earth sciences

CONTINENTAL DRIFT

History of Gondwanaland

Accumulating evidence permits refinements in reconstructions of the pattern of continental drift.

Using new paleomagnetic data for the southern continents, Dr. M. W. McElhinny of the Australian National University in Canberra derived a refined history of the breakup and drift of Gondwanaland.

Polar wandering curves for Africa, Antarctica, Australia, India and South America indicate, he writes in the Dec. 5 NATURE, that Gondwanaland remained a unit throughout the Paleozoic, which ended 230 million years ago. Australia, he finds, apparently broke away about 220 million years ago.

This conflicts with some earlier sea-floor spreading data, which suggest that the break occurred only 43 million years ago. A possible explanation that has some geological support, says Dr. McElhinny is that at that time eastern Australia detached itself from the rest of Australia and later rejoined it.

The India-Madagascar-Antarctica block, says Dr. McElhinny, apparently broke away from Africa between 155 million and 100 million years ago, opening up the Indian Ocean for the first time. An India-Madagascar block then broke from Antarctica. But instead of drifting steadily northward, as is generally assumed, this block first drifted southward.

GEOPHYSICS

Satellite for earth measurements

One of the major problems faced by earth scientists is accurate measurement of geological features and determination of their position on an absolute geographical grid.

Drs. G. C. Weiffenbach and T. E. Hoffman of the Smithsonian Astrophysical Observatory propose that the first satellite launched as part of the NASA Earth-Physics Program be a compact solid uranium sphere equipped with laser reflectors.

With satellite-tracking lasers now in use, the scientists say, this satellite would make it possible to determine ground positions to an accuracy of one meter. Improvements in laser systems, they add, would increase the accuracy to within 10 centimeters.

Such accuracy, they point out, is necessary for achievement of many of the objectives of the Earth Physics Program, such as the measurement of plate tectonic motions, the rotation and wobble of the earth, earth tides, and polar motion and the establishment of a ten-centimeter terrestrial coordinate system.

The satellite would circle the earth at a height of 3,620 to 3,820 kilometers.

METEOROLOGY

Making clouds grow

Where the rainfall potential of clouds is concerned, the total is greater than the sum of its parts.

At the International Conference on Meteorology in Tel Aviv, Israel, Drs. Joanne Simpson and William L. Woodley of the National Oceanic and Atmospheric Administration described the results of their cloud-seeding experiments over Florida this summer.

In experiments seeding single clouds on fair days, they increased rainfall sevenfold. Rainy-day seeding diminished precipitation by 20 percent.

Since large clouds produce more rain than small ones, the scientists also attempted to use their seeding techniques to make clouds grow. Using a numerical model of cumulus cloud behavior to select likely clouds for seeding, the researchers were able to induce significant cloud growth.

The scientists also observed that when two clouds merged, their total rainfall was much greater than rainfall from two separate clouds of the same size. Clouds that were close together were seeded to make them amalgamate, and total rainfall was compared to control days. The three most productive days, the scientists say, were seeding days.

PALEOMAGNETISM

Magnetic model for Mid-Atlantic Ridge

As ocean crust forms at ridges on the sea floor, it becomes magnetized in the direction of the earth's magnetic field and therefore displays magnetic anomaly lines parallel to the ridge.

Drs. E. Irving and J. K. Park of the Canadian Department of Energy, Mines and Resources, with three colleagues, have studied the mineral and magnetic properties of basalt rocks from the Mid-Atlantic Ridge at a latitude of 45 degrees.

They found a rapid decrease in magnetization with distance from the axis of the ridge. There appears to be, they say in the Dec. 5 NATURE, some physical or chemical process which demagnetizes a rock as it moves away from the axial volcanic source. The most likely process, they conclude, is oxidation of the mineral titanomagnetite.

Using their results, the scientists constructed a magnetic model of that area of the Mid-Atlantic Ridge. The volcanic layer, according to the model, is only 200 meters thick.

OCEANOGRAPHY

Gulf Stream velocity

The internal motions of the Gulf Stream, which has a profound influence on the climate of eastern North America, are very complex. But an understanding of their nature is important not only to hydrodynamicists and oceanographers, but to meteorologists and navigators as well.

Dr. William J. Schmitz Jr. and F. C. Fuglister of the Woods Hole Oceanographic Institution and Dr. A. R. Robinson of Harvard University have used current meters moored in the Gulf Stream to obtain two-month records of the bottom velocity directly under it.

The records show large speed variations in the bottom current, the scientists report in the Dec. 11 SCIENCE. At one point, speeds up to 44 centimeters per second were observed 200 meters above the ocean bottom.

Fluctuations in the deep current, the researchers conclude, appear to be associated with shifts in the surface direction of the stream and with both surface and bottom current fluctuations 200 meters upstream.