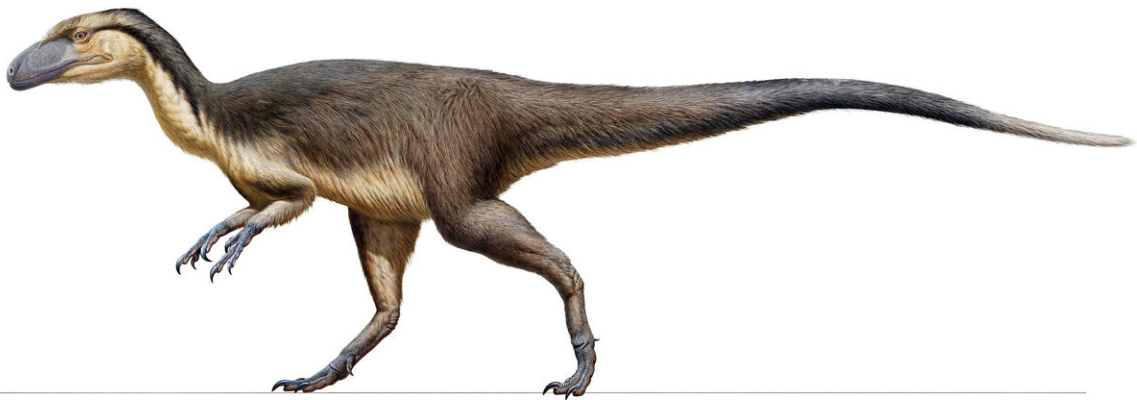


First evidence of feathered polar dinosaurs found in Australia

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Credit: Uppsala universitet

A cache of 118 million-year-old fossilized dinosaur and bird feathers has been recovered from an ancient lake deposit that once lay beyond the southern polar circle.

Feathered dinosaur fossils are famous, but known from a handful of localities worldwide. Examples from the Southern Hemisphere are especially rare, and mainly include only isolated feathers.

An international team of scientists has analyzed a collection of 10 such fossil feathers found in Australia, which reveal an unexpected diversity

of tufted hair-like 'proto-feathers' from meat-eating [dinosaurs](#), together with downy body feathers, and [wing feathers](#) from primitive [birds](#) that would have been used for flight.

Uniquely, the fossil feathers from Australia were all entombed in fine muddy sediments that accumulated at the bottom of a shallow lake close to the South Pole during the Age of Dinosaurs.

"Dinosaur skeletons and even the fragile bones of early birds have been found at ancient high-latitudes before. Yet, to date, no directly attributable integumentary remains have been discovered to show that dinosaurs used feathers to survive in extreme polar habitats," said Dr. Benjamin Kear from Uppsala University in Sweden, a leading author on the study.

"These Australian fossil feathers are therefore highly significant because they came from dinosaurs and [small birds](#) that were living in a seasonally very cold environment with months of polar darkness every year."

The fossil feathers were discovered in the Koonwarra Fish Beds Geological Reserve, which is a heritage listed site 145 km southeast of Melbourne in Victoria, Australia.

"Fossil feathers have been known from Koonwarra since the early 1960s, and were recognized as evidence of ancient birds, but have otherwise received very little scientific attention. Our study is thus the first to comprehensively document these remains, which include new specimens that were examined using cutting-edge technologies," said Dr. Thomas Rich of the Melbourne Museum in Australia, who has led numerous expeditions to the Koonwarra locality.

A suite of advanced microscopic and spectroscopic techniques was employed to determine the anatomy and preservation of the Koonwarra

fossil dinosaur and [bird feathers](#).

"The Koonwarra feathers are preserved in incredible detail," said fossil bird expert Professor Patricia Vickers-Rich of Monash University and the Swinburne University of Technology in Melbourne.

"There are even tiny filament-like structures that would have 'zipped' the feather vanes together, just as in the flight feathers of modern birds."

However, unlike the structurally complex feathers of birds today, which are characterized by interlocking branches called barbs and barbules, different kinds of small dinosaurs had coverings that comprised much more simpler hair-like 'proto-feathers.'

"Dinosaur 'proto-feathers' would have been used for insulation," said Dr. Martin Kundrát, of Pavol Jozef Safarik University in Slovakia, a leading author on the study.

"The discovery of 'proto-feathers' at Koonwarra therefore suggests that fluffy feather coats might have helped small dinosaurs keep warm in ancient polar habitats."

Microscopic remains of possible melanosomes—cellular structures that contain color pigments—were also detected on several of the fossil feathers found at Koonwarra.

These traces occurred across the uniformly dark [feather](#) surfaces, as well as in distinct bands that might represent original patterning from the polar dinosaurs and birds.

Melanic residues have been reported on fossil feathers from elsewhere around the world, and are widely acknowledged as indicators of dinosaur coloration.

The densely packed fossil melanosomes occurring on the Koonwarra feathers could suggest dark colors that perhaps assisted in camouflage, visual communication, and/or heat absorbance in cold polar climates.

Possible preservation of biomolecules was also assessed, but proved to be too degraded, and were apparently lost during weathering of the rock.

The Koonwarra fossil feathers provide the first record of dinosaur integument from the ancient polar regions, and hint what was once a global distribution of feathered dinosaurs and early birds.

Some of the [fossil feathers](#) found at Koonwarra are on display in the '600 Million Years' exhibition at the Melbourne Museum in Australia.

More information: Martin Kundrát et al. A polar dinosaur feather assemblage from Australia, *Gondwana Research* (2019). [DOI: 10.1016/j.gr.2019.10.004](#)

Provided by Uppsala University

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