earth sciences

GEOLOGY

Melanesia's jumbled crust

Different gravity and seismic explorations of the Melanesian Borderland—between Australia and New Zealand—have produced conflicting pictures of the underlying crust. In the April 10 JOURNAL OF GEOPHYSICAL RESEARCH, three researchers from the Scripps Institution of Oceanography explain why.

An extensive seismic survey of the region shows that the Melanesian crust is indeed a jumble of many types, Drs. G. G. Shor Jr., H. K. Kirk and H. W. Menard report. The structure of the Lord Howe Rise is identical to that of Australia, and the Norfolk ridge also appears to be of continental origin. The Tasman and New Caledonia basins appear to be oceanic.

Such varied structures must be the result of a complex tectonic history, the researchers conclude. The Fiji Plateau appears to have been uplifted and may now be an area of sea-floor spreading. The island arcs are also spreading. The central part of the region was subjected to crustal extension at one time, but is now inactive and has subsided. All these effects, the scientists say, may be incidental to interactions between the Australian and Pacific plates.

SEISMOLOGY

A better picture of the San Andreas

It seems logical that the San Andreas Fault, which slices through California to Mexico might be connected to the East Pacific Rise, which seems to terminate in the Gulf of California. But to date there has been no positive evidence of a relationship.

After a month-long seismic survey of the northern part of the gulf, two University of Southern California scientists, Drs. James L. Bischoff and Thomas L. Henyey, have confirmed that the fault does meet an underwater spreading center about 60 miles southeast of the mouth of the Colorado River.

The northern end of the San Andreas connects with another spreading center off the Oregon coast. The geologists believe that the two spreading centers provide the energy for the earthquakes along the fault. The gulf spreading center pushes the earth's crust west of the fault in a northwesterly direction, as the spreading center off Oregon pushes the land east of the fault in a southeasterly direction. The opposing motion of the two sides of the fault creates the buildup in strain that ultimately leads to earthquakes.

TECTONICS

A sea dries up

The Afar depression in Ethiopia was formed when the Danakil Alps, a small mountain range to the northeast, split away from the Ethiopian Plateau. The depression was a marine basin at intermittent periods until the late Pleistocene, when it became severed from the Red Sea and dried up.

To better understand the early stages of the formation of an oceanic body by rifting of a continent, Drs. Enrico Bonatti, Cesare Emiliani, Göte Ostlund and Harold Rydell of the University of Miami's Rosenstiel School of Marine and Atmospheric Sciences have attempted to date these events.

The researchers conducted oxygen and carbon isotope analyses of fossilized marine organisms from a small volcanic cone in the center of the depression. In the April 30 SCIENCE, they report that the volcanic activity responsible for the final separation of the Afar depression from the Red Sea occurred no more than 32,000 years ago. The basin dried up after several thousand years. The northern part of the basin was subjected to alternating episodes of marine flooding and dessication.

The Atlantic Ocean, created by rifting of Pangaea, probably developed in a similar manner, the researchers believe.

GLACIOLOGY

Avalanche forecasting

As part of its Project Skywater cloud seeding program (SN: 12/12/70, p. 447), the Bureau of Reclamation is sponsoring a three-and-a-half-year study of avalanches in the San Juan Mountains of Colorado.

The purpose of the study, to be conducted by the University of Colorado, is to determine if snowslides may be accurately predicted or controlled. The study area will be a 72-mile stretch of U.S. Highway 550, between Ouray and Durango, Colo., an area with one of the highest avalanche frequency rates in the nation.

A seismological network is being installed to detect the tiny tremors that may occur in snow layers at intervals preceding a slide. Snow morphology stations will record changes in the character of snow as it accumulates. Observations will also be made of snow density, snow ablation (conversion from solid to gaseous form without melting), storm total snowfall, snow settlement, air temperature and wind velocity.

METEOROLOGY

Possible cause of thunderstorms

Thunderstorms, and weather in general, are usually explained in terms of high and low pressure areas in the atmosphere. Numerous factors were thought to be necessary for severe weather to develop.

Two University of Wisconsin meteorologists have now developed a theory that provides a more direct explanation. Drs. Donald R. Johnson and Frank S. Sechrist believe that storms in the middle latitudes may be triggered when the cold, dry air of the polar jet stream descends to lower levels and destabilizes the atmosphere.

The polar jet normally meanders around the globe at high altitudes, But in the spring, with the gradual warming of the lower atmosphere, it may descend, forcing warm moist air to pile up in front of it, the scientists explain. As more air accumulates in front of the jet, it is forced upward where, if the air contains enough moisture, thunderstorms will form and a squall line will develop.

The two researchers had noticed that before a storm began, a wedge of clear sky would protrude into a cloudy area from the southwest and grow into a long finger. This finger of clear air was the polar jet stream.