

## The First Humans—Origin and Early Evolution of the Genus *Homo*

Frederick E. Grine, John G. Fleagle, and Richard E. Leakey (eds.)

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#### EARLY *HOMO* COMES FULL CIRCLE

This volume is a result of the third conference organized by Stony Brook University held in October 3–7, 2005. Like some of the other workshop proceedings volumes in this conference series, this book contains chapters and contributions from different perspectives. There are 17 chapters and 31 contributors in total, all collectively covering a range of topics including Plio-Pleistocene environments and fauna, various *Homo* species including African specimens as well as those from Dmanisi and Liang Bua, endurance running, the early *Homo* shoulder, inter-limb proportions, teeth and diet, and Paleolithic archaeology. The fact that this conference and resulting volume were the efforts of numerous individuals and institutions is reflected in the overall high quality of the chapters. A volume such as this has long been pending and is published at a timely juncture in paleoanthropological research. It represents an extremely valuable and useful source of data as well as theoretical concepts and testable hypotheses regarding early *Homo* evolution and dispersal. Additional details, such as the specimen index and site/locality index will be particularly useful for reference purposes.

The introduction chapter by Richard Leakey is a brief background to the discoveries of early *Homo* and some key questions that require further research are outlined. Leakey describes the current taxonomic issues within the genus *Homo*, and the debates are yet far from resolved. The primary questions surround the decision concerning whether *Homo habilis* should be a part of the *Homo* genus or the *Australopithecus* genus. KNM-ER 1470 and KNM-ER 15000 continue to take center stage as they are two of the most well-known and earliest fossil *Homo* specimens in East Africa. Tobias' chapter (2) is a retrospect on the famous and now historical discovery and naming of the first *Homo habilis* specimen from Olduvai Gorge (Olduvai Hominid 7 or OH 7). His views reflect the important background, early implications, and the intellectual context of recognizing an intermediate species between *Australopithecus* and *H. erectus*. In the 1960s, an evolutionary gap seemed to have been filled. Today however, this situation has altered somewhat in that *H. habilis* may share chronological overlap with *H. erectus*, at least in the Turkana area. Although most paleoanthropologists know the story behind the naming of *Homo habilis*, it is delightful and enlightening to read about it first hand from Tobias himself. His account also touches upon the personality and the then strong conviction of L.S.B. Leakey about the interpretation and implication of

OH 7. It is interesting to note that the "assault on *Homo habilis*" may have subsided over the decades but continues to persist among some scientists. One problem with this is the low number of early *Homo* fossils in comparison to Australopithecine fossils.

Chapters 3 and 4 both discuss the biological beginnings of early *Homo*. While Wood (Ch. 3) takes a more comprehensive approach in his definition and criteria of recognizing the earliest *Homo* (adaptations, diet, locomotion, dexterity), Kimbel (Ch. 4) dwells specifically on a suite of anatomical features, specifically the face, calvaria, mandible and dentition. Due to the lack of adequate fossil evidence, it is challenging for both to address the post-cranial attributes in defining early *Homo*. Kimbel provides a useful summary of descriptions of putative specimens representing early *Homo*. Out of the five fossil candidates of earliest *Homo*, two of them are still not well dated—Sts 19 (2.7–2.3 Ma?) from Sterkfontein, South Africa, and UR 501 (2.5–1.9 Ma?) from the Chiwondo Beds of Malawi. Additionally, the fossils from the Chemeron Formation in Kenya (KNM-BC 1) and the Hadar Formation in Ethiopia (A.L. 666-1) are not assigned at the species level. Therefore, not only is the known fossil evidence sparse, but the specimens themselves are highly fragmentary and not well-preserved. Nonetheless, it is perhaps not coincidence that the earliest age brackets of early *Homo* overlap with the age of the earliest-known stone tools from Gona, Ethiopia. The possibility of *A. garhi* being able to make/use stone tools also is important and probably reflects the beginning of biological and behavioral transformations from *Australopithecus* to *Homo*. In his conclusions, Kimbel highlights the contemporaneity of *H. habilis*, *H. rudolfensis*, and *H. erectus* between 1.7 and 1.8 Ma in E. Africa; *H. ergaster* is also thought to be a separate and contemporaneous species by many specialists. Indeed, Wood also does not describe *Homo ergaster* as a separate species per se. In any case, Wood highlights the possibility of *Homo habilis* not being in the human lineage from cladistic analyses done by others. At the same time, he is highly critical about others' decision to include chimpanzees and bonobos within the *Homo* genus, based on comparative molecular evidence. In conclusion, he is of the opinion that *H. habilis sensu stricto* and *H. rudolfensis* should both be excluded from the genus *Homo*.

