Mexico: The Premier Oil Discovery in the Western Hemisphere

Intensive exploration in Mexico is turning up oil fields so immense that they could overturn the conventional wisdom about world oil supplies and significantly alter the geopolitics of energy.

For the past 5 years, the conventional wisdom has been that most of the world's major oils fields have already been discovered, that the United States will have to rely more and more heavily on the Middle East for future supplies of oil, and that the giant oil fields around the Persian Gulf are the result of a unique geological occurrence that is unlikely to be matched anywhere else.

Not only does the conventional wisdom appear to be wrong, it appears to be spectacularly wrong. Oil fields apparently equivalent to those in Saudi Arabia have been found only about 1000 kilometers from the U.S. border. Recent discoveries, whose magnitude has been known to the Mexicans since 1973 but has been divulged slowly to the rest of the world, indicate that an area along the southeast coast of Mexico near the Yucatan peninsula and extending offshore more than 200 kilometers may be one of the world's richest oil fields. The apparent magnitude of the Mexican oil deposit is a "tremendous shock" that "boggles the mind," according to oil experts who are familiar with the discoveries. The potential impact of these finds, which are in the states of Chiapas and Tabasco and extend offshore into the Gulf of Campeche, is all the more substantial because the national oil company, Petroleos Mexicanos (Pemex), has explored only a fraction of Mexico's prospective oil regions.

Every year, for the past 6 years, Pemex has revised its estimates of the country's potential oil reserves upward. By 1977, Mexico had equaled the Alaska North Slope. By early 1978, it was clear that Mexico was at least the equal of another Kuwait, and in September Mexican President José Lopéz Portillo announced reserves that would match Saudi Arabia. Oil experts expect the figures to continue to rise as the exploration program goes forward. What is known of the geology of the Yucatan area, coupled with the success rate so far (no structures drilled in the Chiapas-Tabasco area have been nonproducing) lead key observers to predict that Mexico's total oil and gas reserves will soon surpass those of any of the countries that now qualify as oil superpowers.

What this means for the United States is that during the next 5 to 10 years Mexico will become a world-class oil exporter, and if policies favorable to both sides can be worked out, Mexico could export a large part of its production to its neighbor to the north. In the past 5 years Mexico has increased its production by 300 percent, and by 1988 it could be exporting as much oil as Iran does now.

The Carter Administration is taking note of the Mexican developments, although not in public statements. In mid-August, National Security Adviser Zbigniew Brzezinski called for a broad presidential review of U.S.-Mexican relations, focusing on energy, but including trade and immigration questions. The memorandum establishing the review (presidential review memorandum 41) asked Administration officials to explore "potential U.S. inducements to influence Pemex to expand production capacity" and "possible joint planning for the structural evolution of U.S.-Mexican refining and petrochemical capacity." Vice President Mondale, Secretary of State Vance, Treasury Secretary Blumenthal, and United Nations Ambassador Young have all visited Mexico City during the first 2 years of the Carter Administration, and last month, 1 day after the director general of Pemex announced the discovery of a major new field north of Chiapas-Tabasco, President Carter announced that he would be personally traveling to Mexico for talks on 14 February.

Mexico is not a member of OPEC, the oil producers' cartel, but sells its oil for the cartel price. Since oil from Mexico could be shipped to the U.S. overland by pipeline or to the East Coast through coastal waters by tanker, the prime advantage to the United States of using Mexican rather than OPEC oil is "in terms of physical security," according to a Department of Energy official. The United States is not the only oil importer interested, however. Both the Japanese and the French have been negotiating to purchase oil from Mexico in recent months.

Extolling the magnitude and benefits of Mexican oil and gas has not been a credible activity in Washington, however. A year ago one of the few oil geologists who has consistently predicted larger Mexican reserve figures was called "the lunatic fringe" by major oil representatives. Parts of the government have suspected Mexican oil and gas reserves since 1973 but it was never published, even in classified documents, says one of the few Energy Department spokesmen upbeat about the discoveries to the south. A top Administration official with a role in energy matters notes wryly that the Energy Department "has been telling us that world demand is so high that we will need to find a new Saudi Arabia every five years to meet it, but now we have found one and no one talks about it."

