Explorer: Can Oil and Science Mix?

An ambitious new deep-sea drilling program may produce a partnership between government and the oil industry

Earth scientists have been delighted with the performance of the deep-sea drilling ship *Glomar Challenger* over the past 10 years, but many would like to see her replaced by the bigger and even better *Glomar Explorer*. Unable to fund the *Explorer* alone, the federal government has turned to the oil industry for help. As discussions about a partnership continue, both science and industry are wondering if it would all be worthwhile.

As originally proposed by the scientific deep-sea drilling community (*Science*, 16 June 1978, p. 1254), *Explorer*, the ex-CIA submarine salvage ship, would drill farther into ocean sediment and crust in deeper water than any ship afloat. Because it would not be restricted to areas with no oil or gas potential, as *Challenger* is, *Explorer* could also probe the thick sediments of the continental margins. *Explorer* would drill fewer but deeper holes than *Challenger* on both sides of the Atlantic, in the Pacific, and near Antarctica. Ideally, *Challenger* would overlap *Explorer* for several years as they each pursue drilling targets especially suited to their capabilities.

This ambitious, balanced proposal received strong support from two National Science Foundation (NSF) committees—one an ad hoc scientific advisory group and the other a blue-ribbon committee of scientists and nonscientists. Both committees concluded that between the scientific studies and the assessment of the oil and gas potential off the U.S. coast the program was fully justified. They also agreed that industry should have a minor role, if any, in the project. The only dissenting voice was raised by a National Research Council study committee that suggested that broadly based studies of the ocean margins be carried out before expensive drilling.

Despite widely acclaimed justifications for the *Explorer* program, none of the expected financial backers have come forward. Foreign participants, who have provided one-third of the funding for the *Challenger* program, have offered no support. The Department of Energy and the Department of the Interior, which were expected to take significant roles, have declined to participate as major funding agencies.

Because NSF could not shoulder such a burden alone, Frank Press, director of the President's Office of Science and Technology Policy (OSTP), approached 27 oil companies with an offer to join the program. At a meeting in Houston in early December, academic earth scientists presented a proposal to their oil industry counterparts that the academics thought offered a reasonable return for industry—two-thirds of the drilling time in return for covering 50 percent of the costs. Under this plan, *Explorer* would spend its first 2 years in the Pacific drilling several types of holes of interest solely to academic scientists, and then it would come around to the U.S. Atlantic coast for 4 years to drill holes of interest to both the universities and industry.

Outside of OSTP and NSF, it is widely believed that after the Houston meeting OSTP, at the behest of the oil companies, eliminated the Pacific drilling from the program. Peter Wilkness, drilling program manager at NSF, maintains that the abbreviated program was only a temporary expedient, not a serious proposal. It was born out of a need, according to Wilkness, to contain rapidly inflating costs in the offshore drilling business. Shortly, a reevaluation of scientific objectives in light of the latest cost estimates will redress the apparent imbalance, he says.

Whatever the case was, the response from academic scientists was uniformly critical. "Basically, we said, 'This is ridiculous,' " recalls James Hays of Lamont-Doherty Geological Observatory. The balanced approach that justified the cost of the scientific program seemed to have been abandoned in favor of looking for oil. Because Atlantic margin drilling would be the slowest, most complicated type for *Explorer*, only one or two deep holes could be completed each year at a cost of about $60 million per year. By comparison, *Challenger* drills 25 or more shallower holes per year for $20 million.

Doubts about the scientific return per dollar for a curtailed *Explorer* program have been further stirred by the recent revitalization of the *Challenger* program. In addition to new means of analyzing the geologic record and performing experiments within a drill hole, a new coring technique (the hydraulic piston corer) has recovered exceptionally well-preserved cores for the study of the ancient ocean and climate. But such *Challenger* drilling has a brief future if *Explorer* gets the go-ahead.

Now, NSF is looking for a middle ground that will suit everyone. "Who's in the program will obviously shape its content," says Wilkness, "but this is a basic research program; science is the guiding factor." The draft agreement being discussed with industry states specifically that no one is looking for oil or gas and that no likely reservoirs will be drilled. The other major premise, according to Wilkness, is that one of the new drilling objectives, Atlantic-type ocean margins, proposed by the scientific community "coincides with the interests of private industry" and will be the primary objective in any *Explorer* drilling program. The other three major scientific objectives (drilling into the ocean crust, drilling in the vicinity of deep-sea trenches, and recovering clear geologic records from sediments) will also be a part of the program, Wilkness says, but the extent of their role has not been determined yet.

Academic scientists are not the only ones that are a bit leery of *Explorer*. "Press [of OSTP] is trying to walk a fine line to gain a marriage of objectives," a prominent oil company executive says, "but learning how the earth works and finding oil and gas efficiently are objectives that are extremely difficult if not impossible to marry." Consortia of oil companies have entered into agreements with the federal government to drill test wells for the sole purpose of gathering geologic data, but those data are not made public until the participating companies have bid on leases to drill for oil and gas nearby. Because industry drill ships are capable of drilling on the continental shelf and slope (the steep edge of the shelf), the oil companies have made it clear that any government evaluation of oil and gas potential in the Atlantic will be done below a depth of 1800 meters, that is, on the continental rise. Al-

0036-8075/80/0208-0627$00.50/0

though such a preliminary evaluation would be of some interest to industry, it would appear content to first edge out onto the slope, as it is now doing, and evaluate the prospects of the rise from there.

