New hominin fossils from Malapa: The unveiling of *Australopithecus sediba*

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The odds of archaeologists finding a nearly complete skeleton went up dramatically when humans began to bury their dead in formal graves. But this began only about 50 000 years ago, a relatively recent date in terms of human origins and only a small portion of the four-million-year history of our ancestral line. Before formal burial, the physical remains of our ancestors were processed by the environment in the same way as any other dead animal: chewed up by scavengers, dispersed in a river bed, on the open veld or in a cave, and finally preserved by fossilisation as isolated bones. Nearly complete skeletons in the fossil record of our earliest ancestors are as rare as the proverbial 'hen's teeth'. The discovery of the hominins from Malapa announced by Lee Berger[1] has been just such a rare occurrence.

Berger and his colleagues[1] provide the initial description and context for two fossil specimens recovered from the Malapa site in the Cradle of Humankind, just outside of Krugersdorp, South Africa. The skeletons are securely dated to between 1.95 and 1.78 million years ago,[2] placing them at a critical juncture of human evolution; around the time of the first appearance of the genus *Homo*. The bones are well preserved and were in a state of semi-articulation at discovery, demonstrating no sign of scavenger activity. They were deposited, along with other debris including non-hominin animal bones, in a water-washed environment deep within what would then have been a typical limestone cavern. The two individuals must have fallen to their deaths down a vertical solution shaft and then been washed into a sediment trap deep within an underground river. What had been unlucky for them was very fortunate for Berger and, ultimately, fortunate for us. They had lain buried for nearly 2 million years until erosion exposed the site on the surface and the bones were noticed by Berger's son, Matthew.

The two skeletons are not quite complete. The first, designated MH1, a juvenile approximately 12–13 human years at death, is represented by about 40% of the skeleton, which includes much of the cranium and mandible. The second, MH2, is an adult, but has fewer bones preserved and is missing its cranium. The percentage preservation of MH1 is about the same as the partial skeleton 'Lucy' from Hadar in Ethiopia (AL 288-1), but less than the Nariokotome boy (KMN-WT 15000) from Kenya and, the almost complete but still to be excavated, 'Little Foot' skeleton from Sterkfontein (Stw 573). Although rare, these partial or nearly complete skeletons provide the researchers with information about body proportions and functional anatomy that is much more difficult to glean from isolated bones, so their value cannot be understated.

Berger and his colleagues[1] have considered the anatomy of their find and have come to the conclusion that it represents a new species that they have named *Australopithecus sediba*. In this they had a choice: either they could have lumped the specimens into the pre-existing category of *Au. africanus*, or placed it into the more advanced group known as *Homo habilis*, but they felt that its anatomical features were a 'unique combination of primitive and derived traits'. The cranium, in particular, gives clues that these individuals had not yet crossed the line of humanity that we code with the name *Homo* and thus best fit within the Australopithecine anatomy that was common in the period before 2 million years ago. The cranial volume is relatively small and there is a suite of anatomical features on the cranial vault, face and jaws that are clearly 'primitive' (i.e. Australopithecine). But the post-cranium gives another suite of clues, especially in the pelvis, that are highly reminiscent of the anatomy of *Homo*. Berger and his colleagues[1] conclude by emphasising that the transition from *Australopithecus* to *Homo* was not a smooth process and that there was a mosaic of features appearing at different times. For them, *Australopithecus sediba* is on the transition line of, but still within, the Australopithecines.

The unfolding lineage of human evolution in the Plio-Pleistocene of Africa has been a centre of debate for decades. There are two clear lines of Australopithecine evolution: firstly, a gracile variety that appeared around 4 million years ago, including *Ardipithecus*, followed by *Australopithecus afarensis* around 3.5 million years ago and *Au. africanus* about a million years later and, secondly, a robust line identified as the separate genus *Paranthropus*, appearing around 2.5 million years ago and existing alongside early *Homo* until about 1.5 million years ago. But where did *Homo* come from? Tobias has designated *Au. africanus* as the ancestor,[3,4,5] but Johanson and White[6,7] pushed for *Au. afarensis*, after its discovery was announced in 1978. The Johanson and White[6,7] model suggested an early separation for *Homo* and a long dead-end path for *Au. africanus*. The profusion of new fossils discovered in east Africa in the 1980s and 1990s seemed to support branching human lines between 2 and 3 million years ago, implying that early *Homo* was one of a nest of natural experiments in hominin speciation. The new discovery at Malapa places the late-divergence model back on the table and, again, brings *Au. africanus* into the range of possible ancestors for early *Homo*.

So, how will these specimens from Malapa be received by the scientific community? Anatomical detail is always open to interpretation and, as other scholars get a chance to study the bones, there will be new opinions, but the real issues will be about the taxonomy of the specimen and the philosophical meaning of the categories. Much of the debate will revolve around the validity of the taxon *Homo habilis*, a name that was originally coined by Leakey, Tobias and Napier[8] and based on the fossils from Olduvai Gorge in Tanzania. *Homo habilis* was not an 'easy sell' to the palaeoanthropological community. Some scientists rejected the taxon because they felt it was unnecessary; there was simply not enough difference between the specimens of *H. habilis* and those of *Au. africanus* to warrant a new species. However, Berger and his

