Minorities in the Geosciences: Beyond the Open Door

A glance around any large gathering of scientists quickly reveals that the number of black Americans and other minorities active in the sciences is vanishingly small, almost to the point of nonexistence. Explanations, of course, are not difficult to find. It was not very long ago, after all, that discrimination in government, industry, and a number of colleges and universities was a casually accepted fact of life. Moreover, it is argued, cultural and economic barriers have always kept the poor out of the professions, and minority peoples tend to be poor.

Easily explained as it may be, the ivory tower's persistent lily-whiteness is gradually becoming a matter of genuine concern, if not outright embarrassment, to organized science. Nowadays, nearly every scientific society of any size or stature has its ad hoc committee to study problems of minority education; a handful have gone so far as to spend small amounts of their own money or a government grant on tentative, experimental science education programs for minorities.

The geoscience societies are no exception to this pattern. They have their ad hoc committees, and they suffer the universal problem. By its own reckoning, the profession is almost totally devoid of minority representation. The American Geological Institute (AGI), a federation of 18 societies and 66 corporate members, has been able to find no more than four black Ph.D.'s among 30,000 earth scientists in its affiliate membership. An AGI survey not long ago turned up about the same number of Spanish-surnamed geoscientists and even fewer American Indians. On the basis of the general population, the AGI observes, there should be roughly 5000 minority geoscientists in the United States. "By our records," says William Bromery, the chancellor of the University of Massachusetts at Amherst, and, to the best of his knowledge, the nation's only black geophysicist, "we're at least 4750 short."

One novel feature of the geosciences, however, has begun to set them apart from the pale body of American science. There is a movement afoot within the profession to begin actively recruiting and assisting blacks, Chicanos, and American Indian students to become earth scientists. A generally agreed-upon goal among proponents of this movement is to produce several thousand minority geoscientists by the end of the decade and to reach population parity in a little more than a generation from now. While such visions may be open to accusations of naiveté and quixotism, the effort to alter the racial balance of the earth sciences is nonetheless sincere, and it may well produce some useful lessons for the other sciences before long.

The movement is visible on two parallel fronts, in government and in the professional societies. Last September, the U.S. Geological Survey, the largest government employer of earth scientists, announced that it would make a determined new effort to single out the minorities it already employed and offer them time and financial help in polishing and expanding their skills toward eventual promotion. The Survey is also hunting for more minority employees for technical jobs, and it has vigorously encouraged its regional field offices across the country to provide summer field and laboratory jobs for black and other minority students.

Sharing the Wealth

What's more, the Survey's top management has directed its field offices to draw up plans for sharing some of their expertise with the science departments of local high schools and colleges where minority students predominate—all with the expectation of enticing a few of them into geology, geophysics, and allied fields. The philosophy underlying these directives is simple enough; the Survey's new director, Vincent E. McKelvey, says, "We have determined that it's not enough to sit back with our feet on the desk and say 'The door is open to qualified applicants, regardless of race.' We are trying to help people qualify for employment and advancement in the profession."

With the same philosophy in mind, a committee of the Geological Society of America (GSA) has spent the past year making plans and drumming up support for a minority assistance fund that it hopes will eventually pay out about $1.3 million a year. A tentative shopping list drawn up by the committee proposes to spend most of this on 175 graduate and undergraduate scholarships annually. In addition, about $80,000 would be made available to small, predominantly black colleges in the South to strengthen the one existing earth science department among them (at Virginia State College, Petersburg) and start new ones wherever an interest is expressed.

Smaller amounts would be spent on promoting or improving earth science instruction in high schools and junior high schools, on a job counseling program for veterans, and for such things as summer geology camps for inner-city students.

The GSA committee is particularly eager to try stimulating geoscience instruction in small black colleges through a "paired-college" arrangement that would allow a large, well-endowed school nearby to share its faculty, and possibly its laboratory space, with the black school. (The Geological Survey is trying to start a geoscience department at Howard University in Washington, D.C., using the same approach. Local Survey scientists would be loaned to Howard to form the nucleus of the department and then would be slowly phased out as the university found its own permanent faculty. Although this has been a recurrent idea at the Survey for some years, administrators there seem to think it's closer to fruition than ever before.)

