

First tetrapods of Africa lived within the Devonian Antarctic Circle

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Cleithrum of *Umzantsia amazana*. Credit: Rob Gess and Per Ahlberg

The evolution of tetrapods from fishes during the Devonian period was a key event in our distant ancestry. Newly found fossils from the latest Devonian Waterloo Farm locality near Grahamstown in the Eastern Cape, South Africa, published today in *Science*, force a major reassessment of this event. "Whereas all previously found Devonian tetrapods came from localities which were in [tropical regions](#) during the Devonian, these specimens lived within the Antarctic circle," explains lead author, Dr. Robert Gess of the Albany Museum in Grahamstown, and co-author Professor Per Ahlberg of Uppsala University in Sweden. The research was supported by the South African DST-NRF Centre of Excellence in Palaeosciences, based at the University of the Witwatersrand and the Millennium Trust.

The first African Devonian tetrapods

Two new species, named *Tutusius* and *Umzantsia*, are Africa's earliest known four-legged vertebrates by a remarkable 70 million years. The approximately metre-long *Tutusius umlambo* (named in honour of Archbishop Emeritus Desmond Tutu) and the somewhat smaller *Umzantsia amazana* are both incomplete. *Tutusius* is represented by a single bone from the shoulder girdle, whereas *Umzantsia* is known from a greater number of bones, but they both appear similar to previously known Devonian tetrapods. Alive, they would have resembled a cross between a crocodile and a fish, with a crocodile-like head, stubby legs, and a tail with a fish-like fin.

The first African fossils of Devonian tetrapods (four-legged vertebrates) show these pioneers of land living within the Antarctic circle, 360 million years ago.



Cleithrum of *Tutusius umlambo* Credit: Rob Gess and Per Ahlberg

The Waterloo Farm locality (where the tetrapods were discovered) is a roadcut first revealed in 2016 after controlled rock-cutting explosions by the South African National Roads Agency (SANRAL) along the N2 highway between Grahamstown and the Fish River. This cutting exposed dark grey mudstones of the Witpoort Formation that represent an ancient environment of a brackish, tidal river

estuary that contain abundant fossils of animals and plants.

The first tetrapod found outside of tropical regions

The real importance of *Tutusius* and *Umzantsia* lies in where they were found.



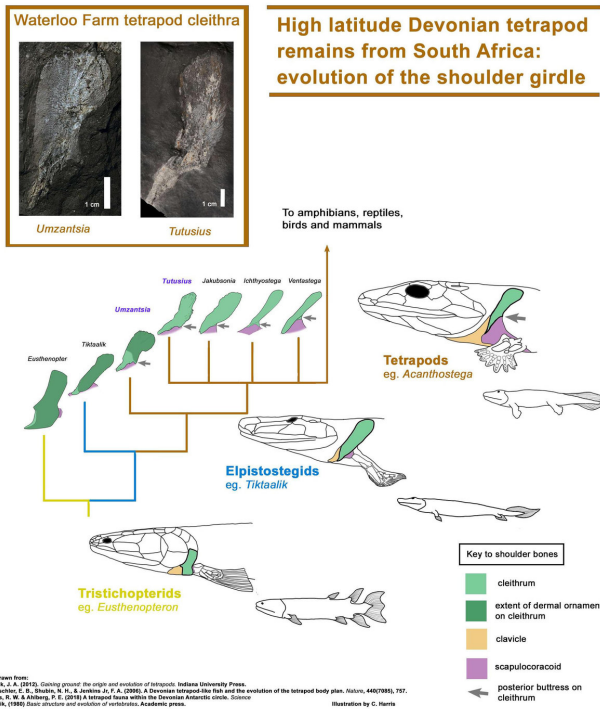
Full reconstruction of Waterloo Farm by Maggie Newman including *Tutusius* and *Umzantsia*. Credit: Maggie Newman

Devonian [tetrapod](#) fossils are found in widely scattered localities. However, if the continents are mapped back to their Devonian positions, it emerges that all previous finds are from rocks deposited in the palaeotropics—between 30 degrees north and south of the equator. Almost all come from Laurussia, a supercontinent that later fragmented into North America, Greenland and Europe.

The much larger southern supercontinent, Gondwana, which incorporated present-day Africa, South America, Australia, Antarctica, and India, has hitherto yielded almost no Devonian tetrapods, with only an isolated jaw (named *Metaxygnathus*) and footprints, being found in eastern Australia. Because Australia was the northernmost part of Gondwana, extending into the tropics, an assumption developed that tetrapods evolved in the

tropics, most likely in Laurussia. By extension it was assumed that movement of vertebrates from water onto land (terrestrialisation) also occurred in the tropics. Attempts to understand the causes of these major macroevolutionary steps therefore focussed on conditions prevalent in tropical water bodies.

South Africa now adds insights into the emergence of land animals to its incredible fossil record, which also includes transition to mammals from reptile-like ancestors and the evolution of humans. There is probably not another country on the planet that so fully documents the long and dramatic evolutionary history of our own lineage.



More information: R. Gess at Albany Museum in Grahamstown, South Africa et al., "A tetrapod fauna from within the Devonian Antarctic Circle," *Science* (2018). [science.sciencemag.org/cgi/doi ... 1126/science.aag1645](https://www.sciencemag.org/cgi/doi/10.1126/science.aag1645)

Provided by Wits University

Infographic of evolution of the shoulder girdle across the fish to tetrapod transition. Includes the proposed position of the cleithra of *Tulusius* and *Umzantsia*. Credit: R. Gess & C. Harris (SA NRF-DST CoE in Palaeosciences)

The Waterloo Farm tetrapods not only come from Gondwana, but from its southernmost part: reconstructed to have been more than 70 degrees south, within the Antarctic circle. Abundant plant fossils show that forests grew nearby, so it wasn't frozen, but it was definitely not tropical and during winter it will have experienced months of complete darkness. This finding changes our understanding of the distribution of Devonian tetrapods. We now know that tetrapods occurred throughout the world by the Late Devonian and that their evolution and terrestrialisation could realistically have occurred anywhere.

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