



## ScienceWatch - Happy Feet Were Big Feet

**“It was as tall as a medium-sized man.” G. Mayr**

Penguins are the most unlikely-looking birds. Even their underwater lifestyle is very unbirdlike. But DNA analysis shows a close kinship to modern pelagic birds like albatrosses and petrels (*Procellariiformes*), and fossil finds give us an idea of how penguins became the 17 species of flightless divers they are today.

DNA mutations occur at a steady rate over time in birds. So the genetic differences between penguins and the *Procellariiformes* tell us that their common ancestor split apart about 66 million years ago.

No one knows exactly when penguins became flightless. But it is likely that a penguin ancestor lost its flying ability as it became more successful at diving deeper and deeper where it found lots of food. The first penguin may have resembled modern auks, which can dive more than 100 feet underwater, and by about 65 million years ago penguins were well-adapted divers. This was just at the end of the Cretaceous period when a mass extinction, known as K-T\*, killed off the dinosaurs due to a combination of volcanic activity and a huge asteroid impact.

Now a team of paleontologists headed by Gerald Mayr, Natural History Museum Frankfurt, Frankfurt Am Maine, Germany, shows in the December 12, 2017 online issue of *Nature Communication* that penguins achieved enormous size very early in their evolution. The scientists describe a 60-million-year-old fossil found in New Zealand containing the bones of a giant penguin they have named *Kumimanu biceae*, or “mythical monster bird” in Maori.

Based on the size of the femur (thigh bone), the team concluded that *Kumimanu* was 1.77m tall (5ft 7in) and weighed 101kg (222lbs). By comparison the largest extant penguin species, the Emperor penguin (*Aptenodytes forsteri*), is only 51kg (111lbs) and 1.22m (4ft) tall.

Paleontologists have found several fossil examples of other giant penguins. So *Kumimanu* is not the only large penguin known to have existed. But according to Mayr, *et al.* *Kumimanu* is the biggest and it is unique: it doesn't fit into the single related group formed by all the other giant penguin finds, and it is the oldest, occurring soon after the penguin lineage evolved.

*Kumimanu* was already flightless, but it had some primitive traits not found in modern penguins. “Their beak looked much more like a stork's. Probably they speared their prey,” said Mayr. In addition, their wing was not as stiff as living penguins. “What would be interesting is to find a flying ancestor of penguins, and we hope that such a find will be made in the foreseeable future. That would certainly be the missing link in penguin evolution,” said Mayr.

The authors conclude that early penguins quickly became giants and gigantism occurred more than once. “It now appears that giant size evolved early and multiple times in penguins,” said Mayr. “We already knew penguins were around and flightless, just a few million years after the

[K-T] extinction. The new fossil shows they achieved immense sizes very rapidly as well, which is cool,” said Daniel T. Kspeka, a paleontologist not connected to the study.

Mayr, *et al.* contend that Kumimanu could achieve its giant size because the K-T extinction not only killed off the dinosaurs, but also wiped out giant aquatic reptiles like pleiosaurs and mosasaurs. Suddenly the oceans were open to a diving bird that could get lots of food and become much larger because its competitors were gone. “It’s an educated guess that makes sense, but there’s no rock-solid evidence,” said Mayr.

So why are there no giants today? They were probably outcompeted by the large marine mammals that arose around 50 million years ago. According to Mayr, “The disappearance of giant penguins indeed coincides with the rise of marine mammals, that is, whales, dolphins, porpoises and seals, but the exact causes and mechanisms of a competitive replacement remain poorly understood.”

Maybe that’s a good thing for penguins. After all, who could imagine a movie like “Happy Feet” promoting the cuteness of penguins the size of people?

Saul Scheinbach

\*Paleontologists call this event the “K-T mass extinction” because it occurred at the boundary between the Cretaceous (K) and Tertiary (T) time periods.