Earth Science

How warming helps Antarctic ice

Climate warming in the last half century has destroyed several of the floating glaciers—called ice shelves—that skirt the coastline of Antarctica. The demise of these smaller shelves has raised questions about the vulnerability of Antarctica's two largest shelves, each nearly the size of Texas.

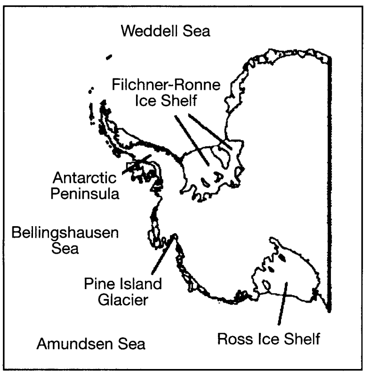
A new study may cool some of that concern. Analysis of water currents beneath the giant Filchner-Ronne ice shelf suggests that warming could thicken the floating ice rather than melt it, reports Keith W. Nicholls of the British Antarctic Survey in Cambridge. His findings appear in the July 31 Nature.

To study the Filchner-Ronne shelf, the British survey drilled holes through the 800-meter-thick ice and lowered instruments into the ocean beneath. The survey's measurements of temperature and currents revealed an apparent paradox: The water flowing under the shelf is warmer in winter than in summer.

This anomaly occurs because of sea ice formation near the front of the shelf in winter. The freezing process locks up freshwater in ice and leaves behind extra-salty water, which sinks to the bottom even though it is slightly warmer than the surrounding water. The salty current flows under the shelf and melts the ice. Sea ice doesn't grow during summer, so the salty current under the ice slackens and melting slows.

If wintertime warming in the future reduces the formation of sea ice, it will weaken the salty current beneath the ice shelf and inhibit melting, suggests Nicholls. As long as the pattern of currents remains similar to today's, "the response of the ice shelf to a warming of the climate will be for it to thicken, rather than threatening its longevity," he says.

Even in this scenario, other processes could threaten the ice shelf, says Richard B. Alley of Pennsylvania State University in State College. Melted water on the surface could weaken the shelf by draining into crevasses. "What this really points out is how blastedly complex this system is and how much we have to learn," says Alley. —*R.M.*



Nicholls/Nature

Map of West Antarctica.

Sea tales from lead

An ugly brown crust that grows on deep-sea rocks may turn into one of the hottest commodities in research on ancient oceans. A team of geochemists has mined a wealth of data from lead isotopes hidden inside crusts from the Pacific Ocean.

Made mostly of iron and manganese, the crusts accumulate at the rate of a millimeter or so per million years. John N. Christensen of the University of Michigan in Ann Arbor and his colleagues analyzed the ratio of three lead isotopes using a new technique that measures isotopic values with high precision. They report their results in the Aug. 15 Science.

Much of the lead in the sea comes from continental rocks and travels by way of windborne dust or through rivers into the ocean. Lead values in various regions can differ greatly, so the researchers were surprised to find that crusts growing 3,000 kilometers apart showed similar up-and-down wiggles in lead isotopic ratios. "The fact that we find these systematic changes tells us there must be important information here to be figured out," says Michigan's Alex N. Halliday. The lead data may reflect shifts in climate and ocean currents, he says. Over the last 45 million years, the lead wiggles match those seen in oxygen isotopic ratios known to track changes in climate. —*R.M.*

Materials Science

Solid hydrogen resists becoming metal

At sufficiently high pressure, solid molecular hydrogen should, in principle, become metallic. In other words, the material should undergo a transition to a state in which electrons roam about freely and conduct electricity as they do in metals such as copper. Researchers have succeeded in explosively squeezing liquid hydrogen briefly into a metallic state (SN: 4/20/96, p. 250). Despite a number of determined efforts, however, they have failed to crush solid hydrogen into a metal.

Calculating the behavior of solid hydrogen at ultrahigh pressures, Neil W. Ashcroft and B. Edwards of Cornell University have now uncovered theoretical evidence of a subtle effect that may explain why this element stubbornly resists turning into a metal. The physicists describe their findings in the Aug. 14 Nature.

A hydrogen molecule consists of two hydrogen atoms bound together, with two protons sharing two electrons. At high pressures, the two electrons prefer to stay close to just one of the protons, producing an uneven distribution of charge known as an electric dipole. Interactions among the molecules stabilize that polarized electric charge distribution. The presence of this partially ionic state frustrates the transition to the long-sought metal. —*I.P.*

The force of a cell's footsteps

Using a set of tiny weighing stations etched onto a silicon chip, researchers at the Duke University Medical Center in Durham, N.C., have measured the traction forces exerted during the motion of connective tissue cells from chickens.

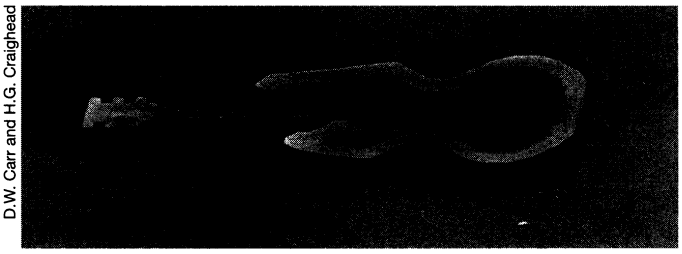
Since cells travel within the animal during embryonic development and wound healing, it's important to understand those movements, says Catherine G. Galbraith. She and her colleague Michael P. Sheetz report their findings in the Aug. 19 Proceedings of the National Academy of Sciences.

The silicon device consists of 5,904 pads, each supported on the end of a beam. By videotaping cells slowly crawling over the device, the researchers could monitor the displacement of the pads and infer the forces exerted.

From their results, Galbraith and Sheetz suggest a model for how the cells move. To go forward, a cell's leading edge pushes backward on the surface like a swimmer at the start of a crawl stroke. The rear of the cell—behind the nucleus—is dragged forward, breaking its sticky contacts. Moreover, the measured forces fluctuate, indicating that the movement is not a "continuous and smooth treadmill," the authors note. —*C.W.*

A guitar only an amoeba could love

Forget acoustic versus electric: Now, guitarists can add microscopic to their options. Scientists at Cornell University's nanofabrication facility have carved a tiny, six-stringed guitar out of silicon. The guitar was made just for fun to demonstrate a new technology for fabricating microelectromechanical devices (SN: 7/26/97, p. 62). Anyone attempting to play "Stairway to Heaven" on the instrument would have to pluck the strings—each about 100 atoms wide—with the tip of an atomic force microscope. —*C.W.*



D.W. Carr and H.G. Craighead

Scanning electron micrograph of a nanoguitar.