PALEOCEANOGRAPHY

Signs of a Warm, Ice-Free Arctic

Drillers returned to Tromsø, Norway, this week with sediment cores from the first holes ever drilled into the deep, ice-covered Arctic Ocean. The cores contain evidence of a dramatic defrosting of the Arctic Ocean near the North Pole 55 million years ago and a long, slow slide toward the perennial ice cover of recent times. Somewhere in the hundreds of meters of mud cored should be a record of the last ice-free Arctic summers of millions of years ago, conditions that may return in the greenhouse world of 2100.

The deep-drilling success of the $12.5 million Arctic Coring Expedition (ACEX) comes after decades of merely picking at the upper few meters of Arctic seafloor sediments. Since the 1960s, scientific ocean drilling in other seas has returned 160 kilometers of rock and sediment cores. But scientific drill ships had to flee at the sight of ice, and in the Arctic only the top few meters of sediment could be sampled through the oceanwide ice.

Now, under the new Integrated Ocean Drilling Program (*Science*, 18 April 2003, p. 410), the 13-member European Consortium for Ocean Research Drilling has fielded a three-ship flotilla: an ice-reinforced drill ship to float 1300 meters above the drill hole plus two icebreakers—one of them nuclear-powered. At the drill sites, just 220 kilometers from the North Pole, ice as much as 4 meters thick covered the surface, usually with only a few small gaps. Despite a string of mechanical breakdowns—a crucial high-pressure pump valve broke three times—the ships were equal to the task. "We found that even in heavy ice conditions, we could stay [over the same hole] as long as 8 days," says Kate Moran of the University of Rhode Island, Narragansett, who with Jan Backman of Stockholm University in Sweden was an ACEX co-chief scientist. "We can probably go any place in the Arctic Ocean and drill."

In 3 weeks of drilling operations, ACEX bored through all 410 meters of sediment at one site on the underwater Lomonosov Ridge and drilled to shallower depths in five other holes. All told, the 19 shipboard scientists from eight nations gathered a total of 339 meters of sediment as old as 80 million years.

Their biggest find was a couple of hundred thousand years' worth of sediment from 55 million years ago. It contains animal and plant microfossils typical of 20°C subtropical waters, not the subzero waters of today. The fossils mark the so-called Paleocene-Eocene Thermal Maximum (PETM) recorded around the globe in marine sediments of the time. "Getting the PETM was a fabulous result," says Moran. Seismic probing of the site had suggested that sediments of PETM age were missing there.

Now, paleoceanographers can try to sort out the Arctic Ocean's role in the PETM. The warming seems to have been triggered by a massive release of methane, a greenhouse gas, stored beneath the sea floor as an icy hydrate (*Science*, 28 January 2000, p. 576). It's unclear what drove the methane release, but a geochemical peculiarity of the ancient Arctic might have been involved. ACEX scientists found strikingly low Arctic seawater salinities during most of the past 60 million years, due partly to large influxes of river water. Such low-density waters might have altered ocean circulation globally if they leaked into the Atlantic, Moran notes.



Ice eaters. Icebreakers (bottom and middle) run interference for the stationary drill ship (top).

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Once global Eocene warmth began to wane, the world was on its way toward the deep chill of the past few million years. The first sure signs of Arctic ice—bits of sand that must have rafted to mid-ocean in one-time grounded ice—appeared in 40-million-year-old sediments. That's earlier than some scientists had expected. Seven million years ago, the delivery of ice-borne sand picked up sharply, suggesting more and possibly year-round ice. But pinning down when Arctic summers last saw ice-free waters—a condition global warming might bring on by the end of the century—will require close inspection of the cores on shore, says Moran. She can hardly wait. –RICHARD A. KERR

ScienceScope

Japan Revises Mad Cow Plans

Japan is scaling back its policy of testing all slaughtered cows for "mad cow disease" (bovine spongiform encephalopathy, BSE). But its new plan to test only slaughtered cows older than 20 months will still be the world's most stringent BSE screening program.

The new policy, set to begin later this month, was a compromise, says Takashi Onodera, a molecular biologist at the University of Tokyo and a member of a government advisory group. Europe and the United States test cows that are 30 months and older, he notes, in part because scientists believe younger cows haven't accumulated enough BSE-causing prions to be picked up by current tests. Japan's Finance Ministry also wanted to cut back on "useless testing" to trim the $30 million to $40 million annual cost, but the Ministry of Health and consumer groups were reluctant to raise the cutoff age any higher because Japan has found the disease in 21- and 23-month-old cows.

–DENNIS NORMILE

FDA Panel Approves ADHD Study

A controversial study that would expose healthy children to a stimulant should proceed, a Food and Drug Administration (FDA) ethics panel recommended last week. The pediatric ethics subcommittee decided that the study, on attention deficit hyperactivity disorder (ADHD), is ethically acceptable. But it urged sponsors to offer less compensation to enrolled families, saying a proposed $570 payment might unduly influence parents who needed the money.

The ADHD study is funded by the National Institutes of Health and led by child psychiatrist Judith Rapoport. It raised red flags among reviewers because scientists wanted to enroll both healthy children and those with ADHD, all aged 9 to 18 (*Science*, 20 August, p. 1088). All subjects would receive one dose of dextroamphetamine, a drug used to treat ADHD, and then undergo a magnetic resonance imaging scan to see whether the brains of healthy and ADHD children respond differently to the drug.

The subpanel's recommendation now goes to the full pediatric advisory committee, which will then make a formal recommendation to FDA.

–JENNIFER COUZIN

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