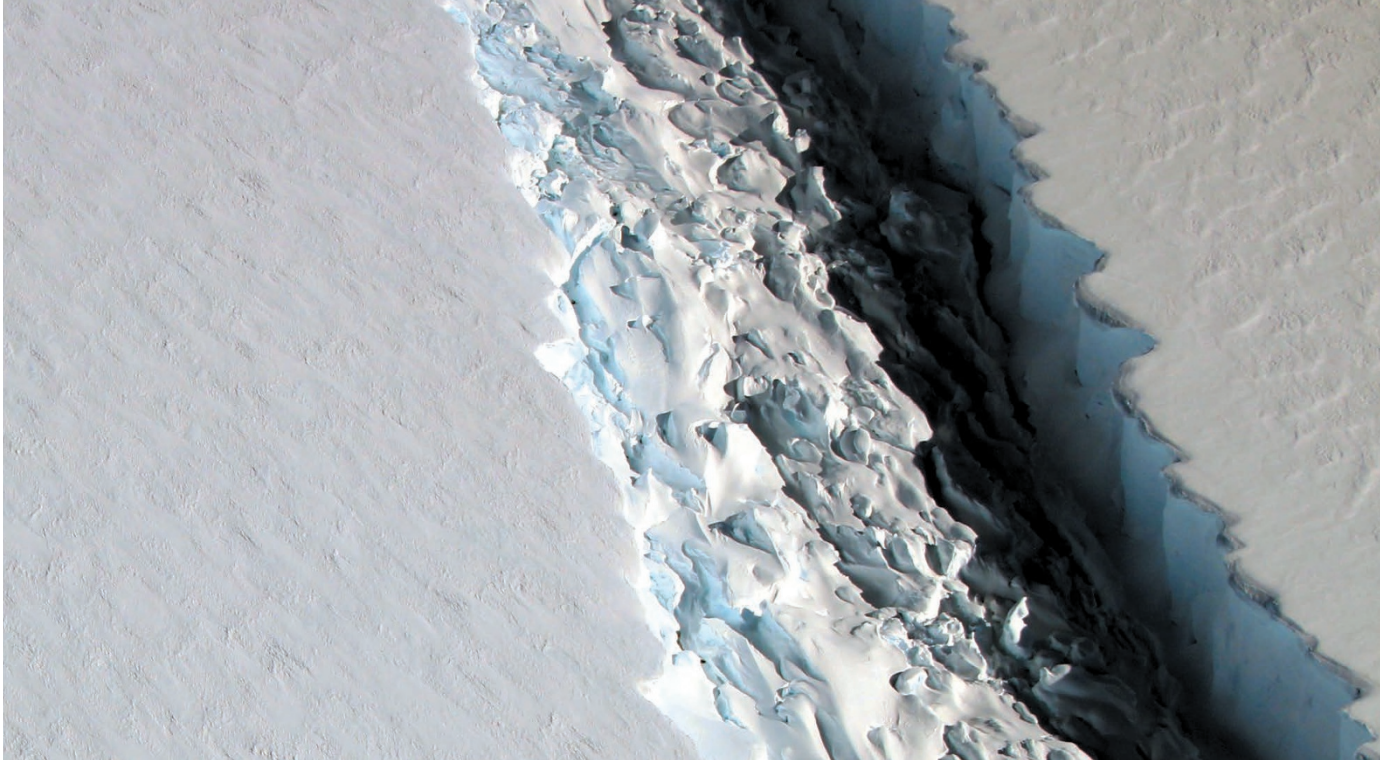


NASA

A massive rift is splitting the Larsen C ice shelf, which covers 50,000 square kilometres of the Antarctic Peninsula with ice up to 350 metres thick.

GLACIOLOGY

Larsen C's big divide

Collapse of nearby Antarctic ice shelves offers a glimpse of the future.

BY JEFF TOLLEFSON

A massive crack in Antarctica's fourth-biggest ice shelf has surged forward by at least 10 kilometres since early January. Scientists who have been monitoring the 175-kilometre rift in the Larsen C ice shelf say that it could reach the ocean within weeks or months, releasing an iceberg twice the size of Luxembourg into the Weddell Sea.

The plight of Larsen C is another sign that global warming is destabilizing ice along the eastern Antarctic Peninsula and raising sea levels. But studies of the rift also illuminate how far glaciology has come since the collapse of the ice shelf's northern siblings: Larsen A in 1995 and Larsen B in 2002, which occupied separate embayments farther out along the peninsula.