The announcements of the past 3 months by Pemex have apparently changed the thinking, if not the public stance, of the energy bureaucracy. "No one any longer doubts," says one source, "that Mexico has a hell of a lot of gas and oil."

Mexico has, of course, had the oil for ages, but it took a long time, many political changes, and modern technology to find the huge deposits that are now in the news.

At the turn of the century, the head of the Mexican railway persuaded a California oilman to start exploration on the east coast of Mexico near Tampico, and a string of very productive fields was found in the geological formation known as the Golden Lane. The major oil companies moved to obtain concessions in this area, and by 1921 Mexico was the world's second largest oil producer after the United States. But the majors drew oil out at an exorbitant rate, and by 1930 Mexico's output had dropped to one-fifth of the 1921 level, the fields virtually ruined by overproduction. This experience, coupled with labor strikes in the mid-1930's, led Mexico to reclaim its concessions, throw out the foreign companies and establish Pemex to replace them. (Nationalization of resources by a developing country is now a familiar scenario, but when Mexido did it in 1938 it was an audacious act. Until then, only the Soviet Union had nationalized its oil resources.)

Most of the oil fields known at the time of nationalization were on the east-central coast, in the state of Veracruz. It was not until 1949 that the first oil and gas field was found along the southeast coast, in the state of Tabasco. More fields were found in the southern area in the 1960's, but these, like Mexico's origi-

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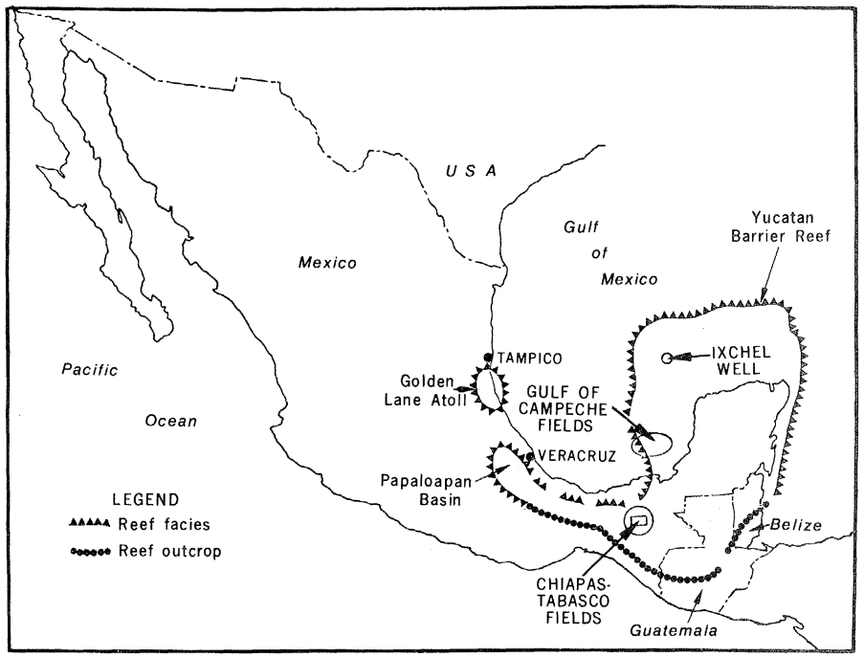

nal fields near Tampico, were shallow and relatively modest.

During the first 30 years of Pemex management, Mexico's projected oil reserves did not change much, fluctuating about the figure of 2.5 billion barrels. Before 1972, Mexico was projected to be a net importer of oil during the 1980's.

Such projections began to change quickly when Pemex drilled deeper and discovered two huge fields in the south not far from the town of Reforma. After that it seemed that almost every potential petroleum structure (previously found by seismic mapping) turned out to be a prodigious producer. For example, Pemex found that five or six nearby structures not only were first-rate reservoirs of oil and gas, but were in fact connected to each other to form one giant field over 200 square kilometers in area. As of the middle of 1978, Pemex was still trying to find the limits of this field as it continued to come up with wells that produce 9000 barrels per day, even on what were thought to be the extreme flanks of the field. From top to bottom, the thickness of the oil pool was found to be as great as 2000 meters in places—more than at any other site in the world—according to one petroleum geologist. This field alone, named for Mexican Senator Antonio J. Bermudez who took over Pemex in 1949 and is credited with transforming it from an inefficient bureaucracy into a businesslike organization, is thought to have about 5 billion barrels of recoverable oil and gas (about one-sixth the amount of U.S. reserves). The bulk of Mexico's current production (1.2 million barrels per day) comes from Bermudez plus the first two deep fields that were found in the Reforma area in 1972.

