NEWS IN FOCUS

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India's Western Ghats mountains contain igneous rock deposited 66 million years ago by a volcanic eruption in the Deccan Traps.

GEOLOGY

Ancient volcanoes exposed

Geologists unearth signs of huge planet-altering events stretching back 3 billion years.

BY ALEXANDRA WITZE

Enormous volcanoes vomited lava over the ancient Earth much more often than geologists had suspected. Eruptions as big as the biggest previously known ones happened at least 10 times in the past 3 billion years, an analysis of the geological record shows.

Such eruptions are linked with some of the most profound changes in Earth's history. These include the biggest mass extinction, which happened 252 million years ago when volcanoes blanketed Siberia with molten rock and poisonous gases.

"As we go back in time, we're discovering events that are every bit as big," says Richard Ernst, a geologist at Carleton University in Ottawa, Canada, and Tomsk State University in Russia, who led the work. "These are magnificent huge things."

Knowing when and where such eruptions occurred can help geologists to pinpoint ore deposits, reconstruct past supercontinents and understand the birth of planetary crust. Studying this type of volcanic activity on other planets can even reveal clues to the geological history of the early Earth.

Ernst presented the findings this month to an industry consortium that funded the work (see 'Earth's biggest eruptions'). He expects to make the data public by the end of the year, through a map from the Commission for the Geological Map of the World in Paris.

"This will probably be the defining database for the next decade," says Mike Coffin, a marine geophysicist at the University of Tasmania in Hobart, Australia.

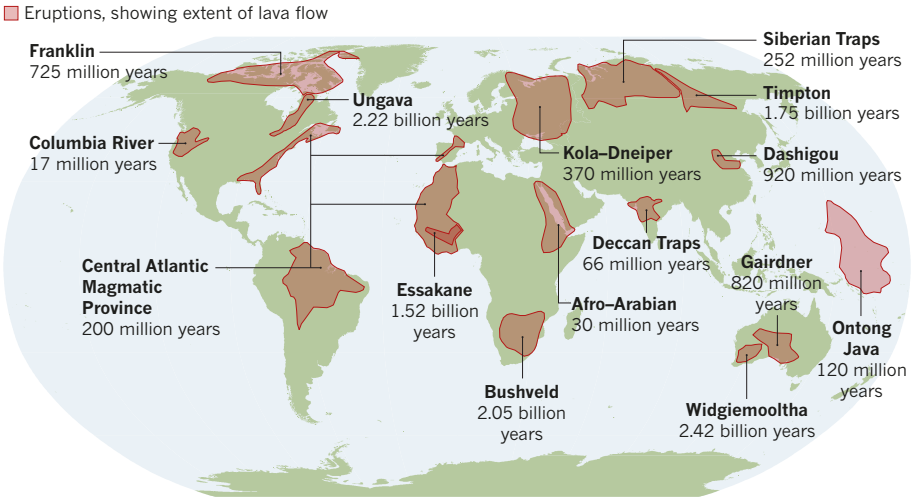
Surprisingly, the ancient eruptions lurk almost in plain sight. The lava they spewed has long since eroded away, but the underlying plumbing that funnelled molten rock from deep in the Earth up through the volcanoes is still there.

TELLTALE TIPS

Ernst and his colleagues scoured the globe for traces of this plumbing. It usually appears as radial spokes of ancient squirts of lava, fanned out around the throat of a long-gone volcano. The geologists mapped these features, known as dyke swarms, and used uranium–lead dating to pinpoint the age of the rock in each dyke. By matching the ages of the dykes, the researchers could connect those that came ▶

EARTH'S BIGGEST ERUPTIONS

Scientists have extended the geological record of massive volcanic eruptions, uncovering evidence for world-changing events that occurred more than 2 billion years ago.



SOURCE: RICHARD ERNST

from a single huge eruption. During their survey, they found evidence of many of these major volcanic events.

Each of those newly identified eruptions goes into Ernst's database. "We've got about 10 or 15 so far that are probably comparable to the Siberian event," Ernst says, "that we either didn't know about or had a little taste, but no idea of their true extent."

