

it. As the downward-moving water is heated, it expands and moves back up toward the earth's surface. Some of the heated water is trapped between layers of rock and circulates in reservoirs.

By drilling with rotary rigs, like those used in the exploitation of oil and gas, these hot water reservoirs can be tapped, and the steam produced piped to power plants to generate electricity.

At Palinpinon, two 3-MW pilot plants are now in operation, their combined output of 6 MW being fed through existing transmission lines to Dumaguete City, the nearby capital of Negros Oriental province. Even this small supply, however, has overloaded the old transmission lines of the small city, triggering almost daily brownouts during peak-use hours. New transmission lines are presently being installed.

In the meantime, construction is moving ahead on the first of two planned 112.5-MW power plants, Palinpinon-I, to provide electricity throughout Negros Oriental. Its first unit of 37.5 MW was expected to begin commercial operation in March, this year, and to be fully operational by November 1983.

Construction of the second 112.5-MW-capacity plant, Palinpinon-II, will begin this year. Engineers at the site say that this plant should be operational by 1986.

An innovative aspect of the Palinpinon development, Brodie says, is the use, for the first time in geothermal exploration, of directional drilling. This technique, used extensively in oil and gas exploration, allows the driller to bend and turn the direction of the drill underground, instead of simply boring a vertical hole.

Directional drilling is more expensive than vertical drilling, but has been found by drillers at Palinpinon to be useful in the rugged mountain terrain. Underground reservoirs as far away as 1.5 km in horizontal distance can be explored without the expensive, time-consuming, and environmentally damaging technique of transporting the heavy rigs through the mountains, clearing land, then moving the rigs to a new area.

Key environmental considerations are being addressed in the Palinpinon geothermal development. For example, once water and steam are extracted, the mixture is piped to a separator and the steam is sent to a power plant. The remaining water cannot be discharged into the local environment because it includes potentially dangerous chemicals leached from underground rocks. Boron, in particular, is a danger to the rice fields that lie at the base of the mountains. Its discharge is limited by law to just two parts per million in the Philippines.

To avoid environmental contamination, water at the field is reinjected into the underground reservoir. The result, say geologists at Palinpinon, is that the geothermal project is almost pollution-free. However, because the piped

water at the plant contains as much as 60 parts per million of boron, a rupture could be extremely damaging to crops downstream.

Another potential environmental danger is the release of hydrogen sulfide (H_2S) from escaping steam. When H_2S mixes with water in the atmosphere, it can produce dilute sulfuric acid (acid rain). This is particularly critical at Palinpinon where mountain cloud cover often drops as low as the wellheads. Geologists at the site say that the amount of H_2S emitted is now at "a safe, minimal level," but when the two large plants come on line it will

be necessary to monitor the level closely.

The two plants may only be a start for geothermal development at Palinpinon. Brodie, who has 10 years of experience as a geothermal engineer in New Zealand, estimates that the entire resource area may be 50 km², with a potential output of around 1000 MW. If Brodie's estimate is proven accurate, it would make Palinpinon the largest steam-water geothermal reserve in the world. □

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THE HELPING HAND

GOH SIEW CHING

"What can I do about the worms in the cabbage?"

The question that launched integrated rural development in the southern part of Negros Oriental province, in the Central Philippines, came from a village woman. It was directed at Dr Fe Sycip-Wale, whose sole commitment at that time — the late 1960s — was to promote maternal and pediatric care in that very depressed region of the province.

Negros Oriental was said to be the most backward province in the Philippines in the 1960s. And Dr Sycip-Wale, a pediatrician with Silliman University, had organized "mothers' groups" to discuss health problems in some of the most poverty-stricken villages dotting the province.

"The person who asked that question was not even sure she should ask it," Dr Sycip-Wale recalls. "She apologized that the question was not related to health, but stressed that it was very important to her. It was then I realized that if we were to respond to what the villagers really wanted we would have to help them in matters other than health." And so the *mothers'* groups became *parents'* associations, concerned with all kinds of community welfare and involving both men and women.

These associations led to the founding of the HAND (health, agriculture, nutrition, and community development) program in 1972 by Dr Sycip-Wale at the Marina Clinic in the Negros Oriental town of Dauin. The privately funded clinic is today part of the extension program of Silliman University, in near-by Dumaguete City.

"What we have been doing here has not been easy," Dr Sycip-Wale says, "but we have gained the confidence and the trust of many *barrios* (districts) in the area. And this, I have learned, is the first step to promoting and providing primary health care to people who have been deprived of these

services."

In an average month in 1982 some 260 people were treated at the clinic. Of these, more than half came in for consultation, Dr Sycip-Wale reports, and the rest were follow-up cases. But while the clinic is the most visible project in the HAND program, the main outreach to the rural communities has been the HAND outposts established in nine of the 21 *barangays* (villages) in Negros Oriental since 1972.

These outposts are tiny shacks erected by the villagers themselves to house the clinics — and sometimes the medical staff. These front-line clinics are staffed permanently by health workers trained to handle simple complaints such as coughs and colds, and to recognize more serious ailments that need referral to doctors. They also handle "simple injections," according to Dr Sycip-Wale.

The clinics are self-supporting, being funded in most cases from cooperative stores staffed and managed by the villagers themselves. It is also at these clinics that people meet to discuss other problems with agricultural workers, nutritional experts, social workers, and other personnel from HAND teams. Because much of the success of such centres depends on the villagers themselves, leadership training programs have been included in HAND efforts.

"I don't want to give the impression that it's all a bed of roses," says Dr Sycip-Wale. "There have been problems, mainly with funding.

