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"THE FULFILLMENT of a life's dream." That is how photographer and writer Fred Ward (right) described his visit to Lhasa in Tibet.

Fred has traveled the world as a distinguished free lance; National Geographic members will remember his articles on Cuba, the Canadian North, and diamonds. With such a background of experience, did Tibet disappoint him?

"I had feared I would finally get to Lhasa and find that it looked like someplace else," he told me on his return. "But it doesn't. It still has a strong sense of mystery, of remoteness, a strange appeal. It is still the Everest of the traveler."

To prepare himself for the arduous journey through China to Tibet, a journey made by very few Western journalists, Fred jogged daily for seven months and lost 17 pounds—"the less weight, the better one works at high altitudes." And work he did, making photographs by day and interviewing by night, a regimen that finally so exhausted him that he missed the farewell banquet for his group.

"I knew I had to use every minute," Fred said. "It is the one place I always wanted to visit, ever since I saw those famous pictures of the Potala in an old GEOGRAPHIC."

Indeed, it was with a feeling of greeting an old and long-lost friend that I viewed his photographs, for Lhasa marks a true turning point in the history of the GEOGRAPHIC.

The January 1905 issue carried the magazine's first photographic story. The Editor had received in the mail fifty black-and-white photographs of Lhasa made by two Russian explorers named Tsybikoff and Norzunoff, and forwarded by the Imperial Russian Geographical Society of St. Petersburg. In a daring and fateful move, Gilbert H. Grosvenor filled a full 11 pages with pictures. He thought he would be fired, but he lasted in the job for fifty more years.

From that day on, the GEOGRAPHIC was a magazine that would use the photographic essay as well as the written word to tell the story of far-off peoples and places. And for people like Fred Ward, those pictures represented the genuinely remote and romantic, the faraway Shangri-la that inhabits the dreams of every adventurous person.

Gilbert M. Grosvenor

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JAMES ABOURSEN

COVER: *Armed with a sling, a Tibetan shepherdess tends yaks on Peng Bo State Farm. Photograph by Fred Ward.*

IN POISONING THE PESTS that each year destroy crops worth billions of dollars, are we also unwittingly poisoning ourselves? This is one of the most hotly debated topics of public policy.

The first synthetic pesticides were chemical miracles that ensured bountiful harvests and malaria-free populations; unquestionably, they saved millions of lives. However, nature's response has been to increase resistance of pests to some poisons; other pesticides pose dangers to human health. There are now some 35,000 different commercial products to control insects, weeds, fungi, and other destroyers. The federal government has the responsibility of permitting on the market only those whose benefits outweigh their risks. Scientists often debate among themselves the efficacy and reliability of the tests used in making that determination.

It has taken more than a year for the GEOGRAPHIC to produce the following article. Seldom has such a project been as thoroughly researched and checked with industry, government, medical, and academic experts.

With a steadily expanding population and a decrease in arable land, the world must use pesticides to maintain high crop yields and affordable food. At the moment there is simply no other way to farm on the scale required. Answers to questions of environmental danger, sensible regulation with diligent enforcement, proper application, and acceptable chemicals thus are a world necessity. — THE EDITOR

The Pesticide Dilemma

By ALLEN A. BORAIKO
NATIONAL GEOGRAPHIC EDITORIAL STAFF

Photographs by FRED WARD
BLACK STAR

ANDRES MURILLO has the face of an Aztec: straight black hair, eyes like obsidian, a high-bridged nose. He is 50 and dignified and strains to shake my hand with strength. His doctor says that pesticide poisoning is destroying his nervous system, that his life will be unnaturally shortened. His wife has guessed this, and Andres's seven children know that the rhythmic tremor in his right arm and leg will spread throughout his body. His heart and lungs too are damaged.

Before he dies, Andres may rouse furious controversy and contention. He has sued the manufacturers of four pesticides he once used as a farm worker, and has filed a workers' compensation claim against his former employer. The outcome is uncertain: Hoping to avoid a precedent-setting jury award, the defendants will produce their own medical experts to counter in court that the chemicals have not harmed Andres. Meanwhile, his plight underscores increasing public concern about the pesticides used in growing much of our food and fiber.

"Some days I get so depressed I say nothing at all, but you are welcome here," Andres told me at his home in California's San Joaquin Valley. The valley is ten million acres of cotton, grapes, and oranges in the


RESTRICTED

STRAFING INSECTS *with toxic spray, a plane barrels along above a Texas cotton field. Billions of gallons of pesticide solutions are applied yearly to United States crops, rangelands, and forests.*

state that uses more pesticides than any other: at least 250 million pounds in 1977, the year Andres became totally disabled.

"For years I sprayed almond orchards at $3.36 an hour," Andres said. "Many things were not done right. For instance, I had to spray even when it was windy enough to blow the pesticides all over me.

"Imagine how strong the sprays were: I mixed them in new plastic buckets that began disintegrating in three days. I fought for gloves and a face mask—the fumes gave me bad headaches and I sometimes vomited—but there was never a clean filter for the mask or enough water to wash with.

"I risked my job to complain to my supervisors, but I got nowhere. Now that I am sick, everything is handy for the workers, and they mix sprays with pumps instead of by hand. But if no one had been hurt, probably nothing would have changed. I still hear nothing from the grower."

Andres gestured with his fluttering arm. "I would not will my illness to anyone, not even my greatest enemy. I cannot work, and now my children are deprived of many things I could give them before. That is why I am suing, even though my case may be difficult to prove."

IT IS NO COMFORT to Andres, but his case illustrates the dilemma of pesticides: They protect us from insects, weeds, disease, and hunger, but some pose a risk of cancer, birth defects, genetic mutations, and sterility.

In a predicament, we vacillate. Even as we try to shield ourselves against chemical pollution, we spread a billion pounds of pesticides each year.

Do they work? Farmers seldom doubt it; environmentalists often do. Consider:

• Herbicides cut fuel-consuming tillage, reduce erosion, and conserve soil moisture. During one season, they can reduce from 60 hours to 12 the time it takes to keep an acre of corn free of weeds. We now use more weed killers than insecticides.

• Insect resistance to pesticides is accelerating. Today 400 species of insects and mites are resistant to pesticides, more than twice as many as in 1965. Some can tolerate whole categories of agricultural poisons.

• Two-thirds of agricultural pesticides

Pest control and damage cost billions

Plagued by two thousand detrimental insects, weeds, and plant diseases, U. S. farmers and foresters devote more than 2.25 billion dollars a year to pest control. Proponents point out that pests damage one-third of our crops—nearly nine billion dollars' worth each year—and can carry death-dealing disease. But grim counterarguments emerge: pesticide-related illness and death, and warnings of dire ecological consequences.

Grasshoppers ravage the West's rangelands

A 1979 grasshopper plague mowed down forage in 17 states. Ranchers counterattacked by joining with state and federal governments in a ten-million-dollar cooperative control program, delineated by areas of dark tan.

Gypsy moths damage northeastern forests

Gypsy moth caterpillars defoliate hardwood trees. The 1978 timber loss: perhaps 18 million dollars. Control cost: three million. The European import escaped the Massachusetts laboratory of a naturalist in 1869; succeeding generations fanned out over the Northeast.

Red mites ruin fruit across the country

Bane of apple trees, the European red mite also maims peach, plum, and pear trees. Leaf-damaged trees produce lower yields and smaller, discolored fruit. Tree damage is cumulative and difficult to assess.

Spraying aggravates the problem, unleashing infestations of the nearly pesticide-resistant mite by killing off its natural enemies.

Pink bollworms and boll weevils destroy cotton in the South

To finance the weevil wars, farmers enlist 50 to 75 million dollars a year in insecticides against an adversary that has devastated 12 billion dollars' worth of cotton since jumping the Mexican border in 1892. Another cotton nemesis, the pink bollworm, prefers the Southwest's hot, dry fields, where it ruins millions of dollars' worth of crops annually.

Grasshopper
ENLARGED 2 TIMES

Gypsy moth caterpillar
LIFE-SIZE

European red mite
ENLARGED 80 TIMES

Pink bollworm
ENLARGED 4 TIMES

Boll weevil
ENLARGED 5 TIMES

PESTS PAINTED BY PAUL W. BREGGIN
MAPS DRAWN BY JANE WOLFE
COMPILED BY PATRICIA J. HARRISON
NATIONAL GEOGRAPHIC ART DIVISION

Pesticide sloshes *out of a plane with a faulty valve. By law, the loader should wear long sleeves, goggles, gloves, and a respirator to escape contamination—an expensive inconvenience, the spray men respond. The Environmental Protection Agency estimates that 40,000 people were treated for pesticide poisoning in 1978, yet most cases go unreported or are misdiagnosed.*

are applied by aircraft. Yet because of error, wind drift, and evaporation, 15 to 55 percent of an aerial spray misses its target.

• Harvest yields have almost doubled and use of insect poisons has grown tenfold since 1945. Even so, insects annually eat nearly twice as much of our crops now as then.

Are pesticides safe? Chemical companies say yes, if used properly; federal regulators worry about them even then. Ponder:

• Chemical companies typically spend ten million dollars and a decade of effort to bring a new pesticide to market; a fourth of that time and money goes to satisfy a great number of federal environmental and toxicological testing requirements.

• Accidental death by pesticide poisoning is declining, says the Environmental Protection Agency: In 1961, 111 people died; in 1969, 87; in 1974, 52 deaths were reported.

• Ninety percent of American householders use pesticides in house, yard, or garden, but it is doubtful if they know that even scrubbing with soapy water scarcely reduces skin absorption of some insecticides.

• According to Dr. Frank H. Duffy of the Harvard Medical School, exposure to even tiny quantities of certain insect killers similar to those found in the home can alter brain activity for more than a year, and cause irritability, insomnia, loss of libido, and reduced powers of recall and concentration.

• Dr. Jack D. Early, president of the National Agricultural Chemicals Association: "No pesticide can reach market without years of testing for safety and effectiveness when used properly. The agricultural chemical industry condemns any improper use of these products. Portraying occasional misuse as reflecting a widespread problem is a disservice to hardworking scientists, farmers, and government regulators—and, ultimately, to the American public, which benefits from these products."

• Douglas M. Costle, administrator of the Environmental Protection Agency: "In the past we willingly accepted claims that pesticides have no long-term effect on humans. Neither EPA nor industry is in a position to make such reassurances honestly."

As in debate on the hazards of food additives or low-level radiation, a confused public wonders: How safe is "safe," and who shall decide?

RACHEL CARSON raised these questions in 1962. Her *Silent Spring* urged a halt to the indiscriminate spraying of thousands of weed, fungus, and insect killers created since the introduction of synthetic pesticides during World War II.

Cheap, easy to use, and potent long after application, these chemicals were spectacular successes at first. DDT, especially, was "the atomic bomb of the insect world": In war it helped stem a typhus epidemic in liberated Naples, Italy, and protected soldiers on Pacific atolls against malarial mosquitoes. In the decade 1946-1956 it reduced malaria in Sri Lanka from nearly three million cases to 7,300. American farmers embraced DDT and its kin as an unqualified benefit, like chemical fertilizers or labor-saving tractors, and synthetic pesticides eclipsed less effective lead arsenate, a deadly compound that had been the leading insecticide before the war.

But synthetic pesticides soon showed a darker side. As early as 1946, DDT no longer killed all houseflies. Red spider mites became destructive apple pests as unselective pesticides decimated predatory mites that once held them in check. Some insecticides, slow to degrade, accumulated to lethal levels in the food chain, killing fish and birds. Ominously, they began concentrating in human fat and mother's milk.

Arrayed in *Silent Spring*, all these facts galvanized public fear that pesticides were unmanageable poisons. Federal pesticide regulation was toughened. In 1970 enforcement responsibility was taken from the Department of Agriculture, which promoted chemical pest control, and given to the new Environmental Protection Agency. DDT was banned in 1972, and 15 other pesticides formulated into hundreds of products have been suspended or banned since. Now EPA is slowly reviewing the remaining 1,400 basic ingredients, looking for, and at times finding, subtle effects on human health.

These reforms did more to intensify controversy than to settle it, as I learned in visits to southern cotton fields, where half our insecticides are sprayed.

Much of that goes to restrain the boll weevil, a quarter-inch pest from Mexico. The weevil drills into cotton bolls with its beak, seeking concealment for its eggs. Larvae mature, eat their way out of the nursery, and look for bolls to deposit their own eggs in. If conditions are right, six generations of weevils can ravage a field in a single season.

In 1892 the weevil invaded the cotton belt near Brownsville, Texas, and quickly blanketed half the state. Panicky legislators offered $50,000 for an effective remedy, but no one collected. By 1921 the weevil had crossed the Mississippi and marched like Sherman through Georgia to the sea. Everywhere the weevil went, cotton yields plummeted 30 to 50 percent.

The cotton industry ailed until the arrival of chlorinated hydrocarbon insect killers, man-made chains of carbon, chlorine, and hydrogen atoms that affect the nervous system. Recovery was swift, as I heard from Perry Adkisson, vice president for Agriculture and Renewable Resources at Texas A & M University.