Although some civil rights activists consider the GSA's ultimate objective a bit on the modest side, it's nonetheless an unusual goal for a scientific society: The proposed fund is meant to attract between 100 and 200 black, Chicano, and Indian students into earth-science studies each year. The GSA's minority committee arrived at this figure by calculating the number of new geoscientists who would be needed annually to maintain minority representation in the profession just in proportion to the general population. The profession is nowhere near population parity now, of course. But by this formula parity would be reached within 30 to 40 years.

The GSA's plan has progressed well beyond the stage of idle talk; the society has rounded up the moral support of five sister organizations, and the AGI

has agreed to administer the program; the institute is currently hunting for a nonwhite program director.

Last month, the GSA took the first step toward raising money for the fund with a letter to its 8000 members requesting donations. The committee hopes this will bring in about $10,000, and, with this in hand as earnest money, the AGI and GSA will begin knocking on corporate and foundation doors with the expectation of raising another $200,000 or so for the first year. One small foundation has already pledged $25,000 but industrial support—a key determinant of success or failure—remains an open question. Perhaps significantly, the only evident reticence to the whole plan has come from within the Society of Exploration Geophysicists (SEG), whose leadership is dominated by conservative oil and mining executives. On the other hand, several large petroleum and mining corporations have expressed an interest in helping the fund.

To a large extent, the recent burst of interest in minority education in the earth sciences stems from dedicated prodding by a handful of influential figures, notably Louis C. Pakiser, a geophysicist with the Geological Survey; Clyde A. Wahrhaftig, a professor of geology at the University of California, Berkeley; and William Bromery, at the University of Massachusetts.

All three have long been involved in minority education projects—for the most part small, personal efforts to interest high school students and entering freshmen in becoming science majors. In September 1970 Pakiser, Wahrhaftig, and several other scientists in the San Francisco Bay area gave the national bandwagon its initial shove by circulating petitions around the country exhorting the GSA and the SEG to begin actively encouraging an influx of minorities into the earth sciences. That November, the two societies' governing councils endorsed the petitions' intent; five other societies have since adopted "supporting positions."

A year later, in September 1971, the spirit had spread to the Geological Survey, where acting director William Radlinski was moved to issue a memo declaring in part that the Survey would grant its employees official sanction, working time, and money "insofar as our mission permits" to engage in minority education and training programs of their own design. Special funds set aside for these programs, above and

Agnes Imperils Chesapeake Bivalves

Tropical storm Agnes, which in late June engendered the worst floods the East Coast has seen in this century, made a shambles of the Chesapeake Bay. But, although it was polluted by silting, garbage, and chemical runoffs, scientists say there is little danger that the bay will sustain any long-term ecological damage.

On the surface, the bay has presented a wild scene for the last couple of weeks, with huge islands containing trees, telephone poles, and 200-gallon gas containers (torn from dwellings on the shores of the Susquehanna) floating to and fro over the thick, muddy, swollen waters.

The debris is now being cleared away, but considerable chaos still reigns below. The bay has been declared off limits for swimmers, and shellfish beds are closed to fishermen, primarily because large amounts of untreated sewage, carried by the floods, have been pouring into the bay.

Swimming will probably be all right by the end of the month, but the damage to the shellfish population—primarily to the mussel, the clam, and the famous bay oyster—is serious, although not yet calculable.

The shellfish are in trouble from three directions: they have been rendered inedible because of sewage, pesticide runoff, and the stirring up of heavy metals. Many communities of shellfish have been smothered by the silt that was washed down from the bay's tributaries and that has settled at the rivers' mouths. Most important, many have died, or will die, because the salt content of the water is too low.