Chapter 5, by Rightmire and Lordkipanidze, has the distinction of being the only chapter on early *Homo* fossil evidence outside of Africa—the now famous and unique site of Dmanisi in West Asia. The evidence from this site

has contributed in several profound ways to changing our perceptions of early *Homo*: 1) that they left Africa earlier than we thought; 2) that a hominid older than and other than *Homo erectus* first left Africa; and, 3) the possibility that *Homo erectus* may have speciated in Asia rather than Africa (White, 1995). Early scientists like E. Dubois would have been happy with the last point as that is what they believed for slightly different reasons. Though the taphonomic history of Dmanisi has yet to be fully understood, this site is now well known for its multiple, well-preserved *Homo* fossils, rich faunal assemblages, and abundant Oldowan artifacts. This is also the first chapter in the book to include an explicit trait list of skull and teeth of the genus *Homo* (p. 42). The main debate that has arisen from the Dmanisi fossils is whether they are *H. habilis*, *H. erectus*, *H. ergaster*, *H. georgicus*, or represent more than one taxon at the site. The finds have also brought into question the degrees of morphological variation within various *Homo erectus* populations as they are very different from both their African and East Asian counterparts.

Grine et al.'s Chapter 6 deals with permanent molar cusp areas to assess phonetic attributes between three fossil-hominin-bearing sites in South Africa. They conclude that these specimens may be regionally unique and possibly represent new species or lineage of early *Homo*. Incidentally, a new species of early *Homo* (*H. gautengensis*) has been recently reported by Curnoe (2010) from South Africa museum collections and is assigned the age bracket of 2.0 to 1.26–0.82 Ma. This makes it the oldest known *Homo* specimen at the species level and possibly one with the longest longevity. From the three chapters on post-cranial perspectives on early *Homo*, Larson's Chapter 7 is unique in specifically addressing the hominin shoulder. She rightly highlights the relatively lengthy preservation of ancestral or primitive shoulder traits despite the habitual stone-tool-making behavior of early *Homo*. Her observations on the hominin shoulder have major implications on the concepts of throwing and running in early *Homo* evolution. In Chapter 8, Lieberman et al. expand upon the controversial topic of endurance running and its evolutionary significance for early *Homo*. Despite criticism by some scientists, the concept of endurance running (ER) and persistence hunting (PH) are theoretically relevant to the behavioral evolution of hunting and in early humans. This is possibly reflected in our anatomical features for the past two million years, as well as several ethnographic accounts.

The final chapter (9) in the post-cranial section is by Jungers and focuses on the variability and scaling of interlimb proportions in humans and fossil hominins. After Rightmire and Lordkipanidze's chapter, this is the second chapter to discuss and utilize fossil evidence outside of Africa – that of the enigmatic *Homo floresiensis* from SE Asia. Basically, a comparative study is done between two small-bodied fossil hominins separated in both time (over 3 myr) and space (East Africa and SE Asia)—A.L. 288-1 ('Lucy') or *A. afarensis* and LB 1 or *H. floresiensis*. Jungers essentially argues that they both have a high humerofemoral index and are not just 'proportionately smaller' humans,

including in locomotor performance. Chapter 10 addresses one of the most famous and most complete hominin fossils to date—WT 15000 or *H. erectus*. The conflicting issue of physical maturity in early *H. erectus* is confronted and Dean and Smith re-assess various features of this juvenile boy's skeleton including detailed SEM analysis of the fossil's dentition or dental microanatomy to estimate age at death. Several times in the chapter Dean and Smith caution against comparing the rate of *H. erectus* growth and development with that of modern humans. Ultimately, the authors suggest comparatively earlier maturation levels or earlier behavioral independence in *H. erectus* as an alternative model. In the next chapter (11), Ungar and Scott go into greater dental specifics to address the topic of early *Homo* diets. Appropriately complementing the other dental studies in this volume (molar cusp proportions and dental microanatomy), the authors of Chapter 11 rely on dental topographic analysis of molars to state that early *Homo* was markedly turning to new types of foods which required adaptive specialization. They link this behavior and dietary 'shift' to changes in the environment, combined with stone-tool use as well as increasing reliance on specific savanna resources.

