VOLCANOLOGY

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

Hot spots and volcanic islands

Many chains of volcanic islands seem to be explainable by the hot spot hypothesis. This is the idea that volcanoes are punched up through the sea bottom in sequence as a crustal plate slowly moves over a fixed warm area in the underlying mantle. The latest volcanoes to have hot spot origins attributed to them are in the eastern Pacific and western Indian oceans.

Oscar Gonzales-Ferran of the University of Chile and four colleagues have studied San Felix and San Ambrosio islands in the Easter volcanic chain at 27 degrees south latitude. San Felix Island is considered to be an active volcano. Its lavas are of very recent origin. San Ambrosio is 30 kilometers to the east. Its lavas are of two types dated at 2.93 and 2.86 million years. Their 30-kilometer separation and 3-million-year age difference is explainable by eastward motion of the Nazca Plate over a hot spot at a rate of 10 cm a year — the rate measured by other evidence.

In the western Indian Ocean, John N. Ludden of the University of Montreal has studied the two volcanoes on the island of Reunion. There is considerable new geological interest in this island, which some scientists have dubbed Hawaii South.

The older of the two volcanoes, Piton des Neiges, is in the center of the island. The one just now reaching maturity, Piton de la Fournaise, lies on the southeast coast. Ludden proposes that the evolution of this volcanic doublet is explained by northwesterly motion of the western Indian Ocean plate over a fixed heat plume in the mantle. Full maturity — development of a caldera — is reached when the volcanic center directly overlies the plume. He believes that is the case now for Fournaise.

Volcanic islands in the making

There are signs that a new subsea volcano is building 30 kilometers southeast of the island of Hawaii. It is known as Loihi Seamount, and it is actually on the south submarine slope of Kilauea volcano. Kilauea is the most southerly and active volcano on Hawaii, which is the youngest and most southerly of the chain of volcanic islands that form the Hawaiian islands.

Loihi's summit is at a depth of 945 meters. Recent underwater photographs taken from a USGS research vessel show fresh-looking pillow lavas (pillow- or bread-loaf-shaped clusters of lava formed when the hot lava comes into contact with cold water and is quickly cooled). Samples dredged from the summit also show young lava fragments. The seamount has also been the site of recent intense swarms of small earthquakes. This seismicity, according to Fred W. Klein and Robert Koyanagi of the Hawaiian Volcano Observatory, "confirms the geologic interpretation of the seamount as an active submarine volcano."

USGS scientists James G. Moore, William R. Normark and Peter W. Lipman report that the lava from Loihi closely resembles lavas from an older group of volcanic rocks on Mauna Loa volcano on Hawaii. "The Loihi lavas hence may represent an early stage in the evolution of Hawaiian magmas," they say. "Likewise, Loihi volcano may represent an early stage in the growth of the large Hawaiian shield volcanoes."

Krafla volcano gets restless

A pattern of events has been observed since 1975 on the Krafla volcano in Iceland that is very similar to a pattern in the 18th century that culminated in an eruption. It consists of jerks of rifting along a lengthy fissure through the volcano. Lava in the magma chamber below the volcano is apparently building up, then suddenly escaping into the fissure. Axel Bjornsson of the National Energy Authority of Iceland says the similar history before the eruption of 1727 to 1729 may indicate that an eruption of Krafla will now also ensue.

PHYSICAL SCIENCES

Highways tune in to microwaves

Microwaves are a versatile radiation. Astronomers tune them in to learn more about the origins of our universe while housewives (and househusbands for that matter) turn them on to cook a fast meal. And now the National Bureau of Standards is studying a new use for the radiation — probing highway slopes.

Currently, engineers have to drill bore holes into highway slopes in order to find fractures and other abnormalities that can lead to rockslides. A microwave probe would replace that tedious method. As the energy is sent into the rock formation and meets irregularities such as holes or cracks, some of the microwaves would be reflected back to the surface. Different subsurface structures would send back different electromagnetic signals.

The NBS Electromagnetic Fields Division in Boulder, Colo., reported "highly encouraging" results in a recent test experiment. The researchers were able to detect a series of abnormalities in granite at depths of more than 19 feet. Four bore holes drilled into the granite confirmed the findings.

In future experiments, the researchers hope to deploy these microwave systems in potential slide areas so that they can monitor subsurface conditions at periodic intervals for several years. This may enable highway engineers to predict when rock and landslides might occur. NBS has already pioneered the use of microwaves in probing other materials such as snow, soils and coal.

Protactinium now fits in

Nestled between thorium and uranium in the periodic table is the radioactive element with the tongue-twister name — protactinium. While its neighbors have long had their superconducting properties measured, protactinium has faced some problems in that area. Since the early 1970s, there have been conflicting reports over whether Pa was truly a superconductor.

But now J. L. Smith of the Los Alamos Scientific Laboratory along with J. C. Spirlet and W. Müller of the European Institute for Transuranium Elements in West Germany report in the July 13 SCIENCE that they were able to obtain a pure enough sample to make an accurate determination. Pa was found to lose its electrical resistivity at the critical temperature 0.43°K, lower than thorium's but higher than uranium's. The critical temperatures of the actinide series elements seem to be smoothly decreasing as their inner *f* orbitals are filling with electrons.

Playing see-saw with the sun

The planet Neptune and Saturn's satellite Titan appear to be playing a game of see-saw with the sun. As the number of solar flares and sunspots declined during the early 1970s, the planetary objects increased in brightness. Then, when solar activity increased during its 11-year cycle of highs and lows, Neptune and Titan became dimmer.

G. W. Lockwood and D. T. Thompson of the Lowell Observatory in Arizona report in the July 5 NATURE that what they may have observed "are changes in planetary albedos [reflective power] induced by solar activity."

Others have explored the possibility that chemical reactions in planetary atmospheres may be initiated by cosmic rays and the solar wind. Lockwood and Thompson suggest that if such reactions occur they must be sensitive to variations in the solar flux. As atmospheric composition changed with solar activity, so would the albedo. Perhaps a photochemical "smog" built up during increased solar activity absorbs more light, decreasing the albedo. The two astronomers stress, however, that this is all still speculative.