New evidence of the possible coexistence of two separate early human species

Philip Guelpa
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The generally accepted theory of the spread of ancient humans from Africa, where they first evolved, known as "Out of Africa," holds that a single species, *Homo erectus*, subsequently migrated to populate portions of Eurasia approximately 1.8 million years ago. There were multiple later waves of more evolved human ancestors emanating from Africa, culminating in the latest migration of modern *Homo sapiens* about 50,000 years ago. Hominin fossil specimens from Dmanisi in the Republic of Georgia, among the earliest known outside of Africa, have been classified as belonging to *H. erectus*. They exhibit marked morphological variation which has raised questions regarding whether or not they all belong to the same species. Does this mean that two different species of hominins coexisted at that time? What would that imply regarding the course of human evolution?

A newly published study seeks to examine the question of whether the Dmanisi specimens represent one or more species (Nery V, Neves W, Valota L, Hubbe M (2025) "Testing the taxonomy of Dmanisi hominin fossils through dental crown area." *PLoS One* 20(12): e0336484. https://doi.org/10.1371/journal.pone.0336484).

The question is important for more than simple taxonomic correctness. There is a longstanding debate among paleoanthropologists regarding whether human evolution developed along a relatively straight line—the Single Species Hypothesis—or with more of a branching model.

The Single Species Hypothesis posits that once early humans began developing and relying on technology to an increasingly significant degree, the selective pressure for biological evolution (i.e., physical changes in the body) lessened. The result, according to this theory, is that whatever adaptations developed in the body in response to changes in the natural environment, including migration to new regions, technological adaptation played an increasingly important role, thus dampening biological change. And, therefore, there was only one evolving species of humans at any given time, despite regional variation. Recent genetic research demonstrating genetic flow between modern humans and Neanderthals and Denisovans indicates that that these were not separate species, at least in the more recent history of human evolution.

The second hypothesis does not discount the role of technological adaptation but sees that there was an ongoing dialectic between that and biological evolution, and that the increasing importance of technology as opposed to biology developed slowly. That opens the possibility that multiple species of hominins, representing different mixes of technology and biology, may have existed at the same time, possibly reflecting adaptations to different ecological niches. When a "parent" species disperses geographically, occupying environmental settings that differ from the one in which it first evolved, both adaptation to new selective pressures and geographic distance tend to reduce gene flow between regions, thus tending toward genetic differentiation which, over time, can result in the emergence of separate species, in a process known as speciation.

The question of which pattern human evolution followed is straightforward. The means of testing it is not.

The standard criterion for differentiating between species is reproductive isolation (i.e., members of different species cannot reproduce resulting in fertile offspring). The classic example is mules, the product of mating between a horse and a donkey. The results of such pairings are live individuals, but they are sterile and cannot reproduce. Therefore, horses and donkeys, although they share a common ancient ancestor, are now members of different species. For obvious reasons, fossils cannot reproduce, so this form of observation cannot be used, unfortunately. Other, less precise, methods of

differentiating between species are needed.

First of all, the archaeological and paleontological record is by its very nature fragmentary. That is both in the number of specimens, archaeological sites, etc. that survive the millennia, and in the state of preservation of the remains. What is recovered is only a tiny fraction of the billions of individual humans who once lived. Paleoanthropologists rely primarily on bones, especially skulls, to classify skeletal remains as to what taxonomic classification (i.e., to what genus, species etc.) a specimen belongs.

Further complications arise due to a number of factors. The preserved remains are usually incomplete and often damaged, making comparison between individuals difficult. Moreover, there are variations in morphology based on age and sex. The inability to observe living individuals makes the significance of these variations difficult to assess. Gorillas and chimpanzees, for example, exhibit marked sexual dimorphism—males and females differ notably in body size, for example, even though they are members of the same species. However, while the size of their teeth is sexually distinct, the morphologies (shapes) are not.

Among the Dmanisi specimens there is significant variation in skull morphology, which has, until now, been attributed to sexual dimorphism. However, the poor state of preservation makes a firm determination as to the taxonomic affiliation of each specimen problematic. Previous studies had identified some similarities between the cranial morphologies of some of the Dmanisi specimens and those of the early hominin genus *Australopithecus*, while others more closely resembled early *Homo habilis*, the earliest recognized members of our genus. Therefore, the authors of the new study chose to use a physical feature that is highly resistant to deterioration—the morphology of dental crown enamel—an already well-established technique for studying taxonomic relationships.

The new study conducted a statistical analysis of dental crown dimensions and morphology of the rear (premolars and molars) dentitions of a sample of both mandible and maxillary specimens from three Dmanisi individuals. These data were then compared to similar data from a range of fossil hominins as well as from gorillas and chimpanzees.

The results indicated that one Dmanisi specimen showed a strong similarity to members of the early hominin genus *Australopithecus*, while two demonstrate stronger affinity to early *Homo*. The authors further observe that the size differences represented by the Dmanisi specimens appear to fall in a range similar to that found between male and female gorillas, but the morphologies differ. On balance, they feel that the dental evidence in conjunction with the cranial favors the conclusion that the Dmanisi fossils represent two different species, which they name *Homo georgicus* and *Homo caucasi*—with the former more closely resembling *Australopithecus*, which is associated with the more robust primitive Dmanisi skull, and the latter closer to early *Homo*.

The implications of this interpretation suggest a more complicated evolutionary history for our genus than the straightforward single species hypothesis. Did these two species evolve separately from an ancestral common early member of the genus *Homo* in Africa, perhaps in different environmental settings, with one retaining more primitive (australopithecine) characteristics, but somehow migrate into Eurasia together? If so, what was the dynamic of their interaction? Or, despite the results of the dental analysis, do the Dmanisi fossils in fact represent a single, highly sexually dimorphic species?

There is other evidence of the coexistence of two distinct early hominin species. At the site of Koobi Fora in Kenya, dating to approximately 1.5 million years ago, a track of footprints interpreted as representing two species were found together—one attributed to *Homo erectus* and the other to *Paranthropus (Australopithecus) boisei*.

It should be noted that the Dmanisi fossils are associated with very primitive, Oldowan stone tools, without the later Acheulean handaxes produced by *Homo erectus*.

Only further research and analysis have the potential to clarify this intriguing question.