earth sciences

Gathered at the annual meeting of the American Geophysical Union last week in Washington

SEA-FLOOR SPREADING

More complications

As scientific evidence accumulates, the process of sea-floor spreading appears more complex. Leg 14 of the Deep Sea Drilling Project recently demonstrated that the mid-Atlantic ridge is spreading asymmetrically—the rate is faster on one side.

Now researchers from Columbia University's Lamont-Doherty Geological Observatory report that spreading rates on different sections of the same ridge may vary in symmetry.

Drs. Dennis E. Hayes and Jeffrey K. Weissel have found that the Southeast Indian Rise between Australia and Antarctica can be divided into three distinct, narrow zones. The easternmost, Zone A, has relatively little seismic activity, and for a long period in its history it spread asymmetrically. The rate of spreading north of the ridge was 3.1 centimeters per year, compared with 2.2 centimeters per year south of the ridge. Zone B shows scattered seismicity and unusually rough topography. Spreading rates were hard to determine. Zone C shows seismicity similar to Zone B and was spreading symmetrically.

The contrast in properties of such narrow zones, the researchers conclude, suggests that the concept of uniform rigid plates may have to be modified.

TECTONICS

Healing the Ethiopian rift

Two years ago, a farmer in the Ethiopian Rift Valley was plowing his field when his ox and plow suddenly disappeared into a deep fissure in the earth. Such fissures occur throughout the East African rift system, of which the valley is a part, but the most spectacular events seem to be concentrated in the Ethiopian valley.

Some scientists believe the African continent may be splitting apart along the rift. In 1969 Dr. Paul Mohr and John Rolff of the Smithsonian Astrophysical Observatory and Emmanuel Kazakopoulos of the National Technical University in Athens set up a network of lines traversing the rift and measured the distances between fixed points on either side of it. The lines were remeasured in 1970.

Preliminary analysis of the first year's results, Dr. Mohr reports, suggests that during that period the rift spread a few centimeters.

Other geological activity in the rift valley, however, is simultaneously repairing the fractures. Sediment, rocks and other effluvia from volcanic eruptions and seismic disturbances constantly refill new fissures, Dr. Mohr says.

CLIMATOLOGY

Effects of pollution

For some time it was thought that aerosols (particulate matter in the atmosphere), by scattering incoming radiation, had a cooling effect on climate. This assumption was supported by the cooling of the surface climate that followed major volcanic eruptions.

More recently, it was found that certain manmade aerosols, especially industrial pollutants containing carbon and iron oxides, absorb as much radiation as they scatter back, thus causing heating.

Dr. J. Murray Mitchell of the National Oceanic and Atmospheric Administration has devised a model to determine under what conditions an aerosol will lead to cooling or warming. For relatively dry surfaces such as deserts and urban areas, he says, climatic warming would result if absorption is equal to or greater than backscatter. Over moist areas, larger amounts of radiation would be expended in evaporation and aerosols would warm the atmosphere, even if backscatter exceeds absorption.

TECTONICS

Galapagos triple junction

In a terrestrial crust composed of a jigsaw puzzle of rigid plates there are bound to be places where three plates meet in what geophysicists call a triple junction. In the eastern Pacific, the Galapagos fracture zone meets a bend in the East Pacific Rise to form such a junction. But the exact nature of this junction had not been definitely established. The Galapagos fracture, according to Drs. K. S. Deffeyes and Richard Hey of Princeton University and Leonard Johnson and Allan Lowrie of the U.S. Naval Oceanographic Office, is a spreading ridge; the junction is therefore a meeting of three spreading ridges.

Bathymetric profiles and magnetic studies of the area reveal that the Galapagos ridge has generated a wedge of crust with extremely rough topography and large magnetic anomalies. In contrast, the other branches of the junction produce smooth topography and small magnetic anomalies.

TECTONICS

Formation of Iceland

Tectonic processes create land features in many different ways. The identification of two active faults in Iceland has led Dr. Peter Ward of Columbia University's Lamont-Doherty Geological Observatory to a new interpretation of Icelandic tectonics.

Much of Iceland, he says, seems to have formed during a period of very slow spreading between 10 million and 20 million years ago. Iceland, the largest land mass on the midocean ridge system, may have resulted from a major change in the stress pattern on a broad fracture zone that allowed large amounts of lava to erupt while there was little regional spreading.

This interpretation, Dr. Ward points out, provides a framework to relate geologic studies in Iceland to worldwide processes at the crests of midocean ridges. Studies of Iceland can provide more detailed data on the structure and processes at spreading ridges than could be collected along submerged parts of the midocean ridge system.