Roche and colleagues look at the archaeological record during the time of early *Homo* in Chapter 12, and address various aspects of technology and typology and touch upon the ongoing debate about hunting vs. scavenging. The authors discuss the Oldowan, the earliest Acheulean, and the transitional interval in between. Several important observations are made such as how distinguishing between cut-marks and non-hominin marks on vertebrate fossils continues to be a methodological problem, despite advances in recent years. In relation, percussion has been increasingly discussed for its role in early hominin behavioral evolution. On p. 138, the authors state that only three specific techniques were utilized during Oldowan tool production: 1) direct percussion with a hard-hammer; 2) direct percussion on an anvil without a hammerstone; and, 3) bipolar percussion between a hand-held hammer and anvil. Perhaps one more technique may be added here—the *throwing* of a clast against a larger anvil to split pebbles/cobbles to obtain striking platforms. The authors also mention the behavior of in-bulk stockpiling of raw materials on the landscape, as previously suggested by others, but there are several problems with that nonetheless plausible scenario. One is that the hominins would have to always remember locations of all or most stockpiles within their catchment zones; also, kills or scavenging events may not always occur near these raw material stockpiles; and, finally, all hominins in a group may not be aware of the locations of these stockpiles. Thus it is perhaps more likely that finished flakes/scrapers and small cores were carried/transported continuously across the landscape rather than stockpiling of raw materials.

At the end of their chapter, they grapple with the age-old question of 'Who made the earliest Oldowan tools?' and make an important point about it (p. 143)—"Oldowan stone tools are found over such a long period of time, and

in so wide a range of contexts that any hypothesis linking their appearance to a one-time-only behavioral shift among a single hominin species is almost certainly wrong.” They also rightly observe that “the initial stages of stone knapping was isolated and sporadic” (p. 135) and that carnivory may have been infrequent during this stage as well. Although the authors mention lithic variability and the contemporaneity of several *Homo* and non-*Homo* species (an observation also repeated in several chapters by others), they do not make a stronger causal link between the two. In fact, there must have been multiple technological innovations and ‘dead-ends’ within the Oldowan and among different hominin groups and species (Chauhan 2011). In my opinion, multiple hominin species making and utilizing the Oldowan would perhaps be the *leading* factor affecting variability within the Oldowan. A hypothetical example—*H. habilis* may have used lithics more for plant processing, while *H. erectus* may have used them more for meat-processing. This would result in significant archaeological variation in terms of assemblage compositions, artifact densities, site contexts, and so forth. Other theoretical interpretations also can be considered—perhaps Oldowan tool-making was not as habitual in the earlier phases, and *not* requisite for dispersals within and out of Africa (Australopithecines radiated to all parts of Africa without habitual/frequent stone technology). *A. garhi* as a stone tool user remains enigmatic and speculative and both may be mutually exclusive at 2.5 Ma. Grine and Fleagle later state that prior to ~1.3 Ma (i.e., the extinction of *Paranthropus*), it is difficult to unequivocally attribute all stone tool technology exclusively to *Homo*. In indirect relation to this, a recent paper by Key and Lycett (2011) demonstrate through controlled comparative experiments (see also Rolian et al. 2011) that “biomechanical parameters related directly to efficiency of use (i.e. gripping), may plausibly have been subject to selection in the earliest stone tool-using hominins.” They further state that “further understanding potential links between changes in human hand anatomy and the appearance and/or intensification of stone tool cutting tools – as indicated by the Oldowan – represents our primary opportunity to investigate the plausibility and prevalence of ‘gene-culture’ co-evolution at the very beginnings of observable hominin material culture.”

Maslin and Trauth cover an important and leading topic of research in their Chapter 13—the causal link between Plio-Pleistocene climate change and hominin evolution in East Africa. The main thrust of the chapter is pulsed climatic variability but they touch upon other related aspects such as tectonic history, moisture availability, orbital-forcing, and lake variability in East Africa. They, more or less, build further upon R. Pott’s climatic instability hypothesis and provide a general framework for establishing testable field projects in different parts of Africa. One of the most obvious geographic biases in the last few decades is that paleoanthropological research has mostly taken place in northern, eastern, and southern Africa but not as much in the intermediate zones. Additionally, it needs to be seen, through long-term projects and database correlations,

whether global climatic changes were influencing global hominin groups to the same degree. In Chapter 14, Reed and Russak approach this broad topic of climate variability in relation to the first appearance of the genus *Homo*. Recently, the Pliocene-Pleistocene boundary was shifted from 1.8 Ma to 2.6 Ma by the International Union of Geological Sciences (McGowran et al. 2009). This has serious implications for the discipline of paleoanthropology (see this link for further details and petition: <http://www.paleoanthro.org/pliocene.htm>).

