Earth Science

From San Francisco at a meeting of the American Geophysical Union

Sitting right on top of an eruption

Oceanographers have captured the first close-up measurements of a subsea volcanic eruption, thanks to a mixture of careful planning and geologic good luck. Their observations offer new clues into how outpourings of lava create the seafloor and season the oceans with important chemicals.

The eruption started on January 25, 1998, at Axial Seamont, a broad-shouldered mountain 300 kilometers west of Cannon Beach, Ore. Researchers with the National Oceanic and Atmospheric Administration (NOAA) had previously surveyed Axial and set out several instruments there in 1997, hoping to record any unrest. In the late summer of 1998, they returned to examine the seafloor and see if their instruments had survived the 10-day volcanic episode.

Using a robotic sub, the team recovered three of the five equipment moorings attached to the seafloor near the eruption site. One sensor, which gauges water depth, indicated that the crater at the top of the volcano dropped by 3 meters during the episode, says Christopher Fox of NOAA in Newport, Ore.

Fox suspects that before the eruption, the volcano's summit swelled up as molten rock gathered beneath it. During the eruption, the magma forced its way to the southern flank of the volcano and erupted out that side. The summit then sank like a cooling soufflé.

The NOAA team also recovered two strings of temperature sensors. According to these instruments, which floated above the ocean floor, the water temperature spiked about 3 hours after earthquakes had started rumbling, says Edward T. Baker of NOAA in Seattle. The lag reflects the time it took magma to work its way up to the seafloor and erupt at the surface.

For all their success, the team may have been a little too lucky in choosing sites for their instruments. The sensors were so close to the action that one disappeared without a trace and another became embedded in a lava flow. The NOAA crew tried to extricate the trapped instrument using the robotic submersible, but the gambit failed. —*R.M.*

Life gets extreme in seafloor chimneys

A set of volcanic chimneys that scientists pulled up from the ocean floor last summer is yielding a rogues' gallery of microbes, including what may be some of the toughest forms of life ever discovered. "There is an abundance of bugs throughout these structures," says biologist Matthew O. Schrenk of the University of Washington in Seattle. "There are some possibly at temperatures higher than we've seen [microbes living at] in the lab."

The chimneys came from a Pacific Ocean site about 200 kilometers north of Axial Seamont on the Juan de Fuca Ridge. The ridge marks where two oceanic plates join. As the plates pull away from each other, liquid rock wells up from Earth's interior to fill the gap, creating new ocean crust.

The chimneys, which resemble stalagmites, form when volcanically heated brines spew out of the ocean floor and instantly deposit a variety of sulfide minerals, such as pyrite. Over the past 2 decades, researchers have found a host of heat-loving microorganisms living on the exterior of these chimneys.

In July 1998, a team from the University of Washington and the American Museum of Natural History in New York City hoisted up four 1.5-meter-tall pieces of sulfide chimneys, each weighing between 500 and 2,000 kilograms. Biologists collected samples from throughout the chimneys. At the center of the structures, water temperatures can reach more than 350°C.

Schrenk and his colleagues cultured microbes from most parts of the chimneys. "They're living quite close to the central conduit, maybe at temperatures of 200°C or more," he says. The team plans to analyze minerals from the chimneys to better estimate temperatures and will try to grow the organisms at high temperatures. The existing record for life in the laboratory is 113°C. —*R.M.*

Food Science

Green tea belittles cancer

Nutritionists have been touting green tea's anticancer benefits for years. Studies have shown that people who drink it tend to develop fewer cancers and that animals administered the brew derive similar benefits (SN: 8/31/91, p. 133). How this tea works its magic, however, has remained an open question.

Researchers at Purdue University in West Lafayette, Ind., now think they've stumbled upon at least part of the answer.

Green tea contains a potent antioxidant with the unwieldy name of epigallocatechin gallate, or EGCg. Biochemist D. James Morré and his colleagues find that this compound shuts down quinol-oxidase, an enzyme that cancer cells need to divide and reproduce. While normal cells also rely on this enzyme to grow and proliferate, EGCg's enzyme-inhibiting effect appears to be restricted to tumor cells.

The tea constituent seems to thwart a cancer by halting the enlargement of its cells—something that "is clearly not an antioxidant function," Morré notes. Many cancer-fighting nutrients studied so far have proved capable of disabling oxidants. In the test tube, when EGCg-stunted cells fail to reach a critical size needed to divide, they succumb to a programmed cell death. Ordinarily, tumor cells live indefinitely.

But what about black tea, the brew consumed by about 80 percent of tea drinkers around the world? It also contains EGCg, though in far smaller concentrations than green tea. Both teas are prepared from leaves of the same plant. Morré suspects that black tea's paucity of EGCg explains why it's only one-tenth to one-hundredth as potent as green tea at inhibiting the quinol-oxidase reaction in test-tube-grown cancer cells.

However, "there's no reason why you shouldn't derive some benefit from drinking black tea"—especially if it's sipped regularly through the day to ensure that at least a little EGCg is usually present in the body, concludes Morré, himself a heavy consumer of this more popular brew.

He and Dorothy M. Morré reported their team's findings in San Francisco last month at the American Society for Cell Biology annual meeting. —*J.R.*

Soy compounds help preserve bone

Soy protein may have benefits that extend beyond those already known—reducing a person's risk of heart disease and of breast cancer. A pair of animal studies now suggests that soy also helps prevent the bone loss that can lead to osteoporosis and fractures in the elderly.

After menopause, women produce less estrogen, a hormone that helps keep bones strong. To simulate menopause in rodents, Bahram H. Arjmandi of Oklahoma State University in Stillwater and his colleagues removed the ovaries of female rats. They then fed the animals diets rich in a protein from milk or soy.

Arjmandi's team found that accelerated bone turnover—breakdown and reformation—followed the simulated menopause. However, only among animals on the soy diets did the rate of bone formation exceed the rate of breakdown.

In a 9-week feeding trial, this net increase in the production of bone was small, the group reports in the December 1998 supplement of the AMERICAN JOURNAL OF CLINICAL NUTRITION. This suggests, the researchers say, "that for soy protein to reverse bone loss, long-term consumption may be necessary."

Findings from a 5-week feeding study, also reported in the issue, indicate that estrogenlike compounds in soy—principally the isoflavones daidzein and genistein (SN: 5/30/98, p. 348)—"are responsible for its bone-sparing effects." How the compounds spur bone growth remains unclear, Arjmandi's team adds.

The researchers say their data indicate that soy probably won't make a good substitute for estrogen-replacement therapy for bone protection, though it may offer a good adjunct. —*J.R.*