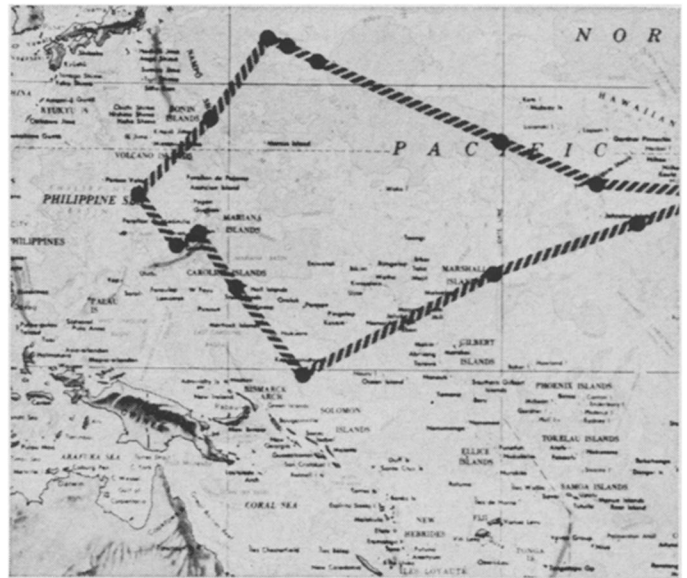


Challenger's sixth leg

Invasion of the Pacific by the drilling ship turns up the world's oldest seabottom and an anomaly in the Philippine Sea



Photos: Scripps Inst. of Oceanography

The Challenger's sixth leg ran from Hawaii to Guam.

The first five voyages of the Glomar Challenger as part of the Deep Sea Drilling Project that began a year ago have produced a vital store of new information about the nature of the ocean floors. They added to the now nearly overwhelming evidence in support of the hypothesis of sea-floor spreading and continental drift (SN: 5/10, p. 449, and SN: 3/23, p. 280).

Now Leg 6 is completed, and again the cores of ancient sediments brought up by the Challenger fit the prevailing theory that new crust is constantly being produced at the mid-oceanic ridges and gradually pushed out laterally to create new ocean floor. In the process the voyage recovered the oldest sediments ever brought up from the bottom of the Pacific Ocean—at least 140 million years old.

But Leg 6 also has produced a surprise, and the project scientists are justifiably excited. It has provided evidence that new crust was formed in the last 25 million to 50 million years beneath the Philippine Sea and the area of the Caroline Islands. If true, this could mean that crust can be created at places other than the mid-oceanic ridges, apparently by processes completely different from those envisioned by the current theory.

"This opens up a whole new possibility for means of crustal formation," says Dr. Melvin N. A. Peterson of the Scripps Institution of Oceanography, project chief scientist.

There had been a few hints of the young crust earlier. It was known that sediments there were thinner, that the

flow of heat upward from the interior was anomalously high, and that certain seismic reflectors that would indicate great antiquity couldn't be traced.

"Still this is the first time there has been direct evidence of a newer area of crust in that region," says Dr. Alfred G. Fischer of Princeton University. "It certainly does not fit into present theories."

Unless there has somehow been an outpouring of new lava over older crust, the finding must mean that new crust was formed there, about 25 million to 50 million years ago. Yet the East Pacific Rise, the nearest crust-former under prevailing theory, is almost an ocean away.

One possibility is that the East Pacific Rise portion of the global mid-oceanic ridge once extended all around the eastern, northern, and western sides of the Pacific.

The other is that some completely different and previously unsuspected processes, distinct from those making crust at the ridge, formed or remodeled the crust beneath the Philippine Sea.

"Perhaps there is a mechanism for formation of crust along the edge of a continental mass," says Dr. Peterson.

He suggests that the previous oceanic floor might have fractured or been torn away from the Asian continent, allowing basaltic material to well up from the mantle and create new crust. "To explain it, you have to get material up from the earth some way. Maybe there was some form of relaxation at the edge of the continent."

Dr. Fischer points out that while there



Peterson: "A whole new possibility."

is no major topographic rise like the mid-oceanic ridge in the young area there is a series of peculiar, small, north-south ridges which could very well be related to centers of spreading. "We desperately need more drilling and other kinds of geophysical exploration in this area," he says.

Leg 6 of the Challenger's journey began in Honolulu on June 11 and ended at Guam on Aug. 5. During that time 34 holes were drilled in the north-western Pacific at 17 sites. A total of 2,259 feet of core was recovered. One site, a depression at the western flank

of Shatsky Rise, north of the Marianas, was the deepest water in which drilling has ever been attempted, 19,622 feet.

Sediments deposited on the ocean floor over the millennia by the rain of organic debris and silt are invaluable tools in the study of sea-floor spreading. Since the sediments ride passively as passengers on the crust as it is slowly forced outward from its birthplace at the mid-oceanic ridge by even younger crust, marine geologists expect to find older and thicker sediments in cores taken farther away from the ridge. This was found to be the case in the Atlantic Ocean, during the first four legs of the project.

The geologists expected to find the sediments increasing in age westward across the Pacific. And since the distance is so vast, they hoped to obtain cores of material from the early Mesozoic or even late Paleozoic eras—about

225 million years ago.

