Homo erectus. Pleistocene Evidence from the Middle Awash, Ethiopia

W. Henry Gilbert and Berhane Asfaw (eds.)
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This book is the first volume in a projected series that will address the full twenty-five years of research that have accrued from the Middle Awash project, founded by the late J. Desmond Clark. An accompanying web site maintained at Berkeley archives digital photographs of the catalogued fossils described in this book, as well as micro CT-scans of selected hominid fossils. Further material will appear on the Middle Awash web site as additional volumes are published. Information about the Middle Awash Project can be accessed at the following URL: http://middleawash.berkeley.edu/middle_awash.php. The photographs can then be accessed via the "Fossil Database" icon. Material can be searched for in a variety of ways (e.g., catalogue number, geological member or formation, mammalian family, age, taxon). All of the fossils are curated at the National Museum of Ethiopia in Addis Ababa. This impressive permanent electronic archive obviously requires extensive stable funding. One hopes that funding sources will not come to a halt.

A large team of researchers worked for over a decade on this volume. There are eighteen chapters, including an introduction and conclusion, chapters on mammalian orders and families, two chapters on the cranial remains of *Homo erectus*, a chapter on hominid postcranial material, a chapter on hominid systematics, and a chapter on the ecology and biogeography of the Daka Member of the Bouri Formation. Archaeological material is abundant, but is not discussed in this book. A bibliography combines references for all the chapters. A forward by Garniss Curtis details fond memories of fieldwork with J. Desmond Clark, still agile and alert in his late 70s. A preface by Tim White dedicates the series to the late F. Clark Howell, who co-authored the chapter on the carnivores.

The introduction details protocols for the collection, recording, and restoration of fossils, most of which were discovered by foot survey, not excavation. Crocodiles and fish were not collected. Over 750 mammal fossils were recovered, including specimens of *Homo erectus*. Sediments in the Middle Awash are 1km thick, but deposition was not continuous. The Daka Member is only one of fifteen separate time intervals that sample windows of time dating from nearly 6 mya to 50,000 yrs B.P.

A separate chapter deals with geology and chronology. The Daka Member is dated by three methods—$^{40}Ar/^{39}Ar$ from single feldspar crystals, sandine crystals from pumice clasts, and paleomagnetism. These methods yield an age of about 1 mya—a period just before the inception of more intense Pleistocene glacial cycles with a 100,000 year periodicity. Ten geological sections are described in detail, along with eight paleontological localities (e.g., BOU-VP-1, etc.). The climate was warm and seasonally generally very dry, with only a single annual wet season, because paleosols and pedogenic carbonates yield a picture of high soil temperatures and evaporation rates. The environment is reconstructed as a mosaic habitat of open grassland with some woodland set in the floodplains of shallow lakes and distributary channels. The closest modern analog is the environs of Lake Nakuru in the Rift Basin of Central Kenya.

Ten chapters deal with non-hominid fossil mammals. Large photographs illustrate important specimens, which are also described. The bovids are the most diverse group, with fossils from seventeen genera. Remains are abundant, with bovines, alcelaphines, and reduncines being especially well represented. Bovid cranial and dental metric data are available in a special appendix. Carnivores are rare (as usual), but lion, leopard, and a new subspecies of spotted hyaena are present. This new subspecies, which is larger than the living spotted hyaena, is formally defined. Cercopithecid fossils are rare. Only seventeen fossils represent both Old World monkey subfamilies. These include dental, cranial, and postcranial remains. Most of the fossils are from the cercopithecine *Theropithecus oswaldi*, a well-known and abundant gelada species present at other sites. Two fossils represent *Cercopithecoides alemayehui*, a formally defined new colobine species. Additional cercopithecid taxa found at other Pleistocene sites in the Afar do not occur in the Daka Member, almost certainly because Daka localities are not sampling habitats represented at other sites.

Equids represent nearly 20% of the total fossil mammal assemblage. These equids include both *Equus* (resembling the modern zebra species) and *Eurygnathohippus* (an extinct hipparionine grazing horse). Several tables and figures give metrical and statistical data on teeth and postcranial material. Rare giraffid fossils, unassignable to species, include both *Sivatherium* and *Giraffa*. Hippopotamid fossils are not completely prepared, but are provisionally identified as *Hippopotamus* cf. *gorgops*, a larger species than the living common hippo, *Hippopotamus amphibius*. These Daka fossils sample a crucial period of time in hippopotamus evolutionary history, because many hippopotamid lineages go extinct at 1 mya, leaving *Hippopotamus* as the dominant living genus. The Daka Member contains abundant elephantid fossils from the species *Elephas recki.* These are photographed, described, and measured. Fossils of both the living white and

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black rhinoceros are present. There is a rich assemblage of Daka suids. Photographs, dental, and cranial metrics are presented. One of the best samples of *Kolpochoerus majus* occurs here, as does the only known complete cranium of *Kolpochoerus olduvaiensis*. The co-occurrence of the living warthog species with *Metridiochoerus modestus* establishes their taxonomic separation. Micromammals and birds are rare. However, the Daka Member contains a fossil grass rat and a large, stork-like wading bird. An unprepared complete cranium of a catfish was also discovered.

