

NSF

Challenger goes global: Around three ocean basins, into the Mediterranean.

ed project will explore the edges of the Gulf of Mexico next February and March in search of evidence to help decide between the two major theories about the origin of the gulf basin. One holds that the gulf was once a shallow sea that sank; the other, that the gulf has been a deep ocean basin dating back to geologically ancient times.

It should also provide more information about the oil deposits found in association with salt domes on the gulf floor on the Challenger's first leg last year—the first demonstration that hydrocarbons can be formed and accumulated in deep sea conditions. Geologists hope that Challenger will be able to provide explanations for major breaks in the topography of the basin west of Florida and off the Yucatan peninsula and for the origin of the Straits of Florida. They intend also to probe into the great cone of sediments built out into the gulf by the waters of the Mississippi.

"There are enough scientific questions that we could put the whole campaign in the Gulf of Mexico," says Dr. Maurice Ewing, director of the Lamont-Doherty Geological Observatory. But the Challenger will move on.

From the gulf, it will head north into the Atlantic, drilling east of the United States. Here, northeast of San Salvador in the Bahamas, the Challenger will return to the site where sediments 140 million years old were found earlier. This time the scientists hope to be able to drill into even older sediments and reach the igneous rock floor beneath.

Here and at many other sites, project scientists hope to be able to penetrate the layer of hard chert, or flint, which the Challenger discovered within sediments in many places (SN: 10/12/68, p. 362), to the great surprise of marine geologists. The chert layers, harder even than granite, are formed

primarily from the skeletons of microorganisms such as Radiolaria, which have been welded together by some unexplained process to form layers that often stopped the Challenger's bits. The existence of the chert in the same time-sequence of sediments from many locations seems to indicate a dramatic change in ocean conditions during the mid-Eocene, about 45 million years ago, that caused the organisms to flourish.

After a drilling leg across the far north Atlantic, the Challenger will investigate the Mediterranean, an area which is strongly suspected to be a product of recent sea-floor spreading. "I have been on two expeditions

NO PANACEA

Social scientists offer themselves

Social and behavioral scientists have been trying for several years to come to terms with society's erupting problems, and with the demands for guidance being made on them by equally frustrated public officials.

They would like to take their place in the councils of government, and this week a Report on the Behavioral and Social Sciences prepared over a three-year period under the auspices of the National Academy of Sciences (SN: 9/13, p. 201), attempted to lay out some of the areas where the scientists might make a contribution.

The report was initiated by the academy's own Behavioral and Social Sciences Survey Committee, composed of more than 60 scientists under the chairmanship of Prof. Ernest R. Hilgard of Stanford University. It is the first large-scale attempt to present a complete view of the current state of the social and behavioral sciences.

Much of the report is devoted to recommendations for involving the behavioral and social sciences in the

in there, and I saw several interesting signs of spreading," says Dr. Ewing. The geology of the land areas of southern Europe has been thoroughly documented, he says, making it possible by drilling to turn up valuable comparisons between land features near the coast and those beneath the sea surface.

European scientists are expected to make up more than half the scientific team on the ship during this phase.

Plans for later segments are not as firm. The Challenger will return across the Atlantic, enter and cruise around the edge of the north Pacific, at one point drilling north of the Aleutian Islands, swing north of Micronesia, and then cut between Australia and New Guinea before heading into the Indian Ocean and around the tip of Africa.

One of the biggest hopes of the next three years, says Dr. Peterson, is to develop the capability to reenter a hole once the drilling has been stopped to change a worn bit or make a repair. Several techniques will be tried, making use of acoustical guidance at the ocean bottom.

As for the future, ambitions are not being limited to the 30-month extension. One day, says Dr. Peterson, the drilling group would like to take the Glomar Challenger into the Black Sea to study its heavily sedimented floor, which is underlain with oceanic-type crust. No official contacts with the Soviets have been made, but many Russian colleagues have made informal invitations in conversation.

formation of public policy. For instance, the survey committee recommends that a system of social indicators be developed to measure the social health of the nation in the way that the gross national product measures the country's economic health.

Inasmuch as the quality of life is more difficult to quantify than economic activity, it is unlikely that a single number such as the GNP will emerge, but the committee hopes that enough meaningful social indicators can be drawn from statistics on such factors as education, health, crime, housing and cultural activities, so that the President can make an annual social report to the nation similar to his annual economic report.

The Office of Statistical Policy in the Bureau of the Budget has already been given the task of creating a system of social indicators; meanwhile, the survey committee suggests that behavioral and social scientists outside the government publish their own annual social report.

The report also urges the Federal Government to establish the controversial centralized national data system (SN: 3/25/67, p. 278), collecting all Government statistics of interest to the social sciences in one place—a move some say would facilitate invasion of privacy. Even in a non-census year, the Government spends more than \$100 million annually on statistical programs; a computerized national data system would make it possible to combine the programs in such a way as to produce new data and to perform experiments which are presently impossible.

The final major recommendation of the report calls for the creation of interdisciplinary graduate schools of applied behavioral science. At the present time, scientists from different social disciplines collaborate on projects in urban research or the study of emerging nations; the graduate institutions envisioned by the survey committee would allow scientists to expand their collaboration beyond the demands of a specific project.