Pemex carefully mapped the Chiapas-Tabasco area by various seismic techniques and found 125 to 150 potential oil structures. So far only 40 or 50 of these have been investigated by exploratory drilling and about 25 are proving to be rich oil producers. As the additional drilling needed for daily production is done, most of the fields are proving larger than anticipated—many as large as the three mentioned above, according to Alvaro Franco, of the International Association of Drilling Contractors in Houston, who has followed Mexican Petroleum closely for 15 years.

Offshore, in the Gulf of Campeche, Mexico has found even more potential oil structures. Pemex director Diaz Serrano told the *Oil and Gas Journal* in an interview in June 1978 that in the Gulf of Campeche "we have mapped over 200 seismic structures, all of them with surprisingly gentle slopes and thus quite larger than those of Reforma." "Should they be oil-bearing," he said, "they would dwarf the potential of Chiapas-Tabasco." Most of Pemex's offshore drilling has been 60 to 100 kilometers from shore, north of the island of Ciudad del Carmen. Pemex first struck oil there in 1975. Geologically, the offshore structures are similar to the onshore ones. Out of ten potential structures drilled so far according to Franco, seven have turned out to be prolific oil fields. One of the largest is the Chac field.

The oil trade journals call the discoveries in the Chiapas-Tabasco area and the offshore fields in the Gulf of Campeche the largest oil province ever discovered in the Western Hemisphere.

Based on Pemex exploration in these two relatively compact regions, President Lopéz Portillo said in his state of the union address last September that Mexico now has potential hydrocarbon reserves equivalent to 200 billion barrels of oil. (Saudi Arabia's proved oil reserves are estimated to be 150 billion barrels, and those of the whole Persian Gulf region about 400 billion barrels.) Yet a large portion of Mexico has not yet been subjected to even the first stage of exploration. The geological explanation of the origin of Mexico's flush harvest of oil and gas offers some clues to what may remain to be discovered.

The explanation put forward by Pemex is that 130 million years ago, during Jurassic-Cretaceous time, the southern region of Mexico was surrounded by a wide barrier reef, creating a giant atoll-like island with a huge brackish lagoon in the center. The barrier reef collected rich layers of marine life, providing the organic residue that would later become oil, and evaporation of the lagoon laid down thick deposits of salt. The reef was not very similar in shape to the present land mass, but instead resembled the shallow shelf called the Yucatan platform which extends out into the Gulf of Mexico 100 or more kilometers from the present coastline. Sediments from later periods buried the reef, and with time the semiplastic salt began to flow toward the reef. Subsequent geological movements, both horizontal and vertical, produced complex fault networks and folded together the reef sediments with a deeper layer of salt, thereby forming sealed structures in which temperature and pressure transformed the marine sediments into oil. (These are the potential petroleum structures Pemex has been mapping with seismic methods.)

As pictured by geologists, the reef extends from the Papaloapan Basin (see map), where several promising new fields have been found, 300 kilometers east through the Chiapas-Tabasco region, then out into the Gulf where it circles the Yucatan peninsula. It comes back onshore through Belize and Guatemala. According to a spokesman for Pemex, A. Fulvio Zama, the company has now traced the Cretaceous edge of the reef all the way around the loop. The connection between the Papaloapan and Chiapas-Tabasco areas has been established. Both are part of the same formation found offshore, and all these are correlated with the Guatemalan discoveries. The reef concept seems to be on firm ground, according to Franco, who until recently was publisher of the Latin American affiliate of the *Oil and Gas*

Journal, "and if it is we are talking about a veritable monster in size." The biggest accumulations of oil, Pemex geologists believe, will be near the ancient reef rather than in the center, where salt depositions would be too thick and other rock conditions unfavorable.

