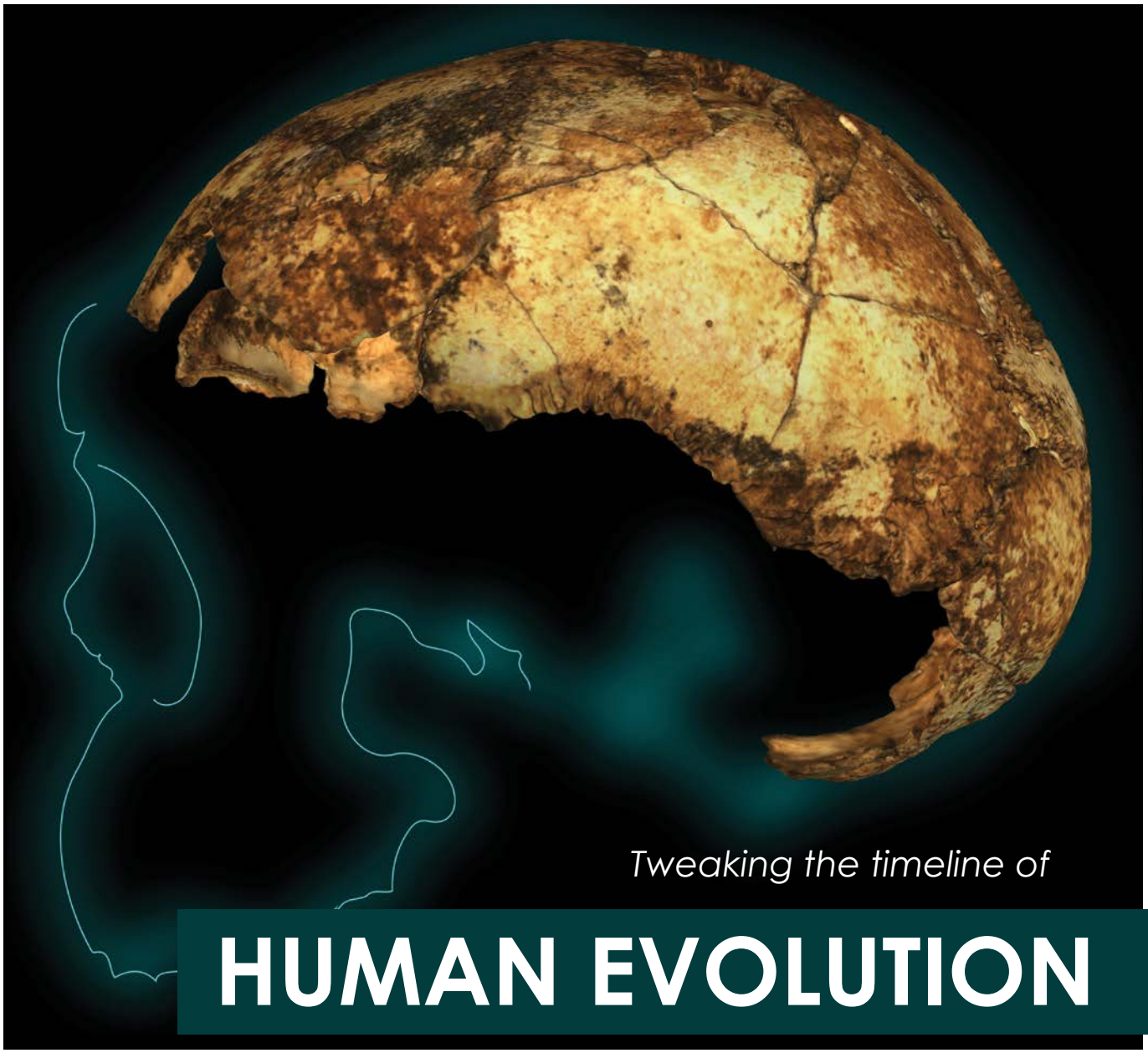

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Tweaking the timeline of

HUMAN EVOLUTION

Quest reports on a fossil discovery that suggests at least three hominin species lived in the Cradle of Humankind two million years ago

Homo erectus, or 'upright man', is considered our earliest ancestor with nearly human-like anatomy and aspects of behaviour. Its fossil remains were first discovered in 1891 on the Indonesian island of Java, but until recently the oldest known *Homo erectus* fossils, dated to 1.8 million years ago, were from Dmanisi in Georgia, sandwiched between Turkey and Russia on the eastern edge of the Black Sea. Other important fossil finds from East Africa have supported the theory that *Homo erectus* arose in that part of the continent before migrating into Europe and Asia.