The longest chapter in the book deals with *Homo erectus* cranial anatomy. The focus is on the Daka calvaria (BOU-VP-2/66), but other cranial and mandibular specimens are described. Collection and preparation of the calvaria is extensively described. There are multiple full page photographs of the calvaria, showing different aspects and corresponding micro CT-scans. The calvaria frontal shows definite evidence of carnivore gnawing. An appendix with Daka calvaria measurements concludes the chapter. These measurements are taken either from the original specimen, micro CT-scan, or microscribe data. The measurements represent a comprehensive list of over 200 cranial metrics taken from other authors publishing on Pleistocene hominid crania. The taxon *Homo erectus* is used, not "*Homo ergaster*," which is utilized by other researchers who study early African material. A major conclusion of the chapter is that there is significant variation in *Homo erectus* crania. This not only complicates phylogenetic reconstruction, but also makes it impossible to associate a particular morphology with a particular geographic region. That is, cranial traits form such a mosaic that it "is impossible to form an argument for regional homogeneity whenever more than a few features are considered simultaneously" (p. 311).

The next chapter deals with micro CT-scans of the Daka calvaria's endocranial features, and also describes a sterolith model of the endocast. Seven pages show coronal, transverse, and sagittal sections of the calvaria and the reconstructed endocast. Ralph Holloway, who is a co-author, estimates the cranial capacity to be 1,001 cc, in the mid-range of African and Asian *Homo erectus* specimens. The bony labyrinth configuration, which yields information about balance and hearing, is similar to that of living humans. Cerebral asymmetries resemble those of living humans, indicating that this individual was not only right handed, but probably also had language. If true, this suggests that complex sociality existed in this taxon.

A single-authored chapter by Gilbert deals with hominid systematics. He begins with the simple observation that the Daka, Buia, and OH 9 specimens are phenotypically very different, although they are close to each other in time and space. He then notes a number of "caveats for cladistics." These include the choice of traits, the non-independence of traits, the problem of anagenesis, the assumption that homoplastic traits are rarer than homologous ones, and, most importantly, the assumption that branching species dichotomies create groups that represent diverging lineages. Gilbert then performs three cladistic analyses—one using individual cranial specimens as OTUs, one combining specimens of the same age and geographic region to forms OTUs, and one combining specimens from the same site to form OTUs, with others left as individual OTUs. The results show that African and Asian specimens do not form separate lineages; early African specimens are not closer to later members of genus *Homo*; and the Ceprano specimen from southern Europe is not closer to Neanderthals than it is to contemporary African specimens. An appendix describes and scores *Homo erectus* cranial traits from specimens throughout the Old World.

Hominid postcranial remains from Daka consist of three femora, one tibia, and a newly discovered talus, which has not been prepared. Because there are no associated cranial remains, the taxonomic affiliation of these remains is unknown. The cortical bone of the femoral shafts is very thick, the minimal shaft breadth is distal, and the cortex on the medial shaft is thicker than that of the lateral shaft. These features separate the Daka femoral specimens from those of *Homo sapiens*. The femora are platymeric and anteverted, suggesting that squatting postures were habitual.

A discussion of biogeography concludes that the Daka fossils cannot be used to confirm exchange between the Palaearctic and Ethiopian realms. The fossil assemblage contains two endemic bovid genera (*Bouria* and *Nitidarcus*). Mammal taxa confirm the existence of open grassland, although taxa dependent on water also occur. The volume concludes with a critical analysis of Potts's concept of variability selection, as well as a discussion of the problems of identifying taxa as either generalists or specialists. These are important because the origins of genus *Homo* have sometimes been associated with either a novel evolutionary process (variability selection) or with selection for a generalist hominid taxon.

This volume is the first book in a projected series of monographs devoted to paleontological research in the Middle Awash. As such, it represents a landmark publication. Descriptions of important specimens are very detailed, and include extensive metrical data. Photographs of important specimens are superb. The comparative analysis of the Daka calvaria is an important contribution to hominid paleontology, and the discussion of hominid systematics is thoughtful. A practical consideration is that the book is moderately priced, given its high production standards. I therefore highly recommend this volume to researchers who study either early Pleistocene African mammals or hominid paleontology, especially those studying the taxon *Homo erectus*.