CHALLENGER: LEG 8

Equatorial current history

Maps of the biological productivity of the Pacific Ocean show bands of organically rich waters around the rim of the ocean and poorer areas in the center. The major exception is a long, tapered spike of productivity extending far westward into the equatorial Pacific from the coasts of South and Central America.

This is the area of the Pacific equatorial current system, where the tradewinds help push water across the ocean in two broad westward-flowing currents, separated by a countercurrent that returns some of the water to the east.

On the ocean floor beneath this current system, like a permanent three-dimensional shadow, is an area of thick organic sediments, produced over millions of years by the skeletons of tiny marine animals that make the current their abode. They find it an especially hospitable place because upwelling and vertical mixing in the area of the currents brings water rich in nutrients up to the surface.

Scientists have known about this equatorial marine graveyard for some time, but for the most part they have no direct samples from anyplace beneath its upper 20 or 30 meters.

Leg 8 of the scientific ship Glomar Challenger's voyage in the Deep Sea Drilling Project (SN: 11/1, p. 394) was planned to help fill the gap. Over a 55-day period ending this month, the vessel drilled eight holes into the bed of the central equatorial Pacific in a large region northeast of Tahiti and southeast of Hawaii, going down as far as 558 meters.

Six of the holes were drilled in an almost straight north-south line across the equator along the 140th Meridian. This is the first time in the project that so many holes have been drilled across one geologic set of conditions—although as Dr. Joshua I. Tracey Jr. of the U.S. Geological Survey points out, six cores along a section 1,300 miles long hardly gives a detailed picture of the ocean bottom. He and Dr. George A. Sutton of the University of Hawaii were co-chief scientists for the expedition.

Emerging from Leg 8 is a picture of the composition, thickness and rates of accumulation of sediments beneath the current system during the last 40 million years.

A marked change of sediment accumulation over geologic time was revealed. Accumulations during the upper Oligocene and lower Miocene epochs of the Tertiary, 15 million to 30 million years ago, were higher than during the late Tertiary, in the last few million years.

In the lower part of one core, the rate of sediment buildup was estimated at 24 meters per million years. In the upper part of the same core accumulation rates had dwindled to 4 meters per million years.

The average rate of accumulation during the early Tertiary was found to be 7 to 10 meters per million years, compared with a rate of 1 to 4 meters per million years in recent times.

"As a generality," says Dr. Tracey, "the rate of accumulation was two to four times faster during the lower Tertiary than during the upper Tertiary. Oceanographic conditions were apparently quite different then."

The decrease in sediment accumulation during the Tertiary might be related to the emergence of the Isthmus of Panama, closing off the Atlantic Ocean's equatorial link to the Pacific and thus greatly altering what may have been an even larger current system at that time, Dr. Tracey speculates. The Atlantic tradewinds would no longer be able to push water through between North and South America.

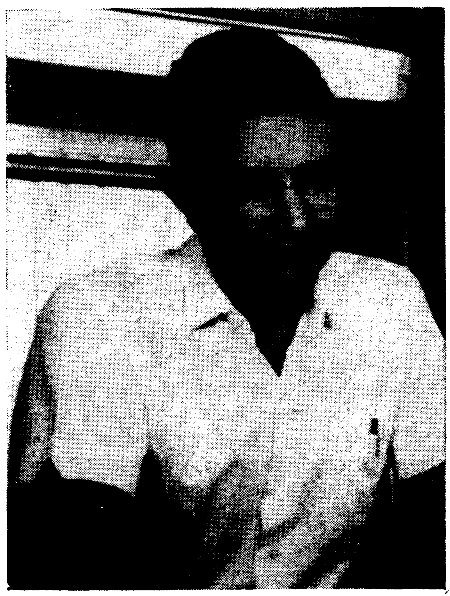
Or it might be related to geologic changes along the coastal regions at the time. But at this stage these suggestions are only conjectures.

One thing that makes interpretation difficult is that rates of sediment accumulation do not necessarily directly relate to changes in biological productivity. Much of the organic material deposited is dissolved under certain conditions, and those conditions may have changed. The accumulation rate is thus the difference between the deposition rate and the rate of dissolution by seawater.

Of sediments deposited more recently, over the past several million years, the Challenger found rough correspondence to patterns of deposition today.

Leg 8 scientists found that they could in effect group the sediment layers into three categories. At the top of the cores are mixed zones containing alternating beds of ooze created by organisms whose skeletons are composed of carbonates and of silica. Then comes the area in which carbonate sedimentation was extensive and rapid. Below this, primarily in the Eocene, about 60 million years ago, are layers of chert or cherty limestone—hard rock nodules that have stopped the Challenger's bits many times in the past year and a half.

Thirty-six feet of chert core was recovered. Dr. Tracey is eager to have the sections studied in detail because the hard rock tends to preserve the very fine structure and texture of sediments deposited.



Scripps Institution of Oceanography

Tracey: Ocean conditions changed.

FOUNDATION TAX

Tougher in principle than in fact

For the last six months, educational and scientific research organizations that depend on charitable grants from foundations and private donors have been in a state of alarm over the threatened Federal tax restrictions on foundations (SN: 10/11, p. 326).

The clause that had aroused the most alarm in the tax bill passed by the House in August was a provision placing a 7.5 percent tax on the investment income of foundations. As Federal funds for a broad spectrum of research become more and more limited, many research groups have been turning to private foundations for help; spokesmen for the major foundations speculated that the House-approved tax might reduce foundation support of research projects by as much as $100 million per year.

