

Digging up new species of Australia and New Guinea's giant fossil kangaroos

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An artist's impression of the newly described fossil species *Protemnodon viator* and its relative *Protemnodon anak*, compared at scale to the living red kangaroo and eastern grey kangaroo. Credit: Flinders University

Paleontologists from Flinders University have described three unusual new species of giant fossil kangaroo from Australia and New Guinea, finding them more diverse in shape, range and hopping method than previously thought.

The three new species are of the extinct genus *Protemnodon*, which lived from around 5 million to 40,000 years ago—with one about double the size of the largest red kangaroo living today.

The research follows the discovery of multiple complete fossil kangaroo skeletons from Lake Callabonna in arid South Australia in 2013, 2018 and 2019. These extraordinary fossils allowed lead researcher Dr. Isaac Kerr, then a Ph.D. student, to unpick a nearly 150-year-long puzzle around the identities of the species of *Protemnodon*.

The article, "Systematics and palaeobiology of kangaroos of the late Cenozoic genus *Protemnodon* (Marsupialia, Macropodidae)" by Isaac AR Kerr, Aaron B Camens, Jacob D van Zoelen, Trevor H Worthy and Gavin J Prideaux has been published in *Megataxa*.

The new Flinders University study reviewed all species of *Protemnodon*, finding that they were quite different from one another. The species adapted to live in differing environments and even hopped in different ways.

Protemnodon would have looked something like a gray kangaroo, but were generally more squat and muscular. While some species were around 50 kg, others were much larger than any living kangaroo.

However, one new species named as part of the latest study—named *Protemnodon viator*—was much bigger, weighing up to 170 kg. This is about twice as much as the largest male red kangaroos.

Protemnodon viator was well-adapted to its arid central Australian habitat, living in similar areas to the red kangaroos of today. It was a long-limbed kangaroo that could hop fairly quickly and efficiently. Its name, *viator*, is Latin for "traveler" or "wayfarer."



A near-complete fossil skeleton of the extinct giant kangaroo *Protemnodon viator* from Lake Callabonna, missing just a few bones from the hand, foot and tail. Credit: Flinders University

The Australian researchers discovered two other new species—*Protemnodon mamkurra* and *Protemnodon dawsonae*—while also revisiting the work of earlier researchers including British naturalist Sir Richard Owen who coined the term "dinosaur" in Victorian England.

The first species of *Protemnodon* were described in 1874 by British paleontologist Owen who followed the common approach of the time, to focus chiefly on fossil teeth. He saw slight differences between the teeth of his specimens, and described six species of *Protemnodon*.

Successive studies have whittled away at some of these early descriptions; however, the new Flinders University study agrees with one of his species, *Protemnodon anak*. This first specimen described, called the holotype, still resides in the Natural History Museum in London.

Dr. Kerr says it previously was suggested that some or all *Protemnodon* were quadrupedal. "However, our study suggests that this is true of only three or four species of *Protemnodon*, which may have moved something like a quokka or potoroo—that is bounding on four legs at times, and hopping on two legs at others.

"The newly described *Protemnodon mamkurra* is likely one of these. A large but thick-boned and robust kangaroo, it was probably fairly slow-moving and inefficient. It may have hopped only rarely, perhaps just when startled."

Dr. Kerr says the best fossils of this species come from Green Waterhole Cave in southeastern South Australia, on the land of the Boandik people. The species name, *mamkurra*, was chosen by Boandik elders and language experts in the Burrandies Corporation. It means "great kangaroo."

It's unusual to have a single genus of kangaroo live in such varied environments, he says. "For example, the different species of *Protemnodon* are now known to have inhabited a broad range of habitats, from arid central Australia into the high-rainfall, forested mountains of Tasmania and New Guinea."



Palaeontologist Dr. Isaac Kerr displays the fossil jaw of the giant kangaroo *Protemnodon viator* and the far smaller jaw of the largest living kangaroo, the red kangaroo. Credit: Flinders University

The third of the [new species](#), *Protemnodon dawsonae*, is known from fewer fossils than the other two, and is more of a mystery. It was most likely a mid-speed hopper, something like a swamp wallaby.

It was named in honor of the research work of Australian paleontologist Dr. Lyndall Dawson, who studied [kangaroo](#) systematics and the fossil material from "Big Sink," the part of the Wellington Caves in NSW,

from which the species is mostly known.

To gather data for the study, Dr. Kerr visited the collections of 14 museums in four countries and studied "just about every piece of *Protemnodon* there is."

"We photographed and 3D-scanned over 800 specimens collected from all over Australia and New Guinea, taking measurements, comparing and describing them. It was quite the undertaking.

"It feels so good to finally have it out in the world, after five years of research, 261 pages and more than 100,000 words. I really hope that it helps more studies of *Protemnodon* happen, so we can find out more of what these kangaroos were doing.

"Living kangaroos are already such remarkable animals, so it's amazing to think what these peculiar giant kangaroos could have been getting up to."

While *Protemnodon* fossils are fairly common across Australia, they have historically been found "isolated," or, as individual bones without the rest of the animal. This has hampered paleontologists' study of *Protemnodon* in the past, making it difficult to say how many species there were, how to tell them apart—and how the species differed in size, geographic range, movement and adaptations to their natural environments.



Digging up the largest-known skeleton of *Protemnodon viator*, a specimen nicknamed 'Old Gregg' for its great size and very worn teeth, suggesting advanced age. The partial skeleton of a *Diprotodon*, an extinct giant marsupial, is in the foreground. Location is Tedford Locality, Lake Callabonna, northeast of the Flinders Ranges in South Australia. Credit: Aaron B Camens, Flinders University (September 2018).

By about 40,000 years ago, all *Protemnodon* were extinct on mainland Australia, maybe lingering a while longer in New Guinea and Tasmania. This extinction occurred despite their differences in size, adaptations, habitat and geographic range.

For reasons not yet clear the same did not happen to many similar and closely related animals, such as wallaroos and gray kangaroos. This

question may soon be answered by further research aided in some part by this study.

"It's great to have some clarity on the identities of the species of *Protemnodon*," says Flinders Professor Gavin Prideaux, a co-author of the major new article in *Megataxa*.

"The fossils of this genus are widespread and they're found regularly, but more often than not you have no way of being certain which species you're looking at. This study may help researchers feel more confident when working with *Protemnodon*."

More information: Systematics and palaeobiology of kangaroos of the late Cenozoic genus *Protemnodon* (Marsupialia, Macropodidae), *Megataxa* (2024). DOI: 10.11646/MEGATAXA.11.1.1 , mapress.com/mt/article/view/megataxa.11.1.1

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