"It was like magic. Farmers planted longer-fruiting cotton and made unheard-of yields under an umbrella of insecticides."

THE MAGIC didn't last. Besides weevils, pesticides killed beneficial insects—ants, spiders, assassin bugs—that preyed on the tobacco budworm and the cotton bollworm. Unleashed, the worms caused heavy damage in the early 1950s before DDT stopped them. Meanwhile, repeated spraying was making the weevil resistant.

Even the most powerful chemical does not kill all the members of a generation of pests: Susceptible ones are culled out, but those with chance genes for resistance live to pass them on to offspring. Constant use of the same chemical favors more and more such individuals, until nearly the entire pest population is resistant. Insects evolve resistance rapidly because they breed quickly and by the hundreds. And even if spraying later ends, they never entirely lose their new ability to detoxify a pesticide (page 154).

"Resistant weevils gave farmers a hint of what was happening to the ecology," Perry said, "but they only mixed chemicals and sprayed more often at higher dosages."

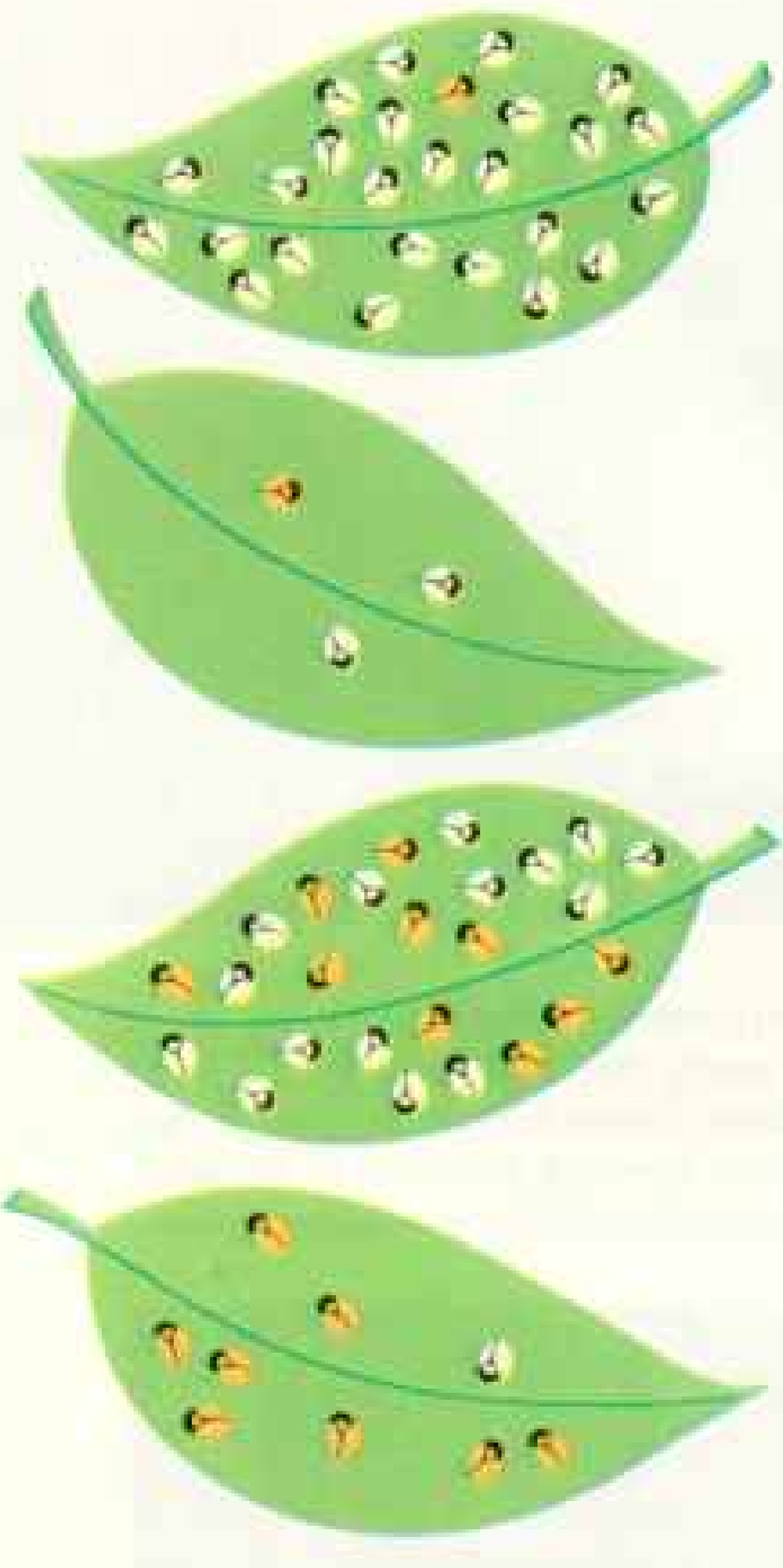
In 1962 resistant budworms and bollworms ate more cotton than did weevils. Farmers skirted bankruptcy while spraying every week, and many quit. In northeast Mexico, half a *(Continued on page 156)*

Pesticide spraying: hit or miss?

WING-TIP TORNADOES swirl from a model crop duster as it passes through a cloud of kerosene smoke in a NASA wind tunnel. During actual pesticide application, a spray plane's turbulent wake forces

some droplets off target by propelling them aloft, where they may drift for miles. NASA research is aimed at modifying wing design to counteract these effects.

For ground application, an electrical charge can combat drift. At the University of Georgia, spray floats above a man's hand ***(left, below)****. Given a negative charge* ***(below)****, it seeks a ground and races to the hand, like filings to a magnet, as it would to a plant.*



Are we breeding "superbug"?

PLOWING THROUGH DDT, *a tobacco budworm* (**above**) *remains unaffected by the white crystals lethal to earlier generations of the pest. If a housefly* (**left, top**) *were a 200-pound human, the DDT drenching it would be equivalent to twenty pounds—a killing dose if ingested. To the fly it might as well be sugar water. These masters of resistance are tested at the University of California at Riverside under the*

direction of entomologist Dr. George P. Georghiou. He explains: "Chance genes enable a few individuals to survive pesticides and multiply."

How the resistant survivors proliferate is shown in the illustration at left: The top leaf is infested with insect pests. Only one, shown yellow, has the genes to resist a given insecticide. When a chemical is sprayed, only the yellow insect survives, to be joined later by susceptible, unsprayed specimens. When the two types mate, many offspring are susceptible, but some are not. The leaf is resprayed, killing nearly all the ordinary insects. But the resistant ones, now an overwhelming majority, can breed, multiply, and injure crops, undisturbed by the pesticide. When new chemicals are formulated, the cycle begins anew, with the insects again the winners.

(Continued from page 151) million acres of cotton dwindled to 1,200 in just four years.

I asked Perry if the lesson had to be so harsh. He paused. "Probably. Farmers can be hardheaded; entomologists, too. They recommended chemicals enthusiastically, and synthetic pesticides caught on before the consequences were fully considered."

SOME FARMERS learned from the cotton disaster. Dan Pustejovsky now grows cotton in the Texas "blacklands" using IPM—integrated pest management. IPM combines beneficial insects, special plant breeds, restrained spraying, and what Dan calls "commonsense farming."

The Texas blacklands slope from north of Dallas south past San Antonio in a crust of dark dirt. In 1900 they yielded more than a third of the state's cotton, much of which has since moved west to the arid High Plains, where weevils freeze to death in the dry winter wind. What stayed, worms and weevils got, and today blacklands farmers harvest scarcely 10 percent of the cotton in Texas.

Dan farms 1,630 acres near Whitney, and two weeks before harvest he showed me cotton two feet high, loaded with fleecy lint. Dan's plants fruit heavy and fast, so he can harvest early and escape late-season worms, weevils, and aphids.

Dan strips his cotton in early September,

Bug birth control *promises new, nonpoisonous tactics in boll weevil control. In a trial program in North Carolina, weevil offspring are nourished to the pupal stage by food containing red dye, which stains their innards for field identification even after they have metamorphosed into adults* ***(left)****. Sterilized by radiation, they are released to mate in the fields with untreated adults, but no new generation is produced.*

In the same trials, synthetic sex lures called pheromones duplicate mating odors and attract weevils to traps and death in a baking sun. Dr. Herbert C. Brown ***(right)*** *of Purdue University won a 1979 Nobel prize for his discovery of chemical transformations involving boranes, which expedite the production of such pheromones.*

National Geographic, February 1980

before the year's last weevils can dig into leaf litter to overwinter. Then, as an added precaution, he shreds the bare stalks and plows them into the earth.

"If those overwintering weevils get by you, you'll be spraying all season," Dan told me. "I did spray once this year, but early, to give beneficial insects time to recover and catch July bollworms."

Four years ago Dan joined a statewide IPM program organized by Texas A & M University. Scouts sweep his fields each week with billowing nets and report their catch to BUGNET, a computer that alerts Dan when worms and weevils are about to reach damaging levels; only then does he spray. In 1976 Texas cotton farmers sprayed only a tenth as much insecticide as in 1964, partly because of integrated pest management and BUGNET.

As I left his farm, Dan handed me a branch of fluffy cotton bolls. "I still need chemicals. But I don't spray anymore to kill every last insect—I live with a lot more bugs than I used to."

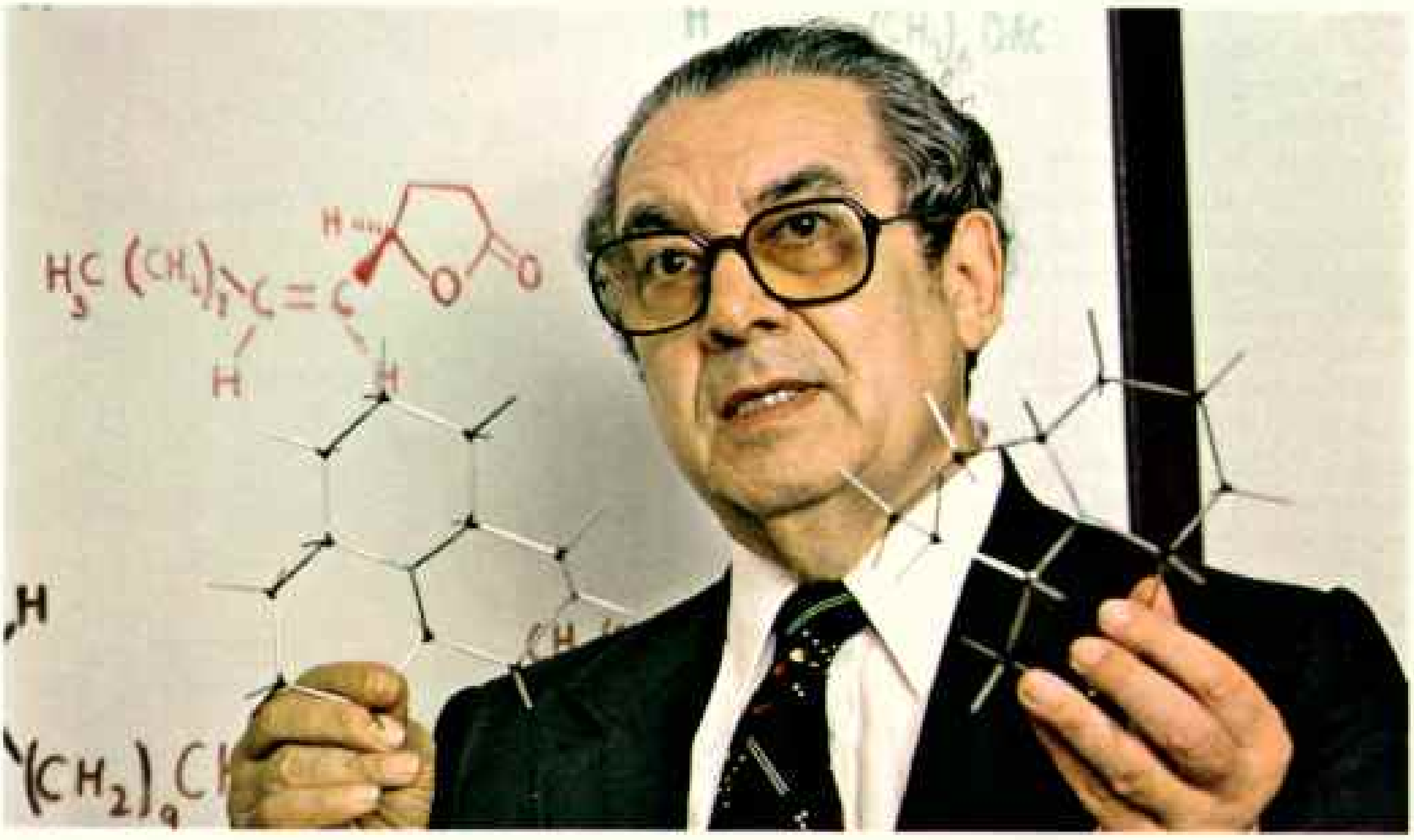
So does Jim Brazzel, but still he wants to wipe out the boll weevil. We met for the first time in a dusty cotton field outside Elizabeth City, North Carolina. As director of the United States Department of Agriculture Animal and Plant Health Inspection Service Boll Weevil Eradication Trial, Jim had come to gauge the enemy's strength.