However, the restrictions on foundations in the tax bill that Congress passed early this week appear to be less stringent, and foundation officials are moderately, though not totally, relieved.

The final version of the tax bill reduces the levy on foundations to 4 percent of their net investment income.

Foundations thus scored a victory in a critical area, although it appears they simultaneously lost a philosophical battle on the tax issue. David Z. Robinson, former assistant to the President's science adviser soon to become vice president of the Carnegie Corp., points out that foundations had wanted the tax to be called an "audit-fee," meaning a payment to cover the Internal Revenue Service's expenses in auditing foundation records. Such a fee might not have meant less in terms of dollars but, says Robinson, it would have "preserved the principle that foundations are tax-exempt."

The other portions of the tax bill curtail some common abuses of foundations as tax shelters.

One provision of the bill, for example, restricts dealings between foundations and persons or businesses closely involved with the foundations. All too often, under the previous law, individuals have donated money or property to foundations set up to receive tax benefits, while retaining effective control over the ostensibly donated assets. The self-serving transactions now prohibited include the sale or exchange of property and the lending of money, goods or services.

In a similar attempt to insure that foundations really carry out the functions for which they claim to be organized, the bill requires them to disburse annually at least 6 percent of their average noncharitable assets in grants or other donations. Also, foundations and the principal persons connected with foundations will generally not be allowed to own more than 20 percent of any corporation's voting stock. Since the purpose of this latter provision is to discourage foundations from involving themselves in pure business speculations, the limitation will not apply to foundations with a fundamentally charitable interest in neighborhood-renovation corporations or in small businesses in central cities.

All these restrictions match those that foundations have set for themselves in the past through a joint committee of the Foundation Center, the Council on Foundations and the National Council on Philanthropy. Francis Keppel, former Federal commissioner of education and now president of the General Learning Corp., says foundations have no objection to laws that "protect them against the misuse of the philanthropic purpose." He speculates that the new bill may thus "strengthen the position of foundations."

Such may be the long-term effect of the bill, but the immediate result will be a period of uncertainty for foundations. "We don't know how some of the provisions in the bill are going to be enforced," says a high official of the Carnegie Corp. "Until these questions of administration are cleared up, we're in a cloud. At the moment, the main effect of the bill is to inhibit our program planning." □

DETERGENTS

Phosphates on the spot

Phosphate is important in a laundry detergent because it helps the other main ingredient: the surfactant, which does the actual cleaning. The surfactant molecule has a water-attracting (hydrophilic) end and a water-repelling (hydrophobic) end. It is the hydrophilic end that breaks up the dirt on clothing or dishes; the hydrophobic end, by repelling water molecules, reduces surface tension. The effect of reducing surface tension is like removing a skin from the surface of the water, thereby giving it greater fluidity and making it a better wetting agent.

The phosphate aids the surfactant by acting as a sequestering, or water-softening, agent. It immobilizes hard-water ions, such as calcium, that might otherwise react with the surfactant to form an insoluable salt and thus render the surfactant ineffective. In this way, phosphates prevent dirt redeposition by keeping dirt particles suspended.

When the detergent has done its job, it is disposed of through the regular sewage system and ends up in lakes and streams, where it contributes to algae growth and the eutrophication of the water courses.

Although the detergent industry recognizes that phosphates are aquatic plant nutrients, it contests the idea that detergent phosphates are the reason for eutrophication. The Soap and Detergent Association cites fertilizer, human waste, industrial effluents and natural run-off from the land as being far and away the biggest phosphate sources.

The detergent contribution is minor compared to these others, claims sanitary engineer Charles G. Bueltman, vice president and technical director of the association. "It clearly follows," he says, "that the elimination of detergent phosphate alone could not possibly mitigate or diminish excessive algae growth. The opinion, therefore, that removal of phosphates alone would help alleviate the algae problem is not supportable from a technical point of view."

Nevertheless, the detergent industry is in hot water with Congress.

A bill is in the House legislative hopper that, if passed, would outlaw phosphates in detergents. The reason: eutrophication. Phosphates are believed to be the primary agent responsible for the growth of algae and aquatic plants that are choking most of the nation's lakes and streams.

The bill's sponsor, Rep. Henry S. Reuss (D-Wis.), concluded two days of hearings on the bill last week. The results of the hearings will be sent to the House in support of the bill.

"We feel we took kind of a beating," summed up a representative of a phosphate manufacturer. "We feel like there's a whipping boy approach."

The indications are there's more whipping to come. "It is essential that phosphate be removed as a basic composition in detergents," declares Carl L. Klein, assistant secretary of the Department of the Interior for Water Quality and Research.

The detergent industry, however, maintains that phosphate can't come out because of its vital role for which no alternative has been found. In fact, the first detergents, which were phosphateless, were resoundingly rejected by American housewives.

But detergent phosphates are neither indispensable nor innocent, according to critics.

Dr. I. A. Eldib, a chemical engineer and president of Eldib Engineering and Research, Inc. in Newark, N.J., contends that out of six billion pounds of synthetic detergents sold last year, 2.6 billion were phosphates, "most of which ended up in our lakes, rivers or ground water.

"Synthetic detergents and fertilizers are the two principal users of phosphates," he says. But "it is generally conceded that the application of chemical fertilizers to farm lands does not cause significant fertilization of streams by surface run-off; they are applied during the growing season and are tilled into the soil."

But putting phosphates into water is one thing; what happens to them is another. "Each lake is an individual, and you have to study individual situations," says a spokesman for one phosphate manufacturer. For example,

Interior

Choked streams spawn a bill.