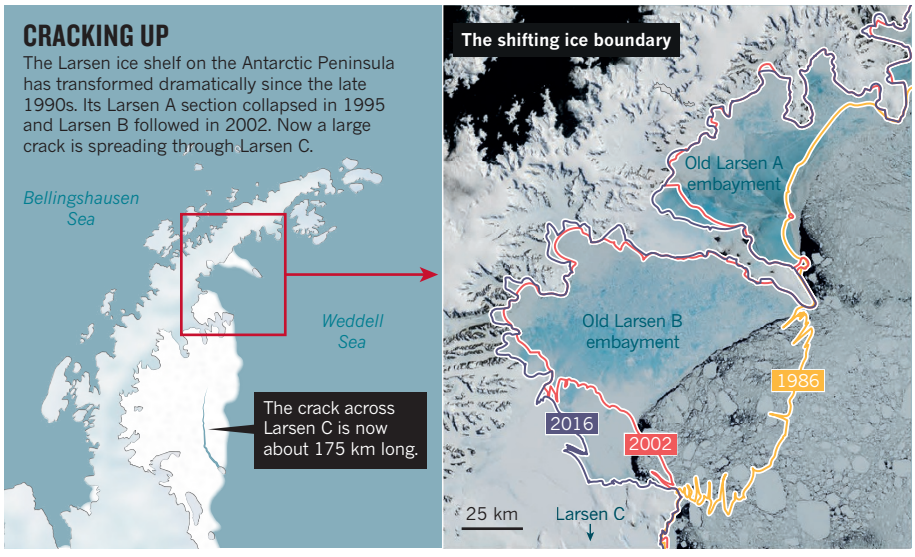
"Larsen B was a turning point in our understanding," says Ala Khazendar, a geophysicist at NASA's Jet Propulsion Laboratory in Pasadena, California. "It was the biggest collapse of its kind up to that point, and it served to demonstrate how ice shelves regulate the movement of ice from the interior of the ice sheet to the ocean."

For decades beforehand, researchers had debated the extent to which ice shelves buttress glaciers on land — acting like corks that slow the land ice's inevitable march to the sea. The late Bob Thomas, a NASA glaciologist who helped to popularize the idea, went so far as to uncork a bottle of wine and pour some out to demonstrate the effect during his talks.

Satellite data collected after the collapse of Larsen B largely settled the debate[1,2]. The speed at which glaciers connected to Larsen A and B flowed to the sea increased — by up to a factor of eight — after those ice shelves disintegrated, says Eric Rignot, a glaciologist at the University of California, Irvine. "Some of [the glaciers] have slowed down a little bit, but they are still flowing five times faster than before," he notes. Khazendar and his colleagues have also found that two glaciers flowing into Larsen B started to accelerate before its collapse, as the ice shelf weakened.

Since Larsen B's collapse, ice-sheet modellers have tweaked their simulations to better reflect the forces driving glacial flow and to help to quantify this corking effect — bolstering confidence that limited observations from the Larsen shelves could be applied more broadly.

Researchers are now looking back to the history of Larsen A and B (see 'Cracking up') to understand what the future might hold for Larsen C, which covers 50,000 square kilometres with ice up to 350 metres thick. Many fear that the expanding crack is a sign that Larsen



SOURCE: NASA EARTH OBSERVATORY/JESSIE ALLAN/US GEOLOGICAL SURVEY

C has begun a long decline that will inevitably end in its total collapse. How soon that could come after the iceberg breaks off is an open question.

The effects of a collapse could be felt far beyond Antarctica. The glaciers that flow into Larsen C contain enough water to raise the global sea level by about a centimetre — and they are likely to flow faster to the ocean in the absence of an ice shelf. In comparison, global sea levels are rising by about 3 millimetres a year, and a recent study estimated that one-third of that comes from ice loss in Antarctica and Greenland[3].

Satellite images show that Larsen C has been receding since the 1980s, and radar measurements suggest that its ice is thinning, Rignot says. Scientists have also seen meltwater ponds forming on the ice shelf's surface[4]; similar ponds probably hastened the disintegration of Larsen B by carving holes in the ice and expanding cracks.

The ice sheet is protected, to some degree, from rapid collapse by favourable sea-floor geometry. A pair of underwater ridges that surround Larsen C create friction that slows the flow of ice to the ocean.

Still, the parallels with Larsen B's decline are striking, says Adrian Luckman, a glaciologist at Swansea University, UK, who heads a team that has monitored the Larsen C ice crack for several years. Larsen B experienced a major iceberg-calving event in 1995, followed by gradual retreat and then complete collapse seven years later. Larsen C may follow a similar pattern, he says, although it's not clear how soon collapse might follow the imminent calving event.

For now, researchers are anxiously watching the expanding ice rift. Chris Borstad, a geophysicist at the University Centre in Svalbard, Norway, is particularly interested in Larsen C's 'suture zones' — areas where glacial ice flows off land and merges. The ice is softer in these areas, which are often held together by ice that freezes from below.