Indeed, salinity is the bay's most extensive problem now, according to Eugene Cronin, director of the University of Maryland's Natural Resources Institute. Near Solomon's Island, where the university has a marine laboratory, the concentration of salt in water is usually 14 parts per 1000; however, since the flood, the concentration has been 2 or 3 parts per 1000, which is several parts per 1000 fewer than what oysters need to survive. Because mollusks can hermetically seal themselves in their shells for a couple of weeks when the saline concentration gets too low, their mortality rate cannot yet be determined. (The Solomon's Island laboratory has scooped up its special stock of brood oysters and put them in a refrigerator, where they will keep a few more weeks.)

The outlook for the oyster crop is uncertain. Harvest time is not until September, but spawning time had just begun when the storm hit, and scientists do not know how well the larvae will fare.

Economically speaking, the hardest hit have been the clam fishermen, who were ordered out of the water at the peak of clamming season. Crabs and finfish appear to be doing all right because of their mobility, but many other creatures, such as sea anemones, worms, and surface organisms, have perished as a result of decreased salinity.

The good news, says Cronin, is that all of the oyster's major predators have been flushed out to sea, and sea nettles, the scourge of bathers, will be seen no more this season.

Because the flooding is unprecedented—Cronin says the flow from the Susquehanna, the bay's main artery, was 50 percent greater than it was during the last big flood, in 1936—scientists are not sure just what is happening or how marine life is being reshuffled. Cronin estimates that, if this summer's heavy rains ease off, the bay environment will be back to normal in about 3 months, although it may take years for some of the bay's noncommercial species to resume their pre-flood distribution.

Meanwhile, the Virginia Institute of Marine Sciences, the University of Maryland, and the Chesapeake Bay Institute of Johns Hopkins University have thrown themselves into a flurry of research projects in their respective domains (Maryland encompasses the upper bay, Virginia the south portion). Aided by emergency logistical and financial support from various government agencies, the three institutions are rigorously sampling and monitoring the physical, chemical, biological, and hydrographical conditions the tempest created. As one scientist said, "It's a disaster, but also a research opportunity."—CONSTANCE HOLDEN

beyond salaries for full-time Survey employees, amount to $150,000 this year.

Yet another stimulus for this effort, it should be added, is the Interior Department's overall record for minority hiring, the lowest for a cabinet-level federal agency. Last year, according to Civil Service Commission figures, only 5.2 percent of Interior's 66,000 employees were black, and of those only 0.9 percent earned $15,000 or more. This contrasts with the top-ranked Labor Department, where 26.4 percent of 10,000 employees are black, and 9 percent earn more than $15,000.

Both "moral and practical" considerations lend urgency to minority recruitment and education, those in the vanguard of the movement contend. In its fund-raising letter, the GSA minority committee said that whatever could be done to adjust the racial balance of the earth sciences would help "right an ancient wrong"—that of discrimination.

"By awakening dormant aptitudes and interests in groups of young people we can tap a neglected reservoir of scientific talent. . . . By encouraging the recruitment of minorities into the fabric of our profession we can help reduce the polarization that threatens our society," the letter said, in reference to society at large.

Practical aspects were discussed in the February issue of the AGI journal *Geotimes*, by Wahrhaftig, Bromery, and Pakiser, who observed that black and other minority legislators were becoming more and more numerous in state legislatures as well as Congress, and that they may well "hold the balance of power" in many issues—not the least of which is funding for research. Perceiving no constituency among earth scientists, the authors predicted, a minority-group legislator is likely to conclude either that earth sciences are of no value to his people or that the sciences are discriminating against them. "In either case," they wrote, "he is likely to question the disbursement of funds for acquisition of geologic knowledge."

If that seems a less-than-altruistic motive for a recruitment campaign, Wahrhaftig replies that it is only an expression of honesty. "We felt that a program of aid conducted entirely in a spirit of charity creates a patron-client relationship that is demeaning and embarrassing to all," he says. "By making clear that all parties stand to gain from it, we feel we make it possible for each to participate without embarrassment."

During the past few months the plans of the GSA and AGI have received some publicity within the geoscience community, but last month they had their most public airing at an unusual national meeting that brought together civil rights activists, representatives from most of the nation's major oil and mining corporations, government administrators, and a number of prominent geoscientists for 3 days of talks in the cool mountain setting of Golden, Colorado. The Interior Department sponsored the meeting, called the "First National Conference on Minority Participation in Earth Science and Mineral Engineering"; the Colorado School of Mines played host to the 300 attendees.