They include a 1.32-billion-year-old eruption in Australia that connects to one in northern China. By linking dyke swarms across continents, scientists can better understand how Earth's crust has shuffled around over time, says Nasrrddine Youbi, a geologist at Cadi Ayyad University in Marrakesh.

Technically, the eruptions are known as 'large igneous provinces' (LIPs). They can spew more than one million cubic kilometres of rock in a few million years. By comparison, the 1980 eruption of Mount St Helens in Washington state put out just 10 cubic kilometres.

These large events also emit gases that can change atmospheric temperature and ocean chemistry in a geological blink of an eye. A modelling study published last month suggests that global temperatures could have soared by as much as 7 °C at the height of the Siberian eruptions (F. Stordal *et al. Palaeogeogr. Palaeoclimatol. Palaeoecol.* **471,** 96–107; 2017). Sulfur particles from the eruptions would have soon led to global cooling and acid rain; more than 96% of marine species went extinct.

But the picture of how LIPs affected the global environment gets murkier the further back in time you get, says Morgan Jones, a volcanologist at the University of Oslo. Uncertainties in dating grow, and it becomes hard to correlate individual eruptions with specific environmental impacts. "It's at the limit of our understanding," he says.

On average, LIPs occur every 20 million years or so. The most recent one was the Columbia River eruption 17 million years ago, in what is now the northwestern United States.

Discovering more LIPs on Earth helps to put the geological history of neighbouring planets in perspective, says Tracy Gregg, a volcanologist at the University at Buffalo in New York. She and Ernst will lead a meeting on LIPs across the Solar System at a planetary-science meeting in Texas next week.

Venus, Mars, Mercury and the Moon all show signs of enormous eruptions, Gregg notes. On the Moon, LIP-style volcanism started as early as 3.8 billion years ago; on Mars, possibly 3.5 billion years ago. But without plate tectonics to keep the surface active, those eruptions eventually ceased.

"Other planetary bodies retain information about the earliest parts of planetary evolution, information that we've lost on Earth," Gregg says. "They can give us a window into the early history of our own planet." ■

INTELLECTUAL PROPERTY

Ugly fights over mutant-mouse patents rise from the dead

University sues US National Institutes of Health over animals used in Alzheimer's research.

BY HEIDI LEDFORD

Like a zombie that keeps on kicking, legal battles over mutant mice used for Alzheimer's research are haunting the field once again — four years after the last round of lawsuits. In the latest case, the University of South Florida (USF) in Tampa has sued the US National Institutes of Health (NIH) for authorizing the distribution of a particular type of mouse used in the field. The first pre-trial hearing in the case is set to begin in a federal court on 21 March.

The university holds a patent on the mouse, but the NIH has contracted the Jackson Laboratory, a non-profit organization in Bar Harbor, Maine, to supply the animals to researchers. The USF is now claiming that it deserves some of the money that went to the contractor.

If the suit, filed in December 2015, is successful, it could set a precedent for other universities, cautions Robert Cook-Deegan, an intellectual-property scholar at the Washington DC centre of Arizona State University in Tempe. And that would threaten the affordability of and access to lab animals used to investigate Alzheimer's disease more broadly.

"It feels greedy to me," Cook-Deegan says. "If other universities start doing this, all it does is push up the cost of research tools."

The mice, on which the USF filed a patent in 1997, express mutated forms of two genes[1]. These modifications help researchers to study how amyloid plaques develop in the brain, and enable them to investigate behavioural changes that manifest before those plaques appear.

The current suit has dredged up uncomfortable memories of a similar case that centred on other types of mutant mice used in Alzheimer's-disease research. In 2010, the Alzheimer's Institute of America (AIA), based in St Louis, Missouri, sued the Jackson Laboratory directly. But the NIH eventually stepped in because it had contracted the Jackson Lab to distribute

CORRECTION

The News story 'Ancient volcanoes exposed' (*Nature* **543,** 295–296; 2017) wrongly said that ancient Siberian volcanic eruptions could have raised global temperatures by 7 °C per year, rather than over 100 years.