The giant formations found in Chiapas-Tabasco and offshore in the Gulf of Campeche comprise only a small portion of the reef's perimeter. "We are talking about 200 billion barrels in these two clusters onshore and offshore," says Bernardo Grossling, a scientist with the U.S. Geological Survey who is regarded as one of the leading U.S. authorities on the Mexican situation. But there is a 100-kilometer gap between the two clusters that has not been drilled yet, according to Grossling, and farther into the Gulf from the scene of current offshore activity, there is another gap of 200 kilometers to the northwest corner of the atoll. At this corner Pemex has sunk one well, named Ixchel 1, as an "outpost" to see what might be encountered when exploratory activity reaches that region. It was a gusher. Beyond Ixchel, across the northern edge of the Yucatan platform, are hundreds of kilometers more of unexplored barrier reef.

The general impression of geologists who have looked at the situation is that further exploration, first by seismic mapping and then by exploratory drilling, can only find more oil. Pemex has two seismic mapping ships working full time and 20 offshore drilling rigs (up from six last year) at work. But the potential offshore fields cover a huge region (Ixchel is 500 kilometers from the southernmost well in the Chiapas-Tabasco area).

"I estimate that it will take 5 years for Pemex to come to the boundaries of this resource," says Grossling, who is advising various government agencies on the matter. "The breathtaking news will come every 6 months," he says, and "what I think is the limit for Mexico I will not even say."

Given the immensity of the southern oil fields, it is probably not in Mexico's interest to disclose what the ultimate yield could be because the information could depress the world oil price. On 24 November, Pemex director Diaz Serrano, while correcting an earlier announcement about new oil fields found under the Golden Lane, said, "We are not racing with anyone to win out on the reserve figure." (The area, called Chicontepec, has 100 billion barrels in situ, but the oil is heavy and only a fraction—perhaps 20 or 30 billion barrels—is thought recoverable.) One Mexican journalist who was contacted by *Science* said that the amount of oil Pemex *thinks it has* is 700 billion barrels.

Such a view is not inconsistent with the estimate of Lawrence Goldmuntz, a Washington energy counsultant, who notes that Pemex is not counting any oil that might be contained in the 200-kilometer region between the present offshore fields and Ixchel, even though Ixchel produced oil. Goldmuntz also notes that a pessimistic CIA report, which earlier this year downplayed the chance of further supergiant oil field discoveries, made a specific exception for the Reforma area. "The Mexican fields, when fully developed," Goldmuntz told *Science*, "may be equivalent to the entire Middle East."

It is no wonder that such estimates of Mexico's ultimate oil stores spark the idea that perhaps the United States should consider eventually replacing oil imports from OPEC with imports from Mexico. Production from the Mexican fields is expected to come into its own about 1985—the time when the Department of Energy has been saying that world oil demand will outstrip supply. A recent study of the subject by National Economic Research Associates (NERA) in Washington concluded that "at the very least, the crunch expected by some will be postponed by several years or ameliorated" and that "at best there should be no significant problem with the physical supply of oil through the remainder of the century if not beyond."

Many see a natural symbiosis between the two countries. The United States, which uses 18 million barrels of oil per day or one-third of the world's consumption, would appear to be Mexico's natural market. Mexico, which does 75 percent of its trade with the United States and is now running a $2 billion per year deficit, would appear to be the United States' natural supplier. What is needed, according to the NERA study, is a North American energy policy, under which Mexico and Canada provide the resources and the United States provides the market. "If there is an energy crisis in the United States in the coming decades," the report says, "it will be because the government forfeited the opportunity to avoid it."

