Manocal, 1995).

This evidence is further substantiated by the fossil mammal records. The gradual decline in abundance of arboreal mammals in Africa became apparent after 3.4 Ma, which is seen as an evidence of increased aridity of climate and the shift towards more pronounced seasonality with pronounced dry seasons. This may have led to the 'movement or extinction' of arboreal and frugivorous animals and the related expansion of grazing mammals after 1.8 Ma (Reed, 1997).

Microhabitats

The East African Rift System is usually seen as the main arena of early evolution of tool-making hominids. Previous investigations had stressed that early hominids lived predominantly in an open savannah. Yet in view of the above-cited evidence indicative of the general climatic change occurring in Eastern Africa 4-2 Ma, that took form of a transition from mesic closed to xeric open habitats, the implication is that the hominids at that stage existed in the mesic environs which included wooded landscapes. This conclusion was corroborated by the mammal evidence showing that *Australopithecus* species existed in fairly wooded, well-watered regions. As for the *Paranthropus* species, according to the same evidence, they lived in similar and in more open environs, that also include wetlands (Reeds, 1997).

Spencer (1997), based on a different set of arguments, arrives to similar conclusions: the primary habitats of the hominids in Eastern Africa included edaphic grasslands with seasonally flooded valleys, as well as secondary, relatively dry grasslands. Following the increased aridity of climate these secondary grassland habitats became increasingly influential in the development and livelihood of *Homo erectus sensu lato* after 2 Ma. These primary habitats of the hominids largely defined their diet and the dietary strategies. Basing on the functional anatomy of extant and fossil carnivores Lewis (1997) argues that the diet strategy included as its crucial element the procurement of meat and marrow that involved a wider range of behaviours than modern carnivores. All along the scavenging constituted the principal dietary strategy, and at the time of initial tool-making the habitats in eastern Africa provided the hominids with a greater range of scavenging opportunities than in any other part of Africa during the Plio-Pleistocene. Yet the increased aridity of climate following 2 Ma led to local and continent-wide extinction events in large-bodied carnivoran guilds and had a substantial effect on carcass availability and the risk to hominid scavengers. These structural changes in the carnivore guild may have provided an opportunity for hominids to widen their niche with respect to dietary behaviour.

New zooarchaeological data reported from three Early Pleistocene assemblages in Olduvai Gorge Bed II (Monahan, 1996) clearly show, that at several locations the bone assemblages refer to bone- crunching carnivores, and not the hominids, implying that stone tool-using hominids and bone-crunching carnivores foraged in the same general habitat. The comparisons to the artefact sites from Bed I, Olduvai Gorge and to the Turkana Basin in northern Kenya suggest that hominid behavioural variability had significantly increased starting approximately 1.7 Ma, probably as a result of increased environmental stress and the intraspecies competition of the scarce resources.

Basically similar conclusions were arrived at with the use of a different approach, based on the estimate of total energy expenditure (TEE) derived from the body size, resting metabolism, and activity budgets for selected anthropoid species and human hunter-gatherers (Leonard and Robertson, 1997). This analysis shows that the TEE values increased substantially with the emergence of *Homo erectus*. This increase is partly attributable to larger body size as well as likely increases in day range and activity level. Assuming similar activity budgets for all early hominid species, estimated TEE for *H. erectus* is 40-45% greater than for the australopithecines. These changes were conspicuously related to changing patterns of resource distribution following the increased aridity between 2.5 and 1.5 Ma. Such ecological changes likely would have made animal foods a more attractive resource. Moreover, greater use of animal foods and the resulting higher quality diet would have been important for supporting the larger day ranges and greater energy requirements that appear to have been associated with the evolution of a human-like hunting and gathering strategy.

The last important point to be addressed in this context concerns the hominids' ability for locomotion which had guaranteed its wide dispersal over a geologically limited period of time. New data suggest (Steudel, 1996) that the transition to bipedal locomotion in itself would not have accrued the energetic efficiency, yet selection for improved efficiency in the bipedal stance would have occurred once the transition was made.

