Life beneath the Antarctic ice

Ice-fishing is a venerable sport in the northern United States and many other parts of the world: drill, cut or hack a hole in the ice, lower a baited line and see what happens. Now it has been tried on the frozen wastes of Antartica's Ross Ice Shelf, where it took the heat and shock wave of a special cutter blasting away with water, diesel fuel and compressed air to punch through 420 meters of ice. And, to the presumed surprise of some researchers who have predicted no life at all in the chilly waters beneath, it worked!

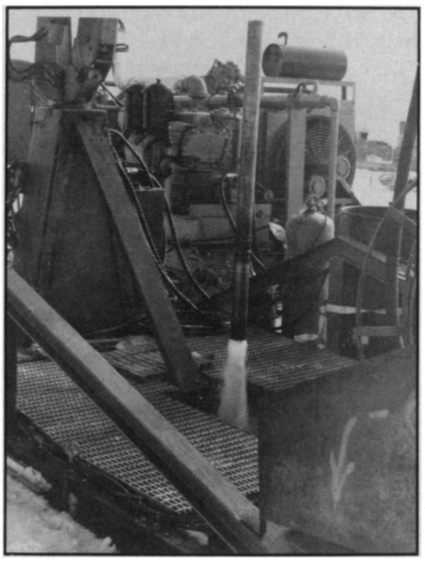
Two days after the making of the hole (SN: 12/17/77, p. 407), researchers with the multi-national Ross Ice Shelf Project lowered a side-looking television camera, which soon revealed a passing pair of what were at first thought to be tiny fish, though review of the videotape suggested that they were crustaceans. Then the camera was turned to focus on some bait that had been fastened to the camera assembly. "Within minutes," the team reported to the National Science Foundation, "various arthropods were seen approaching the bait," and one crustacean was successfully lured into a trap, captured and brought to the surface for preservation and study.

In addition, the scientists have reported finding foraminifera, as well as formations that may be "worm tubes" (tubes left by marine worms living on the bottom). Water samples taken from about 20 meters above the bottom sediment have revealed a variety of microorganisms forming a "biomass" whose size distribution "suggests that bacteria account for at least 50 percent of its composition." Samples of the bottom material itself have yielded "an abundance of well-preserved diatom flora," including some believed to date back as far as the Late Miocene period.

The water overlying the sediments is about 200 meters deep from the bottom of the ice shelf. The coldest water was found to be about halfway down, where the temperature was measured to be 2.15°C (35.87°F.). This could imply that some melting is taking place at the underside of the ice shelf, a condition whose monitoring could provide useful information about the stability and possible rate of turnover of the shelf's material.

Were it not for the diverse signs of life, the material of the seabed under the shelf would seem pretty prosaic. An early core sample produced 10 centimeters of "disturbed, homogeneous, gritty mud," and a second sample yielded more (although with the strata undisturbed), both of them underlying a surface "veneered by broken, angular slabs of plastic clay." Most of the "rocks" observed were less than 15 cm in their greatest dimension.

Some researchers believe that the waters beneath the shelf have been covered by the ice — and thus blocked from sunlight and direct atmospheric interactions — for at least 120,000 years. Such a specialized, yet living environment is truly a new frontier. □



U.S. Navy

Jet drill was key to Ross Shelf hole.

DSDP: Hints at a larger Japan of old

The Japanese, living as they do on an island nation, have understandably made particularly intensive studies of the seas around them. Hence it came as quite a surprise when the latest probings of the Deep Sea Drilling Project ship *Glomar Challenger* revealed previously unknown signs that the main Japanese island of Honshu may once have been considerably larger than it is today.

The signs were in the form of core samples taken during legs 56 and 57 of the *Challenger*'s multi-year, globe-girdling research mission. They suggest that Honshu is but a small part of a former land mass that, many millions of years ago, extended about 300 kilometers farther into the Pacific toward what is now a deep undersea valley known as the Japan trench.

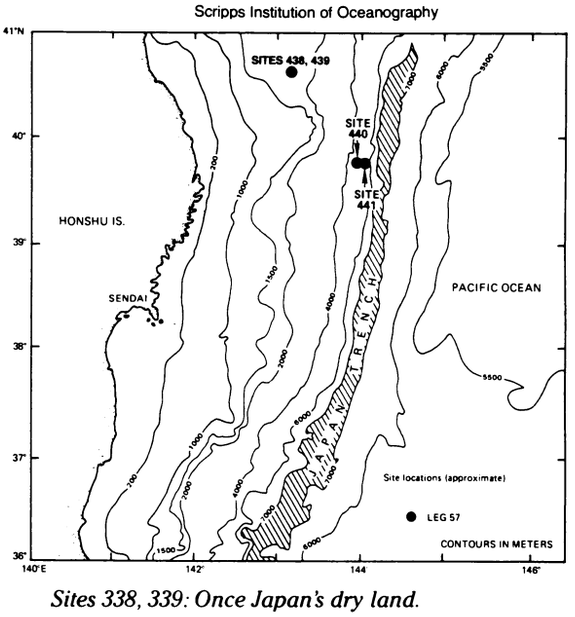
The landmass was actually discovered about 20 years ago by Noriyuku Nasu of the University of Tokyo's Ocean Research Institute, but its significance remained unsuspected even when Japanese geophysicists (using seismic sounding techniques) detected an unusual "horizon" beneath the feature's upper rock strata. The evidence came from DSDP leg 57, of which Nasu was co-chief scientist along with Roland van Huene of the U.S. Geological Survey in Menlo Park, Calif.

Core samples revealed 25-million-year-old sand deposits, from the Late Miocene period, containing perfectly preserved shells of clams and snails typical of shallow marine environments. These deposits were on top of jumbled "boulder beds," about 50 meters thick, which in turn rested on the remains of an older formation bearing signs of erosion from exposure to surface weathering. The boulders consist both of material derived from the eroded formation (which may be more than 80 million years old) and of volcanic rocks.

The resulting sediment sequence indicates that the "Oyashio Ancient Landmass" (so christened by shipboard scientists because of the Oyashio current that flows over it) subsided rapidly from above sea level about 25 million years ago to more than 2 km below the ocean surface. In fact, the researchers report, there is "no evidence" to support the alternate view, that the formation has always been part of the oceanic crust.

Following the drilling into the landmass (which required four attempts, as a result of extremely severe weather conditions), the *Glomar Challenger* moved southeastward to sample sediments from the western (landward) wall of the Japan trench itself. The trench is thought to have formed as the Japanese islands split away from the Asian mainland, with the deep gully appearing where the Pacific crustal plate dipped beneath the outer edge of the island chain. Researchers had expected that sediments overlying the Pacific plate would be scraped off during its "subduction" and added to sediments on the continental side, but samples from DSDP leg 56 (SN: 10/29/77, p. 279) had raised uncertainties. Leg 57 confirmed the mystery: Sediment cores more than 680 meters deep "recovered only material derived from a landward source," the researchers report. "No trace of the expected material incorporated from oceanic crust was found." Yet signs of the plate interaction were there. Horizontal compression had squeezed the trench-wall sediments to more than three times the vertical thickness of "equivalent" sediments only slightly farther inland toward Japan. □

Scripps Institution of Oceanography



Sites 338, 339: Once Japan's dry land.