The battlefield covers 21,000 acres, and in USDA's total war, all is fair. Traps baited with sex lures capture adult weevils, and strategic spraying of a chemical growth regulator—also used against gypsy moths in five states—leaves young insects half-formed. Sterilized males dropped by air divert female weevils from other, fertile partners. The experiment ends in 1981; if it succeeds, USDA may expand it nationwide. Estimated time and cost to the last, lonely weevil: ten years and perhaps seven hundred million dollars.

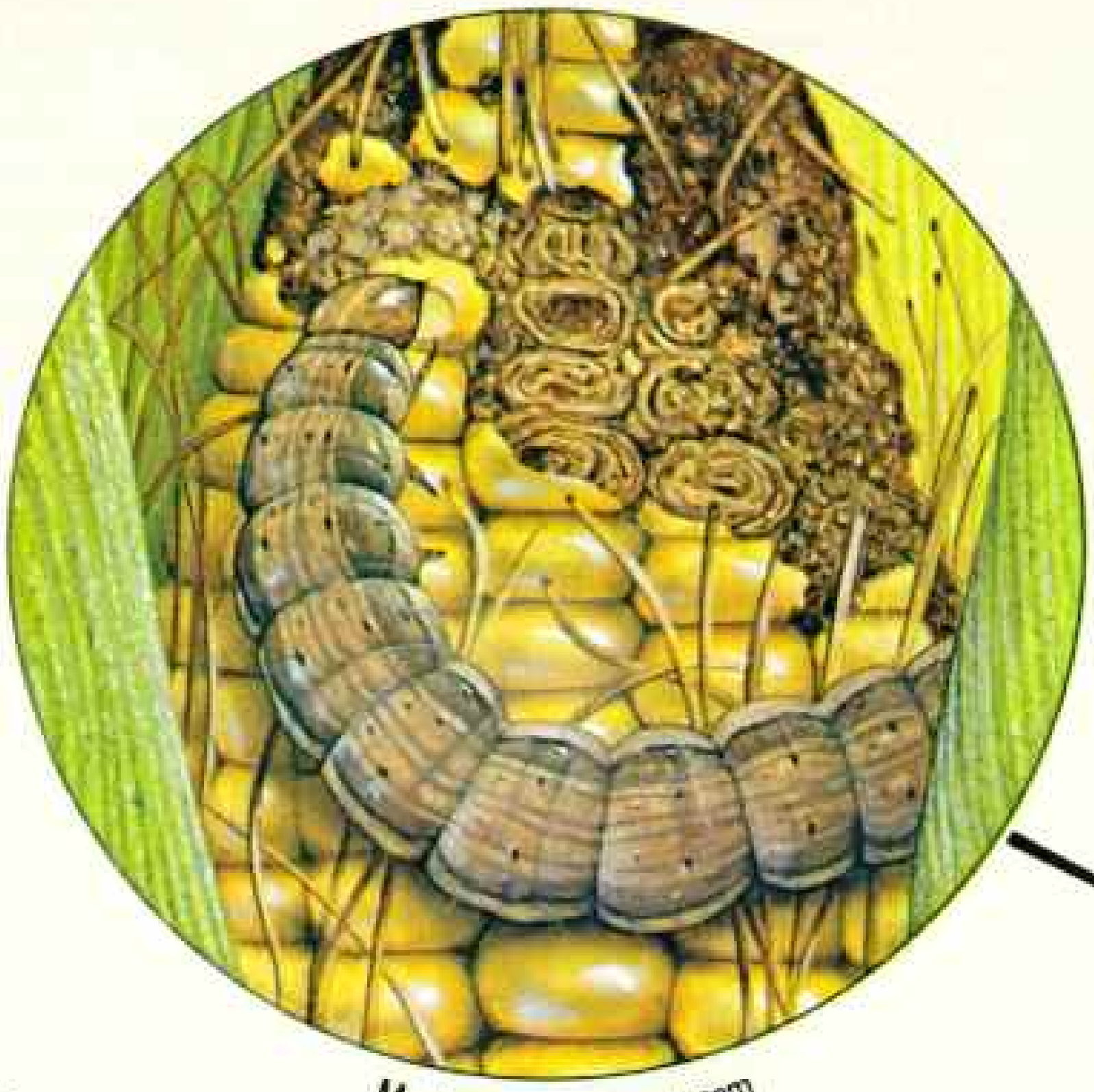
"If we get rid of the weevil and use integrated pest management," argues Jim Brazzel, "we can cut pesticides on cotton by 50 to 75 percent." The prospect tantalizes: Each year cotton receives 26 million pounds of toxaphene alone, an insecticide that in laboratory tests causes tumors in mice and "broken-back syndrome" in catfish.

Jim concedes it is an expensive gamble against long odds to try eradicating the weevil. "But," he warns, "insecticides are failing, and we have to eliminate the boll weevil while we still can. Or learn to live with it."

"ERADICATION is unrealistic," says Dr. William F. Buren, an entomologist at the University of Florida. "Just look at the red imported fire ant." It was Dr. Buren



Despite chemicals, 70 major insect pests plague corn



Mealtime for the earworm
ENLARGED 4X

*ROGUES' GALLERY of pests attacks corn from roots to silk tassels (**facing page**). The corn earworm (**right, above**), most often seen by the consumer, annually robs farmers of millions of dollars.*

*The western corn rootworm has spread from a small area in southern Nebraska to infest 18 states (**map**). Now resistant to once potent poisons like heptachlor, the rootworm profits from the predilection for monoculture, the practice of growing contiguous acres of a single crop. It has fanned out through the endless fields of corn that blanket mid-America—recently at a 140-mile-a-year clip. Control? Crop rotation—interspersing corn with a legume like soybeans—might work. Otherwise, "it may well continue to spread wherever corn grows," predicts entomologist Georghiou, who compiled this map. "It is difficult to tell when an ecological barrier will stop it."*

The pesticide-resistant western corn rootworm has the upper hand in the corn belt—and keeps moving on.

ENLARGED

Corn flea beetle

Adults nibble tiny holes in leaves, opening the door to infection by wilt disease.

European corn borer

Plows through the stem along length of ear and cob. Best defense: insect-resistant varieties of corn.

Chinch bug

Punctures stems and sucks sap, reducing vitality of the plant.

White grub

Kept in check by spraying for other soil-based pests.

Corn rootworm

Feeds on roots and underground parts; weakened plants keel over.

PAINTING BY PAUL M. BREDEN
COMPILED BY PATRICIA J. HARRISON
NATIONAL GEOGRAPHIC ART DIVISION

NATIONAL GEOGRAPHIC PHOTOGRAPHER JAMES P. BLAIR

Drought *followed by heavy snows, favorable conditions for a grasshopper, provoked an explosive infestation in 1979. This adult, feeding on corn, can consume its own weight in 16 hours.*

himself who named the ant: *Solenopsis invicta*. (*Invicta* means "unconquered.")

Brazil's red fire ant probably hopped a freighter to reach Mobile, Alabama, before 1940. Despite a continuous effort by the USDA to control or eradicate what it calls a "people pest," the ant now infests 200 million acres from Texas to the Carolinas.

Red fire ant queens produce new queens year round, dotting an acre with as many as fifty colonies; mature mounds swarm with two hundred thousand ants that attack intruders en masse and mat together to raft floodwaters. Experts disagree on what the insect costs farmers, but a dry fire ant mound can be as tough as a tree stump on the blades of a hay mower or a soybean reaper.

Near Tifton, Georgia, I excavated a fire ant mound in search of a queen. I hacked at rock-hard soil until two ants scrabbled up my shovel to clamp their jaws onto my thumb and pump abdominal stingers into me. Red fire ant stings may raise only ugly pustules or red welts as they did on me, but they can also kill quail nestlings or shock a hypersensitive person into heart failure.

USDA and southern states fought red fire ants with the insecticide mirex for 15 years, until EPA banned it in 1978. It had caused cancer and birth defects in laboratory mice—and had been detected in human tissue samples collected in the South.

Dr. Buren grants the viciousness of red fire ants and the need to control them, but says the ban on mirex was all to the good, and not only for public health. Mirex did kill red fire ants, he points out, but destroyed predatory native ants as well, enabling the more prolific fire ants to reinfest a sprayed area and become predominant. As their population burgeons, they invade adjoining land to spread almost unchecked.

Now nine states want to combat fire ants with Ferriamicide, which contains not only mirex but also additives to speed decomposition. The EPA approved Ferriamicide in January 1979, but withdrew its approval two weeks later. Canadian studies, overlooked earlier, showed that a breakdown product of Ferriamicide was as much as a hundred times more toxic than mirex.

Also belatedly, there is now some evidence that red fire ants can be effective predators of boll weevils and cotton bollworms.

The ants pry larvae out of infested bolls and gang up on young adult weevils.

S. Bradleigh Vinson, an entomologist at Texas A & M University, hopes biology will reveal better ways to control red fire ants. He tests ant proteins as an insecticide bait, trying to make poison so palatable that worker ants will carry it to their queen.

"Mirex," Brad told me, "used to be the ultimate answer. Now it isn't, but once a pesticide is developed and used, we tend to neglect other pest-control methods. Unfortunately, the more effective a pesticide is at first, the more likely it will leave you without alternatives if it fails or is banned."

THE ALTERNATIVES can be bizarre. Take *Nosema locustae*, a one-celled parasite that ate grasshoppers alive—from the inside out—during the western grasshopper plague of 1979.

Last May and June, from Arizona to Montana, grasshoppers pushed out of egg pods and up from the earth in hungry billions. In July they left the rangelands for the corn, and in September the corn for the wheat. Alfalfa turned to stubble, barley became chaff, and prairie grass bent and vanished in a summer storm of grasshoppers.

In northeast Wyoming I rode through the insects on a motorbike behind Jerry Onsager of the USDA Rangeland Insect Laboratory in Bozeman, Montana. Racked on the back of Jerry's bike were aluminum rings like magician's hoops; he set them out at intervals in the sage so grasshoppers could settle in them and be counted.

"How many are out here?"

"About 15 hoppers to the square yard." Parts of South Dakota were smothered by thirty times as many. What harm could 15 to the square yard do?

Jerry prodded a ring with the toe of his boot, launching a shower of grasshoppers. "Leave these hoppers out here, and at the end of summer it'll look like someone went over the range with a lawn mower."

To quell that appetite, scientists at the Rangeland Insect Laboratory cultured *Nosema locustae* in live grasshoppers, mashed the insects to a slurry, extracted the *Nosema* spores, and sprayed them on a wheat-bran bait. The microscopic spores resemble rice grains; each contains a filament cocked like a spring to shoot into a grasshopper's stomach wall, germinate, and multiply. In one month a single *Nosema* protozoan can transform a leaping grasshopper into a fragile shell bloated with billions of spores.

Because *Nosema* kills slowly, ranchers and farmers cannot use it like conventional pesticides to stem a grasshopper invasion already under way; it can, however, forestall future damage. In the wild, *Nosema* outbreaks control grasshoppers for as long as four years as the insects cannibalize and inoculate each other. Then, when grasshoppers become too few to support a reservoir of the parasite, *Nosema* becomes dormant.

Nosema and other biological pest-control organisms have special appeal for EPA, which has proposed to exempt them from certain of the safety tests required of new chemical pesticides. The high cost of testing new pesticides inadvertently discourages the development of viruses, protozoa, bacteria, and molds: Because they attack only specific weeds or insects, they offer chemical companies no large markets from which to recoup expenses.

ASK CLARENCE KORTE what he sees in his future, and he says a Midwest fast-food chain of "beefalo barns." He is shrewd; he already builds and sells rustic log homes and raises buffalo-beef cattle. He grows crops too, organically, and on his 520 acres pesticides are banned.

Columns of mist corkscrewed up from farm ponds as I drove onto Clarence's land one fall morning. It was Sunday and he was at church in Pocahontas, Illinois, so I looked over the farmstead: three-story-tall grain bins; barns crammed with combines and tractors; pens for the beefalo; the farmhouse Clarence was born in, too small now for his wife and nine kids; and, going up, a spacious log ranch house.

When Clarence arrived, I asked if he was really making so much money. He grinned. "And saving it. I don't have any costs for chemicals like my neighbors do.

"I fertilize with fish emulsion and manure from my cattle. I rotate alfalfa with my wheat to smother weeds. In corn I keep them down by cultivating. Insects are no problem either. Alfalfa weevils may hit, but the beneficial bugs take care of them."

Clarence harvests as much per acre as his neighbors who spray, and his crops bring more money because they are grown without chemicals. Last year he sold corn for a dollar a bushel more than the going price.