Its main purpose was to draw together for the first time any civil rights, industrial, government, and professional organizations that might have at least a passing interest in earth science careers for minorities. That objective clearly was accomplished. Louis Pakiser, for one, was delighted that corporate executives had a chance to hear at first hand the angry contentions of militant Indian groups that big corporations were pillaging their lands of mineral wealth, and to hear the thoughts of the Reverend Jesse Jackson, an ebullient, 30-year-old former aid to Martin Luther King:

"If you work for a great company and walk around with a badge on saying you *represent* it, then you can make things happen. If you only work *for* it, then you're only saying what you wish would happen. . . . Conferences like this can be a great diversion, absorbing and stimulating the best minds and yet doing nothing—like exciting a eunuch."

Two Different Worlds

Perhaps inevitably, the conference was never quite able to produce the thoughtful critiques of the GSA-AGI plan that some had hoped for. One difficulty was that the civil rights activists and a number of the government administrators were not at all conversant in the earth sciences. For example, James Frazier, the director of civil rights for the Department of Transportation, frankly admitted that he didn't recall ever hearing the term before. "It points up why we see so few [minority] people in the field," he said. "We just don't know about it."

The conference quickly splintered into caucuses that met after the scheduled daily sessions and late into the night preparing statements and lists of demands for government and industry. In its statement, the Chicano faction said that the absence of Interior Secretary Rogers C. B. Morton and other cabinet officers belied the sincerity of their commitment to minority education. They asked Interior to spend $500,000 a year to hire and advance Spanish-surnamed employees throughout the department, to employ the top 10 percent of Chicano enrollment graduating from every college, and to hire an additional 1600 of the Spanish-surnamed by 1975 to achieve population parity. They also asked the oil and mining industries, among other things, to set hiring goals for Chicanos within 90 days. Their eight-page statement requested a similar master plan for the Colorado School of Mines, but unfortunately failed to mention the professional societies' plans.

Some of the women present, most of whom were geologists and geophysicists, issued a statement saying that their problems were being ignored. They called for an end to sex discrimination and for provision of maternity leave without loss of leave from jobs in government and industry.

By the end of the second day, the demands and accusations began to wear on the patience of many industrial participants. About half the industry contingent packed up that night and left before the meeting was over. Not to be outdone though, they caucused first and left behind a defensive statement that was read by Harold L. Fothergill of the Union Oil Company.

Far from "doing nothing," Fothergill said, industry was paying for numerous scholarships, although the precise number was not known. He said every minority geoscience student known to industry had a summer job this year and still more could have been hired.

In spite of an emphasis on the hortatory, the conference did serve to raise some hard questions about recruiting minorities for the sciences. One question concerned the propriety of enticing any students into science at a time when the job market is at its lowest ebb in a generation. As one black participant put it, "There had better be a pot at the end of the rainbow."

J. R. Jackson, Jr., of the Humble Oil and Refining Company, and chairman of AGI's manpower committee, wasn't so sure that there was. The outlook for new jobs through 1975 was "not highly favorable," and he said that was doubly true for minority graduates, who tend to come from smaller schools.

On the contrary, others, like the

AGI's executive director, Linn Hoover, were much more optimistic. "Jobs definitely will be available," for the relatively small number of minority graduates the professional societies hoped to support, Hoover said. Some other proponents of the plan argued that continuing government pressure on corporations to set numerical hiring goals for minorities, or "affirmative action plans" would help ensure the availability of jobs. And in any event, students who are earth science majors now won't appear on the market for another 4 to 10 years, by which time the market presumably will have improved.

One major theme that wove through the 3-day meeting was that a central difficulty in attracting blacks and other minorities into the sciences, apart from the prohibitive cost of education, lay in the quality of science education well below college level, down in the elementary and junior high schools. A number of black participants expressed the view that science instruction in urban schools contains little material that is familiar to a child whose environment is limited to asphalt and concrete, and that such children may be "lost to science" as early as the sixth grade.

