earth sciences

SEISMOLOGY

Earthquakes and A-tests

Last year a group from the University of Miami published a report claiming that underground nuclear explosions trigger earthquakes up to at least 860 kilometers away. Informal conversations with seismologists at that time indicated widespread disagreement with both the techniques and conclusions of the study.

Now a formal rebuttal to the Miami group has been published in the July 10 SCIENCE by Drs. J. H. Healy and P. Anthony Marshall of the U.S. Geological Survey.

The data, they say, do not show that nuclear explosions have a causative relationship with distant earthquakes—although local effects are well accepted (SN: 10/11/69, p. 322). From 1961 to 1968 there were as many recorded distant earthquakes before nuclear tests as after tests. Perhaps the most important lesson, they say, is that conclusions about the triggering of earthquakes should not be based solely on statistical analysis of earthquake data.

GEOLOGY

Triple junctions

In the concept of plate tectonics, a triple junction is the point at which three plates of the earth's crust and upper mantle adjoin one another.

According to a general theory of plate motion devised two years ago by Drs. D. P. McKenzie of Cambridge University and W. Jayson Morgan of Princeton University, when three plates move away from one another, a typical wedge-shaped area of newer sea floor should appear, with its apex at the junction of the ridges. The wedge should appear to observers as shallower, of rougher terrain with stronger magnetic variations than the ocean floor that surrounds it.

In April and May a Princeton-U.S. Navy scientific team made detailed observations of a triple junction that exists some 600 miles west of the Galapagos Islands in the Pacific Ocean. The scientists were able to determine that the McKenzie-Morgan theory described almost exactly the shape of the new sea floor and its magnetic variations. Precisely how close the theory fits will await several months of computer analysis.

Dr. Kenneth S. Deffeyes of Princeton, head of the 29-day expedition, announced the preliminary results. The expedition also discovered a 30-mile-long undersea valley deeper than the Grand Canyon. He theorizes that it is a result, in effect, of the interior of the earth's inability to supply new rock fast enough to fill in the canyon, at the point where the plates are moving apart.

PALEOGEOCHEMISTRY

Evolution of atmospheric oxygen

In 1964 the late Lloyd V. Berkner and Dr. Lauriston C. Marshall proposed that the absence of land plants and animals on earth before Silurian time, about 430 million years ago, was due to the fact that oxygen in the atmosphere had not yet built up to the level necessary to absorb lethal ultraviolet rays.

Dr. Wallace S. Broecker of the Lamont-Doherty Geological Observatory describes evidence in the June 20 JOURNAL OF GEOPHYSICAL RESEARCH that contradicts their conclusion.

It has long been known, he points out, that the ratio of carbon 13 to carbon 12 is slightly less in organic carbon such as coal and petroleum than in carbonate minerals such as limestone and dolomite. Yet the ratio of C-13 to C-14 in marine carbonate has remained constant over the last half billion years. This implies that the amount of organic carbon in the earth's sediments also has not changed since early Paleozoic time.

Since the amount of organic carbon is a direct measure of the net amount of oxygen produced by photosynthesis, this in turn implies no great change in available oxygen over that time period.

The transition from the low oxygen content presumably typical of the earth's prelife atmosphere to today's level must have largely taken place prior to early Paleozoic time, concludes Dr. Broecker.

GEOPHYSICS

Earthquake effects on ionosphere

Last year three scientists from the University of Hawaii reported that a 1968 earthquake in Japan produced detectable effects on the earth's ionosphere.

They now report a second example of a documented disturbance of the ionosphere by an earthquake—this time by the Aug. 11, 1969, Kuril Islands quake. Seismic surface waves traveling across the Pacific Ocean from the quake launched acoustic pressure waves that apparently traveled almost vertically upward into the atmosphere. These produced vertical displacements of the ionosphere of several kilometers. The displacements were detected by instruments on several Hawaiian islands that monitor the Doppler shifts of radio waves reflected by the ionosphere.

A detailed correlation during a 15-minute period was found between the seismic record of the earthquake and the fluctuations of the ionosphere.

The results, say P. E. Weaver, P. C. Yuen, G. W. Prolss and A. S. Furomoto in the June 27 NATURE, "are further evidence that surface waves generated by earthquakes produce acoustic waves which travel to heights of at least 340 kilometers in the atmosphere."

CLIMATOLOGY

Great Lakes snowfall increases

Since the mid-1950's, winters in the southwestern Michigan-northern Indiana snowbelt have become noticeably snowier. New seasonal and monthly snowfall records have been set at many stations in the area.

Decadal averages of snowfall have nearly doubled at stations near Lake Michigan. Other increases are documented on the lee side of Lake Erie.

Investigations of the detailed meteorological record, says Dr. Val L. Eichenlaub of Western Michigan University, "suggest that the larger snowfall amounts in recent years are indicative of a realistic climatic change." He points out that the snowfall increase has coincided with a general worldwide cooling during the last several decades (SN: 11/15/69, p. 458).

More research is needed to determine the significance of the increases, he says.