Extreme Trapping

One of oceanography's major challenges is collection of data from extraordinarily difficult environments. For those who use sediments traps, two examples of difficult environments are the deepest oceans and the permanently ice-covered Arctic Basin.

Since 1986, Yoshi Nozaki (University of Tokyo) has deployed time-series sediment trap moorings in the Japan Trench where the bottom depth exceeds 9 kilometers. Despite extreme water pressure on the instruments at the deepest trap (8.8 kilometers), Nozaki has successfully redeployed the mooring many times to collect multi-year samples from this enormous depth. The water column at this location, nearly three times longer than in most of the deep ocean, provides an excellent natural laboratory for understanding, on an expanded scale, the chemical reactions at work on settling particles. Nozaki's work also concerns the broad-scale problem of Earth's carbon cycle: The Pacific plate oceanic crust at the bottom of the trench is destined to be subducted beneath the continental crust of adjacent plates. Thus ocean surface life forms contribute to the planet's carbon cycle both in the short-term when respiring carbon dioxide into the atmosphere and in the long-term (hundreds of millions of years) when, following a long trip to the deep seafloor, the carbon of their dead bodies is absorbed into Earth's crust by the plate tectonic process.

Susumu Honjo

Yoshi Nozaki of the University of Tokyo poses with one of the traps he sends nearly nine kilometers deep.

The WHOI PARFLUX group has collaborated over the last decade with the Japan Marine Science and Technology Center (JAMSTEC) to develop Ice-Ocean Environmental Buoys (IOEBs) for deployment in the Arctic. The buoys carry sediment traps to collect descending particles as well as many sensors to detect the variability of atmosphere, ice, and upper ocean layers. A field team led by WHOI Research Associate Rick Krishfield and Kiyoshi Hatakeyama of JAMSTEC fly their gear to an ice island in the Arctic Ocean by ski-equipped cargo plane. They employ a steam auger to cut a hole in the ice and then lower first the anchor, a current meter, and the sediment trap, which together form the lower portion of the mooring, followed by instruments situated farther up the line, and finally the buoy that plugs the hole in the ice. The sediment trap is programmed to open and close every half month.

An ice island slowly describes a circle within the Canadian Basin where the present IOEB study is concentrated. This experiment allows scientists to sample settling particles and make other measurements throughout a wide area over a year or longer without themselves being present during the harsh Arctic winter. The first long-term (one-year), high-resolution, time-series samples have arrived at WHOI, and we expect their analysis will contribute a great deal to our knowledge about how the biological pump operates under the Arctic ice.

—Susumu Honjo

(See *Oceanus* Vol. 37, No. 2 for further information on the Ice-Ocean Environmental Buoy)

Susumu Honjo

From left, John Kemp, Rick Krishfield, and Kiyoshi Hatakeyama deploy a time-series sediment trap through a hole they've drilled in the Arctic Ocean ice cover.

Susumu Honjo