"Five of the nine cooperatives started are not fully active. But the other four are managing well enough to pay the medical workers and buy the bulk of the medicine they need from their own profits."

The latest development, in the *barrio* of Bolok Bolok, is the establishment of a pre-school program for the children of that area. "You see, we cannot predict how development will move,"

says Dr Sycip-Wale. "All we can do is provide as much expertise as possible to meet the needs of the people at a level acceptable to them." And with this principle strongly adhered to, the HAND program has been expanding — although slowly and often "unsurely."

It continues to train traditional midwives in aseptic deliveries; to develop drinking water projects at village level; to preach an unending sermon on the values of nutrition; and to do the "dozens of things coming under the umbrella of HAND objectives," according to Dr Sycip-Wale, who stresses that community development demands time,

patience, commitment, and funds.

It has been almost 20 years since the first "mother's groups" were launched. Since then, Negros Oriental has moved from the bottom rung on the "most depressed province" ladder to third from the bottom. Not a dramatic move, and Dr Sycip-Wale does not claim that her HAND program is fully responsible for this advance. But the work being done at the Marina Clinic and at the *barangay* outposts plays its part — an important one — in such progress. □

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Sumilon: more than a paradise.

TAKING IN A REEF

LILLIAN CHEW

When it comes to preserving the environment, Dr Angel Alcala lets nothing stand in his way — not even blood. He once threatened to put his relatives in jail when they proposed cutting down some trees in a protected forest.

Angel is an appropriate first name for one who has spent a great deal of his 53 years working to protect and preserve the Philippines' natural heritage of forests, animals, fish, and corals. But to some local government officials, fishermen and industrialists, this Angel is a devil.

Dr Alcala is one of the Philippines' leading environmentalists. A marine biologist by training, he is Vice President for Academic Affairs at Silliman University, Dumaguete City, and has a particular passion for the sea and the life within it. He was the prime mover behind the Philippines' first marine sanctuary at Sumilon Island, in the Central Philippines.

Sumilon is a pretty island — not much ground cover, but sparkling white and surrounded by the clearest of blue waters. It fits neatly into most people's conception of a tropical paradise. It's also a diver's dream: cascading, colourful coral gardens, seemingly untouched, with thousands of fish in electric colours.

But to Dr Alcala, and to the many Asian conservationists who watch what's happening there, Sumilon Island is more than just another tropical paradise. It is an experiment in marine conservation, a place that could yield

results upon which future regional marine conservation policies could be framed.

Relevant data are the lifeline of any ecological movement, says Dr Alcala. It is no use making emotional appeals to governments to stop destroying Asia's natural habitats without being able to show specifically that destroying the environment is contrary to improving the welfare of the people — at least in the long run.

For instance, studies done at Sumilon Island have shown that protecting 20 percent of the coral reef as a fish sanctuary is sufficient to maintain the fish productivity in the other 80 percent. Dr Alcala maintains that "in this instance, it has been made clear that sustained yields are possible, at least for a three-year period of study, if a breeding stock in a portion of the habitat is protected."

This is particularly important because coral reefs are key breeding areas for fish in the tropics. Composed of organisms that resemble both plants and animals, the reefs are home for hundreds of species of fish. Unfortunately, the reefs have been subject to widespread destruction — by fishermen who use everything from hammers to bombs to clear away the coral to get at the fish, and by others who mine the reefs to provide lime for industry and trinkets for tourists.

"At Sumilon Island, the fish yield has been 15 to 20 tonnes per km² per year for the last three years," says Dr Alcala.

"This is two to three times higher than that obtained from most waters around the world. Of course, where coral reefs have been destroyed, the fish yield is zero."

Research at Sumilon also aims at finding out how fast coral grows, and how fast the whole reef regenerates.

When Dr Alcala speaks about the problems involved in protecting more reefs in Southeast Asia, he does not take the easy route of blaming official bureaucracy or the lack of funds.

"The number one problem is not money," he says. "We do not need much money or fancy equipment to carry out our kind of natural resources research. It costs only about 1000 pesos (US\$110) a month for the upkeep of Sumilon Island.

"We do not have enough commitment — that is our problem," he says. "Somehow, the tradition among students — certainly in the Philippines — is not to get into sciences, but to study to be business people, or doctors, or lawyers. There are just not enough committed people around."

Awareness is another element that Dr Alcala feels is missing in the battle to preserve the Asian environment: "Insufficient numbers of Asians are aware of the long-term negative effects of the wanton destruction of Asia's forests and reefs. What clouds the issue even more is that many of those who are aware do not really care."

Dr Alcala says that it is even difficult to get across to the public a simple conservation fact: that if everyone who visits Sumilon Island takes a piece of coral as a souvenir there will eventually be no Sumilon reef.

It is easier to explain the efforts of a politically powerful group of local fishermen to prevent Sumilon Island from being declared a sanctuary — they see themselves as being deprived of one of their fishing grounds. They still do not seem to realize that it is they who will be the ultimate beneficiaries of the 700-metre-long protected reef.

Despite his long battle against the anti-conservationists, Dr Alcala does not believe the outlook is entirely bleak. And he points to another island, not too far from Sumilon, that is fueling his optimism.

The villagers on Apo Island have set up their own fish sanctuary. With only a little help from Dr Alcala, they have come to realize that sea life is exhaustible and that, if they want their grandchildren to follow them in their fishing trade, they must help preserve some of that sea life.

To the Apo villagers, conserving means giving up some of their fish catch now so that their descendants can be guaranteed of their share. It requires them to be less selfish, to think of those who come after them. "Conservation means thinking of others," says Dr Alcala. "Perhaps that is what makes it so hard to promote." □

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