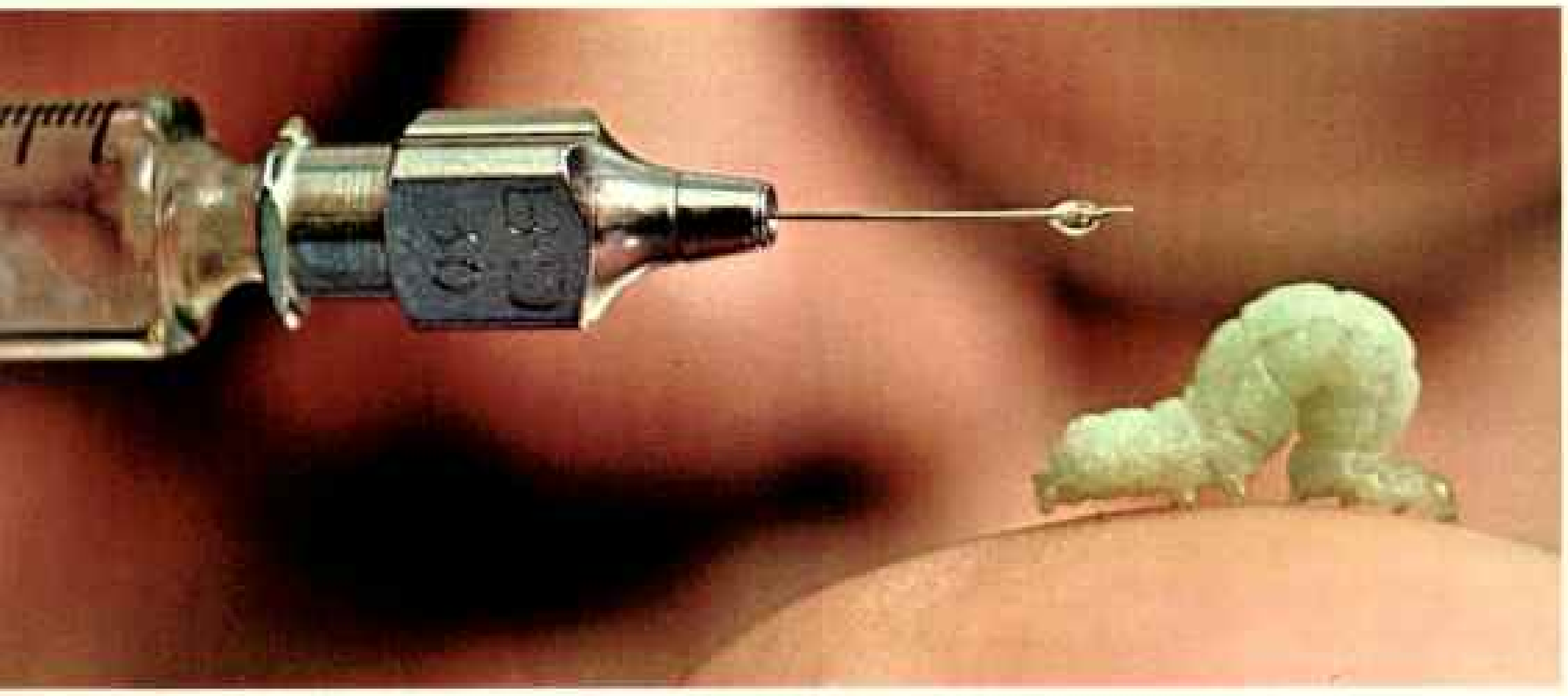
But money is not Clarence's sole motive. "A few of my neighbors share my belief that 'as you sow, so shall you reap,' and if you sow pesticides, you reap poison. I gave up chemicals in 1970, and if I had to go back to them, I'd quit farming."

A recent report from Congress's Office of Technology Assessment estimates that if all farmers gave up pesticides, commercial production of apples, lettuce, and specialty crops, such as strawberries, would cease. Insects, weeds, and plant disease would ruin enough corn, wheat, and soybeans to boost prices 60 percent, but if farmers adopted integrated pest management, grain losses would decline again and pesticide use on major crops could be reduced by 75 percent.

Dr. David Pimentel, an entomologist at Cornell University, agrees there would be losses. By his reckoning, retail food prices would rise 12 percent and food supplies fall 9 percent if farmers abandoned pesticides.

"Pests have taken about one-third of our food every year for more than thirty years," he told me. "Loss of 9 percent more would make our diet plainer, but not necessarily poorer. In any case, we could use less pesticide and do a better job of pest control, help the environment, and have greater confidence that we're not doing something to our bodies for which we may be sorry later."

We *may* be sorry. Aside from acute poisoning, the effects of pesticides on humans



Doom for the cabbage looper *may come in the form of a virus. When the virus is injected (**above**), it hijacks a cell and forces the host nucleus to produce additional viruses (**right**) that attack other cells. In six days the infected looper is reduced to a fragile shell (**left,** at right) that collapses into ooze. Just a quarter gram of this experimental virus can control an infested acre. Viruses are now being marshaled against the pink bollworm and gypsy moth. There are no panaceas, though: Such microbes could pose human health problems, and some pests develop resistance to biological as well as chemical pesticides.*

are seldom distinct, and few farmers and chemical companies are alarmed. After all, goes the argument, if the people most exposed to pesticides are healthy, it is unlikely that anyone who absorbs only minute doses will be hurt.

FRANCES SOTELO concurs. We talked as she moved down ranks of almond trees near Madera, California, waving a white flag and showing a crop duster which row to spray next.

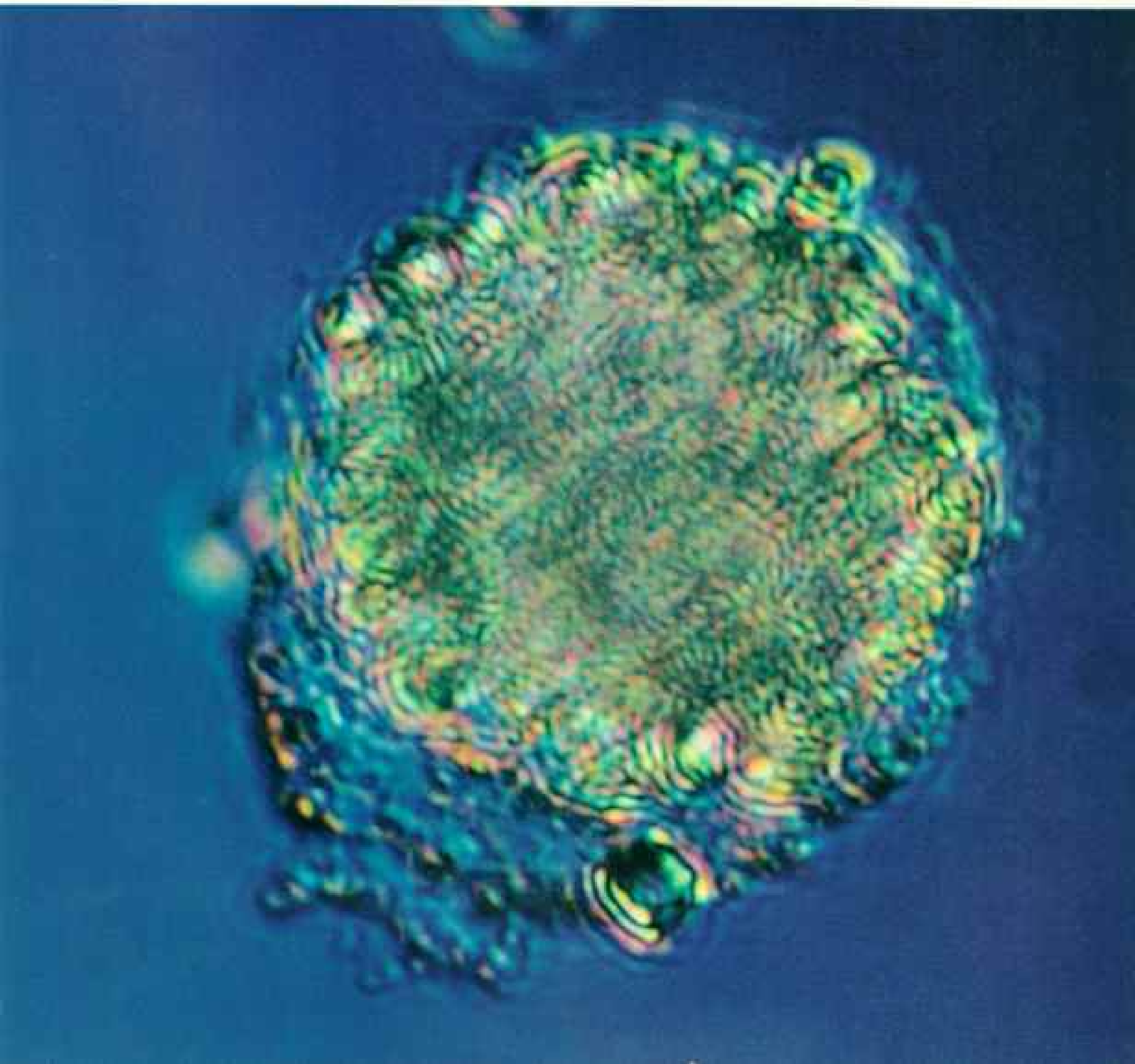
"I've been sprayed with everything you can think of for ten years," Frances said, "and never been sick." Looking past her tanned face and her sunglasses flecked with whitish chemical, I could see a biplane skim a power line and head straight for us.

"You should see me when we spray with copper sulfate; I turn green." Frances handed me her straw hat. A week ago it had been new and white—now it was the color of blue cheese. The plane raced over a grainfield. Frances waved her flag.

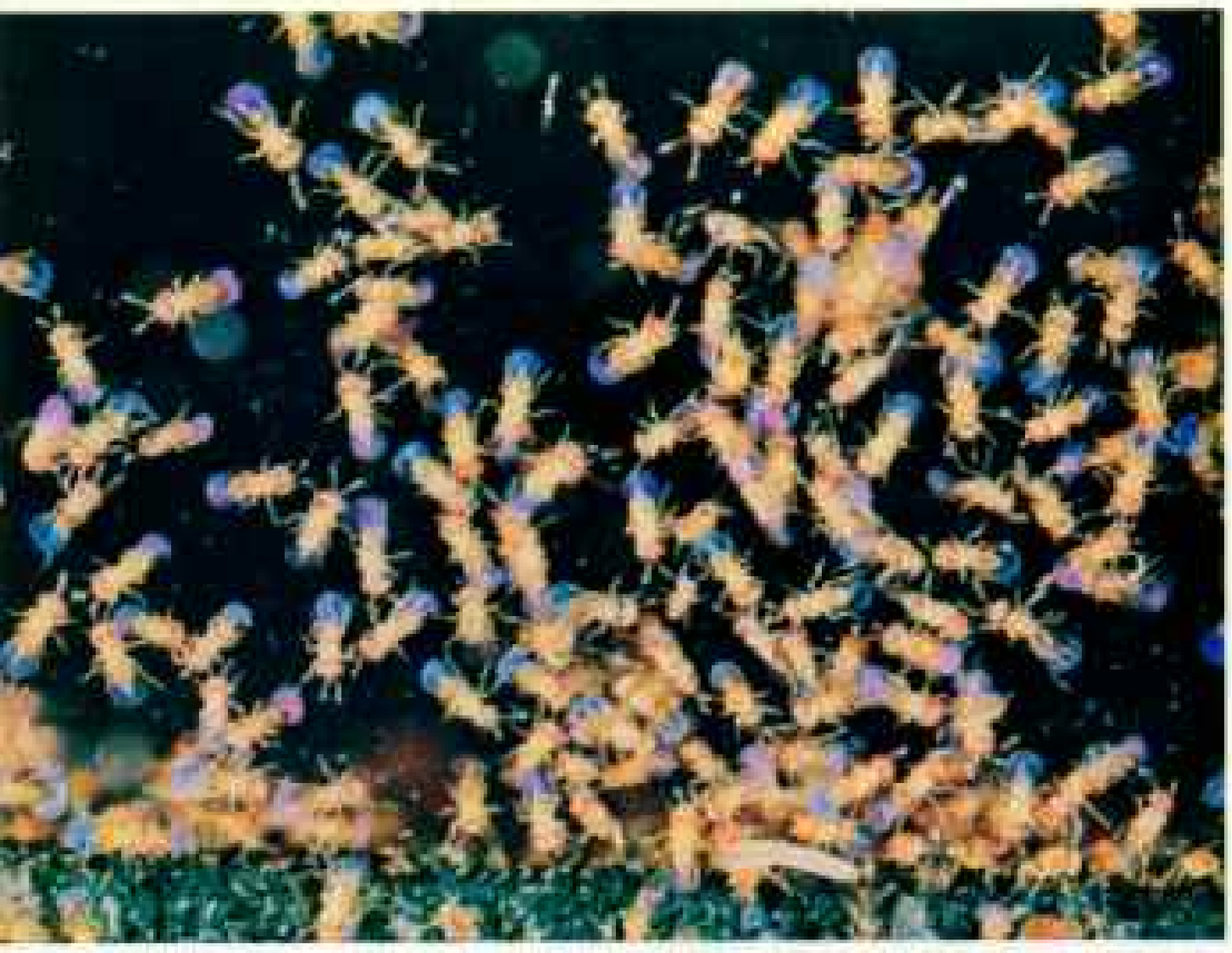
"It's better than being a housewife, and I get $3.75 an hour—not bad for Madera." Frances moved upwind to the next row; I followed. Crossing an irrigation ditch between the grain and the almond orchard, the plane suddenly spurted a sheet of spray.

