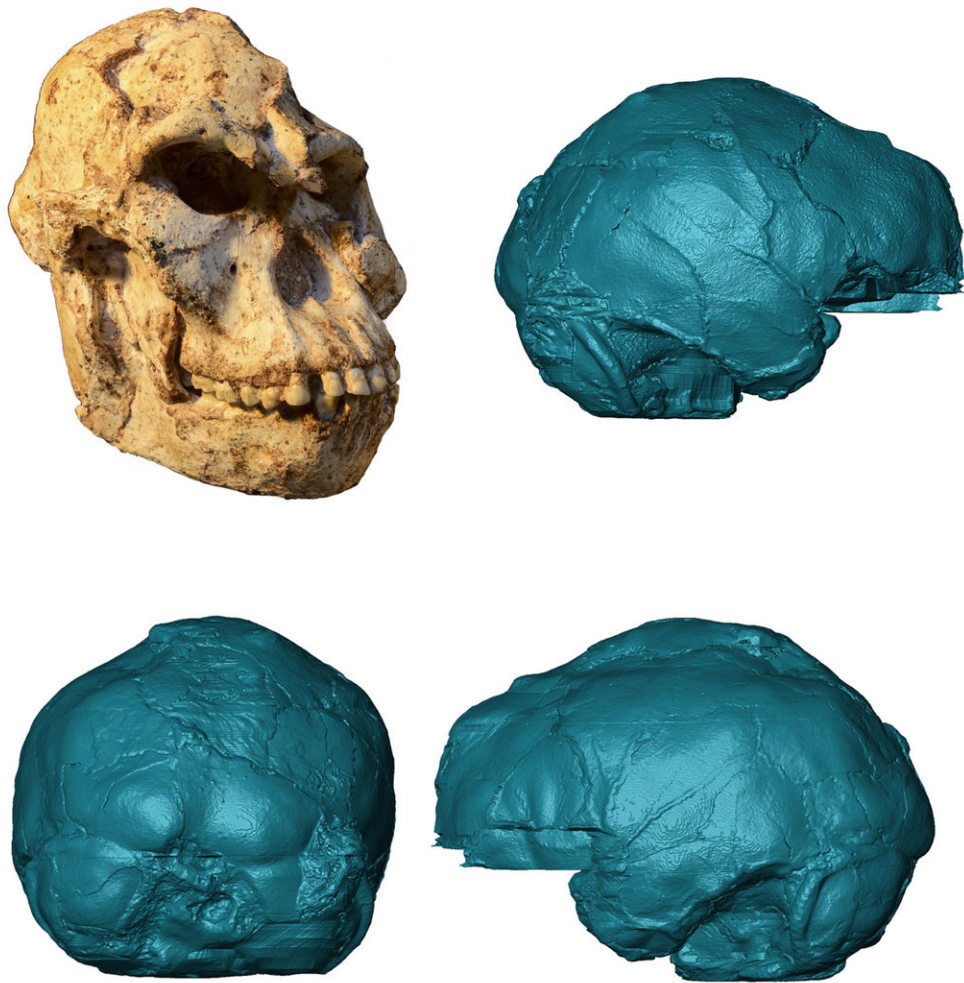


Peering into Little Foot's 3.67 million-year-old brain

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Virtual rendering of the brain endocast of "Little Foot". Photo of the original skull by M. Lotter and R.J. Clarke. Credit: Wits University

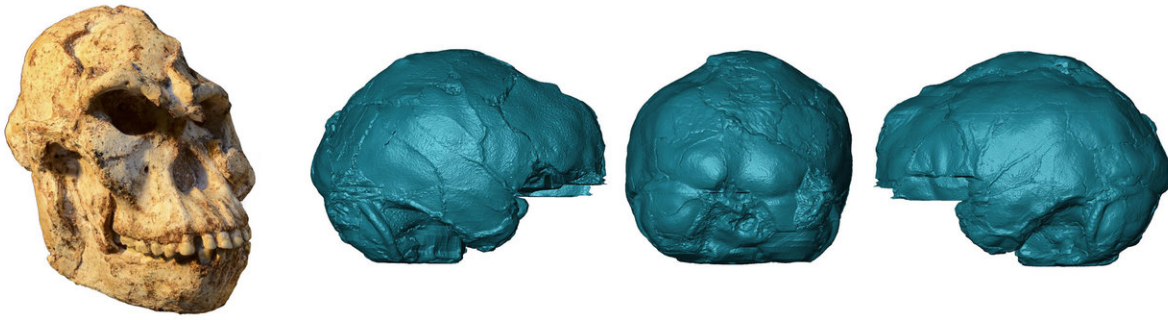
First ever endocast reconstruction of the nearly complete brain of the hominin known as Little Foot reveals a small brain combining ape-like and human-like features.

