earth sciences

GEOPHYSICS

Control of Greenland ice cap

The earth currently is slightly farther from the sun during summer in the Northern Hemisphere than during winter. This astronomical situation varies with the 26,000-year cycle of the earth's wobbling motion called the precession of the equinoxes; halfway through the cycle there will be a long period when the northern summer coincides instead with the close approach to the sun.

A specialist on past sea level changes has noticed a close association between high sea levels and the times when the northern summer coincided with perihelion. The remarkable fit, says Dr. Cesare Emiliani of the University of Miami in the Dec. 19 SCIENCE, suggests that the high sea levels that often occur more than once during each interglacial age are due to major melting of the Greenland ice cap when northern summer and the close approach of the sun coincide.

The precession of the equinoxes thus would appear to control the occurrence of high sea levels by partial or even total melting of the Greenland ice cap during interglacial ages. Greenland would be far more critical than Antarctica because it extends to much lower latitudes.

The next coincidence of northern summer and perihelion will be in about 10,000 years. Dr. Emiliani expects the Greenland ice cap to melt substantially at that time, raising sea levels about 10 meters.

VOLCANOLOGY

Magnetic variations before eruption

Several scientific groups have been seeking to detect local magnetic variations accompanying, and perhaps preceding, earthquakes and volcanic eruptions.

Two scientists at the University of Queensland, Australia, who set up instruments on Mt. Ruapehu in New Zealand last year, report some encouraging results. They measured, before and during an eruption, magnetic variations that greatly exceeded the normal fluctuations during the preceding inactive period. The changes apparently correlated in detail with volcanic activity.

"Of greatest interest," say Drs. M.J.S. Johnston and F.D. Stacey in the Dec. 15 JOURNAL OF GEOPHYSICAL RESEARCH, "is the observation that a magnetic change preceded the first eruption. It strongly supports the expectation that magnetic observations could provide a quantitative tool for the prediction of volcanic eruptions."

The magnetic variations could be a result of substantial electric currents within a volcano during and preceding an eruption. But the researchers regard the magnetic anomalies as a consequence of the switching on and off of a piezomagnetic effect—the creation of a magnetic field by pressure.

GEOPHYSICS

Evolution of rifting in Africa

Extending generally north and south through much of East Africa is a linear area of geological faults, high seismicity, gravity differences and volcanic activity. This East African rift system seems to be a continuation of the worldwide rift in the ocean floor.

A group of British scientists report in the Dec. 20 NATURE that the rift system appears to be an area where the African plate of the lithosphere is getting thin and is in the early stages of breaking up. The African plate is one of half a dozen major blocks, about 100 kilometers thick, into which the earth's upper surface seems to be divided (SN: 11/8, p. 430).

Geological faults, they report, show a general increase in age with distance from the rift system, just as the ocean floor becomes progressively older away from the Mid-Oceanic Ridge. And recent gravity measurements are also consistent with the idea that the plate is stretching and thinning, they say.

As the thinning proceeds, the various features on either side of the seismically active rift zone move apart, they suggest. There is evidence that the spreading seems to have accelerated in the last few million years, now averaging perhaps two centimeters a year.

Drs. R.W. Girdler, J.D. Fairhead, R.C. Searle and W.T.C. Sowerbutts of the University of Newcastle-upon-Tyne reported the conclusions.

PETROLEUM GEOLOGY

Oil potential off Liberia

Government scientists from Liberia and the United States report a promising potential for the discovery of petroleum beneath the Liberian continental shelf.

The interpretations are based on recent airborne measurements of gravity and magnetic differences which, in combination with field studies, suggest the presence of thick accumulations of sedimentary rocks in structural basins.

The basins "appear to be attractive targets for petroleum exploration in Liberia," reports the U.S. Geological Survey.

GEOLOGY

Mountains and plate tectonics

Ever since the concept of global plate tectonics (SN: 11/8, p. 430) has taken hold among many earth scientists, they have been interested in identifying what role the massive shifts of crustal plates have played in producing such major continental features as mountains.

Dr. F.B. Van Houten of Princeton University has examined one type of evidence for such association. He finds that major variations in mountain-building activity on the continents during the last 70 million years have occurred during the same intervals in which changes on the sea floor took place. Three major episodes of greater sea-floor spreading activity correlate with periods of mountain-building.

This coincidence supports the idea that readjustments of movements of the crustal plates cause major geological effects on the continents.

Dr. Van Houten's work focused on measurements of the rates of accumulation of a particular kind of nonmarine sediment—molasse—known to be a product of mountain-building activity. He reported in the Dec. 19 SCIENCE.

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