Through the depth of the magnetic crust

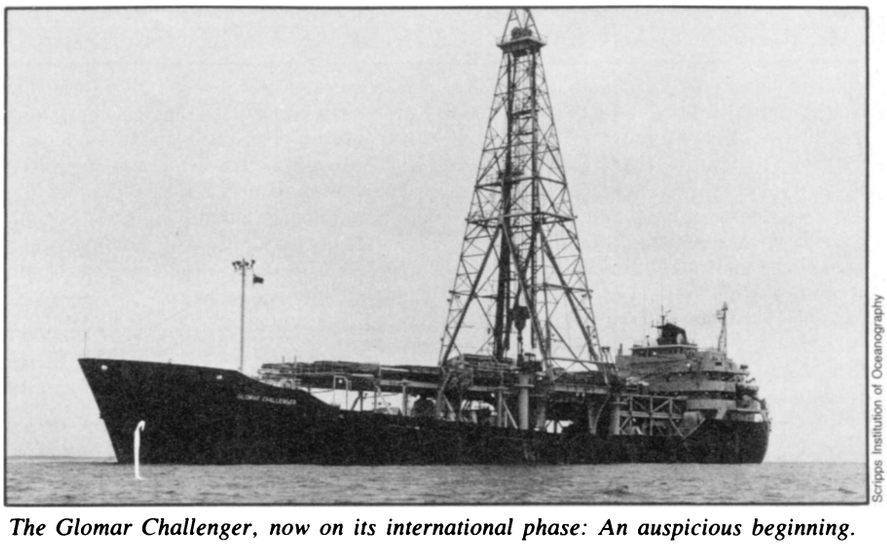
Scientists and technicians aboard the research vessel Glomar Challenger have made an auspicious start on the first leg of IPOD, the International Phase of Ocean Drilling, which is also leg 45 of the already globe-girdling Deep Sea Drilling Project. Working at a site on the Mid-Atlantic Ridge, where new material is continually being thrust up from the earth's mantle to replenish the diverging edges of two of the planet's crustal plates, the Challenger team has extracted core samples from the volcanic bedrock that may encompass the entire thickness of the magnetic layer preserving the local history of the earth's magnetic field. In the process, the researchers set a pair of significant drilling records, prompting officials to predict that holes extending nearly a mile into solid bedrock are now within the realm of possibility.

The transition from DSDP to IPOD (SN: 1/4/75, p. 9) has been subtle. There has always been considerable foreign participation in the deep-drilling effort, but now each leg of the ongoing voyage will include regular representation from the Soviet Union, France, Great Britain, Japan and probably West Germany, with each country contributing $1 million a year to the project's budget. More to the point is an increase in scientific ambition: deeper holes, with a greater part of their penetration being in the hard rock that underlies the thick layers of ocean-bottom sediments. Leg 45—IPOD leg 1—is a promising start.

Two holes were drilled into the Mid-Atlantic Ridge, but one of them, located about 1,500 miles northeast of San Juan, Puerto Rico, seems to be the center of interest. One of the most important developments of the DSDP drill teams has been the ability, using a sonar-guided reentry system, to pull the drill string out of a hole and then put it back in again—a necessity for deep, hard-rock penetrations in which the drill bits must be periodically replaced. At the primary leg 45 site, the crew managed not only to reenter the hole a record-setting nine times, but to do it through a greater depth of water—14,000 feet—than any previous reentry. The result was a hole reaching through the 100 meters of bottom sediment and another 570 meters into the solid ocean floor.

Past data from ship-towed magnetometers and basalt samples dredged from the bottom have indicated that the ocean crust in the area is highly magnetized to a rock depth of at least 450 meters, thereby preserving traces of the changing orientation of the planet's magnetic field. The Challenger core samples, exceeding that depth by more than 25 percent, show traces at their bottom end of a "marked drop" in magnetization, suggesting that the entire magnetic layer has been penetrated to the point where the deep rocks are permeated by heated, circulating water like hot springs on land. The heat source is likely to be the molten magma beneath, which would also obliterate records of magnetic orientation, so it is possible that IPOD has scored a coup on its inaugural journey by capturing the entire available magnetic history of its chosen site in a single set of core tubes.

As for the rocky record itself, it contains traces of at least three field reversals, together with signs that it took several hundred thousand years to accumulate the basalts retrieved from the deep hole, deposited by eruptions at intervals ranging from 10,000 to as little as 200 years. At one point, about seven to eight million years ago, the geomagnetic field was much as it is today, with the poles in nearly the same locations. This week the Glomar Challenger departed on leg 46 of its journey, one of whose goals will be another attempt to reenter that same drill site. □



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The Glomar Challenger, now on its international phase: An auspicious beginning.

Soviets plan Caspian nuclear excavation

As mounting environmentalist pressure has slowly taken its toll of America's Plowshare program—initiated to find peaceful uses for atomic explosions—the comparable Soviet experimental efforts have progressed to the point that Russian experts are planning new, ambitious applications. Already, nuclear blasts have been used to create underground chambers for storing gas and oil, and now Soviet scientists are considering a major, ground-level excavation project to divert water from several northern rivers toward the Caspian Sea.

The Caspian is the largest inland body of water in the world—really more a vast salt lake than a true sea—and over recent decades, the water level has been slowly falling. To correct this decline, engineers have proposed a deep, 113-kilometer canal to divert water from rivers that normally flow toward the Arctic Ocean into the Volga, which empties into the Caspian Sea. Half the length of such a canal would pass through rocky terrain, and the Soviets estimate they can slash construction costs by two-thirds using nuclear explosions rather than conventional technology.

Some 250 nuclear charges would be required, with explosive forces up to three megatons each and strung together in rows of up to 20 charges, according to Boris Belitzky, a science correspondent at Radio Moscow, writing in the Jan. 15 NEW SCIENTIST. A series of three nuclear blasts have already been carried out along part of the proposed canal route, and have reportedly given scientists necessary information on how to choose the size and depth of charges for the excavation.

Russian authorities, writes Belitzky, will cooperate with the International Atomic Energy Agency (IAEA) in Vienna, which is in the process of drawing up safety standards for such excavations: "The Soviet Union declares itself ready to give it [IAEA] every assistance." Neither the 1963 partial test ban treaty nor the nonproliferation treaty prohibits such projects, so long as radioactive debris does not spread to other nations.

Previous Soviet efforts in the field have included sealing off an uncontrolled gas jet in Turkmenia by melting a nearby underground salt deposit with a nuclear device and creating underground reservoirs with up to 150,000 cubic meters capacity. Natural gas could be drawn from one recently constructed reservoir only 120 days after the explosion, exhibiting "no trace of radioactivity." Soviet authorities also claim to have had better success than Americans in stimulating oil and gas production using underground nuclear blasts. A variety of other applications are also under consideration. □