with severe combined immunodeficiency — or 'bubble-boy disease' — a potentially lethal condition in which a person's immune system does not function properly, were doing well up to eight years after treatment (K. L. Shaw *et al. J. Clin. Invest.* http://doi.org/b6bp; 2017). They no longer need injections to be able to go to school, play outside or survive colds and other inevitable infections.

A dozen facilities constructed by CIRM have helped to push California to the forefront of research on ageing and regenerative medicine. Many grant recipients were early-career academics who had not been able to enter the stem-cell field previously because of the federal restrictions — which were loosened in 2009 — and the high cost of getting started in this kind of work. That barrier makes it difficult for researchers to gather the preliminary data typically required to win grants from the US National Institutes of Health (NIH).

To milk its remaining $650 million, CIRM partnered last year with the contract-research organization QuintilesIMS in Durham, North Carolina, to carry out clinical trials. CIRM leaders hope that this move will help to guide 40 novel therapies into trials by 2020.

Bob Klein, the property developer who put Proposition 71 on the ballot and established CIRM, isn't waiting for the money to run out. He leads an advocacy group, Americans for Cures, which will soon poll voters to see whether they would approve another $5 billion in funding. If it looks like at least 70% of Californians support that plan, he'll start a campaign to put another initiative on the ballot in 2018.

Klein hopes that Californians will rise in support of science at a time when the Trump administration has proposed drastic cuts to the NIH budget. If public enthusiasm is not so strong, Klein says, he'll aim for the 2020 elections, when voter turnout should be higher because it will coincide with the next presidential race.

"It would be a catastrophe for California if people say CIRM did not do what it was expected to do."

Currently, CIRM's leaders are seeking other sources of support. "The majority of our projects will not be ripe for interest from big pharma and the venture-capitalist community by the time we run out of funds," Thomas says. He has been courting large philanthropic foundations and wealthy individuals to raise money to continue the work.

John Simpson, who directs stem-cell oversight work at the advocacy group Consumer Watchdog in Santa Monica, California, plans to oppose any effort to extend CIRM. "I acknowledge their scientific advances, but we should not let a flawed process go further," he says. Simpson dislikes the model of using a vote to secure research funding through public bonds, because then the state lacks budgetary control.

Oversight of CIRM has been a problem in the past. In 2012, the US Institute of Medicine found that some scientists vetting grant proposals for CIRM had conflicts of interest. In response, CIRM altered its procedures — but the public still felt betrayed. Jim Lott, a member of the state board that oversees CIRM's finances, says that he is not satisfied with the changes. He also argues that CIRM may not have been strategic enough in directing research. "Some people say if they had a better focus, they might have achieved cures."

But researchers argue that expectations for cures after only a decade are unrealistic, given the typical pace of drug development. "It would be a catastrophe for California if people say CIRM did not do what it was expected to do," says Eric Verdin, president of the Buck Institute for Research on Aging in Novato, California. "They've built the foundation for the field and attracted people from around the world — you can't just now pull the plug." ■

EARTH SCIENCE

Deadly New Zealand quake continues to shift crust

November tremor sparked unexpected slow, deep movements in two tectonic plates.

BY ALEXANDRA WITZE

The consequences of a magnitude-7.8 earthquake that struck New Zealand on 14 November 2016 are still rippling through the country. The quake, which killed two people and caused billions of dollars of damage, ruptured a complex set of geological faults near the surface. It also triggered slow-motion movement as deep as 40 kilometres in Earth's crust, some of which continues to this day, scientists report. That deep 'slow slip' is worrying, because it adds to the risk of another big quake.

"This earthquake is special," says Bill Fry, a seismologist at GNS Science, a government-owned Earth-science research organization in Lower Hutt, New Zealand. He and others described their findings last week in Denver, Colorado, at a meeting of the Seismological Society of America.

The November Kaikoura tremor is a rare example of a large quake triggering widespread slow slip. And what researchers have learned from this tremor could illuminate the seismic risk in other regions that experience slow slip, such as Japan and the US–Canadian Pacific Northwest.

A DANGEROUS BOUNDARY

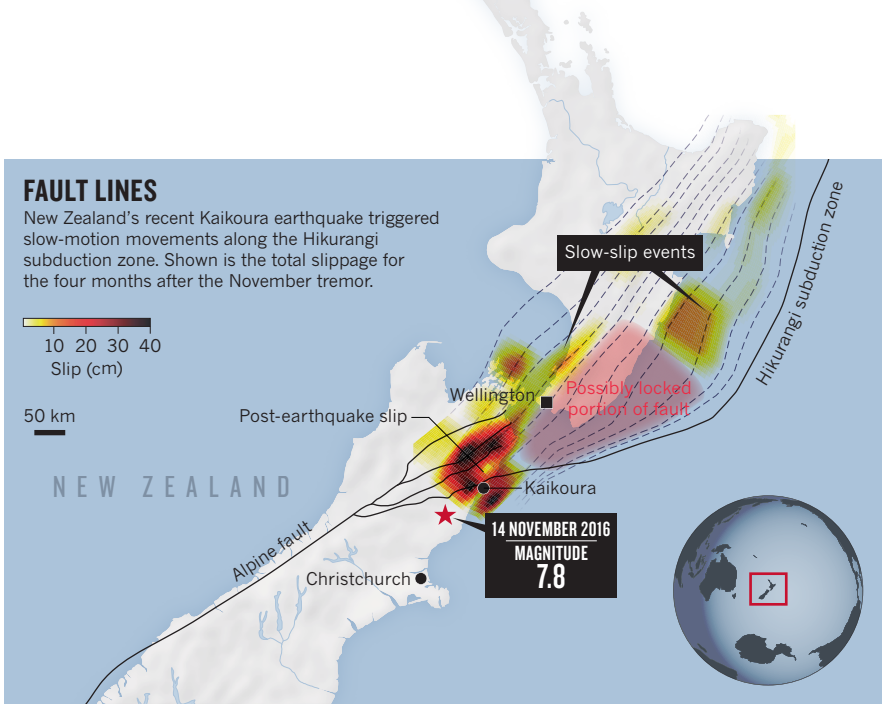
A spate of large earthquakes has rattled New Zealand in the past decade, including one in 2011 that devastated the city of Christchurch. But the Kaikoura tremor stands out for its geological complexity.