Dozens of significant cracks run into one of these zones on Larsen C, and then stop, he says. The current crack was among them, but it somehow broke through in 2014 and has continued to expand ever since. It's not clear why the crack made it through the soft ice, and whether other rifts will follow suit in the coming years.

"We don't know why, but there's something very effective about these boundaries for stopping cracks, and that may be the key," Borstad says. "To answer that question, we really need to get out there into the field." ■

1. Rignot, E. *et al. Geophys. Res. Lett.* **31,** L18401 (2004).
2. Scambos, T. A., Bohlander, J. A., Shuman, C. A. & Skvarca, P. *Geophys. Res. Lett.* **31,** L18402 (2004).
3. Forsberg, R., Sørensen, L. S. & Simonsen, S. B. *Surv. Geophys.* **38,** 89–104 (2017).
4. Luckman, A. *et al. Antarct. Sci.* **26,** 625–635 (2014).

POLICY

Science-adviser delay boosts Brexit worries

Policy experts want science input on post-Brexit decisions.

BY DANIEL CRESSEY

Two government departments charged with managing the United Kingdom's departure from the European Union have not yet appointed chief scientific advisers (CSAs) — and might not do so. That is starting to concern science-policy experts, who worry that scientists won't be at the table when the government makes key decisions on issues such as environmental protection and membership of international collaborations.

The United Kingdom has for years embraced the CSA model, in which highly qualified researchers are appointed to senior advisory roles and embedded in government departments. But neither the Department for Exiting the European Union (DExEU) nor the Department for International Trade (DIT), both of which were created after the United Kingdom's decision to leave the EU, has yet appointed, or committed to appointing, a CSA.

Last October, government ministers told a hearing of the House of Commons science select committee that DExEU was recruiting for a CSA, but this statement was later withdrawn. Then, in a letter sent to the committee on 3 February, a DExEU minister Robin Walker said that the department is still considering whether it needs a CSA.

The letter came in response to questions from the select committee, whose chair, Stephen Metcalfe, is concerned about a lack of scientific advice in DExEU. "I can't really understand why there is such resistance to appointing a CSA," he says.

Metcalfe has also raised concerns about the broader CSA system. On 9 February, his committee sent a letter to the government's CSA, Mark Walport, who leads the network of departmental CSAs and is supported by the Government Office for Science. The letter notes the absence of CSAs in at least six departments; the apparent impending absence in a seventh; and confusion over the role in an eighth.

Science-policy experts are paying close attention. "When you've got a lot of jobs lying vacant, when you've got really quite a lot of departments saying they don't have a CSA and don't have plans to have one, that really does start to raise questions about whether or not the government has reduced the emphasis it places on scientific advice," says Graeme Reid, a science-policy researcher at University College London.

The letter from Metcalfe's committee calls on the government CSA — either Walport, who recently accepted a major new role overseeing UK research funding, or his replacement — to bring the system back to full strength. The Office for Science says that it will reply to Metcalfe's criticisms soon, and that the UK system for scientific advice is "internationally recognized" and "not just strong in its breadth across government but also in its depth".

But Reid and Mike Galsworthy, programme director of the group Scientists for EU, which was set up to campaign against Brexit, say that the lack of a CSA at DExEU might already have affected how the government handled its January announcement that the United Kingdom would leave the European Atomic Energy Community (Euratom). That could jeopardize UK participation in the world's largest fusion experiment, the International Thermonuclear Experimental Reactor (ITER) in southern France, and curtail operations at the Joint European Torus (JET), a nuclear-fusion facility in Culham, UK.

"I can't really understand why there is such resistance to appointing a CSA."

The disclosure, which shocked physicists, was made in brief notes published alongside a parliamentary bill on Brexit. "The Euratom fiasco is a clear case of where some science person in the core Brexit team could have averted the sudden crisis of confidence from the science community," says Galsworthy.

Reid is particularly concerned about getting a CSA at the DIT, which will be responsible for negotiating international trade deals after Brexit. These deals can determine, for example, the patents given to different drug types, levels of environmental protection or how genetically modified organisms are regulated. "All the substance of a trade agreement is underpinned by scientific detail," says Reid. "That's why it's so important the Department for International Trade has a chief scientific adviser."

DExEU declined to elaborate on whether it plans to appoint a CSA. The DIT has said that it is working with Walport and his office to "provide advice on the specification for any such role". ■

CORRECTION

The news story ‘Larsen C’s big divide’ (*Nature* **542,** 402; 2017) erroneously stated that two glaciers flowing into the Larsen C ice shelf have begun to accelerate. Actually, it was glaciers flowing into Larsen B that began to accelerate before the shelf’s collapse. Also, the first reference should have been to E. Rignot *et al. Geophys. Res. Lett.* **31,** L18401 (2004).