earth sciences

GEOPHYSICS

Earth tides and global tectonics

Of the total flow of heat from the earth's surface, probably no more than about three percent results from the dissipation of tidal energy in the solid earth. But, says Dr. Herbert R. Shaw of the U.S. Geological Survey, this amount may play a crucial role in producing magma, the molten rock material considered instrumental in sea-floor spreading.

Earth tides, he suggests in the May 29 SCIENCE, may act as a catalytic agent; they may influence tendencies toward dynamic equilibrium in the earth. This is possible, he says, even though the gross heat balance depends mainly on the distribution of the radioactive material that is the major source of the earth's inner heat and the cooling of the deep interior.

The energy of solid-earth tides is great enough to produce, by melting, about 30 cubic kilometers of magma a year. The injection of magma along mid-ocean ridges, he reasons, transfers heat both from the tidal source and from stored heat in the mantle. As a result, a compensating mass transfer from deeper regions is required to maintain equilibrium. Thus a tidal-magmatic mechanism can act as a trigger to the convective circulation in the mantle.

The cyclic tidal strains along ridge axes may help maintain the access of magma to the surface, he says.

GLACIOLOGY

Fossil ice in Hawaii

The tropical island of Hawaii has been found to contain a deposit of ice that may be a remnant of glaciation in Pleistocene times. The mixture of subsurface ice and lava is near the summit of a 13,775-foot dormant volcano, Mauna Kea.

Drs. A. H. Woodcock, A. S. Furomoto and G. P. Woollard of the University of Hawaii's Institute of Geophysics report in the May 30 NATURE that seismic refraction measurements indicate the ice extends hundreds of meters horizontally and tens of meters in thickness. They speculate it has survived intact since the ice ages because uneven radiation makes certain areas of the mountain's craters colder. A part of the ice is within the bases of the south walls of two craters.

Plans for further work include drilling to collect deep ice samples. The scientists believe the ice may yield clues to climatic, biological and other conditions during Hawaii's remote past.

PALEOCLIMATOLOGY

Continental climatic variations

Temperature fluctuations on earth in the past 30,000 years are fairly precisely known, although some disagreement persists about them (SN: 5/23, p. 505). But for earlier periods much better data are needed.

A group of French scientists has determined a temperature curve for the period between 130,000 to 90,000 years ago. Their work is based on study of a stalagmite that formed during that period in a cave in southern France. Oxygen isotopic composition in a cave is related to temperature variations, if there is no air movement and if certain other conditions are met.

Their study shows that the temperature increased slowly from 130,000 to 120,000 years ago. It then remained approximately constant. This relatively warm period ended abruptly 97,000 years ago when, in about 1,000 years the temperature fell about 2.5 degrees C. A period of variations ensued. Then in the 1,000 years beginning 93,000 years ago the temperature rose by 4 degrees C.

The work is reported in the May 16 SCIENCE by Drs. J. C. Duplessy, J. Labeyrie, C. Lalou and H. V. Nguyen of the National Center for Scientific Research in Paris.

GEOLOGY

Probing an undersea hole

A team headed by U.S. Geological Survey geologists was to depart this week to determine the origin and physical characteristics of an uncharted depression in the ocean floor 30 miles east of Crescent Beach, Fla.

The depth of the ocean floor averages only 82 feet in the area, but the hole is said to be about 400 feet deep and 125 feet across.

The scientists are interested in determining whether it is related to a fresh-water spring discovered 25 miles west of the site a few years ago. Another possibility is that the depression is a sinkhole, a collapsed cavern beneath the sea floor.

Commercial fishermen have apparently known of the depression's existence for some time, but scientists learned of it only recently.

GEOLOGY

Guyot in a desert

The Afar triangle region of eastern Ethiopia is an area of strange and rugged geology. Much of it consists of below-sea-level desert. Until very recent geologic time, the area was a submerged part of the Red Sea.

Geological expeditions in the last three years have produced new insights into the history of the area; they also now provide a clue to the evolution of the many flat-topped seamounts (SN: 9/21/68, p. 293) called guyots found throughout the oceans of the world.

The smooth and level surface of these undersea platforms, which are generally at least 200 meters deep, is usually attributed to erosion by ocean waves at a time when the structures were assumed to have been at sea level. Later, so the theory goes, they subsided by some unexplained mechanism to their present depth.

But direct geologic studies of a guyot now exposed on dry land in the Afar triangle suggest otherwise. The guyot, now a 1,200-foot flat-topped volcano, Mount Asmara, shows no evidence of wave erosion on its top, report Drs. Enrico Bonatti of the University of Miami and Haroun Tazieff of the French Center for National Research, in the May 29 SCIENCE. The flat top seems instead to be a primary, constructional feature.

They suggest therefore that the level tops of not all oceanic guyots are the result of wave truncation; at least some, they suggest, are primary structures built by a mechanism of submarine volcanic activity.