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Cover image: Ben Wiseman

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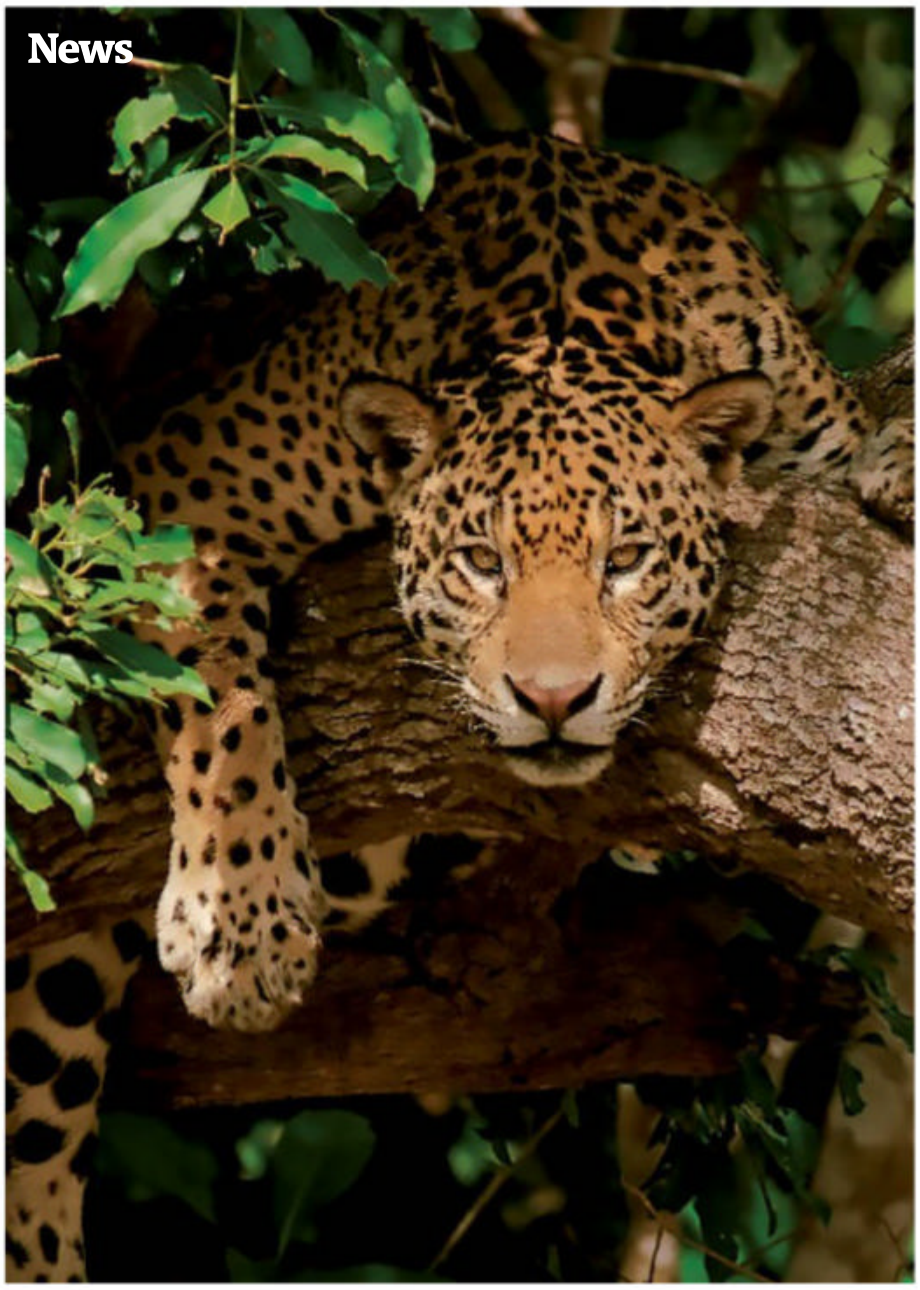

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18 High life Flooding has forced some jaguars to live in trees for months

Features

The back pages

Animal behaviour

Electric catfish can't be stunned and it isn't clear why

Cameron Duke

ELECTRIC catfish can emit up to 300 volts to stun their prey. The fish is immune to its own jolts, and seemingly can't be shocked at all.