Not everyone sees it that way. The Energy Department says that a substantial amount of Mexican oil production has already been factored into its projection* of the oil situation in the 1980's, and that we should not count on any additional production because the next Mexican presidential election in 1982 could alter the policy of rapid oil development that is now being followed. "In trying to calculate the Mexican contribution to total oil supply you cannot be mechanistic," says Walter J. McDonald, the Energy Department's special assistant secretary for international affairs. McDonald said that the Energy Department could "live with" estimates for proved and probable reserves "in the range of 50 to 100 billion barrels," but warned against making too much of the "ebullience and extraordinary optimism" associated with the larger numbers. (Pemex currently says it has 20 billion barrels of proved reserves, 37 billion barrels of probable reserves, and 200 billion barrels of potential reserves.) Whether or not Mexico has more than 50 billion barrels of oil "makes no difference over the next 10 years," McDonald argues, because Mexico's credit rating with foreign banks is already good enough to finance a pace of oil development as fast as logistical problems will permit. Grossling and others predict that Mexico will be exporting 10 million barrels of oil per day by 1990. McDonald says that Mexico could produce 4.5 to 5 million barrels per day by 1985, but may decide not to produce more than that. He refers to 10 million barrel per day estimates as "blue sky" numbers.

More is at stake than numerology, however, because 9 to 10 million barrels per day is about what Saudi Arabia produces, and about what the United States imports, although not all from Saudi Arabia.

Wouldn't it make sense for the United States to encourage Mexico to produce more oil and export it northward? The Energy Department position, as outlined by McDonald, is that this country does not need to offer Mexico any special incentives—that it will be to Mexico's advantage to sell here for three reasons: because of the traditional relationship of the two countries, because of the price advantage to Mexico (which could charge the United States not only the $12 world price but also the $2 cost of transporting OPEC oil to North America), and because of the ease of delivery.

Not only has the Energy Department done nothing to facilitate sales of oil, but it has done things that some observers think might jeopardize future oil sales through its handling of the matter of Mexican gas.

The gas matter came to a head last January, when Pemex broke off negotiations with the United States after Energy

* The April 1977 report of the Central Intelligence Agency, *The International Energy Situation: Outlook to 1985*, which was used to substantiate the DOE's position, did indeed project that Mexican oil production would be between 3.0 and 4.5 million barrels per day in 1985.

Reactor Sale to Libya Challenged

The Federation of American Scientists (FAS) has called on the Soviet Union to halt the planned sale of a 400-megawatt nuclear power reactor to Libya. At a press conference held on 30 November, FAS chairman George Rathjens and director Jeremy Stone explained that the Soviet Union is making the sale despite the fact that Libya, which ratified the Nuclear Nonproliferation Treaty (NPT) in 1975, has openly declared its intention to acquire nuclear weapons.

"This may be the first time anyone has asked a government to challenge a signatory to the NPT," said Stone. The FAS has written to President Carter proposing international sanctions against "bad faith adherence" to the treaty, and to Soviet Ambassador Anatoly Dobrynin suggesting that the sale be reconsidered.

Stone returned in October from a trip to Libya with about 100 Americans who were invited to Tripoli for an "Arab-American dialogue." Press reports over this decade have indicated that Libyan president Mouammar Qaddafi is eager to lay his hands on an atomic bomb, but Stone said he was "startled" to receive personal and unequivocal confirmation of the country's nuclear aspirations from top Libyan official Ahmed El-Shahati.

Libya in the past has asked Communist China for a nuclear weapon and is currently trying to obtain enriched material from the Pakistanis. It has already purchased a small research reactor from the Soviets. The new reactor would produce enough spent fuel to manufacture a half-dozen nuclear weapons a year, said Rathjens. The sale must be accompanied by a safeguards agreement approved by the International Agency for Atomic Energy; also, it is Soviet practice to retrieve spent fuels from reactors it sells. Nonetheless, the FAS contends the sale should be stopped in view of Libya's blatant attempts to acquire a nuclear weapons capacity.

Stone wrote a letter pointing this out to the Arms Control and Disarmament Agency and received a bland reply observing that all the requirements of such a sale were being adhered to and adding that the general absence of U.S. relationships with Libya made it difficult to exert any leverage on that country.

Relations with Libya are at quite a low ebb. According to Stone, the Pentagon has ranked that country only after the Soviet Union, the People's Republic of China, and North Korea as a possible source of hostilities. Official interactions with Libya are limited to educating their students (of whom there are 2000 here, 10 percent of them studying nuclear science) and buying their oil (Rathjens noted that Libyans could produce power much more economically by building gas and oil plants rather than nuclear ones). Stone, whose December FAS newsletter is devoted to an account of his trip, says the Libyans are trying through business dealings in "small" states such as Idaho to gain political influence in the United States.