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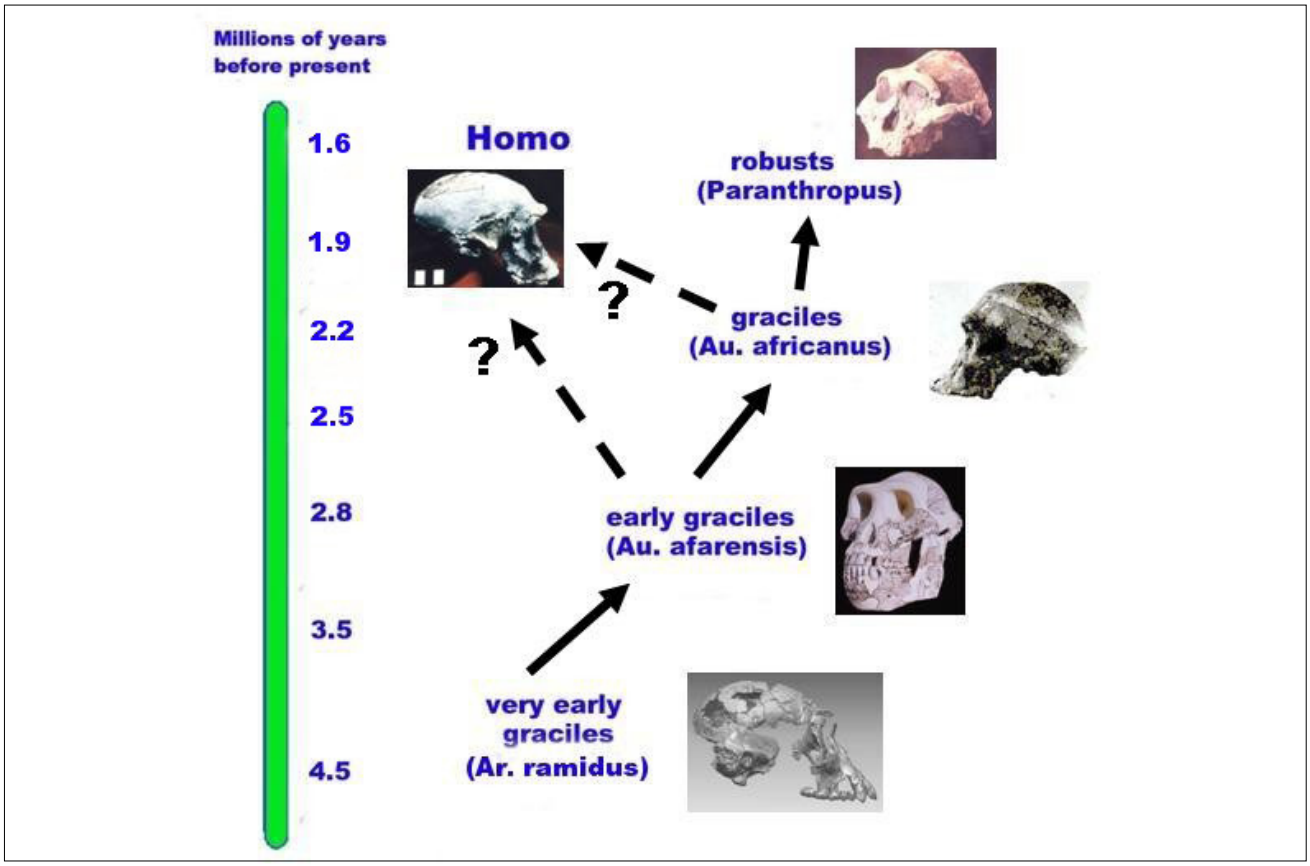

Simplified chart of Plio-Pleistocene Australopithecine evolution with late and early divergence points for the genus *Homo*

colleagues[1] have suggested that some of the specimens placed into *H. habilis*, such as the Sterkfontein skull Stw 53 and the Olduvai post-cranial set OH 62, are more like their discovery and less like *Homo*. This will certainly open up the whole *H. habilis* argument once again. The relatively late date for Malapa might also trigger some debate. *Australopithecus garhi*, a relatively newly identified species of *Australopithecus*, discovered in east Africa and dating from around 2.5 million years ago,[9] was associated with animal bone that had been chopped with stone tools and thus may represent the same anatomical grade described from Malapa. Phillip Tobias[5] has said that the hallmark of humanity was the manufacture of stone tools and, as such, *Au. garhi* could make a better ancestor, both in terms of behaviour and anatomy, than the Malapa remains that are more recent by half a million years.

Early in January 2010, a group of international scholars met in Johannesburg, under the auspices of the Institute for Human Evolution at the University of the Witwatersrand, to gather information about the post-cranial bones of the Australopithecines. The workshop, in honour of the late Charles Lockwood, provided a real opportunity to discuss the anatomy of the accumulating set of fossil bones stored in Johannesburg and the plan was to discuss the production of a definitive volume on the post-cranial anatomy of the genus *Australopithecus*. Berger was invited but chose not to attend. The workshop project is on-going and it is anticipated that the skeleton of 'Little Foot' (Stw 573) will be made available during 2010, as it is removed from the adhering matrix that has held it for the past 3 million years. The specimen, Stw 573, is at least 2.7 million years old and comes from the lower members of the Sterkfontein cave deposit.[10] This age is important because it is either an early form of *Au. africanus*, or it is the first evidence we have found of *Au. afarensis* outside of east Africa. Either way, the fact that it is so complete means that it represents our best opportunity by far to study the 'whole body' anatomy of these creatures. Hopefully Berger will make his new specimens available as well, now that his find has been officially announced. One of the outcomes of the January workshop was the recognition that naming new species on the basis of single specimens (or double in the case of Malapa) may not be the wisest idea when the species under observation is extremely variable. It is precisely this kind of discussion involving anatomical experts and the full range of available specimens that will lead to the consensus that will ultimately make clear the importance of the new finds from Malapa. ■

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