earth sciences

GEOLOGY

Anomalous basaltic intrusion

According to present sea-floor spreading concepts, oceanic crustal basalt is generated at midocean ridges, and the ocean floor away from ridge crests and fracture zones is thought to be quiet.

But John D. MacDougall of the Scripps Institution of Oceanography reports that a rock sample from Leg 2 of the Deep Sea Drilling Project seems to conflict with this view.

The sample is from a spot about midway between Bermuda and the Mid-Atlantic Ridge. But, though it lay under 456 meters of sediments with ages up to 80 million years, glassy fragments in the sample turned out to be only 15.9 million years old. At the sea-floor spreading rates for that region, the part of the ocean floor where the sample was found would have been a full 750 kilometers from the ridge crest at the time the sample was intruded.

Data from one sample do not justify any generalizations, MacDougall cautions in the March 26 SCIENCE, but they do raise questions about accepted theories. Perhaps basalt flows occur commonly in areas far from ridge crests. If so, magnetic anomaly patterns may have a more deep-seated origin than is generally believed.

GEODETICS

Size and shape of the earth

A four-year program to take what the Commerce Department says are the most accurate measurements yet made for determining the size and shape of the earth has just been completed. Analysis of the data collected will take about two years.

In this program, part of the National Geodetic Satellite Program, camera teams spaced roughly 2,500 miles apart took simultaneous photographs of the balloon satellite PAGEOS. By comparing the apparent positions of the satellite against the background of stars, distances between the stations can be accurately calculated.

Though the program was carried out largely by the United States, camera teams from West Germany, the United Kingdom, Australia and South Africa were also involved. These teams made observations at 45 locations on every continent and a number of islands.

In addition to determining the size and shape of the earth, the program will also result in establishment of a worldwide geodetic network that will allow surveyors to define precise positions on earth.

TECTONICS

Formation of abyssal hills

Most normal sea-floor topography is created at ridge crests during generation of the crust. But some smaller features, such as low abyssal hills, can be formed by local tectonic and volcanic activity after the crust was formed. Detailed studies of these features might therefore give clues to the history of the ocean crust.

Researchers from the University of Hawaii conducted a detailed survey of a small section of the north Pacific between two fracture zones, concentrating on an 806-meter-high hill. The hill, Dr. James E. Andrews reports in the February GEOLOGICAL SOCIETY OF AMERICA BULLETIN, was apparently created by faulting and associated volcanism caused by variations in spreading rate within the plate.

These variations appear to increase abruptly at fracture zones, rather than gradually throughout a plate. In the area studied, the hills that were formed after the crust was generated are aligned at an angle to the fracture zones. This indicates, Dr. Andrews says, that there has been a major episode of shearing motion between crustal segments on either side of the fracture.

SEISMOLOGY

Seismotectonics of Australia

One of the more spectacular advantages of plate tectonic theory is the explanation it provides for the concentration of seismic activity along midocean ridges and island arcs. It seems reasonable, therefore, that the theory might be extended to explain seismicity within a continent.

Collecting seismic data from several sources, Drs. J. R. Cleary and D. W. Simpson of the Australian National University have constructed a picture of the pattern of seismicity of the Australian continent and surrounding oceanic areas for the past 70 years.

The map shows three major Australian seismic zones, dividing the continent vertically into four sections or sub-plates. The researchers propose in the March 26 NATURE that differences in spreading rate between these four sections create stresses within the plate which are in turn responsible for the patterns of seismicity.

The two scientists then propose a model to account for specific tectonic behavior within the continent in terms of characteristics of the upper mantle.

SEA-FLOOR SPREADING

Ages and elevations of ocean ridges

The magnetic anomaly patterns paralleling the Mid-Atlantic Ridge have been correlated with reversals in the earth's magnetic field and can be used to predict the age of the ocean floor.

In other parts of the ocean, however, the magnetic pattern is less distinct. But, say Drs. John G. Sclater of Scripps Institution of Oceanography and C. G. A. Harrison of the University of Miami, it may be possible to predict the age of the ocean floor in these regions by another technique.

Since both the age of the ocean crust and the depth of the floor increase with distance from the ridge, they write in the March 19 NATURE, depth of crust increases with age, and topography can be used to help determine age of crust.

However, age predictions based on topography are accurate only for crust younger than 60 million years. After that point elevation changes only slightly with increasing age. But the correlation may reveal shifts in ridge location or spreading rate, the scientists say.

They applied the theory to the Southeast Indian Ridge, long a problem area in tectonic reconstructions. The ridge, they found, could have resulted from a change in direction of spreading of the Central Indian Ridge, which meets it at an angle.