Libya is a haven for controversial figures from all over the world—ranging from Spiro Agnew, who arrived in town at the same time as the American delegation, to Idi Amin, whose pictures were plastered about the city, to innumerable revolutionary groups. In 7 hours, reported Stone, one American journalist said he met with members of underground movements from black Africa, Palestine, the Philippines, Panama, Tunisia, Turkey, and Sicily. Libya is a thriving training ground for terrorist groups and is known for its lenient attitude toward airplane hijackers; its policy, says Stone, seems to have changed from "brazen defiance to plausible deniability" now that it says it is anti-hijacker but sympathetic to terrorism "in the cause of national resistance." All in all, noted Stone, "they could hardly be worse customers" for nuclear hardware.

Stone believes that the Russians might rethink the reactor deal since "the U.S.S.R. has at least as much interest in nonproliferation as the U.S. does." In any case, the FAS thinks it is time to challenge the "bland assumption" that countries are adhering to NPT just because they have ratified it. The FAS notes that there are other "potential nuclear states" eager to join the club that are also "potential false adherents" to the treaty. Countries named were Taiwan, South Korea, Iraq, and Iran.—C.H.

Secretary Schlesinger vetoed as too high a price that had previously been agreed to by both Pemex and the consortium of U.S. companies that wanted to buy the gas. It created strong political opposition in Mexico toward any hydrocarbon exports to the United States. The price that Schlesinger rejected ($2.60 per thousand cubic feet) was based on the world oil price, calculated in terms of the Btu value of number 2 heating oil delivered to New York, and the idea that Mexico should tighten its belt and sell off its resources to the United States for less than the world price resulted in nationalistic outrage, particularly in view of the history of petroleum relations between the two countries. According to sources in Mexico City, the Mexican people were angry with Schlesinger personally and the government had to assume a strong position. In early April, Foreign Minister Santiago Roel said Mexico would not accede to pressure from rich nations looking for resources. The rebuff was all the more embarrassing to the government because a huge pipeline from the oil fields in the south to the vicinity of the Texas border was already under construction.

The Mexican domestic market for natural gas is modest, and as the development of the southern oil fields (which contain about 35 percent gas) speeds along, the amount of gas produced is quickly exceeding the capacity of the Mexican economy to absorb it. To liquefy the gas and ship it to other countries would be an economic debacle (because of the huge costs for special ships and liquefaction plants, Mexico's net earning would be reduced from $2.20 per thousand cubic feet for gas piped to Texas to 27 cents for gas shipped to Europe), so in fact Mexico does have few options other than to sell to the United States. But to state this publicly, as Schlesinger did when he said last January that Mexico "has to sell us the gas sooner or later," was impolitic, at the very least, and possibly shortsighted because the way the gas matter is handled—according to many observers—will have a large impact on the way the oil is developed. "Mexico may have to sell its gas to the United States," says one Washington energy analyst, "but it can sell its oil anywhere."

The gas matter is expected to come up again next spring, and to be on the agenda for Carter's visit in February. The White House has asked the State Department to get involved in preparing a "nonpolitical" assessment of the top price the United States could afford to pay at this time, and Brzezinski has re-

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portedly advised President Carter that Mexican imports could be the key to a far-reaching series of agreements.

Even though there is oil in the ground, some critics question whether Mexico is capable of extracting it at a rate that will make an impact on the U.S. market. Although Pemex makes extensive use of U.S. consultants and companies that provide technical support services, almost all the surface exploration and drilling has been done by Pemex itself. The company currently has more drilling rigs in use than all of Western Europe, and it is spending $10 to $20 million per day for exploration and development (Pemex gets one-fifth the national budget). Not only is there a crash program in exploration and development, but Mexico is also moving ahead of schedule in building 16 gas processing plants, 71 new petrochemical plants, and two new refineries. Mexico's proved oil reserves are certified by what many consider the world's leading mineral evaluation firm, De Golyer and MacNaughten of Dallas.

