Meetings

Drilling and Coring the Deep-Sea Floor

On the occasion of the award of the Vetlesen Prize to Francis Birch (Harvard University) and Sir Edward Bullard (University of Cambridge) a symposium was held at Columbia University, 25 November 1968, on drilling and coring the deep-ocean floor. The symposium was chaired by T. O. Jones (National Science Foundation) and included some reflections on the value of deep-sea drilling by Birch and Bullard, as well as reports from the members of the scientific party on the *Glomar Challenger* on the first leg of the drilling program initiated by JOIDES and operated by the Scripps Institution of Oceanography under a contract with the National Science Foundation.

In Jones's opening remarks, he commented on the fact that funding for basic research has become much tighter in recent years and expressed the hope that the Deep Sea Drilling Project (DSDP) would demonstrate the relation between basic research and future development as well as increase our knowledge of the earth and show that major projects of this type can be managed by scientists working cooperatively.

W. Nierenberg (Scripps Institution of Oceanography) described the development of the project and paid special tribute to Tj. van Andel and W. Rand for their early work in the planning and development of the project. The philosophy of operation has been to concentrate on the fundamental purpose of recovering cores from beneath the ocean floor and to rely as much as possible on off-the-shelf technology developed by the petroleum and drilling industries. This philosophy has paid off due to the cooperation of industry and the ability of Global Marine to deliver the *Glomar Challenger* in such remarkably short time that the first two legs of the program could be completed within a year of the signing of the subcontract. A. Maxwell (Woods Hole Oceanographic Institution) described the history of the JOIDES group which includes the Institute of Marine Sciences of the University of Miami (IMS), Lamont Geological Observatory of Columbia University (LGO), Scripps Institution of Oceanography of the University of California (SIO), Woods Hole Oceanographic Institution (WHOI), and, since early 1968, the Department of Oceanography, University of Washington (UW). He noted that JOIDES grew from an interest in sediment sampling on the part of several groups connected with Project Mohole through several short-lived organizations to its present form in 1964. Planning initiated at that time resulted in the drilling program on the Blake Plateau operated by the Lamont Geological Observatory and culminated in the present program. Details of the development of the program and the drilling on the Blake Plateau have been recorded [*Science* **150**, 709 (1965); *Trans. Amer Geophys. Union* **48**, 817 (1967); *Bull. Amer. Ass. Petrol. Geol.* **51**, 1787 (1967)].

Discussion of the results of Leg 1 was begun by J. L. Worzel (LGO) who presented the results of the first three holes in the Gulf of Mexico. The first of these, in 9259 feet of water at the base of the Sigsbee scarp, penetrated 2528 feet of slumped and somewhat contorted Pleistocene sediments. This hole was logged with open-hole gamma ray, qualitative gamma-gamma (density) and open-hole resistivity logs as well as with an in-pipe gamma ray per neutron log. Hole No. 2, in 11,720 feet of water, was located on one of the diapiric structures which make up the Sigsbee Knolls and went through Pleistocene clays, Pliocene pelagic oozes, and Miocene limestone and at about 450 feet beneath the bottom into caprock consisting of gypsum, anhydrite, and vein sulfur and containing both oil and gas. It seems quite clear from these results that the Sigsbee Knolls and the associated diapiric structures are salt domes. Hole No. 3 was drilled in 12,294 feet of water in the abyssal plain away from the diapiric structures. The section here was much thicker than in Hole No. 2; depth to the top of Miocene being 442 meters as compared with 122 meters in the latter, indicating that the knoll drilled has been a topographic high for some time.

C. Burk (Mobil) reported on Holes Nos. 4 and 5, both in about 17,500 feet of water east of the Bahama Islands. These were located where a prominent reflector, known as Horizon A and thought to be of Cretaceous age, outcrops on the bottom. Drilling was difficult here and efforts to go deep were thwarted by layers of indurated siltstone and chert. Both roller and drag bits were worn beyond recognition. However, on Hole No. 5, with a diamond bit, deeper penetration was achieved and Jurassic (Tithonian) sediments were recovered, the oldest sediments to date from the deep ocean basins. Burk pointed out that the sediments in this area have been of deep-water character since Jurassic time. However, a well on the adjacent Bahama platform went through over 14,000 feet of shallow-water Cretaceous limestones, thus posing some interesting questions for those concerned with the structural history of continental margins.

The last two holes, Nos. 6 and 7 in about 17,000 feet of water on the Bermuda Rise, were described by M. Ewing (LGO). In this area the reflecting Horizon A has been elevated and, since it is a turbidite, the elevation must postdate its deposition. Horizon A also splits into two reflectors on the Bermuda Rise and it had been thought that the upper part represented the same event as found elsewhere. However, the upper reflector was found by drilling to be mid-Eocene in age and it now seems likely that the lower reflector is A. Once again cherty turbidites or siltstones were encountered and these impeded drilling. They were penetrated in Hole No. 7 and unfossiliferous deep-sea clays were recovered beneath.

W. Berggren (WHOI), E. Pessagno (Southwest Center for Advanced Studies), and D. Bukry (U.S. Geological Survey) reported on the microfossils in the cores. In the Atlantic foraminifera tests were not numerous, probably having been dissolved, and nannoplankton fossils and radiolaria were the most useful. Nannofossils have the special advantage that they can be used to date extremely small samples. In the Gulf, on the other hand, forams were abun-

dant in sufficient quantities to demonstrate that this program has the possibility of establishing fundamental levels of biostratigraphy. The finding of Jurassic sediments with a considerable thickness of older sediments beneath points up the fact that studies of radiolaria need to be advanced because these have been represented in the fossil record since at least Paleozoic time, while coccoliths are not known prior to Jurassic nor forams prior to late Jurassic.

