VOLCANOLOGY

Kendrick Frazier reports from Hilo, Hawaii, at the Hawaii Symposium on Intraplate Volcanism and Submarine Volcanism

Capping volcanoes for energy

Thirty-five kilometers south, southeast of Hilo along the lower east rift zone of Kilaeua Volcano, a geothermal test well has been sunk 6,450 feet beneath the surface of the island of Hawaii. It's a geothermal steam demonstration project being carried out by the University of Hawaii, the state and the county under Department of Energy funding.

A visit to the site finds it unassuming enough. A chain link fence surrounds a shiny wellhead and two large cylindrical "silencers." A faint odor of sulfur hints at the volcanic power being tapped. Here at the bottom of the well at the 6,000-foot depth, the hole has penetrated a reservoir of high-pressure steam at 358°C, making it one of the hottest wells in the world.

When a generator is installed over the wellhead sometime in late 1980, it is expected to produce 3.5 megawatts of electricity for the island. This is about 7 percent of the island's usage. University of Hawaii's engineering dean John Shupe says the steam reservoir beneath the well could eventually produce 500 megawatts.

There are some difficulties, though. Flow tests give off noise and hydrogen sulfide odor, neither appreciated by downwind residents. And the well site, although 40 km from the summit of Kilaeua, is only 100 meters from the lower rift zone fissure that erupted lava in 1955. For that reason, the electrical generator is designed to be portable, capable of being moved within 24 hours in the event of a nearby eruption. The wellhead itself could be protected — it is hoped — by a wall of old lava.

Meanwhile, Thorbjörn Sigurgeirsson of the University of Iceland reports that about one-fifth of the homes in the port town of Heimaey, Iceland, are now receiving their heat from the lava flows of the 1973 eruption on the island. The eruption produced masses of lava up to 130 m thick that are still hot inside. Water sprayed onto their surface percolates into the lava and produces steam that becomes trapped between the water-saturated surface and the molten rock. The steam is tapped by concrete ducts buried beneath the surface layer. It is sucked through a heat exchanger by a chimney. Sigurgeirsson says the system will soon be enlarged to provide heat for all of the town's homes, at a savings of several million dollars a year.

In Central America, El Salvador, tapping the energy from some of its ten dormant volcanoes, now has 60 megawatts of installed geothermal power. In 1978, it produced 20 times more power by this method than by oil, even exporting electricity to Guatemala.

Hot spots and high spots

Africa, according to much evidence, has moved little over the past 25 million years with respect to the underlying mantle (SN: 6/18/77, p. 393). Thus, effects of mantle disturbances may be better displayed on the African plate than elsewhere on earth. Kevin Burke and colleagues at the State University of New York at Albany have analyzed the numerous sites of volcanism in Africa. Many are associated with major structural elevations. Burke explains this as a thinning and swelling of the crustal plate over hot spots in the mantle.

Yet the amounts of volcanism vary enormously and are not obviously correlated with the degree of uplift. Burke proposes that hot spot-caused uplifts do not necessarily exhibit much volcanism on the surface. "Although the volcanism is perhaps the most prominent feature of the hot spots, we suggest that it is of secondary importance compared to the structural uplifts [high spots]."

The idea allows the hot spot hypothesis to be invoked in explaining other areas of uplift, even though no volcanic activity may have been observed. Such possibilities include the Adirondacks, the Bermuda Rise and the Siberian plateau.

BIOCHEMISTRY

Julie Ann Miller reports from Toronto at the XIth International Congress of Biochemistry

A voice for genes' silent regions

An egg protein called conalbumin now holds the record for the most divided gene. Pierre Chambon of the National Center for Scientific Research in Strasbourg, France, reports that the gene for conalbumin includes 17 intervening sequences interspersed with the coding regions.

Although biologists are beginning to deduce the rules underlying how the split genes are processed, little is known about the function of the "silent" intervening regions (SN: 7/7/79, p. 12). Two researchers at the congress reported indications that those regions do have some voice, however, in gene expression. Benjamin Hall of the University of Washington finds that mutations in the intervening sequence disrupt the functioning of the genes for the yeast transfer RNA that carries the amino acid tyrosine in protein synthesis. Similarly, Gottfried Schatz of the University of Basel in Switzerland reports that mutations in the intervening sequence of a mitochondrial gene interfere with gene expression. The biologists suggest that the mutations hinder the binding of the enzyme that transcribes RNA from the genes or later processing of the RNA.

Evolutionary biochem: Ape and man

Human genetic material includes various chromosome sites that direct production of similar proteins. Which gene acts in a given cell often seems to depend on where the cell is located. For instance, genes at three human chromosome locations can produce the enzyme alkaline phosphatase. One gene is active in human placenta, another in intestine and a third in liver, bone and kidney tissue. The resultant enzymes differ somewhat in their electrical charge, stability, chemical interactions and antibody binding.

The placental form of alkaline phosphatase is rare among animals, Harry Harris of the University of Pennsylvania reports. In most species, the placental and liver alkaline phosphatase appear to be the same, resembling the enzyme found in human liver. Only the chimpanzee, gorilla and orangutan have been found to have placental enzyme that can be grouped with the human placental form. The gene for human placental alkaline phosphatase thus arose recently in evolution, Harris suggests. Among humans, scientists have found a variety of forms of placental alkaline phosphatase. However, all people have the same intestinal alkaline phosphatase and liver alkaline phosphatase. Harris suggests that the diversity of the placental alkaline phosphatase gene may be related to the site's recent evolutionary emergence.

Inspecting the muscle machinery

For 25 years, scientists have held that muscles contract by a sliding of overlapping filaments and a breaking and reattachment of cross bridges. Yet the details of that rapid action have been elusive. The problem has been to obtain fast enough records to follow the dynamics of cross bridge behavior during contraction of living muscle. Hugh E. Huxley of the Medical Research Council in Cambridge, England, reports that such information is now accessible.

Huxley and collaborators have used the physicists' tool, the electron storage ring in Hamburg (SN: 3/24/79, p. 186), as a powerful X-ray source (SN: 12/31/77, p. 426). An experiment that takes a day in the laboratory takes 1 minute with the storage ring, Huxley says. An image intensifier can increase that resolution to 1 second, and if the scientists compile data from repeated contractions, resolution can reach a few milliseconds. One recent experiment demonstrates that cross bridges must attach to the action filaments to stay in their activated position.