earth sciences

GEOPHYSICS

Earthquakes and the Chandler wobble

In 1967, Drs. D. E. Smylie and Lalatendu Mansinha of Western Ontario University proposed that the circular motion of the earth's pole known as Chandler wobble is excited by earthquakes. They had found a correlation between large magnitude earthquakes and sudden shifts in the center of wobble. But the correlation seemed to depend on the source of polar data.

In the Nov. 10 JOURNAL OF GEOPHYSICAL RESEARCH, Dr. Robert J. Myerson of the Joseph Henry Laboratories of Physics in Princeton approaches the same data from a different angle. Instead of correlating specific polar breaks with specific earthquakes, he compares yearly means of the wobble amplitude with yearly earthquake counts from 1918 to 1962. He found what he calls a good long-range correlation that indicates that earthquakes are associated with wobble excitation. But the poor correlation of wobble amplitude with very large earthquakes, he concludes, suggests that the association may not be causal, but that a deeper mechanism may be responsible for both.

GEOLOGY

Permian disturbance in New England

For some years, geologists have been finding rock and mineral ages in southeastern and central New England that are considerably lower than the age of the host rock. Samples from the area indicate a thermal disturbance 230 million to 260 million years ago.

Four geologists from four different institutions, Drs. Robert E. Zartman of the U.S. Geological Survey, Patrick M. Hurley of the Massachusetts Institute of Technology, Harold W. Krueger of Geochron Laboratories and Bruno J. Giletti of Brown University, have compiled 200 radiometric ages for mineral and rock samples from New England.

They show that the disturbed area forms a north-northeast belt extending from Long Island Sound in Connecticut to southeastern Maine.

The most likely cause of the disturbance, the researchers say in the November GEOLOGICAL SOCIETY OF AMERICA BULLETIN, is that the rocks were once buried and heated and later uplifted and exposed by erosion.

Whatever the cause, they conclude, the existence of the belt is significant. It and a similar belt in the southern Appalachians, they suggest, may be clues to an important undiscovered geological structure.

GEOLOGY

Rock music

In Bucks County, Pennsylvania, there are some rocks that ring when you tap them with a hammer.

All materials are capable of producing some kind of tone under proper conditions, but the rocks in Bucks County have an audible tone of unusual duration and frequency for rock material.

Dr. John F. Gibbons II of Rutgers University and Steven Schlossman, a graduate student at the University of Massachusetts, believe they have found the reason for the peculiar musical talent of the Bucks County rocks.

The rocks, the researchers found, are under abnormal stress from slow mineralogical changes, which are in turn the result of unusual environmental conditions that combine to prevent the rocks from retaining moisture and to subject them to wide temperature variations.

In addition, the geologists report, the rocks are amazingly elastic. Since elastic strain applied to a material can change its frequency, the unusual stress on the rocks in Bucks County could be the source of the observed change in their characteristic tone. The geologists describe their work in the December NATURAL HISTORY.

SEISMOELECTRICITY

Cause for earthquake lightning

In some parts of the world, earthquakes are frequently accompanied by various forms of lightning. Seismic strains must somehow create an electric field in the air, but the mechanism is unknown.

Drs. David Finkelstein of Yeshiva University in New York and James Powell of Brookhaven National Laboratory propose that a piezoelectric effect—the production of surface electric charges when a crystalline substance is subjected to elastic deformation—in the earth's crust causes the electric field.

The only significant piezoelectric constituent of the earth's crust, the scientists write in the Nov. 21 NATURE, seems to be quartz. They calculate that this mineral, when in sufficient quantities and when arranged in the proper crystalline order or texture, could generate enough voltage to produce lightning.

For instance, they point out that the North Idu peninsula, a region of widespread quartz-rich lava flows, was the scene of an earthquake in November 1930 that was accompanied by a spectacular seismoelectric display.

There is a tradition in Japan of predicting earthquakes from unusual clear sky lightning. "It may be possible," the researchers suggest, "to put this kind of prediction on a more systematic basis."

PALEOCLIMATOLOGY

The sands of time

The surface features of a quartz sand grain often reflect its history.

Drs. Stanley V. Margolis of the University of California at Riverside and James P. Kennett of the University of Rhode Island have examined sand grains from 18 South Pacific Ocean deep-sea cores.

They report, in the Dec. 4 SCIENCE, that in sediments older than the Lower Miocene (about 20 million years ago), quartz grains show signs of having been carried out to sea by icebergs, while grains in later sediments were moved by underwater turbulent flows.

Ice-rafted sands were found north of the present limits of iceberg drift, the scientists report, indicating southern ocean conditions cooler than at present. And, if changes in the proportion of ice-rafted quartz represent oscillations in temperature, the coolest conditions occurred about 53 million, 43 million and 25 million years ago.

Planktonic foraminiferal diversity, which increases with an increase in temperature, they point out, was low during the same period, confirming the testimony of the sand grains.