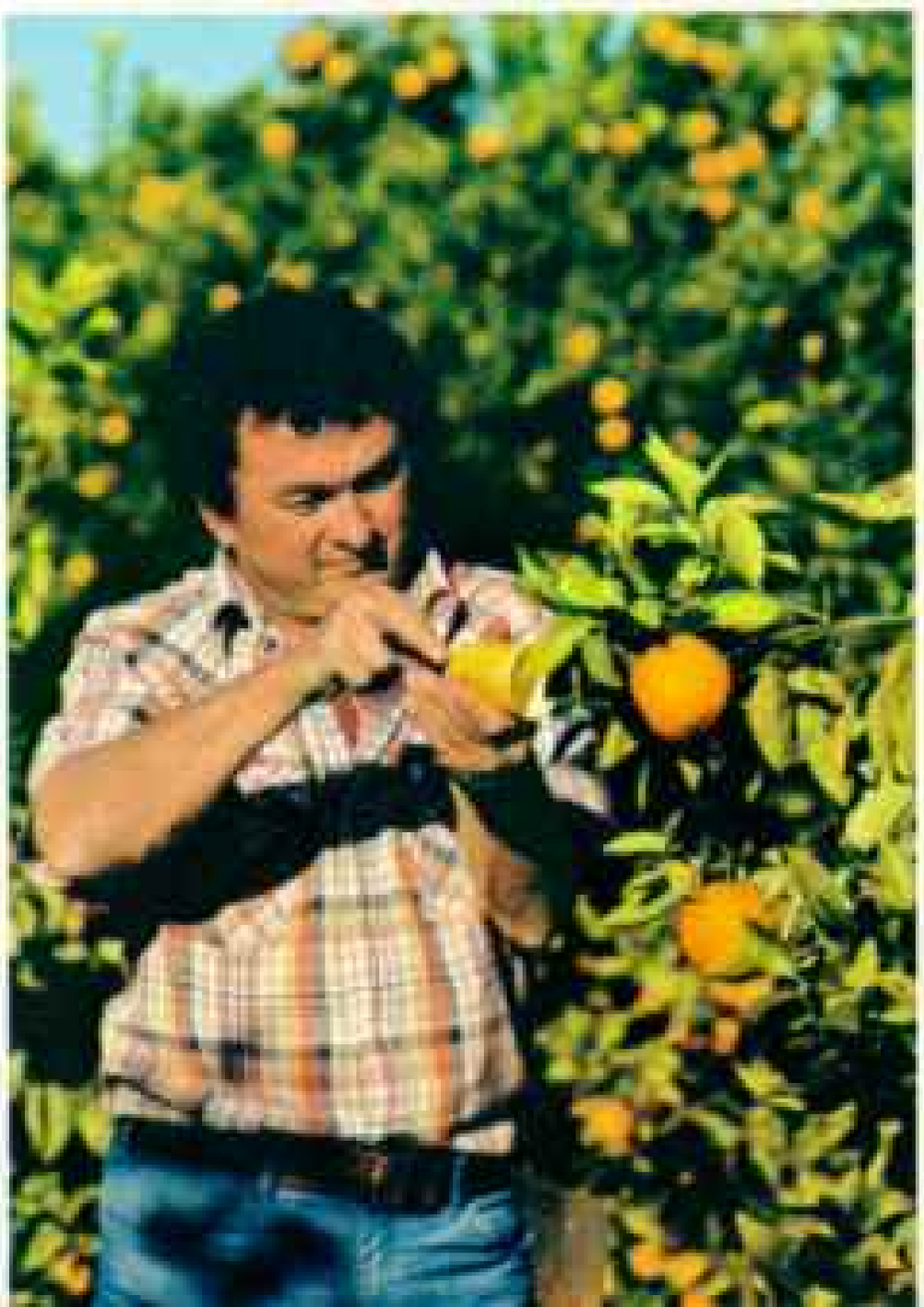
"My 18-year-old loves to flag. She comes out in shorts and a tank top to tan herself while the planes spray." Frances scarcely flinched when the plane roared by thirty feet away, drenching the trees with fungicide. It drifted in all directions. It stank like rotting mushrooms and it stung my eyes.

The plane veered our way after its final



Bug-vs.-bug *tactics of biological control pit* Trichogramma *wasps* ***(below)*** *against bollworms. The dust-mote-size wasps lay their eggs in those of the bollworm* ***(right)****. The wasp larvae hatch and consume the bollworm eggs before emerging as adults. Jack Blehm of Rincon-Vitova Insectaries in Ventura, California, releases another beneficial wasp,* Aphytis melinis ***(bottom)****, which controls citrus red scale for twenty dollars an acre, compared to two hundred dollars an acre for spraying. Biological control does not pollute the environment but lacks the swift punch of chemical pesticides. An alternative: integrated pest management, a combination of biological control, pest-resistant plants, and restrained spraying.*





pass. Suddenly Frances started yelling. "You slob! You're going to drown us!" The pilot leaned out of his cockpit, all smiles, as the spray slapped us. Frances threw down her flagstaff. Pesticide coated it, except where her fingers were outlined like ancient Indian handprints stenciled on rock.

"CALIFORNIA has the best farm-worker protection in the country." Clearly the best is not always good enough, adds Dr. Ephraim Kahn of California's Department of Health Services. He tracks pesticide illness among the state's farm laborers.

"Our safety regulations are more effective than they were a decade ago," Dr. Kahn told me in his Berkeley office, "but farm workers in this state are still exposed to space-age chemicals and protected only by Model-T standards and enforcement."

Dr. Kahn pointed out that farm workers are not covered by pesticide-exposure limits comparable to those that protect chemical-plant workers. Other critics cite low fines that make stringent environmental rules toothless. And they charge conflict of interest to the enforcers: California's 54 agricultural commissioners are appointed by county supervisors, some of them growers. Sensitive to such criticisms, state officials are revising pesticide regulations.

More than 300,000 farm workers toil in California. A third work full time, like Frances Sotelo and, once, Andres Murillo. Housewives and students join them in summer, and an unknown number of illegal aliens supplement them year round.

No one, Dr. Kahn said, knows for sure how many farm workers suffer pesticide poisoning, or to what degree, for the symptoms—nausea, headaches, diarrhea—can mimic those of other illnesses. Few doctors are trained to link a farm laborer's rash, vomiting, or blurred vision to pesticides.

Dr. Kahn pushed a sheet of numbers at me: 1,518 cases of reported pesticide illness in California during 1977. Nearly half involved farm workers. "Work-injury reports provide us a lot of information about job hazards, except in field labor. Officially we hear of only a small fraction—possibly as little as one percent—of the pesticide illness in field workers, mostly pickers."

"How can anyone say that seriously?" The query, half derisive, half defensive, came from Jake Mackenzie, assistant chief for pesticide regulation in California's Department of Food and Agriculture in Sacramento.

Jake's Scottish burr sharpened in anger as he spoke. "Sure, not all poisonings are reported. Social and economic pressures are against it. Machismo for one: Some farm workers will not admit pesticides affect them. Many speak no English, and workers' compensation is a mystery. Unregistered aliens risk deportation if they see a doctor. With these caveats," Jake asserted, "our reporting system is effective."

Yet farm workers can get into trouble just for mentioning safety hazards. They may be fired or blackballed as potential agitators for the United Farm Workers union, which negotiates pesticide-protection clauses in its labor contracts.

What about the courts? I consulted Dr. James Dahlgren, a specialist who diagnosed Andres Murillo's illness and who teaches occupational medicine at the University of California at Los Angeles. He had a question for me.

"Can Andres's lawyers *prove* he was hurt by pesticides?"

Seldom, if ever, Dr. Dahlgren said, have California growers admitted in court that pesticides injured a farm worker. "They know that the more awards there are for pesticide injuries, the higher production costs and insurance premiums will skyrocket. A judge hearing a pesticide-poisoning case balances a farm worker's right to justice against the economic health of a corporation or of society."

MEN AND OUTFITS like those I found in the Imperial Valley have other worries. At one of the valley's larger pest-control companies, a field dispatcher—who prefers anonymity—complained vehemently of overregulation.

I found him at five one morning in his office. Just back from a night mission—dusting mites with sulfur—he was unshaved and planning new raids. Like a squadron leader, he tapped a wall map, briefing his pilots and warning that their pesticides had better hit the right target.

"Our big problem is spray drift," he told

me, "And sometimes pilots get careless. We accidentally sprayed the municipal water plant once; the city had to drain and refill the reservoir." Pause. "Cost us $4,000."

On busy days company pilots and tractor drivers will spray 3,000 acres, drawing on a warehouse stacked floor to ceiling with pesticides in sacks, cans, drums, and plastic jugs labeled Pounce, Ambush, Lasso. Pounce costs $204 a gallon, and the firm's pest-control adviser receives a commission on the pesticides he prescribes for farmers. In one agriculture magazine a chemical company urges him to sell more and win "air fare to anywhere."

"We're regulated like you wouldn't believe," the dispatcher said later, as we watched a tractor spray herbicide on a field shimmering with heat. "People make regulations with no idea what they're talking about." Squinting in the glare, he explained, "By law, we're sometimes supposed to wear coveralls, rubber boots, a hat, gloves, and a face shield. *You* try that in this 105° heat."

Other compromises have been achieved. "The law says we have to notify the county agricultural commissioner each time we use insecticidal dusts Monday through Friday. We do it, but it's a nuisance. On weekends we dust like hell and notify him Monday. We're 100 percent behind regulations, but not when they interfere with business."

"A LOT OF FARMERS and applicators would like the right to spray anytime, without liability. As it is, that's just about the way things are." Brian Ferguson's words carry bitterness. In 1978 careless pesticide spraying cost him 2,500 colonies of honeybees.

Brian is big; his hands can scoop up hundreds of poisoned honeybees at a time. Big in another sense as well: With 15,000 colonies, Huston-Ferguson Apiaries is the largest bee operation in California.

Honeybees pollinate fruits, vegetables, and other crops that make up one-third of our diet; even dairy cattle eat alfalfa pollinated by bees. Pesticides annually destroy or damage more than 400,000 colonies, however, and some bee experts worry about a future "pollination crisis."

While Brian is less alarmed, the carnage rankles. USDA inspectors can recommend

The color that kills: *Jeannine Baskin adds dye to mosquito larvae at Mississippi State University (**above**). Ingested dye absorbs solar radiation, causing molecular changes that bring death. At the University of Kentucky, cucumber plants treated with tiny amounts of infectious pathogens (**below**) resist diseases that claim untreated plants, lower right.*

Reaping benefits *of organic farming, Curt and Chris Korte bale alfalfa on their father's farm in Pocahontas, Illinois* (**top**). *Tawny fields of wheat* (**facing page**) *and green rectangles of soybeans and corn checker the 520 acres. Clarence Korte renounced pesticides ten years ago. Instead, he relies on beneficial insects, such as the assassin bug—here killing a tobacco budworm* (**above**)*—and mail-order ladybugs.*

federal indemnities for part of his losses, but need not trace the pesticide at fault.

In beekeeper's netting, I went with Brian to judge the damage in one of his beeyards near Visalia. An orange grove nearby had been sprayed without notice the day before, and now the grass in front of 170 hives was matted with honeybees. At each hive "housekeeper" bees dragged out dead "field workers" that had been foraging among orange blossoms. Others stung drones to death to husband their colony's stored nectar; with no field force to gather more, there were too many mouths to feed. "If killer bees ever reach California," Brian says, "they won't survive the pesticides."

Conscientious growers spray in the evening or at night, when bees do not forage. Yet even this cannot protect bees against methyl parathion sealed in microscopic hulls that leach their contents slowly, like timed-release cold capsules.

This packaging prolongs the effectiveness of methyl parathion and thus reduces spraying, but to pass through sprayer filters, the capsules are only the size of pollen grains. Bees unwittingly mix them with pollen to feed their brood, and packed in the comb, they can kill bees from one year to the next. Though less toxic to spray men than ordinary methyl parathion, the capsules have weakened or destroyed twenty thousand bee colonies since 1974 (pages 172-3).

The honeybee's plight does not move Amon Fonville, an orange grower I met hardly a dozen miles from Brian's decimated beeyard. Amon was towing his speed sprayer, a ground rig that blasts out pesticide with enough force to whip tree limbs like a hurricane. Because of honeybees, Amon groused, he was spraying his trees for thrips an extra time, at extra expense.

