Earth Sciences

Cheryl Simon reports from Santa Fe, N.M., at the Sixth International Symposium on Environmental Biogeochemistry

Bug nuggets

When the gold panners in Alaska sifted through tons of metal-rich glacial sand-and-gravel deposits called placers, they dreamed of striking it big. Often their fortunes built up in nugget-sized increments. Gold nuggets. Or "bug nuggets," as United States Geological Survey (USGS) scientists now suggest. John Watterson of USGS in Denver says that when exposed to gold in solution, some species of soil bacteria won't germinate, but they do accumulate crystals of the metal on the outside of their spores. "With increasing exposure, there are increasing amounts of gold," he says. In laboratory studies, Watterson and colleagues found that the gold eventually forms around the bacteria, making a dodecahedrous (12 plane faces) gold nugget similar to those found in Alaska. Once the crystals start growing, he says, the nugget continues to form long after the spore is dead.

The researchers replicated nature's work by placing *Bacillus cereus* spores in 1,000 microgram per liter solutions of aqueous gold chloride. The solution was agitated gently for 36 hours, and all of the spores, when examined under a scanning electron microscope, showed gold on their surfaces. The researchers suggest that ionic gold binds chemically with the spore surface, forming a "foundation for growth of crystalline gold." They think that growth of gold crystals on bacterial spores "may be one of the mechanisms by which certain Alaskan gold placers are formed from soluble gold in waters draining low grade auriferous cherts [gold-bearing rocks]."

The cloud in the silver lining?

Of all the elements, silver is one of the most toxic to microorganisms, but relatively few studies have been conducted on the effects of silver contamination in a natural environment. With colleagues at the University College of Wales, Peter Peterson of Chelsea College in London took advantage of a made-to-order field site — the spoil heaps at abandoned lead mines at Graig Goch in West Wales. (Lead tailings often are high in silver content.) The researchers found that soils were contaminated with silver more than 800 meters from the spoil heaps, "suggesting that airborne dust is the major source of the pollution." The agricultural lands downwind of the spoil heap are yellowed in the same areas where silver concentrations are highest. "We're trying to get a clearer view of the distribution of tailings in the valley, then we can study the effects on agricultural productivity," Peterson says. He says that only about 10 percent of the silver is in a form that can be used by microorganisms, but even so, the silver may be toxic in field conditions. The highest values the researchers measured were 70 parts per million (ppm). It is known from laboratory studies that silver in concentrations of 10 ppm is sufficient to reduce the amount of carbon dioxide released by soil microbes by as much as 30 percent.

Spores still viable after 7,000 years

Seven thousand years ago bacterial spores were embedded in the muds lining Minnesota's Elk Lake. When samples of those muds were retrieved recently by researchers at the United States Geological Survey (USGS) in Denver, the spores were warmed to surface air temperature — 55°C — from the 4°C of their chilly sub-lake resting place. When the bacterial spores, *T. vulgaris*, were placed in a nutrient-rich culture, "they grew like crazy," says Nancy Parduhn. The sediments containing the spores were dated at 7,518 years, using carbon-14 isotope dating methods and sediment analysis. Previously the oldest known viable spores were found in sediments 5,800 years old near Catalina Island, Calif. Parduhn suggests that the organisms are able to survive because when necessary, they can lower their rates of metabolism, sustaining themselves until conditions again are conducive to growth.

Martha Wolfe reports from the U.S. Geological Survey's Polar Research Symposium in Washington, D.C.

New Dry Valley seismic station

For more than a decade the United States Geological Survey (USGS) has been collecting seismographic data at the South Pole. The effort is part of an overall goal to evenly distribute seismic sensing equipment around the world, pooling the data into a global network of earthquake detection. The Antarctic continent occupies one-tenth of the earth and seismic data from there fills an otherwise vast void in the global data network. However, wintertime comunication with the South Pole is at best unreliable, and data collected there can only be retrieved for integration into the network once or twice a year.

This December and January, seismologists from the USGS in cooperation with their New Zealand colleagues will search for a site in the frozen continent's Dry Valley region (SN: 4/24/82, p. 284) on which to construct a new seismic sensing station. Gary Holcomb at the USGS Albuquerque Seismological Laboratory will be leading the expedition. "This year we will be looking for a site with low background noise and easy accessibility to Ross Island, where the main U.S. and New Zealand stations are," he says. "We can't put the station on Ross Island because there is an active volcano there." The scientists chose the Dry Valleys because they are ice-free, there is a well-supplied New Zealand summer outpost nearby, and they are within helicopter distance of Ross Island. Within the next five years they expect to have the new equipment operating and connected by satellite to the Global Telemetered Seismic Network.

When installed, data from the proposed 100-meter bore-hole digital seismometer will be transmitted to Scott Base — the New Zealand Station on Ross Island — where a land-based INTELSAT station will transfer it to the equatorial geostationary satellite by that name. "The problem with the pole seismic equipment," Holcomb says, "is that it is an older analog surface system and the data are inaccessible." Ultimately, the USGS Albuquerque office will receive the high-grade Dry Valley data, and integrate it into world seismic data in real time, providing a critical, continuous link to the world's seismic data network.

Marine geology on the Ross Sea Shelf

The *S.P. Lee,* a USGS "ice strengthened" research vessel—reinforced for extra strength but not for breaking ice — will spend January and February of 1984 in the waters of the Antarctic continental shelf near Wilkes Land and the Ross Sea. Researchers from the USGS Marine Geology Branch in Menlo Park, Calif. will carry out 24-channel seismic surveys of the coastal margin to determine its stratigraphic configuration and origin.

According to the widely accepted tectonic plate theory of earth's geological evolution, Antarctica was once connected to Australia, South America, Africa and New Zealand in a megacontinent called Gondwanaland. Ninety-eight percent of the continent is now covered with ice, the weight of which has forced much of the land below sea level and effectively starved it from the tons of sediment that collects on the shelves of temperate continents. The stratigraphy of the shelf's sediments should therefore closely mirror the ancient history of the rifting process that ripped the continents apart, sending Antarctica on a slow drift toward magnetic south. Furthermore, according to the Gondwanaland puzzle pieces, the area where the *Lee* will be investigating may be the structural counterpart of mineral-rich areas in Australia.

Steve Eittreim, chief geologist on the Wilkes Land leg of the *Lee's* voyage, says," This year's expedition will be the first of about five. The data we collect over that time combined with that of the French and Germans who have done extensive surveys on other parts of the coast should help us shed considerable light on the tectonics of Antarctica, the possiblity of mineral resources in the Ross Sea area, and the basin's interesting post-rift evolution."