From Hawaii westward, the sediments did increase steadily in age. Layers of nearly impenetrable chert, or flint, in the sediments often prevented the diamond-tipped bits from penetrating as deep as the scientists had hoped, but samples at least 140 million years old—from the Jurassic period of the Mesozoic—were recovered. The area of antiquity lies east of the Mariana-Bonin Islands and north of the Caroline Islands. Only in a thin strip at the very western edge of the Atlantic have sediments this old previously been found.

“What we found is a substantial segment of the Pacific floor which is as old or older than the entire history of the Atlantic Ocean floor,” says Dr. Peterson. “It is just one section of the ocean floor that has survived the vicissitudes of continental drift and sea-floor spreading.” ◇

ORAL CONTRACEPTIVES

Only a yellow light

Legally, birth control pills are safe. After three years of exhaustive study of oral contraceptives, advisers to the Food and Drug Administration conclude that the benefits of the pills outweigh the risks and, within the meaning of the law, it is safe for the 8.5 million women in the United States who take these drugs to go on doing so.

However, the specter of dangerous side effects ranging from blood clots to cancer still looms.

A 200-page report issued last week by the FDA's Advisory Committee on Obstetrics and Gynecology raises as many questions as it answers and in no way removes the suspicion that oral contraceptives may be a hazard to health.

The document is the committee's second statement on the pill. The first, issued in 1966, said that there were no adequate data to prove these hormone compounds unsafe for human use, though there were “possible theoretical risks” (SN: 8/27/66, p. 131). The second report supplies some of the previously missing data.

The relationship between birth control pills and thromboembolism is but one example, illustrating both a case of known risk and the difficulties in determining a cause and effect connection between the drugs and disease. Says Dr. Louis Hellman of the State University of New York at Brooklyn and chairman of the advisory committee, “Eight years were required from the time of the first reported death to establish the relative risk and an etiologic relationship to the hormonal contraceptives.”

Now, two studies have satisfied authorities that there is a direct connection. Research conducted in Great Brit-

ain (SN: 6/28, p. 611) shows women taking the pill are eight times more likely to develop blood clots than those who do not take it. In the U.S., a survey called for in the 1966 FDA report and directed by Dr. Philip E. Sartwell of Johns Hopkins University finds the risk of clots to pill users is four times greater than for non-users.

A possible carcinogenic action of hormonal contraceptives, by contrast, remains unproved. Estrogens are known to cause cancer in at least five species of animal. Whether or not they can have the same effect in man is open to speculation. But, according to Dr. Roy Hertz, a committee member from Rockefeller University in New York, extensive investigations should be launched to find an answer.

Dr. Philip Corfman, FDA adviser and director of the Center for Population Research at the National Institutes of Health, emphasizes the importance of determining the effect of birth control pills on human metabolism to evaluate their relationship to hypertension, kidney function, neurologic disease and diabetes. To tackle these questions and to find new and better contraceptive drugs, the NIH center has \$3 million to support a host of research projects, with 70 underway (SN: 6/7, p. 556).

Summarizing the FDA's present stance, Commissioner Dr. Herbert L. Ley Jr., says overall findings on oral contraceptives are favorable, particularly in view of the low incidence of reported reactions compared to the extraordinarily high number of women who take the drugs. Dr. Hellman, however, says only that “the light is still yellow—meaning caution.”

QUARKS

Five cosmic events

Physicists using the most powerful accelerators available have repeatedly failed in their efforts to produce and detect quarks, theoretical particles with fractional charges, of which all known particles might be composed. Failures at Brookhaven National Laboratory's 33-billion-electron-volt (GeV) accelerator, CERN's 27 GeV and Serpukhov's 76 GeV have convinced the physicists—those who still believe in the physical existence of quarks—that they would have to go to considerably higher energies (SN: 5/31, p. 538).

And while those physicists await the next generation of accelerators, CERN's 300 GeV and the 200-400 GeV at Batavia, Ill., theorists, including quark inventor Dr. Murray Gell-Mann of the California Institute of Technology, have tired of the hunt. They are willing to call quarks simply a mathematical concept that helps explain particle physics, and go on to greener pastures.

But there is a source of particles more powerful than even the most powerful foreseen accelerator can produce: cosmic rays. And from a British-born cosmic ray physicist who has built the world's largest array of cosmic particle detectors has come a report of the discovery of a quark, a report that has physicists buzzing and, if it stands, could set the whole world of particle physics on its ear.

Dr. Brian McCusker of Sydney University invested eight months and 60,000 photos of tracks in four intricately connected low-pressure cloud chambers. His report of five heavy quark tracks, each two-thirds the charge of an electron, was made last week to the Budapest cosmic ray congress of the International Union of Pure and Applied Physics. His paper has been referred and accepted for the journal *PHYSICAL REVIEW*, where it will be published shortly.

Quarks are supposed to come in three configurations, each with an antiquark: one with two-thirds the charge of an electron and two with one-third the charge, one plus and one minus. McCusker's five tracks are described as those of the two-thirds variety. And, despite criticism from his colleagues of the possible statistical inadequacy of his results, McCusker and his allies stand firm. He is convinced that, despite the small number of positive events he has detected, the deviations of the tracks he has recorded from what would otherwise be expected are adequate proof of the discovery of the fractionally charged particles he was seeking.

“Too many precautions and too much care was taken for five tracks all to