It began near the north end of New Zealand's South Island and ripped northward for more than 170 kilometres (I. J. Hamling *et al. Science* **356,** eaam7194; 2017). At least 21 separate faults broke along the way. Landslides buried roads and the shaking damaged buildings in the central business district of Wellington (A. Kaiser *et al. Seismol. Res. Lett.* http://dx.doi.org/10.1785/0220170018; 2017).

The earthquake immediately triggered slow-slip movement in at least three separate areas, according to GNS Science. The regions stretched from off the east coast of the North Island to the northern part of the South Island. In each case, the Australian and Pacific plates of Earth's crust ground against one another extremely slowly, at a dangerous interface known as a subduction zone.

Most of the slow slip ceased within weeks, although a little of it continues. Cumulatively, the plate motions have released as much energy as a magnitude-7.3 earthquake would have.

These patches of Earth's crust have slipped slowly before — but never all at once, said GNS Science seismologist Anna Kaiser at the meeting. The areas in motion surround a section that experiences no slow slip at all. This region,



SOURCE: LAURA WALLACE, TEMBLOR/GNS SCIENCE/UNIV. TEXAS

extending east of Wellington, may be locked and building up stress that could break in the next large quake (see 'Fault lines').

Seismologists have observed slow-slip movement in other subduction zones, in some cases coming before large tremors, including the devastating magnitude-9 Tohoku quake in Japan in 2011. How the two phenomena relate to one another is not entirely clear. "We're at the very early stages of trying to understand the relationship between slow-slip events and earthquakes," says Laura Wallace, a geophysicist at GNS Science and the University of Texas at Austin.

PEERING INTO THE FUTURE

The revelations from New Zealand could alter future planning in quake-prone areas. Earthquake forecasts look at past seismic activity and calculate the probability of tremors of a certain magnitude within a certain time period. They typically do not include the effects of slow slip.

But after the Kaikoura quake, GNS scientists added that movement into their own calculations and found a 5% chance of a similar quake within a year. That is a relatively low probability, but is still six times higher than it was before the quake.

With the New Zealand government busy retrofitting buildings and roads in preparation for future quakes, researchers are working to quantify what they do and do not know. For instance, seismic-risk models typically consider the rupture of one fault at a time — but after Kaikoura, geologists now realize they need to plan for the possibility of the simultaneous rupture of multiple faults. "This just really emphasizes that that needs to be done," says Matt Gerstenberger, a GNS seismologist who works on the national seismic-hazard model.

Researchers will gain greater insights into slow-slip movement late this year and next, when several project teams descend on the region. In November, the JOIDES Resolution ship will begin the first of two expeditions to drill into the slow-slip area off the New Zealand coast. A ship-borne seismic survey, to begin in early 2018, will provide a 3D look at where the slow slip is happening. And a bevy of new ocean-bottom seismometers will track the shaking as the plates continue to move.

"We're at the very early stages of trying to understand the relationship between slow-slip events and earthquakes."

"It will be the best-imaged slow-slip area, anywhere in the world," Wallace says. "We're trying to apply everything we can to this." ■

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CHINESE FOSSILS

Early-animal fossil site under threat in China

Protests result in temporary halt to phosphate mining.

BY DAVID CYRANOSKI

Palaeontologists are fighting to save a site in China that contains fossils of some of the earliest animals on record. This month they gained a temporary halt to the phosphate mining that has already destroyed some fossil beds.

The threatened site is part of the Doushantuo geological formation in the Weng'an region of Guizhou province in southern China. It became famous in the late 1990s, after scientists began finding well-preserved fossils of sponges and embryos of other unusual animals, dating to around 600 million years ago. These discoveries challenged the theory that almost all major animal lineages emerged during the 'Cambrian explosion', some 540 million years ago. Microscopic fossils, assumed to be embryos, that have been excavated from Doushantuo more recently have sparked debates over the origins of bilateral symmetry in animals.

"We may never find a comparable site and may lose the chance to truly understand early animal evolution on Earth," says Dave Bottjer, a palaeobiologist at the University of Southern California in Los Angeles, who estimates that just 5% of the site's fossils have been recovered. On a visit to Doushantuo this month, palaeontologist Zhu Maoyan of the Nanjing Institute of Geology and Paleontology in China was stunned to find a newer fossil site, opened in 2015, completely stripped of fossil-bearing sediment by phosphate mining. The locale that produced the area's first fossils was destroyed years ago. And a third key fossil-hunting area was buried by a landslide that had been triggered by mining in 2014. "It is really a disaster," says Zhu.

Phosphate miners operated in Doushantuo before the palaeontologists discovered the site. But the pace of mining has increased dramatically over the past two years, says Zhu, who organized a workshop, held on 2–3 April in Weng'an, to make a case for preserving the site. Several days later, local government officials ordered a halt to mining in the area, while they work out a strategy. Zhu says that measures are likely to include finding other sites for mining. He hopes eventually to get a central fossil-hunting zone, 1.2 square kilometres in area, closed to mining and designated a national geological park. ■