MicroCT scans of the Australopithecus fossil known as Little Foot shows that the [brain](#) of this ancient human relative was small and shows features that are similar to our own brain and others that are closer to our ancestor shared with living chimpanzees.

While the brain features structures similar to [modern humans](#)—such as an asymmetrical structure and pattern of middle meningeal vessels—some of its critical areas such as an expanded [visual cortex](#) and reduced parietal association cortex points to a condition that is distinct from us.

The Australopithecus fossil named Little Foot, an ancient human relative, was excavated over 14 years from the Sterkfontein Caves in South Africa, by Professor Ronald Clarke, from the University of the Witwatersrand (Wits). Its brain endocast was virtually extracted, described and analysed by Wits researcher, Dr. Amélie Beaudet, and the Sterkfontein team by using MicroCT scans of the fossil.

The scans reveal impressions left on the skull by the brain and the vessels that feed it, along with the shape of the brain. Beaudet's research was released as the first in a series of papers planned for a special issue of this journal on the near-complete "Little Foot" skeleton in the *Journal of Human Evolution*.



Virtual rendering of the brain endocast of "Little Foot". Photo of the original skull by M. Lotter and R.J. Clarke. Credit: Wits University

"Our ability to reconstruct features of early hominin brains has been limited by the very fragmentary nature of the fossil record. The Little Foot endocast is exceptionally well preserved and relatively complete, allowing us to explore our own origins better than ever before," says Beaudet.

The endocast showed that Little Foot's brain was asymmetrical, with a distinct left occipital petalia. Brain asymmetry is essential for lateralisation of brain function. Asymmetry occurs in humans and living apes, as well as in other younger hominin endocasts. Little Foot now shows us that this brain asymmetry was present at a very early date (from 3.67 million years ago), and supports suggestions that it was probably present in the last common ancestor of hominins and other great apes.

Other brain structures, such as an expanded visual cortex, suggests that the brain of Little Foot probably had some features that are closer to the ancestor we share with living chimpanzees.

"In human evolution, when know that a reduced visual cortex, as we can

see in our own brain, is related to a more expanded parietal cortex—which is a critical cerebral area responsible for several aspects of sensory processing and sensorimotor integration," says Beaudet. "On the contrary, Little Foot has a large visual cortex, which is more similar to chimpanzees than to humans."

Beaudet and her colleagues compared the Little Foot endocast with endocasts of 10 other South African hominins dating between three and 1.5 million years ago. Their preliminary calculation of Little Foot's endocranial volume was found to be at the low end of the range for *Australopithecus*, which is in keeping with its great age and its place among other very early fossils of *Australopithecus* from East Africa.

The study also has shown that the vascular system in *Australopithecus* was more complex than previously thought, which raises new questions on the metabolism of the brain at this time. This might be consistent with a previous hypothesis suggesting that the endocranial vascular system in *Australopithecus* was closer to modern humans than it was in the geologically younger *Paranthropus* genus.

"This would mean that even if Little Foot's brain was different from us, the vascular system that allows for blood flow (which brings oxygen) and may control temperature in the brain—both essential aspects for evolving a large and complex brain—were possibly already present at that time," says Beaudet.

Given its geological age of over 3 million years, Little Foot's brain suggests that younger hominins evolved greater complexity in certain brain structures over time, perhaps in response to increasing environmental pressures experienced after 2.6 million years ago with continuing reduction in closed habitats.

"Such environmental changes could also potentially have encouraged

more complex social interaction, which is driven by structures in the brain," says Beaudet.

More information: Amélie Beaudet et al, The endocast of StW 573 ("Little Foot") and hominin brain evolution, *Journal of Human Evolution* (2018). [DOI: 10.1016/j.jhevol.2018.11.009](https://doi.org/10.1016/j.jhevol.2018.11.009)

Provided by Wits University

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