earth sciences

MARINE GEOLOGY

Salt layers along Atlantic margins

Deep-sea drilling by the research ship Glomar Challenger in the Gulf of Mexico in 1968 proved that the up-folded geologic structures there known as diapirs contained cores of salt (SN: 10/12/68, p. 361). Seismic studies have also revealed diapirs in the western Mediterranean, off northwest Africa and off the Grand Banks.

Recent cruises of the French vessel Jean Charcot have revealed the same type of structures off the continental margins of Labrador, Newfoundland, Morocco, Portugal and in the Bay of Biscay, report Drs. Guy Pautot, Jean-Marie Auzende and Xavier LePichon of the Oceanographic Center of Brittany in the July 25 NATURE. These findings, they say, suggest the existence of a continuous deep-sea salt layer off the continental margin of the North Atlantic.

The salt layer, they suggest, is related to the early phase of the rifting apart of the continents. It was laid down, they believe, 140 million to 180 million years ago when the Atlantic was a narrow, closed ocean shallower than today. When the ocean expanded to a width of 1,000 to 2,000 kilometers, the continental margins subsided to a level too deep to allow further salt deposition.

GEOPHYSICS

Coriolis force and plate tectonics

The Coriolis force resulting from the earth's rotation is already known to be responsible for the clockwise deflection of atmospheric and ocean currents (and even vines and tree roots) in the Northern Hemisphere and the counterclockwise deflection in the Southern Hemisphere. This force has now been postulated to explain the difference in the two hemispheres between the direction of rotation of the transform faults in the ocean floor along the mid-oceanic ridges.

In the past, little attention has been given to the effects of this force in mantle convection because the predicted effect is small for slow movements. Recent analysis of mapped transform faults by Dr. B. F. Howell Jr. of Pennsylvania State University reveals, however, that the offsets along two-thirds of the faults are rotated clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere. Rotation of the San Andreas fault in California also fits this pattern, if the fault is assumed to be of the transform type.

The amount of displacement of these faults was also found to increase with distance from the equator. This observation corresponds with the known increasing effect of the Coriolis force with distance from the equator. In his summation, Dr. Howell poses the intriguing question: "Can there be a linkage of the mantle convection with the earth's rotation, as appears to be the case with the magnetic field?"

PALEOCLIMATOLOGY

Pleistocene history of oceans

Earlier this year two Columbia University scientists presented data which suggested that at times during the last million years when the surface waters of the Atlantic Ocean were cooling, those of the Pacific Ocean were warming. This was contrary to much previous evidence.

In the July 24 SCIENCE, three University of Southern California researchers, Ronald W. Morin, Fritz Theyer and Edith Vincent, further dispute the claim of opposing cycles. They suggest that the Columbia group's work was distorted by the species of fossil plankton selected as a temperature indicator. The area from which the studied cores were taken was not the typical habitat of the species, they say.

This, in addition to earlier evidence, leads them to conclude that the Pleistocene climatic history of the two oceans was not opposed but parallel.

OCEANOGRAPHY

Tidal prediction method

Present-day tidal prediction charts give the times of high and low tides for certain points on the world's coastlines. The usual methods permit the prediction of tides at a particular place only if there are observations from that place. The physical laws governing the motion of the water are not used at all.

But a new method of predicting oceanic tides and tidal currents, using the differential equations of hydrodynamics, has been successfully tested in partially enclosed areas of the sea.

The tests were undertaken by the Institute für Meereskunde of Hamburg University in Germany. According to W. Hansen, reporting in OCEANOLOGY OF THE ACADEMY OF SCIENCES, U.S.S.R. (vol. 9, no. 1, 1969), the calculated predictions of the times of high and low tides in the Persian Gulf and the North Sea agreed remarkably well with the published tidal prediction charts.

The results give reason to hope that the numerical hydrodynamics technique will make possible the quantitative description of the tides in the open oceans of the world, says Dr. Hansen. The difficulty of handling the vast computational work involved is the main obstacle.

PALEOCLIMATOLOGY

Arctic ice cycles

A study of four sediment cores taken from the Arctic Ocean, only a few hundred miles from the North Pole, has produced abundant evidence of alternating cold and milder periods during the last six million years. The sediments deposited during much of that time contain pebble-size rock fragments and skeletons of small shallow-water marine animals. This material, suggests Dr. Yvonne Herman of Washington State University in the July 31 SCIENCE, was entrapped in shelf ice that broke away from land and drifted across the Arctic. When the ice thawed, the debris was dropped to the sea floor.

This all seems to indicate that although continental glaciation had begun in high latitudes prior to six million years ago, the Arctic Ocean nevertheless remained free of permanent pack ice.

About 700,000 years ago, however, conditions changed. This section of the cores contains layers rich in fossils representing conditions prevailing today—permanent ice cover. But the layers are separated by deposits of warm-water fossils. This implies that during the past 700,000 years the Arctic Ocean has gone through a succession of ice-covered and ice-free periods.