Thus, based on the available evidence on early African tool-making hominids and their habitat, several conclusions may be drawn.

1. The intensive tool-making coincided with an important climatic shift which included the general aridisation and the seasonality with the prolonged dry season, and the development of more open landscape that included wetlands;
2. Scavenging constituted the principal dietary strategy, yet the increased aridity of climate following 2 Ma had a substantial effect on carcass availability and the risk to hominid scavengers;
3. Within their initial habitats the hominids were exposed to substantial competition on the part of bone-crunching carnivores foraging in the same general setting;
4. Bipedal locomotion and the ability of wide dispersal was an element of the biological adaptation of the hominids even at an early stage.

Dmanisi Case

The discovery in late 1991 of a well preserved early human mandible at Dmanisi in a clear association with Late Villafranchian mammalian fossils and dated to 1.8 and 1.6 Ma (Gabunia and Vekua, 1995) provided a new and important dimension to the early dispersal of hominids.

The analysis of the palaeoenvironmental setting, as well as its comparison with that of early hominids in East Africa and the Middle East show their striking similarity. In the case of Dmanisi, the site was located in an area of a small lacustrine basin in the vicinity of the volcanic outcrops (Tvalchrelidze and Lordkipanidze, 1998;

Maisuradze *et al.*, 1998). The similarity was further substantiated by data on the palaeoecology which indicates the combination of open and wood ecotones and marshes (Ganbunia, Vekua and Lordkipanidze, 1998).

Summing up the available evidence (Kvavadze and Vekua, 1993), the following vegetative zones could be identified within the catchment of the Dmanisi site:

1. Closed woodland: high-mountain forests with *Abies, Betula, Pinus* and *Vaccinium* in the undergrowth;
2. Open broad-leaved forests in the middle mountain stage with *Fagus, Carpinus* and *Ulmus*, and *Castanea, Tilia* and *Quercus* in the lower mountains.
3. Grassland: meadow, steppe and savannah-like vegetation with *Gramineae, Chenopodiaceae, Compositae* and *Artemisia* on the adjacent elevated plateaux.
4. Floodplain forests with *Alnus, Corylus* and *Cornus.*

Among the vertebrates inhabitants of open habitats, such as the horse, Etruscan rhino, southern elephants, hyenas, hamster, gigantic oyster, are in a clear dominance. At the same time, the number of forest game is significant and includes the bear, red deer, roe deer, leopard, lynx and wolf.

The deposition of the faunal remains at the Dmanisi site, namely, the accumulation bones of the animals often in anatomic order, amongst which the hominid mandible, found in an aquatic environment, strongly suggests a 'death assemblage', an arena of natural deaths of animals and the subsequent scavenging rather than a conscientious hunting activity. This was the case of a great many African open-air sites (Klein, 1989).

The presence of hyena, identifiable by the coproliths, is significant. This strong predator and scavenger, fed largely on carrion, should have constituted a strong competition to the hominids.

Conclusions

Summing up the available evidence one may suggest the following:

1. The initial tool-making and the dispersal of the hominids in Africa and Western Asia were practically identical in time coinciding with the global aridisation of climate.
2. The area of initial tool-making and the dispersal was spatially confined to the major tectonic structures which included the collision area of the African and Eurasian plates and the Rift system.
3. The initial habitats of tool-making hominids included lacustrine basins with the diversity of savannah-like grassland, open and closed woodland.
4. From the very beginning the subsistence of tool-making hominids was based on scavenging with the wide use of aquatic resources and plant life.
5. These habitats, providing the hominids with a comparatively stable food resources, did not preclude competition with other predators and scavengers.
6. The survival package of the hominids in their precarious environment included tool-making, opportunistic scavenging, long-distance locomotion and a system of social communication.

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