Georg Welzel and Stefan Schuster at the University of Bayreuth in Germany explored the degree to which electric catfish (*Malapterurus beniensis*) are insulated from electric shocks.

In one test, in which a goldfish and one of two electric catfish used in the trials shared a tank, they coaxed the catfish into discharging its electricity by gently brushing its tail. In another, they used a commercial electrofishing device to give the entire tank a jolt. In both trials, the goldfish spasmed and contorted its body briefly before recovering, but the catfish was unaffected.

"It was absolutely amazing to see how unexpressed and relaxed electric catfish swam through their tank when being confronted with electric shocks that usually narcotise other fish," says Welzel.

To test whether the catfish's nervous system has the same insulation as its muscles, they added electrodes that maintained a current in the water. They then played a loud blast of sound to startle the fish into emitting a shock. If the animal's nervous system was impaired by the ambient electric field, the fish probably wouldn't react by producing a shock, says Welzel.

High-speed cameras were used to watch for any delay in the fish's reaction, if one occurred. When the sound was played, the catfish reacted normally and emitted a shock, displaying what seems to be a nearly complete immunity to electricity (*Journal of Experimental Biology*, doi.org/f2jt).

The paradox of the electric catfish becomes more mysterious when you consider that catfish often hunt by sensing weak electric fields emitted by their prey – so it isn't as though they lack a way to detect the fields. ▮

Geology

One side of Earth's interior is losing more heat

Michael Marshall

PAUL CAMPBELL/GETTY IMAGES

Earth's Pacific side loses more heat than its African side

OUR planet is a bit lopsided. One half of Earth is losing heat from its interior faster than the other half, and has been for much of the past 400 million years.

The uneven heat loss may be a relic of past supercontinents, when all the land masses were joined together on one side of the planet.

"We see that the Pacific has lost more heat," says Krister Karlsen at the University of Oslo in Norway. Karlsen and his colleagues reconstructed the rates of heat loss from Earth's interior over the past 400 million years by combining two sources of data.

The first concerns the amount of heat from Earth's interior that flows up through the crust. This data set shows that oceans aren't as good at trapping heat inside Earth as the continents are, says Karlsen. That is partly because continental crust is often many kilometres thicker than oceanic crust, so it is a better insulator.

175

million years since Pangaea began to break up

The second data set relates to the movement of the continents deep in prehistory. Some continental rocks carry telltale traces of Earth's magnetic field, which varies around the globe.

Data from these rocks can be used to show that Earth has, on several occasions, been home to a supercontinent – and can help establish some of those supercontinents' approximate positions. The most recent supercontinent was Pangaea, which existed from around 335 million to 175 million years ago and was centred roughly where Africa lies today.

When Karlsen and his colleagues reconstructed the pattern of heat loss over the past 400 million years, they found that more heat had been lost from the Pacific hemisphere of the planet than from the opposite African hemisphere, where Pangaea once lay (*Geophysical Research Letters*, doi.org/fz6s).

The cycle of supercontinent formation and destruction is intimately linked to the heat of Earth's interior, says Louis Moresi at the Australian National University in Canberra. "The supercontinents insulate the Earth," he says, so heat accumulates underneath them.

Moresi says some of that heat escapes on the supercontinent-free side of the planet, creating the hemispheric imbalance that Karlsen's team observed. But the heat build-up under supercontinents may also be what destroys them.

"When all the continents come together, they're pushed together by the plates, so they heat up and everything moves faster and it breaks everything up," says Moresi.

Other factors may also help explain why the Pacific side loses more heat. At mid-ocean ridges – long chains of volcanically active mountains on the sea floor – magma cools to form new oceanic crust. Crucially, the mid-ocean ridges in the Pacific create new crust faster than those in the Atlantic.

"The fast-spreading ridges produce lots of young oceanic crust that can transport heat out quickly," says Karlsen.

The research team also found that rates of heat loss were higher over most of the past 400 million years than they are today. That is because Earth currently has an unusually large amount of old oceanic crust, says Karlsen. "Older oceanic crust is thicker and doesn't allow as much heat to escape," he says. This means the present-day situation might not be very representative of Earth's history.

"They're making the case that right now is not typical," says Moresi. "I think that's right." ▮