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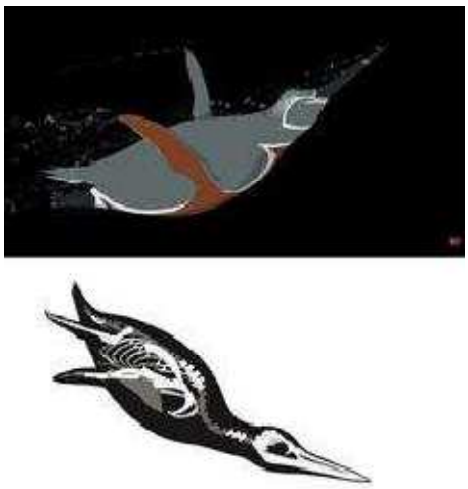
News

# Emperor penguin's old clothes are unveiled

**Fossilized feathers reveal colourful past.**

Lucas Laursen

A 36-million-year-old fossilized penguin skeleton found on a cliff-face in Peru has given scientists insight into how penguin feathers, originally used for flight, adapted to swimming. The fossil, found by palaeontology student Ali Altamirano of the Museum of Natural History in Lima, contained intact pigments which researchers say mean that, instead of the black and white plumage of modern-day penguins, the ancient bird sported grey and reddish-brown feathers.



The fossilised remains of a giant penguin reveals the birds were not always black and white.

*Katie Browne, U.T. Austin*

Altamirano's colleague Julia Clarke, a palaeontologist at the University of Texas at Austin who led the study, knew that they had an especially well preserved specimen when she chipped away a stone and exposed fossil feathers. "What's cool is that at one point this flake came off and you could see the tiny striped bases of the feathers where they entered the skin," Clarke says.

It was the melanosomes, structures inside cells that give feathers their colour and stiffness, that surprised Clarke the most. The pigments inside bore traces of grey and reddish brown. "In my own personal vision I thought ancient penguins were black and white," she says. The melanosomes were also nearly spherical, making them more like those found in modern tubenosed birds such as petrels and albatrosses — penguins' closest living relatives — than like the oval melanosomes of modern penguins. The elongation of modern penguin melanosomes is thought to affect the shape of the feathers, making them more hydrodynamic, so the intermediate form of the fossil melanosomes suggests a bird just adapting to swimming and changing environmental pressures. The findings are published online today in *Science*[1].

## Water emperor

Trying to explain feather colours is a rare problem for palaeontologists, because soft tissues don't often leave a fossil record. This example, the first known penguin feather fossil, shows "remarkable and unexpected preservation", says Ewan Fordyce, a palaeontologist at the University of Otago in Dunedin, New Zealand.

The completeness of the skeleton also makes it important, says biologist Piotr Jadwiszczak of the University of Bialystok in Poland. "Many fossils are isolated bones and it's impossible to say that this humerus or that ulnar belong to the same individual."

The well-preserved feathers of *Inkayacu paracasensis* are a rare find.

*Science/AAAS*

The fossil includes an intact skull with a long, hooked beak, wing and leg bones, vertebrae and impressions of feathers. The species has been named *Inkayacu paracasensis* — meaning the water emperor of Paracas, the Peruvian natural reserve in which it was found. The research team estimates that the living bird would have been about 1.5 metres long when swimming and have weighed about 55–60 kilograms, making it twice as heavy as a modern emperor penguin (*Aptenodytes forsteri*) and among the biggest extinct giant penguins found so far.

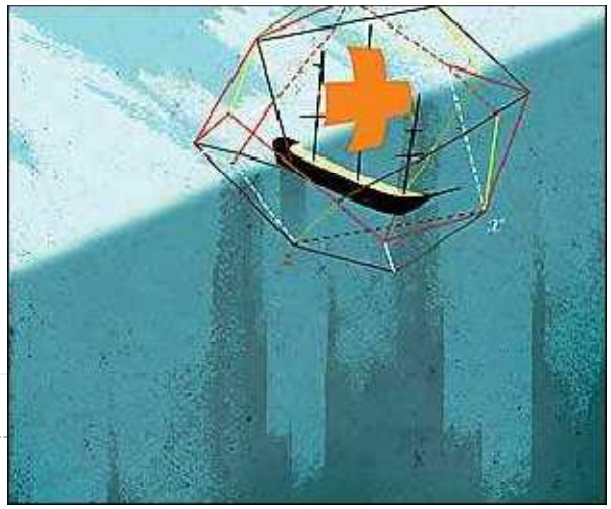
The bird's presence in Peru adds to evidence that penguins diversified and spread around the world early in their evolution, says Clarke. Other ancient penguins reached modern-day New Zealand, Antarctica and other parts of South America, where in 2005 Clarke's Peruvian collaborators found another giant penguin from the same time period (See **'Giant penguins lived in Peru'**).

## In transition

The find offers researchers a snapshot of an intermediate stage in the evolution of bird feathers from flight aids to parts of the firm flippers in water, which is 800 times denser than air. While at visible scales the ancient feathers are similar to modern-day penguin feathers, the unique shape of modern-day penguin melanosomes may be a later improvement designed to strengthen feathers for swimming, write the authors. "This is an understudied locomotor transition," says Clarke.

The melanosome appears to have evolved at a different rate from the bird's overall shape, write Clarke and her team. "If the authors are right, then perhaps we cannot reliably predict ancient feather colours" using family trees and modern species for guidance, says Fordyce.

But Marcel van Tuinen, a biologist at the University of North Carolina in Wilmington, says that the feather colours identified by Clarke and her colleagues are "widespread in the closest living relatives of penguins, the petrels, shearwaters and albatrosses, which from an evolutionary perspective makes total sense".



### References

1. Clarke, J. A. , *et al. Science* **doi:10.1126/science.1193604** (2010).

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