To protect bees, California limits use of some pesticides on blooming crops. "Bees were on my bloom earlier this month," Amon said, "so I couldn't use parathion to kill thrips that scar my oranges; I used another insecticide that cost more and gave me less thrip control." Amon markets his oranges fresh, under the Sunkist label, and perfect skin—no thrip scars—is vital. Back home after spraying, he poured me juice and said that people demand attractive produce. But as Amon sees *(Continued on page 175)*

To outwit *a fire ant, U. S. Department of Agriculture scientists in Gainesville, Florida, laced a corn pellet with insecticide* (**above**), *hoping for delivery to the nest-dwelling queen. A stowaway from South America,* Solenopsis invicta *hopped off at Mobile before 1940. Its nasty, jabbing sting* (**left**)*—delivered with mandibles clamped on flesh—pesters farm workers in infested fields. Blade-bending ant mounds hamper farm machinery. A federal-state program has futilely spent 150 million dollars on eradication or control since 1957. "An atom bomb couldn't eradicate this thing," an entomologist observed. Yet fire ants have their good side; they attack pests like the tobacco budworm* (**right**).

Surgery on a fire ant *at Texas A&M* ***(below)*** *reveals the post-pharyngeal gland, important in absorbing oil-based pesticides. Such research, along with behavioral studies employing hair-thin copper bands* ***(center)****, may lead to effective control strategies.*

Casualties of carelessness, *bees were inadvertently killed when a grower sprayed an orange grove with dimethoate without informing nearby beekeeper Brian Ferguson of Visalia, California* ***(below)****. His bees gathered pesticide-laden pollen, returned to the colony, and died. Survivors remove a victim from the hive* ***(bottom)****. Pesticides annually claim 10 percent of the nation's bees. Some entomologists fear a coming shortage of the beneficial insects, which each year pollinate about three billion dollars' worth of honeybee-dependent crops.*

Deadly ringer: *Capsules of methyl parathion, magnified 450 times and dyed pink for identification, dot a pollen-filled storage cell in a comb* ***(left)****. Bees that forage blossoms sprayed with pesticide micro-capsules accidentally harvest them with pollen. Brushed into the hind-leg baskets—much as is this almond-blossom pollen* ***(above)****—capsules are shuttled to the hive, pigeonholed in the comb, and fed to other bees . . . with fatal results. The pesticide's longevity in the field, an asset to growers who can spray less often, increases its liability in the comb, where it can remain lethal for more than a year.*

MICHAEL BURGETT (LEFT)

(Continued from page 168) it, "Thrips make no difference in the taste of fruit." Nonetheless, packers downgrade blemished oranges, and growers must spray or risk lower profits.

Even cannery crops must look good. Florida growers spray to kill mites whose major fault is coloring oranges russet, though the fruit is intended only for juice. In California, a principal reason tomato farmers spray is to ensure that whole shipments have no more than one percent cosmetic damage, or canners may refuse to process their crop into paste or catsup.

PESTICIDES ON FOOD, whether processed or fresh, give many people pause, and some a shudder: Are we poisoning ourselves? I sought an answer at the Los Angeles Santa Fe Terminal Market, a four-block-long emporium where wholesalers job nearly half a billion dollars' worth of fruit and vegetables every year.

With Otis Rashe and Jack Musselman I dodged "housemen" hustling hand trucks of crated lettuce, cabbage, and melons. Otis and Jack are inspectors for the state of California, and police growers, wholesalers, and supermarket warehouses in eight counties, checking produce for pesticide residues that exceed state and federal safety limits, or tolerances.

Jack pried open crates of romaine lettuce, mustard greens, beets, and kohlrabi to collect samples for analysis. Once Otis sniffed a handful of grapes dusted with sulfur, then, mindful that the state budgets only $7,600 to pay for sampled crates and cartons, decided not to spend $25 for a full crate of the fruit, hoping to purchase a smaller amount later.

Jack paid for the crates of romaine lettuce and mustard greens not only because they were cheaper, but also because the leafy

Fungicide spatters *a flagger garbed in protective clothing, as prescribed by law. Though federal and state regulations provide some measure of protection to those who work with and around pesticides, critics charge enforcement is lax, prosecution difficult. Relatively few cases of health and safety violations involving pesticide use reach the courts each year.*


BAGDAD
BAGDAD
BAGDAD

vegetables shield pesticides from sunlight that breaks them down. Rain washes away some of the pesticide but flushes the rest deeper among the leaves, where it stays unless a consumer thinks to scrub it off.

"Then people are eating pesticides?"

Jack was only somewhat reassuring. "Definitely, but not in harmful amounts. Most produce that we check either has no pesticides or negligible amounts within state tolerances. Of course, things are bound to slip by. We're like traffic cops—we can't catch all the speeders."

In California five inspectors gather about 7,000 fruit and vegetable samples annually; about one percent contain more pesticide than the law allows. When analyzed, each of the vegetables I saw Jack collect at the wholesale market was shown to carry tiny residues of pesticides, seven kinds in all, and well within legal limits.

Not everyone is satisfied that what is legal is necessarily safe. The federal government's General Accounting Office repeatedly criticizes EPA for setting pesticide residue tolerances without adequate safety testing. Some imported food may legally contain pesticides banned in this country. GAO also questions the Food and Drug Administration's performance of its several monitoring programs aimed at enforcing safe levels of 268 pesticides on domestic food, charging that FDA monitors only 30 percent of them. And skeptics point out that food may carry pesticides in unpredictable combinations that can affect our bodies in ways individual "safe" doses cannot.

Yet another complication: pesticides in drinking water. Last year in California, state health officials discovered surprising levels of the soil fumigant DBCP (*dib*romo*c*hloro*p*ropane) in some wells of water systems serving 420,000 people from Sacramento to the Mexican border. Banned in California in 1977 after it sterilized men at a pesticide-formulation plant, DBCP had percolated down to groundwater.

DBCP destroys rootworms, and farmers injected it into soil in vineyards, orchards, and citrus groves. After it was found in wells, including some in Arizona and one in Hawaii, EPA suspended its use. A subsequent temporary ban has been imposed in all states except Hawaii.

Dr. Keith T. Maddy, staff toxicologist of the California Department of Food and Agriculture, is concerned about DBCP's carcinogenicity, or power to cause cancer. EPA considers lifetime use of water carrying as little as one part per billion of DBCP (equivalent to one drop in 12,000 gallons) to be unsafe. Not because DBCP is significantly more potent than other carcinogens, but because we consume more water than food.

One of but five *inspectors in California—producer of one-third of the nation's vegetables—Otis Rashe* ***(left)*** *collects grapes, peaches, plums, and other produce for pesticide testing. Of the 7,000 samples analyzed by the state each year, about one percent exceed legal limits. Thorough washing can reduce contamination.*

Dangerous levels of DBCP, an EPA-suspended pesticide that has been shown to cause male sterility in humans, taint a well near Fresno used by farm worker Lupe Arredondo ***(above)****. "You have to drink water," he shrugs.*

"An orange," Dr. Maddy said, "may carry DBCP but be only 2 percent of your daily diet. But you drink two quarts of water a day, making your DBCP dose much greater. It's like contaminating all your food—not just the orange—twice over."

I TURNED A WATER TAP more than once in California after I had learned about DBCP, and many times thought of contamination. But I heard the word itself most often in Oregon's Coast Range, where women wonder if the herbicide 2,4,5-T has cost them unborn children.

The herbicide is 2,4,5-trichlorophenoxyacetic acid but simply "T" to foresters, utility work crews, rice growers, and ranchers. In 1978 they sprayed more than nine million pounds of it on trees, weeds, and brush in forests, along power lines, in paddies, and on rangeland. Homeowners sprayed silvex, a similar herbicide, on their lawns.

Last February EPA suspended use of 2,4,5-T and silvex on forests, pastures, and rights-of-way, saying that animal studies suggested the herbicides threatened four million people with cancer, birth defects, genetic mutations, and miscarriages. Compared with their neighbors, said EPA, women near Alsea, Oregon, had miscarried unusually often after 2,4,5-T had been sprayed on forests surrounding their homes.

Bonnie Hill noticed first (pages 182-3). She lives atop the backbone of the Coast Range, among the tall Douglas fir that foresters prize and the scrubby thimbleberry, salmonberry, and alder that slow the growth of conifer seedlings if left unsprayed. Bonnie miscarried in 1975, but a daughter, Cedra, was born the next year. The little girl slipped shyly behind the hem of her mother's maternity smock when I visited. Cedra's sister Katalin was born four days after EPA's suspension of 2,4,5-T.

Between 1973 and 1977 Bonnie and seven other women had 11 miscarriages. All but one happened after spring spraying; the exception followed a September spraying. At other times of the year the women had normal pregnancies. Family doctors had no explanation, and in April 1978 the women asked EPA to investigate.

Citing the animal studies and comparing six years of births and miscarriages in the heavily sprayed Alsea Basin with those of a control group, EPA declared 2,4,5-T and silvex "an imminent hazard." Foresters call them irreplaceable, cheaper and more effective than other herbicides. A wide range of critics assailed the EPA miscarriage study as "seriously flawed"; the timber industry and Dow Chemical U.S.A., which makes more 2,4,5-T than any other manufacturer, appealed the suspension in federal court, but lost. Legal sparring for two more years is likely before the question of a permanent EPA ban on 2,4,5-T is resolved.

Possible links between 2,4,5-T spraying and miscarriages around Alsea, birth defects in a northern California county, and ailments elsewhere in the country are startling, but circumstantial. Yet as Bonnie told me, "The more we look into this, the more unanswered questions we see."

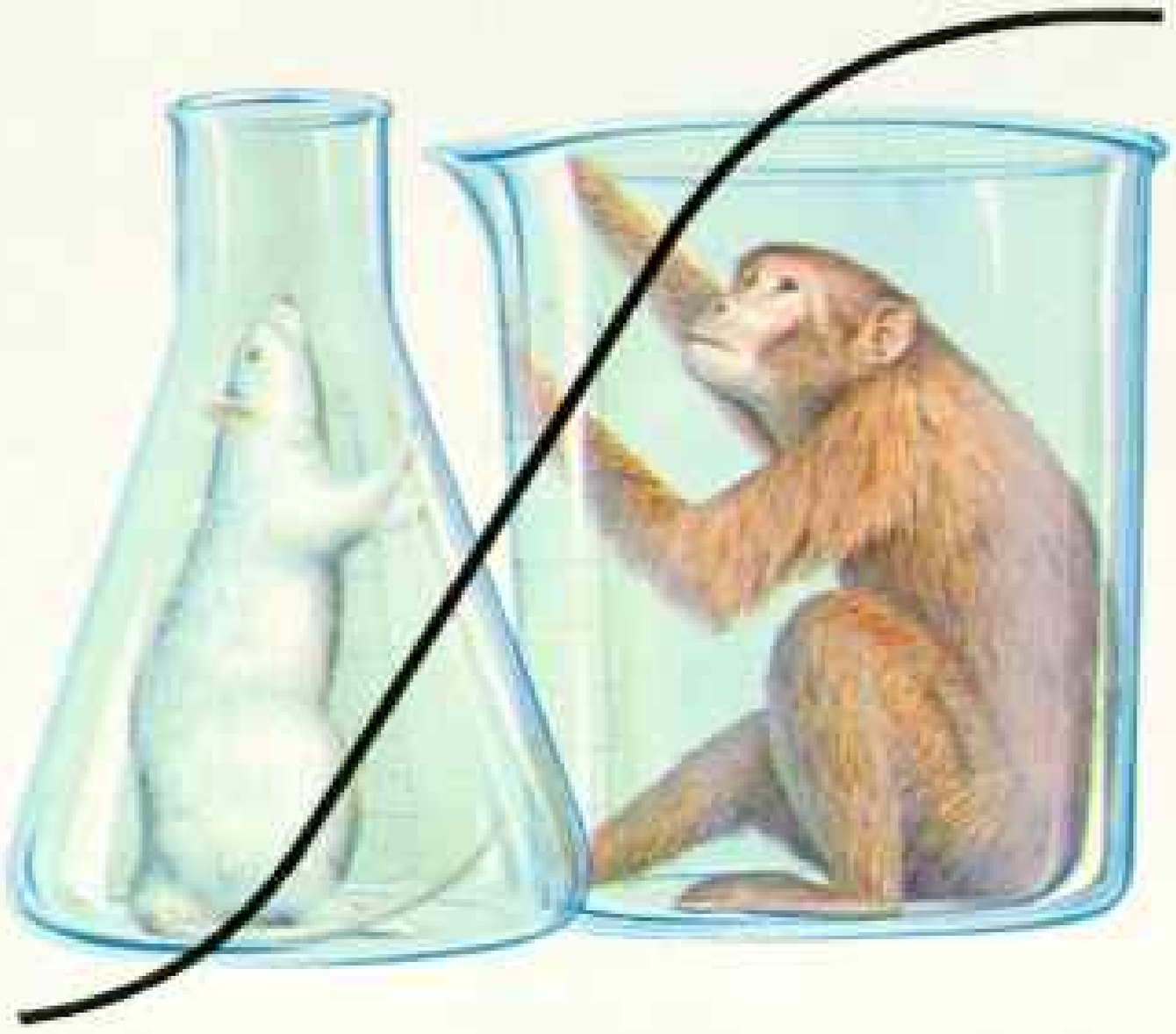
The biggest question turns on the hazards of "dioxin," specifically TCDD (even chemists find 2,3,7,8-*t*etra*c*hloro*d*ibenzopara-*d*ioxin unwieldy). The chemical reactions that produce silvex and 2,4,5-T unavoidably contaminate them with trace amounts of TCDD, the deadliest man-made molecule ever assembled. Minute doses of TCDD have injured or killed test animals, and some scientists believe that even a fraction of a part per trillion in the diet may, over time, harm humans.