But the discovery of a *Homo erectus* fossil in South Africa has shown that the species existed 150 000 to 200 000 years earlier than previously thought, and was already further south. What's more, the additional find of a new *Paranthropus robustus* fossil at the same site has indicated that – given the overlapping timeline – the two species would have been sharing the landscape two million years ago with *Australopithecus sediba*. Both *Paranthropus robustus* and *Australopithecus sediba* were hominins from a 'side branch' of our evolutionary tree, rather than our direct ancestors.

This important finding was outlined in the research article 'Contemporaneity of *Australopithecus*, *Paranthropus*, and early *Homo erectus* in South Africa', published in the journal *Science* in early April. Lead author Prof. Andy Herries is from La Trobe University in Australia, while his 26 co-authors are from 13 institutions in five countries, including the University of Johannesburg and University of Cape Town in South Africa.

The fossils are cranial bones from the top of the skull, and were unearthed at the Drimolen archaeological site, which is part of the Cradle of Humankind, situated north-west of Johannesburg. Drimolen's 'main quarry' site is a former cave that was mined for its lime in the early 1900s. Its

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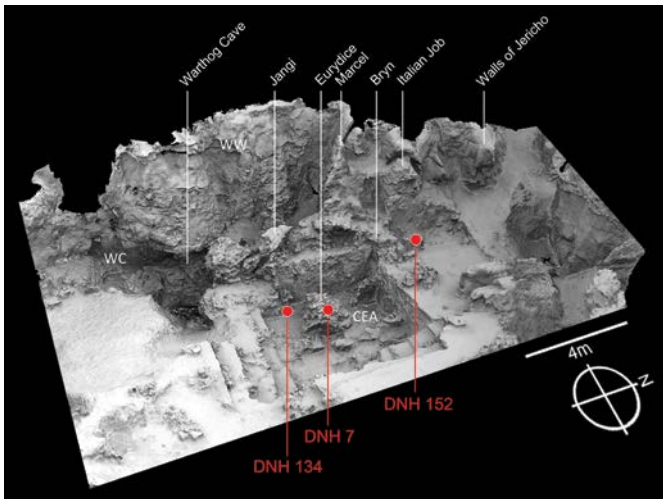
Drimolen is a former dolomitic cave, the roof of which has eroded away. The 'main quarry' was excavated during lime-mining in the first half of the 20th century.

archaeological potential was discovered by André Keyser in July 1992, and by April 2000 – when papers describing its fossils were published in the *South African Journal of Science* – almost 80 hominin specimens had been found by Keyser and his collaborators. These were mostly teeth, jawbones and fragments of other bones from both *Paranthropus robustus* and unidentifiable *Homo* species, but more significant was Keyser's discovery in 1994 of the most complete *Paranthropus robustus* skull ever found.

After Keyser's death in 2010, Colin Menter directed research and excavations at the site for the following six years, and then Stephanie Baker of the University of Johannesburg's Palaeo-Research Institute took over the permit in 2017. She acts as co-Director of the Drimolen excavation activities with Prof. Herries, who manages an Australian Research Council Discovery Project at the site. There's been considerable international involvement at Drimolen for many years, though, with annual field schools offered by foreign universities since 2006. Initially these were operated by two universities in Italy and Canada, but more recently run in collaboration with La Trobe University – where Prof. Herries heads the Department of Archaeology and History – and Washington University in St Louis (Missouri, USA).



David Strait

A 3D laser scan of Drimolen main quarry showing the discovery location of the new *Homo erectus* (DNH 134) and *Paranthropus robustus* (DNH 152) crania relative to the position of the complete *Paranthropus robustus* skull (DNH 7) found by Keyser in 1994.

Matthew Caruana

Co-director of the Drimolen excavations and University of Johannesburg PhD candidate, Stephanie Baker, with the *Homo erectus* skull, thought to be that of a small child. It was pieced together from about 150 individual fragments.