Both chapters (13 and 14) complement each other and the latter utilizes several statistical tests using paleo-ecological data from a number of fossil hominin sites—changes in environments, fauna and hominin association vary from region to region but overlap at some sites/zones. In Chapter 15, Bobe and Leakey go a step further by focusing on mammalian ecology in the Omo-Turkana Basin, which has direct implications for land-use difference (or similarities) for the multiple *Homo* species there. One challenge or problem they outline is pinpointing the first appearance of *Homo* in the region due to taxonomic difficulties as well as preservation factors (hominins make up less than 1% of the paleofauna there). The fauna broadly reflects a major increase in grasslands soon after 2.0 Ma though early *Homo* had already arrived here by at least 2.4 Ma. The last chapter with data is that of Sponheimer and Lee-Thorp (16), who provide biogeochemical evidence from three South Africa sites, which can be broadly compared in the context of the faunal and general climatic evidence discussed in the previous chapters. This work and that of Grine et al. (Ch 6) both address different types of data from Sterkfontein and Swartkrans. Two different sources of stable isotopic data are presented—herbivore dental material and sediments from the concerned sites. Their main aim is to compare differences in habitat use/preference between *Homo* and *Australopithecus* groups and whether both were differentially adapted to arid and moist environments, respectively. They caution against linking the “opening up of African landscapes” with aridification and linking the appearance of *H. ergaster/erectus* with specific climatic changes (i.e., development of Walker circulation). Again, the lack of adequate fossil evidence for *Homo ergaster* is pointed out and this fact resonates throughout the volume in different chapters. Obviously more fieldwork is required in sediments dating between 2.5 Ma and 3.0 Ma (or even up to 3.5 Ma) to search for the earliest *Homo* fossils and the beginning of stone tool making, especially in regions outside East Africa. For example, McPherron et al. (2010) have reported possible stone tool cut-marks from Ethiopia, dating back to about 3.4 Ma (however, see Dominguez-Rodrigo et al. 2010 and 2011 for criticism). Due to such causal links casually made over the decades (based on unreliable or insufficient evidence), Sponheimer and Lee-Thorp conclude with an important question: “Could the emergence of *Homo* be explained by intrinsic (e.g., social, cognitive, reproductive) rather than extrinsic (e.g., climate, environment, community ecology) factors?” One simple but probable answer is that both intrinsic *and* extrinsic factors played varying but

important roles in the biological appearance and development of *Homo*.

While Leakey introduced the volume in his opening chapter, the two remaining volume editors (Grine and Fleagle) end with a summary chapter synthesizing all the previous contributions and topics in the volume. Divided into five distinct parts, the authors confront the various problems, interpretations in relation to early *Homo* and also explore future prospects of related research. One very vivid point that is made at the end of their synthesis chapter is that there are still many questions that remain to be answered on early *Homo*:

- “Were there several species, only one of which gave rise to *H. erectus*? Did one or more disappear for reasons that remain unclear?”;
- Which species first left Africa?;
- Was early *Homo* responsible for the gradual extinction of contemporaneous non-*Homo* species?;
- Are Lower Paleolithic points of origin only in Ethiopia or elsewhere?
- We also still do not know that much about early *Homo* evolution in Africa, e.g., exploitation of central African region; earliest colonization of northern and southern Africa; the general absence of Australopithecines in northern and western Africa; the role of West Africa in early human evolution.
- It is also not known which *Australopithecus* species—including *A. afarensis*—was ancestral to the *Homo* genus.

As noted, scenarios to emerge in the coming years are likely to reveal a highly complex origin and history of early *Homo*, the discovery of new species/genera withstanding. One important point they raise along with some of the other authors is that there are more assumptions than facts in our understanding of early *Homo*, including our interpretations of the level of carnivory at the time (the current amount of sites with cut-marked bones is extremely low). Grine and Fleagle also refer to the specimen WT-15000 as “the aptly named “strapping youth,” a description coined soon after the fossil was found. A recent study (Graves et al. 2010), however, suggests an alternate possibility—that this individual died at age 12 (instead of previous younger estimates) and, more importantly, would not have been as “strapping” as previously thought. Unfortunately, our entire understanding of *Homo erectus* growth and development is largely limited to a sample of one—the Nariokotome boy—as almost no other *Homo erectus* post-cranial fossils are known (but see recently reported *H. erectus* female pelvis [Simpson et al. 2008; also see for Ruff 2010 for criticism on taxonomic identification and ecogeographic implications of that pelvis]). Despite the lack of adequate fossils, our knowledge of early *Homo* has increased considerably since the discovery of OH 7. Old concepts are being revised and new concepts are being introduced (e.g., physical maturity, levels of carnivory, dynamic ecological adaptations, endurance running, stone tool complexity, etc.). This volume clearly demonstrates that early *Homo* has, indeed, come full circle.

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