Antarctic waters' broad and icy reach

To the landsman's view, the solid portion of earth's surface displays its infinite variety—forests, mountains, deserts—while the oceans are just "the water," homogenized and blurred together. But the oceanographer sees myriad variations in his wet domain: hot spots, cold fronts, interacting currents, patterned mixings and other distinct features. The most exhaustive project yet mounted to study the anatomy of the oceans completed its 10-month Pacific phase last week, when the GEOSECS (Geochemical Ocean Sections Study) expedition's research ship, Melville, berthed at its San Diego harbor.

Scientists from 15 U.S. institutions and six foreign countries are participating in the program, which completed its Atlantic explorations last year using a different vessel. Thousands of deep-water samples and reams of other data are helping the GEOSECS teams understand just what water goes where, how it gets there and what it does when it arrives.

One of the major findings of the Pacific study is that the cold Antarctic water that sheathes the Pacific bottom arrives there not as the comparative spurt that had been supposed, but as a massive, wide influx that is one of the ocean's major circulation patterns.

Previous hypotheses had it that the Antarctic waters thrust northward in a rapid, narrow boundary current that peels off from the Antarctic circumpolar current and moves north along the western edge of the Pacific basin. Instead, says Harmon Craig of the Scripps Institution of Oceanography, the oceanographers found that cold water travels in a vast swath as much as 1,200 miles wide, which moves northward so slowly that it takes about 1,000 years for a given portion of the influx to reach the central Pacific region where it begins to dispense.

This deep, cold layer, together with the benthic front (similar to a weather front) where it borders the warmer waters above, has a major effect on climate, due to its temperature influence on the atmosphere above. The front itself is an important controlling factor in the mixing of ocean constituents such as nutrients, dissolved gases, pollutants and nuclear fallout.

Next year: the Indian Ocean. □

Drilling a volcano (and telling about it)

Drilling a deep hole in the side of an active volcano sounds like asking for trouble, but earth scientists at Dalhousie University in Nova Scotia, motivated by the search for mineral and energy resources as well as for greater knowledge of the living earth, have tried it anyway—and gotten away with it.

Already experienced in less lively deep-drilling projects in the Mid-Atlantic Ridge and the Bermuda Islands, a group headed by James M. Ade-Hall decided to attempt their adventurous project in the Azores, on the island of San Miguel. The site was Agua de Pau, a volcano that has not erupted since 1563 but is still considered active. "We were warned by the islanders," says geologist Fab Aumento half seriously, "that we would be held totally responsible if our drilling caused an eruption."

The drilling rig was set up on the slope about 230 feet above sea level. The researchers expected that they would soon hit lava which had erupted under water, and that at the bottom of the planned 5,000-foot hole temperatures would indicate geothermal steam below. They were doubly wrong.

"It was a bit of an embarrassment," says one participant. "Temperatures got hotter and hotter, and at much shallower depths than had been anticipated. All of the rubber gaskets used in the drilling rig were failing, and we were afraid we were on the verge of a blowout."

New gaskets made of Teflon were made back at the university and flown in from Canada. The drilling continued. At 1,600 feet, when technical problems prevented further temperature measurements, the heat was up to 446 degrees F., and still the drill churned downward.

Finally, just past the 3,200-foot level, as the drill string was being lowered into the hole for another push, the cork came out. The pressure against the ever-thinning layer of rock at the bottom of the hole suddenly broke free, blasting a jet of live steam up the shaft and promptly terminating the project.

The local power company was so turned on by the project that it threw in some money of its own, and may make a geothermal well from the hole, which contains surprisingly old lava at relatively shallow depths.

"The island sinks as lava leaves its reservoir underneath, but then the lava gets pumped up and redeposited on the surface," says Aumento. "It seems like nature is playing with a deck of cards." □