Earth Sciences

Cheryl Simon reports from San Francisco at the meeting of the American Geophysical Union

Looking out for luminous phenomena

The lookout stationed at the Sopelia observation point in the Yakima Indian Reservation in Washington state was alert to signs of fire, but he saw a stranger, if less alarming, sight: "A very strong white light about the size of a baseball was floating along just north of me down the slope....Really looked like someone *could* have been out for an evening stroll with a light in their hand. But nothing to stroll on but air....No noise at all. All quiet," he wrote. Scientists call these spheres of light "luminous phenomena" and some believe they happen where movement of the earth's crustal plates causes strain over a large region.

John S. Derr, of the United States Geological Survey in Denver, distinguishes the luminous phenomena from earthquake lights (SN: 6/5/82, p. 375) which have been observed at the same times as an earthquake, and are associated directly with a fault or the location on the earth's surface where the quake is centered. The luminous phenomena appear to be related to the earthquake lights, but have not been linked to specific quakes. Derr suggests that they may be earthquake lights for very small, local quakes, less than Richter magnitude 1.0 that are too small to locate precisely. Between July 1972 and April 1977, 82 luminous phenomena were reported from three lookout posts on the Yakima reservation. Photographs reveal a strong resemblance to ball lightning but weather conditions at the times of the sightings preclude that explanation. Derr and colleague Michael A. Persinger of Laurentian University in Sudbury, Ontario, say that the lights may be electrical or chemical in nature or may be generated by frictional heating.

There is a strong relationship between monthly increases in reports of the lights and increases in the number of earthquakes over the same interval. The lights also may reflect release of strain in the region, the researchers note. They speculate that the luminous phenomena may be useful in forecasting large earthquakes or volcanic eruptions. In the decade before the 1980 eruption at Mt. St. Helens, the number of luminous phenomena sighted was greater than the number spotted since.

Tube worms preserved in sulfide mines

A sulfide mine in Oman has yielded fossilized remains of worm tubes similar to those made by animals living today in the lightless, mineral-rich environs surrounding vents on the ocean floor (SN: 4/7/79, p. 231; 6/19/82, p. 410). The fossils are the first found embedded in massive sulfides, the ore bodies that form when mineral-laden, superheated water circulating through the earth's upper crust meets the colder, ambient sea water. The fossils also provide evidence that the deep sea communities have persisted since at least 95 million years ago, when the now-fossilized animals were living.

Rachel M. Haymon of the Marine Science Center at the University of California at Santa Barbara, and Randolph Koski of the United States Geological Survey in Menlo Park, Calif., found three distinct types of worms. Haymon says the organisms appear to have been much smaller than those found today on the East Pacific Rise, and were slightly smaller than worms living on the Juan de Fuca Ridge in the Pacific. The fossils themselves formed when the original chitinous tubes were filled and surrounded by sulfide and quartz or amorphous silica, creating a cast of the worms' tubes. Such ore deposits, originally formed at spreading centers on the ocean floor, are called ophiolites. Over millions of years, the sulfide bodies were carried along with the moving crustal plates, and eventually were shoved up and pasted onto land. "It's not easy to preserve such delicate [organic] structures over so much time," Haymon says. She believes the worms were preserved when the biological community was buried by debris emitted by submarine volcanoes. When the seafloor was pushed onto land, the fossils "managed not to be too badly stressed by heat and pressure," she says. "They've been through a lot."

Biology

Tabulations of biotechnology boom

From a dozen private laboratories operating on shoestring budgets five years ago, the biotechnology industry has indeed boomed. According to a survey by BIOTECHNOLOGY NEWS, in 1983 the nation's 600 biotechnology firms spent $2.7 million and employed about 30,000 people. The firms together have total assets of $10 billion, approximating those of Dow Chemical Co., one of the largest U.S. industrial corporations.

A separate study estimates the financial impact of biotechnology on agriculture. L. William Teweles and Co., a consulting firm in Milwaukee, Wis., predicts that innovations in plant genetics in the next decade will add $5 billion per year to the value of major crops. That figure will increase to $20 billion a year by 10 years later. Included is an annual retail value of $6.8 billion by the year 2000 due to seed improvements. The study predicts world food production in the next 25 years will rise by 5 to 10 percent as a consequence of biotechnology.

RNA as a catalytic agent

According to classical enzymology, only a protein can catalyze a biological reaction. But a year ago scientists reported that a chemical known as RNA, or ribonucleic acid, can in at least one case rearrange itself without the aid of any protein enzyme (SN: 11/27/82, p. 342). Now Sidney Altman of Yale University and colleagues there and at the University of Colorado report a further extension of RNA capabilities. A small RNA molecule can under certain laboratory conditions catalyze the cleavage of appropriate target molecules. In at least one part-protein, part-RNA enzyme it is the RNA component, not the protein, that performs a catalytic action, Altman reports in the December (part 2) CELL. This enzyme, called ribonuclease P, breaks the chemical bonds of nucleic acids. Altman suggests that the protein may hold the reacting nucleic acid molecules in the proper position. The new-found enzymatic abilities of RNA strengthen the argument that RNA was the genetic material in primitive organisms and also provided the first enzyme-like activities. Small RNA molecules bound to modern proteins are involved in several biochemical reactions important to expression of genes.

Biology briefs

- The team of scientists who last year created large mice by introducing rat growth hormone genes into mouse embryos (SN: 11/18/82, p. 389) has now performed the same feat with human genes. Richard D. Palmiter of the University of Seattle, Wash., and colleagues reported in the Nov. 18 SCIENCE that human growth hormone gene fused to a mouse gene-control region produced excessive growth hormone. The human growth hormone, like the rat growth hormone, was manufactured in a variety of inappropriate organs, rather than just in the pituitary gland.
- Indigo, the textile dye that gives blue jeans their color, has been produced by a new recombinant DNA process by Amgen, a biotechnology firm in Thousand Oaks, Calif. Work described in the Oct. 14 SCIENCE demonstrated genes from two different bacteria could be combined into a cluster to produce a product, in this case indigo, neither bacterium alone synthesizes.
- Human interferon has been produced efficiently in laboratory-grown insect cells. Max D. Summers of Texas A&M University in College Station used genetically altered insect viruses to produce copious amounts of human interferon (the type called *beta*) in cells from ovaries of the fall army worm.
- Two new species of destructive termites have been described by Jean Luc Clement of the University of Paris in France. He discovered the insects while visiting the University of Georgia in Athens. The termites are anatomically similar to other common North American species but they employ very different sets of chemicals for recognition, defense and sexual attraction.