An academic possibility, say defenders of 2,4,5-T. TCDD, they note, adheres to soil, does not move readily into plants, is all but insoluble in water, and breaks down in sunlight. For all that, TCDD has been detected in the fat of cattle grazing sprayed pastures and in fish from Vietnam, where jungles were defoliated with Agent Orange, a mixture of the herbicides 2,4-D and 2,4,5-T that contained extraordinary amounts of TCDD. Dow Chemical disputes these findings, but has itself discovered TCDD in fish downstream from its 2,4,5-T plant in Midland, Michigan.

DOW CONTENDS that the Michigan fish absorbed TCDD from the exhaust of local incinerators, and that *all* combustion produces TCDD—an assertion other scientists sharply reject.

Some scientists perceive a pattern in the kinds of birth defects among the children of

The testing controversy



SCIENTISTS often learn how pesticides and other chemicals may affect human health by experimenting with mice, rats, and monkeys. Because all mammals share similar genetic and metabolic mechanisms, scientists can observe a chemical's effect in rats and reasonably expect a like effect in humans.

Rodent studies may span three years and cost $500,000, although they typically involve only 400 test animals and 200 untreated controls. Since expense and time limit the number of test animals, they are dosed with chemicals in amounts far larger than those humans normally encounter.

If fifty rodents are fed a cancer-causing chemical at levels humans meet with, the chance of even one developing cancer is scant; depending on the chemical, 10,000 rodents might have to be tested to note a single cancer. That incidence seems trivial, yet in the American population of 220 million, that would mean 22,000 cancer cases. But testing 10,000 rodents to detect the danger is impractical. The alternative is to increase dosages, leading some of the public to think that anything in big enough doses will cause cancer. In fact, of 1,500 suspect chemicals, only a third have been evaluated; 60 percent of those produced cancer in test animals, and 26 are known to cause human cancer.

Animal tests indicate hazards, but cannot measure risk or predict human sensitivity to chemicals: Test animals, unlike humans, eat uniform diets, may be bred to have predictable rates of spontaneous disease, and usually are exposed to only one chemical.

But tests using animals do correlate degrees of chemical exposure and resulting toxic effects, a relationship classically shown as an S curve ***(above)****. Industry scientists argue that since lower doses produce fewer symptoms in animals, there must be exposure levels below which even the most toxic chemical is harmless; thus a ban on a cancer agent may be unnecessary. Other experts caution that such thresholds—if they exist at all—are likely to be so low that animal tests cannot pinpoint them.*

Most of the 63,000 chemicals in commerce have not been thoroughly tested in animals, but cheaper and faster methods using microbes are helping scientists catch up. One test, conceived by Dr. Bruce N. Ames of the University of California at Berkeley, checks the ability of compounds to mutate Salmonella typhimurium, *a food-poisoning bacterium.*

The Ames test indirectly measures a chemical's potential to cause cancer: 90 percent of known cancer-causing compounds also cause genetic mutations. Salmonella *genetically incapable of producing the amino acid histidine are incubated for 48 hours with the test chemical and ground rat liver. Nutrients, but not histidine, are added. If the test chemical mutates the* Salmonella, *some of the mutant bacteria manufacture histidine, multiply, and form colonies* ***(left)****.*

Though not infallible, the Ames test is a sensitive early-warning system. Testing of chemicals on one billion bacteria, rather than 400 rodents, reduces the chance that a hazard will go unnoticed. In 1975 the Ames test implicated peroxide hair dyes as cancer agents; in 1977 it did the same for Tris, a flame retardant then used in children's sleepwear. Later tests confirmed that both Tris and the dyes cause cancer in animals.

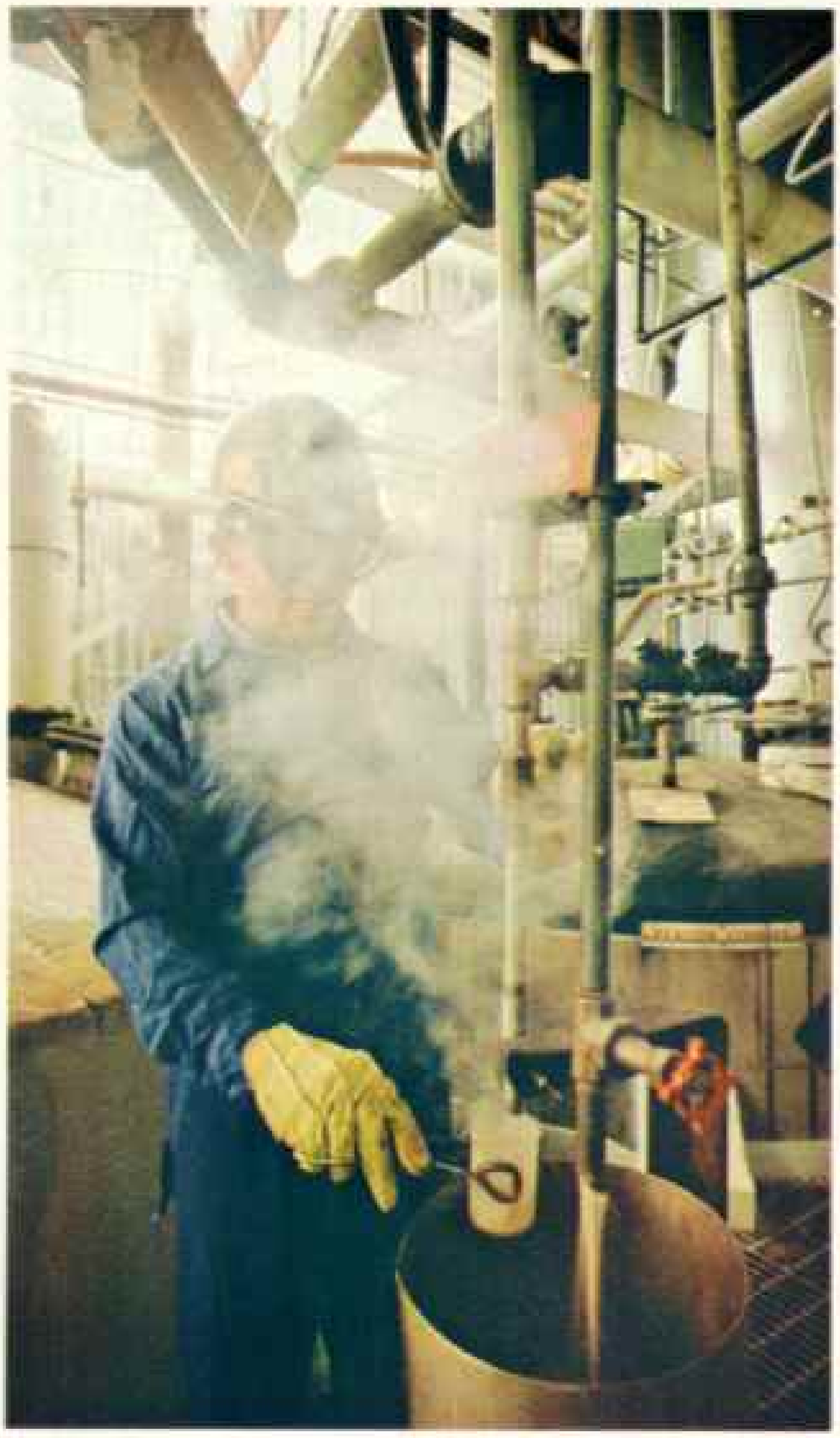

9
4
2

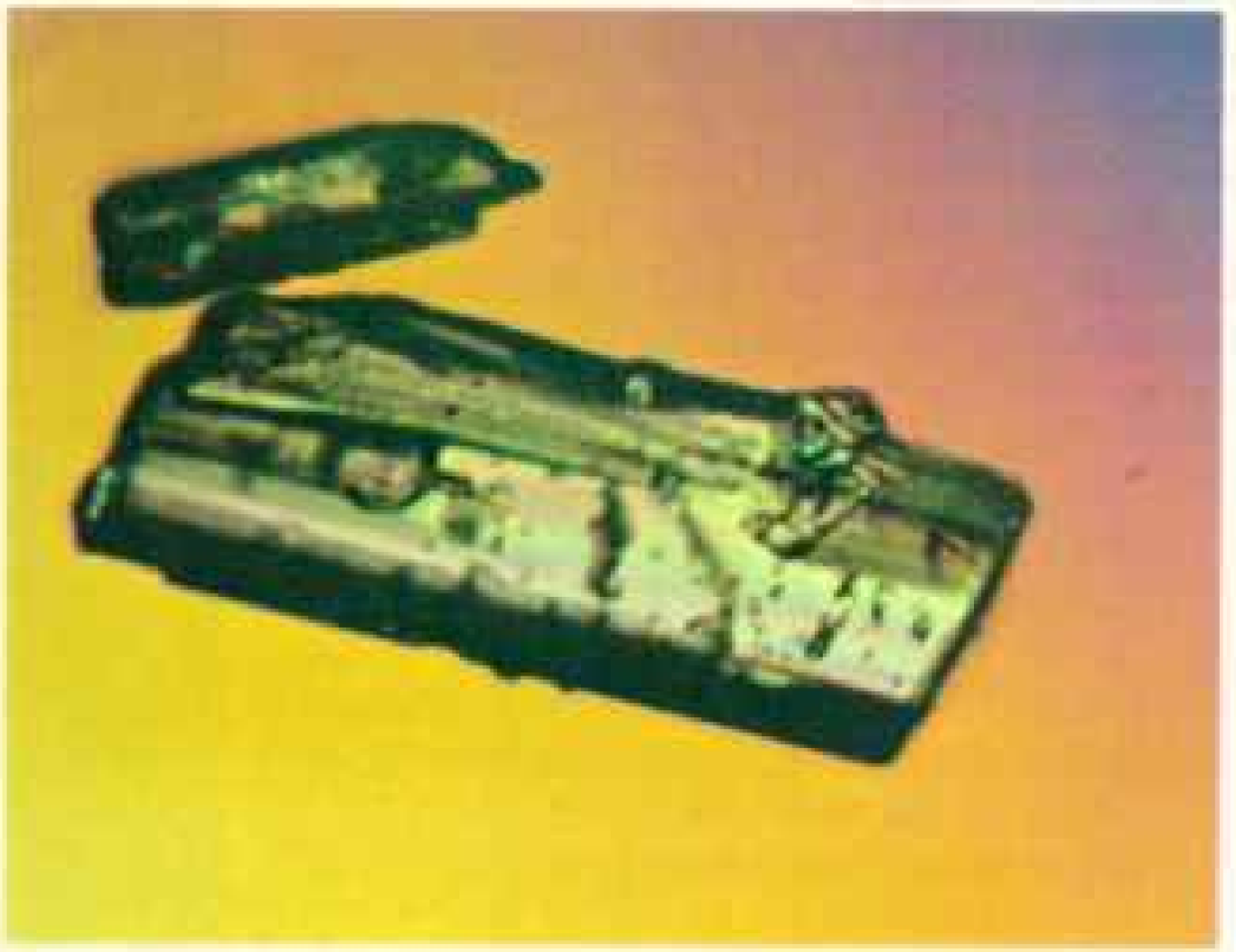
TCDD: the perilous by-product

*DEADLIEST of all man-made poisons, according to most scientists, TCDD—shorthand for 2,3,7,8-tetrachlorodibenzoparadioxin, frequently called simply dioxin—is the inevitable by-product of the manufacture of the herbicides 2,4,5-T and silvex. TCDD crystals, synthesized by Dow Chemical U.S.A., fleck a vial cradled in protective gloves (**left**). These 25 milligrams equal the amount in a ton of 2,4,5-T. Some of the crystals, here magnified 45 times (**lower right**), were given to the government for toxicological study. At Dow's Midland, Michigan, plant, 2,4,5-T samples drawn to assay TCDD levels (**right**) register between .02 and .03 parts per million—well below EPA's recommended limit of a tenth of a part per million.*

Is the TCDD in 2,4,5-T a true menace to human health? "There's good scientific basis for that concern; it's not something you can shrug off," says biochemist Dr. Matthew Meselson, who has detected traces in beef fat. As little as five parts per trillion (ppt) of TCDD in the diet caused tumors in rats. Five hundred ppt caused female monkeys to abort and die.

