

EARTH SCIENCES

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

Meeting of plates, deep-focus quakes

Most earthquakes near Cape Mendocino in northern California occur between 15 and 35 kilometers beneath the surface. Thus, scientists monitoring seismic activity were startled to learn that the May 19, 1981 earthquake 130 kilometers from the coast was focused at a depth of 58 kilometers. The event is the deepest earthquake recorded in the state and one of the deepest in the contiguous United States. Robert Cockerham of the U.S. Geological Survey in Menlo Park, Calif., reports that "we now have a well-defined dipping seismic zone," a feature that occurs where ocean plates are being subducted beneath continental margins. While similar deep-focus quakes are reported near Puget Sound in Washington, Oregon also is assumed to be a subduction zone but has yet to show any seismic activity related to movements of the Gorda and Juan de Fuca plates. Cockerham said that the Cape Mendocino seismic data indicate that the crust is cool enough 58 kilometers deep for the plate to break rather than simply bend as it approaches hot mantle; the quakes may not be caused by subduction at all. Alternatively, Cockerham suggests, as the Gorda plate moves under Cape Mendocino it is "carved and broken up" as the North American plate rips pieces from the smaller Gorda.

Chlorine monoxide: Innocent until . . .

One of the chemical nasties suspected of reacting with and depleting stratospheric ozone may be less guilty than thought. When scientists from NASA's Goddard Space Flight Center in Greenbelt, Md., measured concentrations of chlorine monoxide in the stratosphere, they found it 75 percent less abundant (less than 1/4 part per billion) than indicated previously by similar measurements. Though it is not known how much chlorine monoxide occurs naturally, the gas is assumed widely to be contributed by chlorofluorocarbons, chemicals used in refrigeration and commercial processes. "If what we observe does not change with time, the effect of the chlorines in chlorine monoxide in the destruction of ozone is not as high as we thought," said Theodore Kostiuik. Jerry Rogers, Michael Mumma and others also participated in the project.

Brighter prospects for magma energy

Economical extraction of energy from magma, bodies of molten rock, still may be 10 or 20 years away but progress in research and technology has transformed the prospect from fantasy to possibility. Scientists from Sandia National Laboratory in Albuquerque, N.M., reported that field tests conducted earlier this year demonstrate that it is possible to drill as deep as 90 meters below the surface through magma hotter than 1,000°C, recover a complete core, and conduct experiments through the hole in molten rock. The U.S. Geological Survey estimates that magma bodies within 10 kilometers of the earth's surface in the continental United States contain 800 to 8,000 times the amount of energy the nation consumes each year.

In April 1981, a 35-meter-thick molten zone of Kilauea Iki Lava Lake in Hawaii was drilled and cored. While a stream of continuously flowing water kept the hole open, two techniques for extracting energy were tested. The first system, a conventional closed heat exchanger, extracted heat from the magma at a rate of 17 kilowatts per square meter. This is a standard 30-year performance average for commercial electrical generating plants. The second technique involved an open hole extending 16 meters into the molten zone. When water was injected into magma hotter than 700°C, a steady flow of steam was produced, allowing energy to be extracted at a rate of 93 kilowatts per square meter.

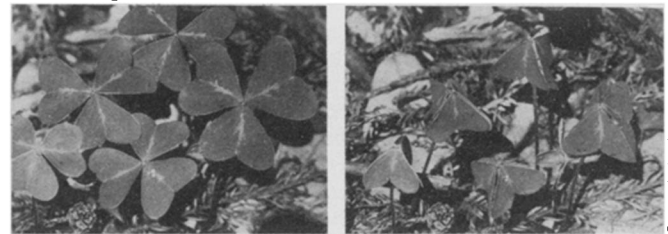
BIOLOGY

Folding 90° in the shade

On the shaded floor of California redwood forests is a plant that thrives in the shadows. It predominates in areas that receive only 0.5 percent of full sun. But the redwood sorrel (*Oxalis oregana*) has developed a remarkable defense against damage by occasional bursts of direct sunlight. This adaptation is valuable because in areas near forest clearings, the level of sunlight may increase 200-fold in a few seconds, and the full sunlight may last for an hour or two.

Many plants can change the orientation of their leaves, usually to maximize reception of light. But *Oxalis* leaves also respond to minimize injurious impact of direct sunlight. Under sudden illumination, each of the three leaflets folds downward, so the leaf surfaces are parallel to incoming rays. The light interception drops from more than 90 percent to less than 10 percent. The response is complete in 6 minutes, after just a 10-second lag. Recovery after shade returns, however, is a slower process. There is a lag of about 10 minutes, and the leaves revert to their horizontal position in approximately half an hour.

Olle Björkman and Stephen B. Prowles of the Carnegie Institution, who have described this unusual plant response, find that light, primarily blue light, is sensed by a small structure located where each leaflet joins the stem. The botanists add, "It is likely that the leaf-folding response has the additional advantage of improving the water and heat balance of the leaves during exposure to high radiation."



Early start for paternal genes

How long does it take the genes delivered to the egg by the sperm to click into operation? Only one cell cycle, University of California at San Francisco investigators find. In what they believe to be the earliest demonstration of mammalian embryonic gene expression, Janet A. Sawicki, Terry Magnuson and Charles J. Epstein have detected a gene product inherited from the father in two-cell mouse embryos. Maternally and paternally derived material, in this case genetic variants of a peptide called *beta*₂-microglobulin, is present in the embryo in approximately equal amounts. The scientists suggest in the Dec. 3 NATURE that maternally derived messenger RNA for this peptide is degraded at fertilization, and the embryo's genetic material directs subsequent synthesis.

Careful with the goat's milk

Toxic components of common plants may contribute to human birth defects, report scientists at the University of California at Davis. They have been examining a case of a baby born with severe bone deformities in his arms and legs. His mother raised goats, which had given birth to kids with similarly deformed bones, and a dog had given birth to deformed pups. Wendell W. Kilgore and collaborators speculate that the teratogen is a chemical in a local forage plant, *Lupinus latifolius*, eaten by the goats and transferred into their milk. Both the boy's mother and the dog drank milk from the goats. The investigators say they have ruled out significant exposure to the herbicide 2,4-D, which was originally suspected as the cause of the defects.