

Press backgrounder

Postcranial evidence from early *Homo* from Dmanisi, Georgia

embargoed for release until September 19, 2007, 18:00 London time

(publication date in *Nature*: September 20, 2007)

Topic

The fossil hominins from Dmanisi, Georgia, are the earliest representatives of our own genus outside Africa. New finds now show that these small-sized, small-brained representatives of early *Homo* already walked and ran like modern humans.

Where is Dmanisi? And how was the fossil hominin-bearing site found?

Dmanisi is in Southern Georgia, close to the city of Kazreti, about 100km from the capital Tbilisi. Dmanisi was a medieval city situated on a hilltop. In 1983, archaeological excavations in the ruins of the old city led to the fortuitous discovery of Plio-Pleistocene sediments containing animal bones. Later on, stone tools and hominin remains were recovered from the site.

What is the special significance of the Dmanisi site?

This site yielded the best-preserved and largest sample of early fossil *Homo*. Up to now, remains from at least six individuals have been found. Their state of preservation is exceptional, such that many previously unknown aspects of the skeleton of fossil hominins can be studied here for the first time, and in more than one individual. Thanks to the volcanic origin of the Dmanisi sediments, the site is well dated to 1.77 mio years before present, just at the border between the Pliocene and the Pleistocene (ice age).

Together with the hominin skeletal material, a wide variety of animal and plant remains were found, which permits reconstruction of the ecological context: the climate was temperate and relatively humid, and the landscape comprised forested as well as steppic areas. Stone tools found at Dmanisi and cutmarks on animal bones indicate that the hominins were actively involved in meat processing.

Geologic analysis of the stratification pattern of the Dmanisi site suggests that all hominin and faunal material was transported by water over a short distance, then rapidly covered by sediments. The geologic time frame for the formation of the site is relatively short (some millennia), which leads to the conclusion that all hominin finds represent a single palaeopopulation.

Who were the Dmanisi hominins? And where did they come from?

They are the first representatives of our own genus (*Homo*) outside Africa, and they represent the most primitive population of the species *Homo erectus* known to date. *H. erectus* is known from fossil finds from Africa through to East Asia (China and Indonesia) in the time between 1.7 to 0.4 mio years ago. The geographic origins of *H. erectus* are still unknown. The Dmanisi hominins might be ancestral to all later *H. erectus* populations, which would suggest a Eurasian origin of *H. erectus*. Another scenario proposes that *H. erectus* originated in Africa, and that the Dmanisi hominins might represent its first dispersal out of Africa. More and earlier hominin fossils are needed to support one or the other hypothesis.

What are the most relevant new findings presented in the Nature paper?

Up to now, the anatomy of *H. erectus* was almost exclusively known from skulls. Skeletal remains from the rest of the skeleton (the so-called postcranial skeleton) were extremely rare and fragmentary. Up to now, only one juvenile *H. erectus* individual from Nariokotome (Africa) was known. So we did not know much about the “erectness” of *Homo erectus*.

Now we have postcranial remains from four individuals. The bones are extremely well preserved, and many elements of the skeleton are seen for the first time in the fossil hominin record. This permits an array of inferences regarding the evolution of body constitution, locomotion and arm movement in early *Homo*:

- **The Dmanisi hominins were of short stature and had small brains.** The Dmanisi postcranial skeletons are associated with skulls found earlier in the same fossil-bearing layers. This provides the unique opportunity to estimate stature, body mass, and most importantly, brain size relative to body size (the so-called encephalization quotient). Our analyses show that the Dmanisi people were small (ca. 150cm). When related to body size, their brains were smaller (600-800 ccm) than those of “classic” *Homo erectus* from Africa and Asia (700-1000). In this respect, they are closer to the very first representatives of the genus *Homo* (*Homo habilis* from Africa, ca. 2 mio years) than to their later conspecifics.
- **The Dmanisi hominins were small compared to African *Homo erectus*.** Differences in body size might reflect differences in ecological context, as we see it in modern humans. Dmanisi was a forested, relatively humid habitat in a temperate zone with cool winters, while East Africa was a relatively dry and hot steppic environment. This might explain the contrast between the stout, short Dmanisi people and the lean, tall *H. erectus* from Africa.
- **The Dmanisi hominins walked and ran like modern humans.** We infer this from their limb proportions, which were similar to those of modern humans: legs are longer than arms; thighbones are especially long. Moreover, the vertebral column had an S-shape, and the foot had a well-developed arch. These features indicate that the Dmanisi hominins were well adapted to long-distance walking and running, like modern humans.
- **Shoulders and arms of the Dmanisi hominins were quite distinct from those of modern humans.** The upper arm bones were less twisted than in modern humans, such that the hands were more outward oriented in resting position. We interpret this condition as an ancestral feature. We do not yet know what this pattern means in terms of function, but obviously, the Dmanisi arms had a range of movement that was different from that of our own species.

What do the new finds tell us about the evolution of *Homo*?

The Dmanisi hominin fossils provide a snapshot of one important time period during the evolutionary making of humans. The Dmanisi hominins exhibit a unique mosaic of “primitive” (ancestral) and “derived” (novel, descendant) features. This shows that human evolution is a process during which novel features of the body evolve over long time periods. Obviously, the pace of evolution was different for different body parts. While the Dmanisi people were almost modern in their body proportions, and were highly efficient walkers and runners, but their brains were tiny compared to ours, and their arms moved in a different way. Nevertheless, they were sophisticated tool makers with high social and cognitive skills.

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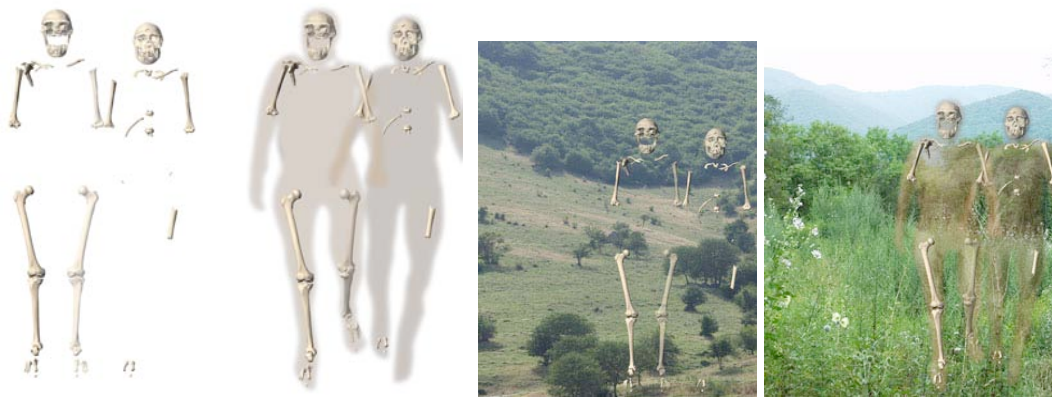
picture gallery

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Dmanisi_site1, 2, 3, 4: snapshots from the excavation site, showing various animal and hominin bones in their original position in the sediment.

Picture credits: Tea Jashashvili, Univ. Zurich



Dmanisi_skeletons1, 2, 3, 4: computerized virtual reconstruction of the two most complete skeletons from Dmanisi, that of an adult (left) and that of an adolescent (right); background: landscape at Dmanisi.

Picture credits: M. Ponce de León & C. Zollikofer, Univ. Zurich



Dmanisi+human_femur, Dmanisi+human_tibia: thighbones (femora) and shinbones (tibiae) of the Dmanisi hominin (bottom of pictures) and of four modern humans

Picture credits: Tea Jashashvili, Univ. Zurich