Although the new Report on the Behavioral and Social Sciences foresees an expansion of Federal social planning and cites the past successes of the applied social sciences (among them, the city-manager form of government, the social security system and the census), it also deals with the problems of applying these sciences to national difficulties.

One problem is simply the question of whether the behavioral and social sciences are competent to solve the riddles they would like to tackle. The report mentions the 1964 income tax reduction as an example of the "spectacular success" of applied econometric theories: Faced with a comparable situation in 1932, the Government raised taxes, and, says the report, "The difference between 1964 and 1932 reflects the substitution of systematic social science for the obvious 'common-sense' solution."

Ironically, some economists feel that the inflation of the past few years demonstrates the failure, rather than the success, of modern theories. Other economists blame inflation on the Vietnam War, but in any case the issue is more disputed than the report suggests. Nevertheless, the survey committee points out that "most actions the society takes to improve social conditions are untried, risky and undertaken in at least partial ignorance of their effectiveness."

A more subtle problem is one concerning the political inclinations of behavioral and social scientists as a group. It can be argued that, because social scientists are interested in normal social functioning and require a degree of social and institutional regularity in

order to perform their studies, they are inherently conservative. The survey committee argues, on the contrary, that the social sciences challenge traditional concepts of human nature and society and hence are "potentially some of the most revolutionary intellectual enterprises ever conceived by the mind of man."

The survey committee does not offer the behavioral and social sciences as a panacea for all the nation's ills. Social problems frequently arise that are too

PULSAR TOOL

Testing relativity, measuring corona

The pulsar in the Crab nebula, NP 0532, has served astronomers as a kind of exemplar since it was found a year ago. Theoretical models have been made with NP 0532 in mind, and much of what has been learned about pulsars comes from studies of it.

Now, because the sun passes in front of it, NP 0532 is being put to additional use; its radiation will help to study the structure of the solar corona and may enable astronomers to distinguish between two rival theories of gravity.

When the pulsar passes behind the solar corona, the arrival of its pulses of radiation is delayed. The delay comes in part from a slowing of the signal by the electrons in the solar corona and in part from the effect of the sun's gravitational field.

Observations now underway at the Arecibo Ionospheric Observatory in Puerto Rico, which is operated by the Cornell-Sydney University Radio Astronomy Center, are aimed at determining the amount of the slowing, and separating its two parts. In this way the Arecibo scientists hope to learn more about the structure of the corona, and to test theories of gravity.

There are two theories of gravity now under serious consideration. One is the general relativity theory proposed 50 years ago by Albert Einstein; the other was put forward during the last decade by Drs. Carl H. Brans of Loyola University and Robert H. Dicke of Princeton University (SN: 6/1/68, p. 532). The two theories differ in the way they describe gravitational forces, and their cosmological predictions vary widely.

Both theories predict that a strong gravitational field, like the sun's will slow down an electromagnetic wave passing through it. The amount of slowing differs by about 10 percent from one theory to another.

The data from the Arecibo observations are not yet completely analyzed, but Dr. Frank Drake of Cornell reports that what has been done so far shows

urgent to await a considered scientific opinion, or that involve fundamental questions of value.

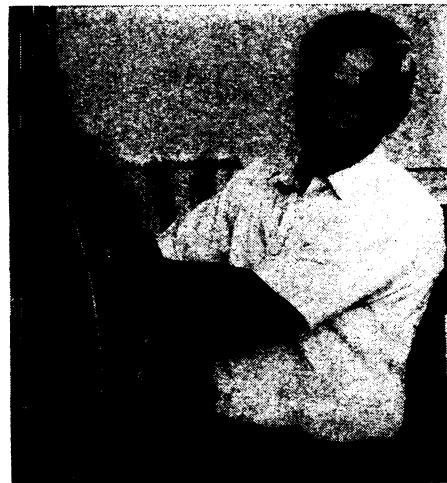
"Many problems of human behavior," the report concludes, "are solvable only through political decisions and are aided only moderately by scientific knowledge." But the committee suggests that the social sciences are "our best hope, in the long run, for understanding our problems in depth and for providing new means of lessening tensions." □

a definite time lag in the arrival of NP 0532's pulses when the solar corona was in front of the pulsar. Dr. Yervant Terzian adds that the experiment seems to be improving the picture of the solar corona.

Separating the amounts of slowing due to each of the causes has yet to be done. To do it requires comparing data taken at two different frequencies. According to both theories, the gravitational slowing should be the same at all frequencies, but the electrons in the corona will retard the less energetic lower frequencies more than they will the higher frequencies.

Subtracting one set of data from another should separate the two components of the slowing. But the data reduction is delicate, since the amount of slowing due to the electrons is about 50 times the expected contribution of the gravitational field.

That such a gravitational slowdown of electromagnetic radiation does happen was shown by an experiment last year that sent a radar beam past the sun to the planets Venus and Mercury (SN: 3/9/68, p. 229). But the radar experiment was not accurate enough to choose between the two gravitational theories.



Cornell Univ.
Drake: Testing gravity theories.