Andy Herries, Twitter

A Drimolen field school team, with Stephanie Baker at front left, Prof. David Strait at back left and Prof. Andy Herries at back right. The field school has fee-waiver scholarships for African students and supports UJ's palaeo-anthropology honours programme.

It was one of these field school students who found the first fragments of what turned out to be the *Homo erectus* skull. "We could see that they were parts of a skull. But they weren't immediately identifiable," said Stephanie. "Over the course of the field season, more and more fragments were uncovered. We began piecing them together. No one could decide what this skullcap was from, until one night it all came together – and we realised we were looking at a hominin!"

Eventually, through a painstaking process of careful scraping and brushing, about 150 individual fragments were collected. One of Prof. Herries' PhD students at La Trobe University, Jesse Martin, was tasked with assembling them all properly, back in the lab. At the end of April, following the publication of the research, he was interviewed on a science programme called Einstein A Go-Go on the Melbourne-based radio channel Three Triple R (102.7FM, 3RRR). The host, Dr Shane, remarked that many people were doing jigsaw puzzles during lockdown, but generally they had the picture on the box to guide them. He asked Jesse how he'd managed to reconstruct the skull out of 150 weathered pieces, with no idea of what it was supposed to look like.

"Very very slowly, and very very carefully," quipped Jesse. "But you've described it perfectly – it really is just a big three-dimensional jigsaw puzzle. You certainly don't have the picture of what it's supposed to look like, but – to follow the metaphor – you're also missing a good portion of the pieces. So when you start putting it back together, you work from the biggest bits to the smallest bits. You try and get – like a jigsaw puzzle – some of the more distinct parts together, and from that you can build the small parts."

He added that the smallest parts were about a third of the size of his pinky fingernail. Fortunately, his efforts earned him second authorship on the *Science* paper, but he expects to be busy with his PhD for another year at least.

On the day the paper was published, La Trobe University issued a media release in which Prof. Herries was quoted as saying, "The *Homo erectus* skull we found, likely aged between two and three years old when it died, shows its brain was only slightly smaller than other examples of adult *Homo erectus*. It samples a part of human evolutionary history when our ancestors were walking fully upright, making stone tools, starting to emigrate out of Africa, but before they had developed large brains."

The University of Johannesburg also put out a media release, which gave more detail about the dating techniques used. While on site, the field research team had collected soil samples from around the fossils as well as fragments of small animals, such as bats and lizards, with their positions precisely recorded and then mapped, based on a 3D laser scan of the site. Later, every possible available dating technique, namely palaeomagnetism, electron spin resonance, uranium-lead dating and faunal dating, was used to pin down an accurate date for the deposit.

The results showed that the *Homo erectus* and *Paranthropus robustus* fossils found by the team date to 2.04–1.95 million years ago, making each the oldest example of its species ever found. If both hominins did indeed co-exist with *Australopithecus sediba*, which is known from fossils discovered in Malapa Cave, about 10 km away, they might have needed to use different parts of the landscape to avoid competing with one another.

"*Paranthropus robustus* ate things like roots and tubers, which is why their teeth are really big," Stephanie explained. "They used their enormous teeth for grinding down what we call fall-back foods – tough, hard plants."

In comparison to the other two species, *Homo erectus* hominins were tall and slender. They ate more easily digestible foods, such as fruits and berries, as well as meat, which they probably scavenged initially from carnivore kills.

"We also know that they were able to cover long distances. Which turned out lucky for them, because during their time, the climate changed in southern Africa," she added. "*Paranthropus* and *Australopithecus* evolved in warm and humid climates, and were used to that. But then the weather began to shift from warm and humid, to cool and dry."

Gradually the tree cover diminished, and the landscape became dominated by grasslands. The cooler weather suited the more mobile and social *Homo erectus* better, and it was able to thrive. In fact, fossil evidence reveals that the species was still around as recently as 110 000 years ago. Compare this long existence to that of our species, *Homo sapiens*, which only arose 300 000 years ago.

But lest we presume that we're in for a similarly long reign on Earth, Prof. Herries sounds a cautionary note.

"As the last surviving human species, we should not think we are immune to the same fate as *Australopithecus*, who likely became extinct as a result of the changing climate two million years ago."

- For a good overview of research conducted at Drimolen, search YouTube for 'Drimolen palaeocave'.

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Quest Volume 16 Number 2 2020

Academy of Science of South Africa (ASSAf)

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