William Bromery said he thought it necessary for any minority-assistance program "to go down below high school, even into the grade schools, where children first hear about rocks—if they ever do—to capture and hold their interest" before they learn to think of science as part of an alien and unattainable world. Hoover acknowledged that elementary and secondary education are "the real problems" and that "a lot more needs to be done in this area."

It is entirely possible, of course, that the geosciences' attempt to alter their social stratigraphy may fizzle out for lack of interest or from sheer impossibility. At the very least, however, the professional societies may be able to ensure that no minority student who chances into the earth sciences will be lost for lack of money or encouragement. And even that would seem an exemplary goal.

—ROBERT GILLETTE

High Voltage Engineering: Accelerating Away from Science

Accelerators are almost indispensable to nuclear physicists. If they function reliably, a scientist can publish prolifically; but if they don't, brilliantly conceived experiments may die. For the last 20 years most accelerators for nuclear physicists around the world have been built by the High Voltage Engineering Corporation in Burlington, Massachusetts, and the corporation has depended on nuclear physicists for almost all of its sales. But in 1970 High Voltage Engineering suffered huge losses when its greatest research gamble didn't immediately pay off, and today it is struggling to become profitable again as a company with a rather different composition—a miniconglomerate with most of its sales in products for industrial rather than scientific markets.

Like many firms near Cambridge, High Voltage Engineering Corporation started just after World War II as a spin-off from Massachusetts Institute of Technology with a few men struggling to put together a prototype in a garage near Harvard Square. Three people really made the company work. Robert Van de Graaff was noted as the inventor of the Van de Graaff accelerator that is pictured in many high school science texts. John Trump was a professor of electrical engineering at M.I.T. who wanted to use Van de Graaff accelerators for cancer therapy. Denis Robinson was a physicist with the air of a statesman who had been the wartime representative of the British government to the M.I.T. Radiation Laboratory. Van deGraaff became chief scientist, Trump technical director, and Robinson president. As nuclear research efforts increased after the war, the company found a growing market for its accelerators, which were far more reliable than the "homemade" machines that scientists had previously built.

High Voltage Engineering Corporation was often referred to as "Van's company." As a young boy growing up on an Alabama cotton plantation, Van de Graaff had developed an interest in machinery which later came to fruition when in 1931 he put together a working model of an invention for producing high voltages. This simple machine had the potential for producing high-speed beams of particles, and the perfection of sophisticated versions capable of higher and higher voltages became Van de Graaff's life's work.

As chief scientist of High Voltage Engineering Corporation, Van de Graaff was looked upon as nothing short of a genius and almost hallowed by his associates. According to Robinson, he was the "spiritual and scientific" head of the company, and a special research laboratory was built to bear his name and to be his birthday present in 1967, the year in which he died. All his thoughts about technical matters were recorded for several years before 1967 "in order that we might not lose any of his momentum," said Robinson several years ago.

Some critics of Van de Graaff say that he was a ponderous thinker, and not the "world's cleverest experimental physicist." With hindsight it is clear that his legacy of technical ideas carried High Voltage Engineering Corporation into financial disaster when it continued to invest heavily in the construction of the machine that had been Van de Graaff's dream, the transuranium (TU) accelerator. The TU was to be the culmination of a successful line of tandem accelerators, a conceptually elegant machine that could reach 20 million volts and accelerate a beam of uranium atoms to energies of 1 billion electron volts. High Voltage Engineering Corporation (HVEC) invested more than $4.5 million in developing the gigantic accelerator, even though there were no orders for it, and the first machine is still to be sold. According to Jason Weisman, a former employee of HVEC, the paper work needed to justify such an expenditure, such as market analysis and projection of investment return, was never completed. Apparently HVEC liked the image of a science company, and continued to follow a formula that had worked well in the past.

The decision to go ahead with the TU accelerator started a sequence of events that fundamentally changed the character of the company. Even at the time of heavy investments by HVEC in the

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Science **177** (4044), 148-151.
DOI: 10.1126/science.177.4044.148