"The notion that Mexico could not produce the oil by itself is absurd." says Grossling, noting that Pemex has 6000 trained geologists and geophysicists and the Mexican Petroleum Institute has trained 3000 engineers in recent years. "Pemex has very good people," says Peter Flawn, chairman of the geology department of the University of Texas. "We know them and we have trained many of them," he says. He calls the Pemex organization "fully capable," and says the rate of daily production is dependent only on the amount of money Pemex spends on development. With certified reserves that are large and rising, lack of capital is no longer a limitation.

Such enormous stores of oil in a world thought to be hungrily draining its last reservoir present a potential revolution of energy expectations. Whether Mexico offers the world another 10, 20, 30, 40, or more years of oil cannot yet be determined. The stakes are high for the United States and the stakes are high for Mexico.

What seems clear are Mexico's present intentions. "We are exploring and finding reserves which will be used in the twenty-first century," said Diaz Serrano on the 40th anniversary of nationalization of the petroleum industry, "because we have already found the petroleum that Mexico will consume during the present century."

—WILLIAM D. METZ

Environmental Groups Lose Friends in Effort to Control DNA Research

In popular lore, the environmentalist has the soul of St. Francis and the nerve of a lion tamer. He is not driven by a lust for wealth or glory, but by a vision of a world in which men live in harmony with nature. Given that the environmentalists share something with the saints, it is surprising to learn that many scientists who once counted themselves friends now consider themselves adversaries of groups such as the Natural Resources Defense Council, the Environmental Defense Fund, and Friends of the Earth. The new adversaries are not industrialists, but pure research scientists, primarily academics.

Several well-known figures, including Paul Ehrlich of Stanford University, and René Dubos of Rockefeller University, publicly broke with environmental groups this year over differing interpretations of the hazards in recombinant DNA research. The break developed when the environmental groups sought to have the federal government tighten up on safety measures that apply to laboratory experiments, while scientists were working to relax the rules. The new DNA guidelines are due to be published as this is written, and, according to several people who have seen them, they will lessen physical safety standards while greatly increasing the requirements for bureaucratic and public review of experiments. As is often the case in political decisions, this remedy seems designed to mollify both parties but satisfy neither.

In telling how the controversy over DNA research has created a feud between friends, two respected biomedical researchers referred to the environmentalists they had run into as thugs, flunkeys, sharks, and worse. These scientists said they gained new insight into the tactical methods of the environmentalists by watching them lobby for controls on recombinant DNA research. Neither wanted to be quoted, although both have spoken their mind in more guarded phrases at public meetings. In recent interviews they said they were disillusioned, having come to the conclusion that some of the environmental lobbies are in business to peddle paranoia.

Although they spoke with varying degrees of acerbity, a number of prominent scientists expressed at least some ill will toward the environmentalists this year. James Watson, one of the discoverers of DNA and a combative fellow always ready to take a swat at perceived villainy, was angry enough to publish an article in the Sunday editorial section of the Washington *Post* on 14 May. He lashed out at "disgruntled biochemists" and "noisy academic leftists" for agitating against certain DNA experiments, and he accused the environmentalists of scaring the public needlessly. "I fear," Watson wrote, "that such groups thrive on bad news, and the more the public worries about the environment, the more likely we are to keep providing them with the funds that they need to keep their organizations growing."

Among those who doubt the environmentalists' good faith are National Institutes of Health (NIH) researchers Malcolm Martin, Wallace Rowe, and Maxine Singer—all of whom have been involved in the DNA debate from the outset. Paul Berg of Stanford, Bruce Ames of the University of California at Berkeley, and Norton Zinder of Rockefeller University as well as others not directly involved in the politics of DNA have told the environmentalists that they are flatly wrong in the recombinant DNA case. Because of the ruckus, and partly as a result of peer pressure, several well-known scientists have publicly criticized the environmental groups of which they were members or directors. Paul Ehrlich, a trustee of Friends of the Earth (FOE), tried to have FOE relax its policy on recombinant DNA, without success. He wrote to the director of NIH, Donald Fredrickson, on 15 September, saying that "the potential benefits from recombinant DNA research are so great that it would

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