That part of the oil industry has shown any interest at all in *Explorer* is indicative of other pressures felt by the oil companies. Although not of one mind on the question, many companies feel that it would be imprudent to refuse an offer to help evaluate the country's energy reserves, however costly and far-off their utilization may be. Although new drilling technology may be developed and new geologic data gathered, industry seems primarily interested in maintaining its public image as an enthusiastic developer of energy resources.

NSF is assuring everyone that enough oil companies have shown an interest for planning to proceed. In the next few months, a general drilling program must be hammered out that will satisfy all parties, including Congress. It will have to be strong enough to stifle the often-heard argument that *Explorer* is an expensive scientific tool looking for a job to do.

—RICHARD A. KERR

Osteoporosis: New Help for Thinning Bones

New evidence suggests that osteoporosis, once thought to be an unavoidable consequence of aging, may be preventable or at least treatable

No one knows why George Bernard Shaw climbed a tree when he was 93 years old, but the act had a most unfortunate consequence. He fell from the tree, broke his hip, and subsequently died.

This may be an extreme example, but the phenomenon is not all that unusual. Each year in the United States as many as 190,000 people, in late middle age or older, suffer broken hips. Perhaps one-sixth of these individuals die from the ensuing complications, and many of the survivors are incapacitated.

Most of the broken hip victims have an underlying condition, called osteoporosis, in which the bones lose abnormally large quantities of the calcium-containing mineral that helps to give them their strength. As a result, the bones become fragile and subject to fracture by stresses that would not break normal bones. Hip fractures, for example, often result from a relatively minor trauma such as falling from a standing position. Falling down stairs—or out of a tree—is not necessary. Says Robert Heaney of Creighton University, "Osteoporosis is a very significant problem. About 25 percent of all white women have had one or more fractures by age 65." These fractures include, in addition to the broken hips, about 100,000 broken wrists every year.

Vertebral fractures are another major feature of osteoporosis. They are usually the type called "crush fractures," in which the vertebrae collapse simply from carrying the weight of the body upright. There is no good estimate of the annual number of crush fractures, but they are a frequent complaint of patients who are seeing physicians for osteoporosis. The vertebral fractures, which cause the height loss and humped backs often seen in the elderly, can cause severe back pain.

Not only does osteoporosis cause a great deal of death and disability, but the dollar costs are also high. According to B. Lawrence Riggs of the Mayo Clinic, the cost of acute medical care for elderly patients with broken hips is more than $1 billion a year. This does not include such indirect or long-term costs as lost income and fees for nursing homes.

Many people, physicians included, consider osteoporosis to be an unavoidable consequence of aging. But as investigators learn more about what causes the abnormal loss of bone mineral in some people, they are beginning to think that the condition may be preventable. The research suggests that, contrary to popular opinion, dietary calcium requirements may increase with age, rather than decrease. Moreover, several experimental therapies for slowing bone loss and possibly decreasing the number of fractures experienced by individuals who have already developed osteoporosis are under investigation.

Although everyone begins losing bone mineral at around 40 years of age, women, especially white and Oriental women, are the most likely to suffer the fractures that are the major clinical feature of osteoporosis. Women usually have lighter bones than men, and there is general agreement that people with lighter bones run a higher risk of fractures than persons of the same age who have heavier bones. The heavier bones of black women may help to explain their decreased risk of osteoporosis.

Not only do women have lighter bones than men to start with, but women's bone losses accelerate at menopause. The high rate of loss continues for about 20 years, during which women lose 0.5 to 1.5 percent of their peak bone mass every year. The rate of loss eventually decreases, but before it does a woman's bones may be significantly weakened. Men do not show a comparable acceleration of bone loss during aging.

Over the years a picture has developed that shows bone to be in a constant state of change, undergoing alternate cycles of resorption (bone dissolution) and formation in a process known as remodeling. Because bone mineral consists primarily of a calcium phosphate salt called hydroxyapatite, remodeling helps to maintain the calcium and phosphate concentrations of blood and the other body fluids within normal bounds. Bone is resorbed, for example, when the blood calcium concentration drops and then replaced when the concentration returns to normal. Work in Heaney's laboratory has shown that in normal circumstances bone mineral dissolution is obligatorily coupled to a more or less equivalent amount of formation, with the result that the mineral content of adult bones remains roughly constant even though calcium is periodically withdrawn.

That menopause accelerates bone loss and predisposes women to osteoporosis has been known since the pioneering work of the late Fuller Albright during the 1940's. The acceleration has been generally attributed to the deprivation of the hormone estrogen that occurs when the ovaries stop functioning. Direct proof that estrogen can slow bone loss did not begin to accumulate until about 10 years ago, however. And only within the past 5 years or so have investigators begun to understand how it affects bone.

Osteoporosis could be caused by increased bone resorption without a coun-

0036-8075/80/0208-0628$00.50/0