Unique volcanic subsea specimens

Traveling to the far corners of the world's oceans, the research vessel Glomar Challenger has sampled all sorts of diverse material from the ocean floor in the years of the Deep Sea Drilling Project. As if to underscore this diversity, the latest phases of the journey, Legs 51 and 52, have bored into two areas of the seabed only 450 meters apart with results of nearly equal but opposite significance: samples of some of the most- and least-changed ancient volcanic material ever brought to light by the DSDP.

The holes were drilled along the southern border of the Bermuda Rise in the western North Atlantic, a region where the oceanic crust is believed to be about 80 millon years old. The crust there is thought to have formed when the North Atlantic was about half its present width, as the world's great ancient land masses were separating to create the present continents. One of the most important goals of the DSDP has been to study the growth of the crust as it was born in, and moved away from, the boundaries such as the Mid-Atlantic Ridge between the earth's moving crustal plates. This has been an even more specific goal of the DSDP's International Phase of Ocean Drilling, of which DSDP Legs 51 and 52 are Legs 4 and 5.

The first hole was drilled high on the slope of a rugged hill in the oceanic crust along the edge of the rise. Although it was planned only as a "pilot hole" to check out the terrain for the deeper drilling to follow, the 200-meter core extracted from the site yielded "what is probably the most-altered basalt ever seen in the deep sea." Leg 51 chief scientists Thomas W. Donnelly of the State University of New York at Binghamton and Jean Francheteau of the Centre Oceanologique de Bretagne in Brest, France, feel that the sample has at last provided a clear measure of what happens to basalt that has been exposed directly to seawater for many millions of years. According to an official of the Scripps Insitution of Oceanography, which manages the DSDP, "It soaks up water and potassium like a sponge, forming abundant secondary minerals, including masses of brilliant green mica and sparkling zeolite crystals equal in quality to fine museum specimens."

The second hole, though only 450 meters away, was made far down on the hill, where the underlying material was quickly buried as the hill was first thrust up from the surrounding seabed. As a result, glassy material found in the core sample was protected from the ocean almost since birth, and thus appears to be "among the world's oldest samples of truly fresh volcanic glass." Furthermore, the basalts from the two sites apparently resulted from a vertical displacement of the same eruptive sequence, probably due to faulting, so they provide an ideal example of contrasting submarine weathering effects on matched substrates.

The basalts themselves, although highly uniform in composition, are nonetheless significantly different—higher in calcium and aluminum and lower in magnesium—than what is considered typical for young basalts from the mid-ocean ridges. The scientists are uncertain as to whether this is just a chance variation or a sign that past ideas of "typical" basalt are mistaken. To determine whether the more accepted basalts underlie those in the Leg 51 samples, the Challenger was sent on Leg 52 to reenter the second hole, the first time that a drilling site from one leg has been reentered on another. The reentry was successful (and at a record water depth of 5,479 meters, making the task all the harder), but last week the "bottom hole assembly" of the drill string broke off in the hole, leaving engineers and technicians this week still trying to get it out.

The drilling team still has plenty to show for its labors, however. The Bermuda Rise is the site of some of the largest known anomalies, or irregularities, in the earth's magnetic field. Minerals recovered from DSDP drilling in the area of other magnetic anomalies have failed to show the amount and polarity of remnant magnetization that would explain the effect. But in the Rise samples, the inclination of the remnant magnetization—indicative of the inclination of the earth's magnetic-field axis at the time the basalts were formed—differs by only 6° from what had been predicted for 100-million-year-old basalts in this part of the Atlantic. The magnetic orientations were so well preserved, in fact, that analysis revealed a subsequent minor rotation of the rocks due to faulting.

The sediments overlying the sites, meanwhile, have hinted at a fascinating story of their own. Buried deep in the sediments was a group of rounded, highly polished pebbles that bear a strong resemblance to the wave-worn pebbles found on beaches. If further study shows that they are indeed wave-worn, it may mean that the site region, one of the deepest parts of the Atlantic, was once nearly at sea level. It is possible, in other words, that this portion of the sea floor dropped by as much as 5.5 kilometers during the last 100 million years. □

Cattle drug: 'No evidence of cancer hazard'

Any substance shown to cause cancer in man or animals is prohibited as a food additive, according to the 1958 Delaney amendment to the Food, Drug and Cosmetic Act. But the issue is far from settled in both theoretical and practical terms. Can there be safe, low levels of cancer-causing substances? Can the benefits of a food additive outweigh the risk of a slightly increased incidence of cancer?

The latest argument about food additives and human cancer focuses on a synthetic hormone, diethylstilbestrol (DES), that is added to livestock feed. The hormone has caused cancer in laboratory animals and in daughters of women who were given high doses during pregnancy to prevent miscarriage. The federal law contains a provision, referred to as the DES clause, that allows cancer-causing agents in livestock feed provided that no residue is measurable in the meat. The Food and Drug Administration will soon be holding hearings in its third attempt to ban DES from livestock feed.

The Council for Agricultural Science and Technology (CAST), a consortium of 19 agricultural science societies, recently charged that DES is safe as used in livestock and that the FDA prohibition of any substance causing cancer is unrealistic and unscientific. A group of 20 agricultural scientists, toxicologists, physicians, economists and lawyers prepared the CAST report which concludes, "There is no evidence of a cancer hazard attributable to use of hormonally active substances in livestock production."

The report compares the low levels of DES that may remain in meat with the much higher levels of estrogen and estrogenlike hormones in normal human bodies, in plants and in birth control pills. It says DES has no known biological effect beyond that of estrogen. The CAST scientists calculated that a woman's body contains hormones with natural estrogenic activity 2,500 to 25,000 times higher than the maximum amount they estimate would be absorbed from beef liver, the organ with the highest DES concentration.

Plants also contain estrogenlike hormones. "In a meal consisting of whole wheat bread, green salad, mashed potatoes, green peas and ground round steak from DES-implanted cattle, the component of the meal that would contain by far the least estrogenic activity is the ground round steak," the report claims.

Finally, by assuming that the effect of a cancer-causing agent is proportional to dose and noting that there is no evidence of increased cancer from birth control pills, the CAST scientists reason, "The use of DES in beef production is 600,000 times safer than a widespread practice that has shown no evidence of a cancer hazard."

An FDA spokesman said the report is under review, but the FDA position remains that DES is carcinogenic and should be banned from livestock feed. Scientists in the FDA counter the CAST report conclusions by arguing that the current tests for monitoring DES in meat are not sensi-