

New species of large tortoise discovered after a century of mistaken identity

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Most of the island tortoises of the Indian Ocean are now extinct (pictured in grey), with the majority of the remainder on the verge of being wiped out. Credit: Michal Roessler and photo © Massimo Delfino

Southwestern Madagascar was once a tortoise hotspot, with multiple species of the giant reptiles roaming alongside their much smaller cousins.

We can now add a <u>new species</u> to that picture. Estimated by the team to



have had a carapace measuring around 50 centimeters long, Astrochelys rogerbouri would have been one of the island's large tortoises.

Though the fossilized leg bone of the species from which its description was based was discovered more than 100 years ago, its intermediate size meant it was identified as the juvenile of the giant tortoise Aldabrachelys abrupta.

Only a DNA analysis recently carried out on the fossil revealed that the extinct reptile was a species in its own right, with researchers naming the species in honor of a former colleague.

Dr. Sandra Chapman, a co-author on the paper and the Museum's former Curator of Fossil Reptiles and Birds, says, "I am honored to pay tribute to the late paleontologist Roger Bour as part of this project, which named the new species Astrochelys rogerbouri after him."

"I met Roger on several occasions when he was a frequent visitor to the Museum's turtle collections in the early 2000s."

Like many other Indian Ocean tortoises, Astrochelys rogerbouri was likely driven to extinction by the arrival of humans on the islands, either during the arrival of Madagascar's first inhabitants from Southeast Asia or more recently by European colonists.

The description of the new species is part of a larger study, published in the journal *Science Advances*, which reveals that the tortoises living across the Indian Ocean evolved during two separate dispersals, with turtles found in the Seychelles only distantly related to those formerly found on Mauritius.

The tortoises of the Indian Ocean



The first tortoises to colonize the islands of the Indian Ocean are believed to have evolved around 40 million years ago on the African mainland. The animals are believed to have dispersed by floating in the sea, with living giant tortoises sometimes found washed up on beaches today.



Credit: AI-generated image (disclaimer)

Though Madagascar is closer to the African mainland, the researchers' genetic analysis of tortoise remains suggests that the reptiles reached the more distant Mascarene islands first. The Cylindraspis tortoises colonized the now submerged islands such as Saya de Malha, before island hopping south until they reached Mauritius, Rodrigues and Réunion.



It would be more than 10 million years later that the first tortoises would arrive in Madagascar. One group of the Aldabrachelys tortoises would later make the 2,000-kilometer journey north to the Seychelles, and then across to the island of Aldabra.

These tortoises would dominate the islands of the Indian Ocean for millions of years. With no humans or large carnivores to contend with, <u>giant tortoises</u> with shells measuring over a meter long would have roamed the islands alongside other species around a tenth of their size.

Although all these species were herbivores and found in large numbers, they were able to coexist. The researchers believe that the 'exceptional' diversity that would have been seen in southwest Madagascar, where as many as five species were living alongside one another, is because they consumed different types of plant and so occupied different niches.

These tortoises were keystones of the ecosystem, and are believed to have helped maintain the mixture of forest and savannah by trampling seedlings, reduced the risk of fire through grazing, and helped to spread the large seeds of native baobabs.

The arrival of humans would change all this. While debate on when people first arrived on the island is still ongoing with estimates ranging from 10,000 to 1,500 years ago, it is agreed that people from what is now Indonesia and Malaysia were the first to settle.

By around 1,000 years ago, most of Madagascar's unique megafauna which included gorilla-sized lemurs and pygmy hippos, were driven to extinction. A combination of human hunting, creation of farmland and drought have all been suggested as causes.

Giant tortoises were also under threat, with Astrochelys rogerbouri thought to have become extinct during this time period along with other



large species such as Aldabrachelys grandidieri and Aldabrachelys abrupta.

The Cylindraspis tortoises of the Mascarene islands hung on until the arrival of Europeans in the 1600s, with all species believed to have been driven to extinction by the 1840s as they were harvested for food by passing sailors.

"We often think that humans only started to wipe out species in recent times," says co-author and research team leader Professor Uwe Fritz. "In reality, humans exploited local food resources and changed their environment early on."

"As a result, most of the giant tortoise species in the western Indian Ocean disappeared, leading to a major disturbance of the natural balance of these islands."





Credit: AI-generated image (disclaimer)

What threats do Madagascar's tortoises face?

While the Mascarenes are now without any native tortoises, Madagascar still has five species remaining today which live in different areas of the island. Though one species, Bell's hinged tortoise, is found across central Africa and is considered to be of low extinction risk, the other four species are classed as Critically Endangered.

Habitat loss for agriculture has driven these species to the edge of extinction, with the ploughshare tortoise estimated to number just 400 individuals in the wild. The scarcity of these tortoises has driven demand from collectors, with wild tortoises being illegally captured for the exotic pet trade.

If these threats can be brought under control, then tortoises could play a significant role in helping to restore Madagascar's biodiversity. For example, while fire poses a major issue in conservation on the island, the tortoises could help to control this threat by selective grazing and clearing out potentially flammable vegetation.

Some studies have also suggested introducing the Aldabra giant tortoise to the island to aid with this, as the species shares the same ancestors as Madagascar's extinct giant turtles.

This follows a similar project on the island of Rodrigues which has been credited with restoring seed dispersal routes and tackling invasive species without harming native flora.

Understanding where extinct tortoises used to live could aid with any



future reintroduction projects by identifying which sites may be suitable for tortoises to be moved into.

Patrick Campbell, Senior Curator of Reptiles at the Museum, says, "Conserving the species we have today is one of the main reasons we carry out this kind of research. Giant tortoises are important for the ecosystem and they support other groups such as certain trees by part digesting the outer shell of seeds."

"This assists with their dispersal and germination, and without them, there would probably be fewer trees on these islands."

The researchers have called for further genetic analysis of <u>tortoise</u> remains to help build a more detailed picture of where these gentle giants used to live.

More information: Christian Kehlmaier et al, Ancient DNA elucidates the lost world of western Indian Ocean giant tortoises and reveals a new extinct species from Madagascar, *Science Advances* (2023). DOI: 10.1126/sciadv.abq2574

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