The sediments and their properties were discussed by A. Beall (Continental Oil Co.) and A. Fischer (Princeton). It was observed that the sediments at depth were in a reduced state and in some instances showed evidence of having been deposited under stagnant conditions. Of particular interest were examples of diagenesis in deep-sea sediments including cementation, dolomitization, and silicification.

Birch commented that a long distance separated geophysical results and the nature of the rocks, and noted that the importance of a drilling program as a beginning of greater understanding of these could not be overemphasized. He gave as an example the remarkable correlation between heat flow and heat production in New England, in which the observed flow could be attributed to that produced by a 6-km thickness of rock with the equivalent uranium content of that of the surface rocks. If the radioactivity of the oceanic basement were equivalent to that of granite it could make a significant contribution to the heat flow through the ocean floor.

Bullard mentioned that the new tool has become available at just the right time since ideas about the origin and development of the oceans have only recently become established. We are now seeing only the last stages of the development of the oceans but, with properly chosen sites, we should be able to decipher much of the earlier history. He discussed many of the current problems which require explanation and pointed out the need for geologists working on land to produce a picture which is compatible with current thoughts about the ocean.

The program concluded with comments by Hollis Hedberg (Gulf Oil and Princeton) who noted that some 2 million holes have been drilled to depths from a few hundred feet to more than 5 miles on land and the contribution of these to geologic knowledge has been immense. If this is the case on land where outcrops are abundant, how much more so it must be in the oceans where outcrops are few. He looked forward to an exciting new era in the earth sciences.

During the following discussions a number of interesting points were raised. E. Baker (Mellon Institute) reported that preliminary studies of the oil sample from Site No. 2 indicated that it was of marine origin, of Cretaceous or younger age, and that it had not been subjected to thermal stresses. The gas samples (J. Hunt, WHOI) showed a complete spectrum of hydrocarbons. Nierenberg, in response to a question, gave some preliminary results from Leg 2 which he had obtained from M. Peterson and N. T. Edgar (SIO), co-chief scientists on *Glomar Challenger*. Basement was reached in the three holes drilled between Bermuda and the Mid-Atlantic Ridge. The age of the sediments immediately above basement was, from west to east, Lower to Middle Cretaceous, Middle to Upper Cretaceous, and Miocene, respectively. It should be noted that these ages are not in disagreement with current thinking about the development of the Atlantic Ocean basin.

Jones concluded the seminar by citing the drilling program as another example of a project, too big for a single institution, being managed as a national program.

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Enzyme Regulation in Mammalian Tissues

The Seventh International Symposium on Regulation of Enzyme Activity and Synthesis in Normal and Neoplastic Tissues was held at Indiana University School of Medicine in Indianapolis on 30 September and 1 October 1968. A. Szent-Györgyi (Institute for Muscle Research) discussed the steric separation of enzyme and substrate which underlies the regulation of enzymic systems connected with the repair of mechanical damage. He suggested, tentatively, a very simple theory of cancer—a cancer cell is a cell which is unable to bind its glyoxalase.

The regulation of pyruvate kinase in the rat was described by G. Weber (Indiana University School of Medicine) as operating through both control of enzyme biosynthesis and control of enzyme activity. The mechanisms of inhibitory action of free fatty acids, acetyl-coenzyme A, adenosine triphosphate (ATP), and reduced nicotinamide-adenine dinucleotide (NADH) and the competitive inhibition of liver pyruvate kinase by L-alanine and that of brain pyruvate kinase by L-phenylalanine were described. In man, during prolonged starvation, administration of exogenous L-alanine results in a prompt hyperglycemic response, suggesting that provision of precursor substrate is an important rate-limiting step in the control of hepatic gluconeogenesis under these conditions (G. F. Cahill, Jr., Harvard Medical School).

Adenyl cyclase, in "ghosts" prepared from isolated fat cells from rats fasted and then fed, has higher specific activity and increased sensitivity to epinephrine (T. Braun, American Medical Association Education and Research Foundation's Institute for Biomedical Research, Chicago). The activity of tyrosine transaminase in rat liver shows markedly time-dependent variations that appear to be generated by the interaction of an endogenous factor (the tendency of the animal to eat cyclically) and an exogenous factor (the presence of protein in the diet) (R. J. Wurtman, Massachusetts Institute of Technology).

The perfused heart system differs from adipose tissue preparations in that insulin is without antilipolytic activity in the heart although it inhibits activation of lipolysis in adipose tissue (J. Ashmore, University of Massachusetts). Vitamin K_1 stimulates *de novo* synthesis of prothrombin and possibly other clotting factors which are dependent on vitamin K in isolated perfused rat liver (R. E. Olson, St. Louis University).

The control of protein synthesis in protoplasts of *Escherichia coli* infected with bacteriophage T4 was studied in a two-part incubation in which the processes of transcription and translation were separated by the use of inhibitors of RNA and protein synthesis (J. M. Buchanan, M.I.T.). The allosteric regulation of the catalytic activity of tryptophan oxygenase is accompanied by changes in molecular architecture (P. Feigelson, Columbia University).

At branching points of metabolism, control processes operate by competi-