earth sciences

Gathered last week at the annual meeting of the Geological Society of America in Atlantic City

GEOMAGNETISM

Volcanism and magnetic reversals

Eight deep-sea sedimentary cores from the Antarctic region south and southeast of New Zealand contain evidence that extensive volcanic activity may occur at the time of reversals of the earth's magnetic field.

Layers of volcanic ash were most abundant in the cores at the time of the last two major magnetic reversals 700,000 years ago and 2.4 million years ago. Other less well-defined ash layers appear to be related in part to shorter duration geomagnetic events. Little or no volcanic material was found elsewhere in the cores.

The findings, report Drs. James P. Kennett and N. D. Watkins of Florida State University, add further support to the hypothesis that there is a correlation between magnetic reversals and mantle movement.

The reasoning for this view, as put forward recently by Dr. J. R. Heirtzler of Columbia University, is that periodic wobbles of the earth's axis may either cause, or be caused by, large-scale earthquakes.

These events, so the speculation goes, may be able to trigger magnetic reversals. The increased convection in the mantle associated with the reversal could then readily stimulate volcanic activity that would be recorded as ash in the cores.

PALEOCLIMATOLOGY

Pleistocene temperature variations

A number of estimates comparing glacial and interglacial temperatures at Middle European and North American latitudes have been published in the last century. Recent new work has produced estimates for the variations at low latitudes.

A close evaluation of this data has allowed Dr. Cesare Emiliani of the Institute of Marine and Atmospheric Sciences in Miami to establish the limits of the temperature changes between glacial and interglacial periods. The differences ranged from a minimum of 2 degrees C. to 6 degrees C. for yearly averages for latitudes 0 to 30 degrees north in the Atlantic. More important than the yearly averages are the season minima, which decreased by at least 5 degrees C. and possibly 7 degrees C. in the equatorial Atlantic during glacial periods. The fluctuation as averaged over the entire world ocean was no less than about 3 degrees C., he says.

GEOLOGY

Continental accretion in Laurasia

Laurasia is the name given the northern hemisphere supercontinent that most scientists believe broke apart to create the present continents. Much work is being done to trace events since the breakup, but at the Massachusetts Institute of Technology Dr. Patrick M. Hurley has been trying to explain how Laurasia formed in the first place.

He has taken the available geochronological data and plotted zones of similarly aged tectonic and igneous activity on maps showing the northern hemisphere continents in their estimated predrift positions.

The configuration of age provinces, he now reports, definitely suggests a concentric arrangement of the zones, with the oldest material at the center and youngest material at the periphery.

This, he concludes, supports the hypothesis that Laurasia was formed by a continental accretion, or coalescence, process in which an ancient nucleus of crust was surrounded by progressively newer crust being continually generated by the mantle and shoved by an inward-moving sea floor toward the nucleus.

The work, he notes, supports the concept of Laurasia as a continuing and developing land mass up until the time, several hundred million years ago, when the process was reversed. The supercontinents then broke apart and the great drift episode now in progress began. There apparently was no large-scale breakup of Laurasia prior to that, he says.

GEOLOGY

Possible midcontinent rift

Detailed aeromagnetic surveys of a 600-mile-long rock formation extending mostly underground from Lake Superior to central Kansas lend support to the idea that the feature may once have been part of a global rift that failed to develop laterally.

Upwelling of material from the underlying mantle was apparently localized along a relatively narrow belt, report Elizabeth R. King and Isidore Zeitz of the U.S. Geological Survey.

The magnetic data indicate the structure of the area, known as the Keweenawan fault, closely resembles that of the midocean ridges, they report.

GRAVIMETRICS

Gravity anomalies in Black Sea

Continuous shipboard gravity measurements carried out by the research vessel Atlantis II during its expedition in the Black Sea from March 21 to May 6 reveal that much of the sea is an area of reduced gravity.

Large negative gravity anomalies, as great as minus 50 to minus 100 milligals, occur offshore from the northern coast of Turkey and off the south-central and eastern coasts of the U.S.S.R., reports Dr. Carl O. Bowin of the Woods Hole Oceanographic Institution. The axes of these areas of lower-than-normal gravity are approximately parallel to deformed zones inland in the Soviet Union and Turkey.

The reduced gravity means that the crust is being depressed. Dr. Bowin feels the observations indicate the crust beneath the Black Sea is being deformed by the slow collision of the African and Eurasia crustal plates (SN: 11/8, p. 430). The deformation, he suggests, is in its early stages. The unusually thick sediments in the Black Sea are therefore not the cause but a result of the crustal lowering; they are, in effect, merely filling the hole.