# EARTH SCIENCES

## Warming to the hotspot hypothesis

A point on the Pacific Ocean floor west of the Galapagos Islands marks the junction of three plates of the earth's surface. From that point, the Pacific plate moves west, the Cocos plate moves northeast and the Nazca plate moves east-southeast. A study of recent plate motions in the Galapagos area now provides further strong support for the hypothesis that some prominent ocean bottom features are formed by movement of a plate over a fixed hotspot of magma in the earth beneath.

Three scientists have found that the orientations of two undersea ridges near the Galapagos Islands and the Cocos and Carnegie ridges fit very closely with that predicted by assuming they were formed by the motion of the Cocos and Nazca plates over a Galapagos hotspot. Richard Hey of the University of Hawaii, G. Leonard Johnson of the Office of Naval Research and Allen Lowrie of the U.S. Naval Oceanographic Office report that their analysis predicted that, assuming the hotspot, there should be ridges trending 50° and 92° away from it on the Cocos and Nazca plates, respectively. The actual trends of the two ridges are roughly 43° and 98°, and are in "excellent agreement." This, they conclude in the October Geological Society of America BULLETIN, strongly suggests that the two ridges were formed by motion of the two plates over a Galapagos hotspot. (For other recent hotspot data, see SN: 10/1/77, p. 215.)

## Do air data show sun cycles?

A new analysis has revealed evidence of a solar-terrestrial relationship in data on air pressure taken at sea level from 1874 to 1974 over the North Atlantic. Using principal component analysis, P.M. Kelly of the University of East Anglia, United Kingdom, has identified pressure peaks that vary at intervals of 11, 5.0, 3.4 and 2.2 years. The latter figure may be associated with the so-called quasi-biennial oscillation; the other three peaks Kelly tentatively assigns to the 11-year sunspot cycle and its harmonics. Jointly, the peaks have a 95 percent level of statistical significance, Kelly says in the Sept. 22 NATURE.

Further evidence that the 11-year pressure cycle is associated with solar variation comes from a close correspondence of the cycle with upper air circulation anomaly patterns associated with high solar activity at the times of solar flares. "This close correspondence . . . lends added support to the reality of the solar-terrestrial relationship," Kelly says.

Another scientist has suggested, meanwhile, that the 11-year solar-cycle effects may really be the results of an 11-year amplitude variation in a much shorter cycle. H. Volland of the University of Bonn's Radioastronomical Institute cites evidence from yet another research group that there is a tendency for sunspots to appear on preferred solar longitudes, with the effect that sun's mean rotational period of 27.5 days "is clearly visible in the sunspot number." This reintroduces a key question in any such studies: What kind of link can there be between sunspots and atmospheric responses on earth?

One idea (there have been many) is suggested by P. V. Foukal and colleagues from the Harvard-Smithsonian Center for Astrophysics, in the Aug. 1 ASTROPHYSICAL JOURNAL. Looking over 30 years of data recorded from 1923 through 1952 at mountain stations of the Smithsonian Astrophysical Observatory, they note an increase of just under 0.1 percent in the apparent solar constant at the ground, "related specifically" to times when the area occupied by faculae (essentially "bright sunspots," says Foukal) on the sun's surface is large. Yet measurements made in space—outside earth's atmosphere—by the Mariner 6 and 7 spacecraft show no changes in the solar constant larger than 0.03 percent.

This at least implies the possibility of some atmospheric effect that amplifies the terrestrial response to the tiny solar variation associated with facular area. An idea worth studying, Foukal's group suggests, is that ultraviolet radiation from faculae and their overlying coronal regions (plages) may increase the earth's atmospheric transmissivity. This could happen, for example, if the solar UV being modulated by the faculae is in the 2000-angstrom range, leading to a change in the atmospheric concentration of ozone.

Volland, reporting in the Sept. 29 NATURE, calculates that the atmosphere's response to the altered heating caused by the observed 0.1 percent change in the solar constant at the ground would be small—a pressure difference of 0.1 millibar in the troposphere. The troposphere is a region for which other researchers have reported changes in the altitude of the 500-mb pressure level, correlated with the 27.5-day sunspot effect.

## Uneven rise of sea level

When scientists talk about some future partial melting of the West Antarctic ice cap, the usual assumption is that the resultant rise in sea level would be uniform everywhere. Not so, say two researchers. J. A. Clark of the University of Colorado and C. S. Lingle of the University of Maine have analyzed the situation in the Sept. 15 NATURE.

The sea level rise is non-uniform because the ocean floor changes form under the weight of the changing ice and water loads, and the ocean surface distorts as masses redistribute on the surface. Furthermore, the rise changes with time because after the earth's immediate elastic response, the viscous flow of material within the earth slowly compensates for the new distribution of weight.

Off Antarctica's Ross Ice Shelf and at Cape Horn, sea level would actually drop for about 1,100 years, due to the immediate uplift of the nearby ocean floor. At Hawaii, the sea level rise would be 25 percent greater than the world average. Similarly, at other locations distant from the ice sheet, like New York and the North Sea, the sea level rise would initially be 10 to 15 percent greater than the world average, followed by gradual equalization with other areas after about 1,000 years.

## U.S. Antarctic agenda

Meteorites, ancient fossils and the common cold are all among subjects that will be studied during the 1977-1978 season of the U.S. Antarctic Research Program. There will be about 335 researchers involved in 90 separate projects under the program, many of them as parts of larger, multinational efforts.

The on-going Ross Ice Shelf Project, for example, which includes about 60 scientists from 5 countries, this season will include an attempt to drill completely through the shelf's 420-meter thick ice. Besides providing samples of the ice itself, the borehole will let cameras, hydrophones, fishing lines and other equipment be lowered into the underlying water. One hope is the chance of sampling "life forms never before seen by man."

A U.S.-Japanese team will continue its search for meteorites, which are well-preserved by the Antarctic environment. Last season's effort yielded a 407-kilogram prize that was the largest meteorite ever found in Antarctica and one of the largest stony ones ever found in the world. This season will also see the beginnings of a replacement for Siple Station, which was originally built in 1969 but is slowly being crushed by ice and snow. Triassic fossils will be sought in the central Transantarctic Mountains, while researchers elsewhere will continue to study the breakup of the ancient super-continent of Gondwanaland. A potentially significant biological program will be a population study of Antarctic krill, shrimp-like creatures considered a possible major protein source for humans (SN: 10/15/77, p. 247). Another scientist will study transmission of the common cold, rare in winter-long resident researchers but predictably introduced by newcomers.