Though no one denies its toxicity to laboratory animals, TCDD's effect on human beings is hotly debated. Avows James H. Hanes, a vice president of Dow U.S.A., "There is not a single Dow scientist I know of who doesn't think that 2,4,5-T is one of the safest products we make."





Vietnamese farmers, American veterans, and families near Seveso, Italy, where in 1976 an exploding chemical plant broadcast TCDD by the pound. They interpret limited American and Italian studies and anecdotal reports from Vietnam as evidence that malformed fingers and toes are unusually common among these children, a conclusion not shared by most other experts. The Air Force plans to investigate the health of airmen who flew spray missions in Vietnam; other researchers are studying men who worked in now defunct 2,4,5-T plants in West Virginia and Arkansas.

Dr. Lewis Shadoff doubts they will find much. He is senior research specialist at Dow's analytical laboratory and showed me TCDD synthesized for research.

Wearing disposable plastic gloves, Dr. Shadoff gingerly held up a vial containing one one-thousandth of an ounce of crystalline TCDD (page 180). It looked like baking soda. It could probably kill 500 people.

"I may be one of only 15 people in the world," Dr. Shadoff said, "who have handled pure TCDD. It makes me nervous every time." After he had put away the vial, he peeled off his gloves, packed them in a carton, and sent it by courier to an incinerator to be burned at 1000°C.

Dr. Wilbur McNulty of the Oregon Regional Primate Research Center in Beaverton also respects TCDD. He knows what tiny doses can do to rhesus monkeys.

The effects are striking. Production of sperm cells, red and white blood cells, and thymocytes—cells that combat infection—stops. Pregnant monkeys abort; important, Dr. McNulty says, because monkeys and humans share the same ovulation cycle and hormonal phases. And at first their embryos develop at about the same rate. From his monkey studies, Dr. McNulty concludes that a teaspoon—or even less—of 2,4,5-T may be hazardous to women during some critical period in early pregnancy.

Dr. Matthew Meselson and colleagues at the Harvard Biological Laboratories are biochemists who have found TCDD in beef fat and Vietnamese fish. Mother's milk is also suspect. He believes TCDD may concentrate to dangerous levels in the body.

"Dow's Dr. Shadoff says it's excreted," Dr. Meselson told me. "But more important, is the damage it does cumulative? Can it be repaired? X rays pass through a person with the speed of light, but it's ridiculous to say that therefore there are no aftereffects. Each exposure works injury, and if TCDD acts similarly, it's cumulative. Genes don't

Suspicion dawned *in the mind of Bonnie Hill, here with daughter Cedra, when she and seven other women suffered 11 miscarriages following 2,4,5-T spraying of forests around Alsea, Oregon. Animal tests and the unusual miscarriage rate led EPA to suspend the herbicide in March 1979; a permanent ban awaits further study . . . and debate.*

forget, though the chemical may be gone."

Dr. Meselson also believes TCDD may cause miscarriages among women in forests sprayed with 2,4,5-T. "There may never be rigorous proof," he told me, "but it's entirely plausible. What it comes down to is whether society demands that scientists prove it causes miscarriages,or simply show that it *might* cause them."

WHAT IT COMES DOWN TO is, who carries the burden of proof in the pesticide dilemma? Must damage be done before a pesticide is indicted? Or must a company prove beyond all reasonable doubt that its products will not make the public unknowing guinea pigs, and the environment a laboratory?

Definite answers will be long in coming. Our ability to detect infinitesimal traces of pesticides in food, air, and water surpasses our understanding of how they may affect our bodies. A farm worker may develop cancer decades after exposure to a pesticide. Is the chemical at fault? Could the cancer have been prevented? At what cost?

I put my questions to Dr. Meselson, who told me, "It won't be like this forever; in fifty years, if we use our heads, our understanding will be greater and we'll be able to act more intelligently. But right now we have to do it the hard way." □

Tunisia:

By MIKE EDWARDS
Photographs by DAVID ALAN HARVEY
BOTH NATIONAL GEOGRAPHIC STAFF

KASSERINE PASS ON A DAY of cold and rain. Water forming pools on the flat ground where the road runs, low clouds hanging on the ribs of Jebel Chambi.

Kasserine Pass as it was in February 1943, and the thought in my mind sticks like the mud on my boots: so many invaders. History in Tunisia is a catalog of conquest, of the rise and fall of Carthage, Rome, and Byzantium, of the coming of the Vandals, Arabs, Ottoman Turks, the French.

And then the Americans. They are still remembered: the soldiers with so much equipment, and chewing gum to swap for eggs.

For Thibab Ben Ammar the war that brought GIs had no meaning. "Not a war of Tunisian people," Thibab said, pulling the wool of his jellaba tight against the cold. Planes screaming overhead, tanks churning the mud, and soldiers—all foreign.

The Frenchman who owned the farm where Thibab worked, hard by the southern end of the pass, fled before the battle. He instructed Thibab to stay and care for the livestock. "So I stayed," Thibab said.

German generals came wanting food. Thibab killed a lamb. Courteous men, they offered to pay. Was one of the officers the Desert Fox, Field Marshal Erwin Rommel? Thibab resists this bit of fame; he says he isn't sure.

A gentle notch in west-central Tunisia beneath Tunisia's highest mountain, 1,544-meter (5,066 feet) Jebel Chambi, the pass in February 1943 seemed to hold in balance the Allied forces' first major overland offensive of World War II.

Landing in Morocco and Algeria the previous November, American and British soldiers drove into northern Tunisia while other British forces were pressing the Germans and Italians from the southeast. To block this closing vise, Rommel determined to give the Americans "an inferiority complex of no mean order." He struck on February 14, sowing fear among the green troops and confusion among their commanders.

Retreating eighty kilometers, the Americans formed a line at Kasserine with odd units and stragglers. The troops facing Afrika Korps veterans included engineers more at home in dump trucks than foxholes. "Pull a Stonewall Jackson," a colonel was ordered. He did, for a day. The next day German infantry climbed the mountains while tanks lumbered forward. Again the Americans retreated.

But the pickup defense bought time. Hastily collected artillery discouraged Rommel from attempting a breakthrough that might have chased the Americans out.

Ahmed Djelidi still marvels at the motor he salvaged from a truck. "A GMC," he said. "I put it in a bus and it ran five years." In his automobile repair shop, commandeered by GI mechanics, a souvenir of World War II remains. It is some sergeant's order, painted on a wall: HANDS OFF TOOLS.

Tunisia is a bent spike of land, head on the Mediterranean, point buried in Sahara sand, not quite Missouri size. (See the double supplement map, **Africa and Its Political Development**, included with this issue.) Little remains from World War II, but those earlier invaders left a treasury unmatched in North Africa. I think of Dougga and Sbeitla, temple-crowned Punic and Roman towns.

The sweetest of gushers *to a Tunisian farmer is well water lifted to his fields by a pump he bought with a government loan. With little cash from crude oil, Tunisia's development relies in large part on agriculture, irrigated since Roman times by the resource that may run dry at times but will never completely run out.*

Sea, Sand, Success

Built for bloodletting, the coliseum at El Jem (Roman Thysdrus) is somewhat

smaller than Rome's. Although looted for stone, it is as well preserved.

Of the labyrinthine medina of Tunis, built by Arabs, embellished by Turks, later flanked by architecture that has the look of Marseille. Of mountaintop villages that harbor a few Berbers, the people who possessed Tunisia before any others.* And I think of Carthage—Phoenician first, then Roman.

Who are the six million Tunisians heir to this many-branched legacy? Businessmen in Tunis usually speak French. In the south, skin shading from bronze to jet recalls a trade in human beings from sub-Sahara. But for me, the decisive answer comes on a plain in Tunisia's midsection.

A Long Climb for a Lofty Purpose

He is a bony man of more than 60 years, and the 101 steps to the minaret's parapet seem almost beyond his strength. Again and again he stops for breath. "I don't do this for the money," he says.

From the parapet I look out on Kairouan, Islam's revered city in North Africa; only Mecca, Medina, and Jerusalem rank higher. Removed from the crowded suqs, I sense—can almost touch—the peace radiating from the spires and domes of shrines.

Now Hajji Ammar Baccar is ready. Summoning a voice far younger than his body, he becomes that which he has been five times a day for thirty years, Allah's messenger.

"*Allah akbar*—God is most great!" The call to prayer floats over the city. He listens to the echo and gives me a look that says, "Not bad for an old man, eh?"

Islam reached Tunisia in 670, only 38 years after the death of the Prophet, and Kairouan became its bastion. I was once inside the prayer room of Kairouan's great mosque, now closed to non-Muslims. Too many tourists came—too many wearing shorts and smoking where they shouldn't.

Nine thousand worshipers have knelt at once there. Sparrows flutter among the heavy iron chandeliers, finding their own tranquillity in this great cool room.

The roof is supported by 288 columns of marble, granite, and porphyry, in as many shades as one can imagine. Many of these columns adorned temples to Roman gods, perhaps to others as well. The mosque's builders gathered them and brought them to

*Carla Hunt described a Moroccan Berber festival in last month's NATIONAL GEOGRAPHIC.

Just married, *an elaborately gowned bride receives her friends as she sits alone and motionless by custom (**right**).*

*As the reception in a Tunis hotel warms up, a guest (**below**) dances without inhibition or partner, since the men keep to themselves.*

By law, and increasingly in practice, women in Tunisia are no longer routinely sequestered and dominated. Now that many have been educated, they are moving into trades, the professions, and even political office.

Kairouan. This great edifice is much like Tunisia's gene pool: of many origins but, in sum, Arab.

There are Arabs and Arabs. "I may fast at Ramadan this year," a young Tunisian said while sipping a beer. Tunisia is often influenced by those other gene streams. She absorbs the good and bad of the West more readily than some of the Arab states to which she feels kin. It is ironic that the Arab League chose Tunis last year when, ostracizing Egypt because of the peace treaty with Israel, it withdrew its headquarters from Cairo. Far from being the league's most resolute member, Tunisia outraged other Arab states by saying as early as 15 years ago that they might as well acknowledge Israel's existence.

Tourists Oil Tunisia's Economy

In the coin of resurgent Arab influence Tunisia is painfully deficient. Gushers to the east: Libya, 750 million barrels of petroleum a year. Gushers to the west: Algeria, 460 million barrels. Between, an anemic 38 million. Oil companies prospecting in Tunisia usually go home poorer and puzzled. The six producing fields pay only 14 percent of the government's expenses.

An Allied soldier returning to the Tunis he liberated in May 1943 would recognize many buildings on the main street; Tunisia can't afford flashy redevelopment. While other Arab states pour millions into investments abroad (including tourist hotels in Tunisia), Tunisia offers foreign manufacturers tax breaks. She needs jobs. Using what she has—antiquities and beaches—she earns as much from tourists as from oil.

Yet in the 24 years since she became independent from France, Tunisia has made a record of economic and social progress that most of the developing world envies.

All those cars jamming the streets of Tunis and all those serviceable—seldom fancy—apartment high rises making new

Peace seems perpetual *at the huddled village of Takrouna, but in April 1943 it was an outpost of hell as New Zealanders met fierce German resistance here. Yet within a month the Allies had secured Tunisia and were preparing to assault Sicily.*

skylines on the capital's outskirts attest to her growing middle class of shopkeepers, bureaucrats, teachers.

Consider also Bir Thlethine, far down in the southeast, on a road beelining for the Sahara. This village is as plain as its name. Bir Thlethine—Well Thirty. Houses shaped like cubes and loaves cringe under the sun. Two eucalyptuses struggle in the dust.

Beauty wasn't important to Ahmed Dababi. He came to Well Thirty a year ago to change his life. Ahmed was wise in the ways of animals, and he knew the country. To give up the life of a nomad, the life of every forebear Ahmed knows about, was no easy decision. He discussed it with his wife, his widowed mother, his brother, other nomads. At last he sold his sheep, goats, and camels and made a down payment on a house offered by a government agency.

We sat on grass mats in one of the two rooms, sipping thick coffee. "It is a nice house, is it not?" Ahmed's brushy mustache twitched, anticipating my approval.

In the 1960s the government put a pump in the well and added a storage tank. The word went out to nomads: Come here and find a future. There is water, we will give you a little land, there will be a school.

Ahmed still misses the wandering life—"I enjoyed the freedom, the adventure"—but Well Thirty has what he wants now. Especially that school, three rooms crowded with children writing sums on slates. "I had no education," he said. "But I want my sons to go as far as they can. My oldest is only in the first grade, but he reads and writes." For Ahmed, Well Thirty is beautiful indeed.

Since gaining independence, Tunisia has plowed 30 to 40 percent of her budget into education, year after year. Thirty thousand students study free at the University of Tunis and other higher institutions, including three medical schools. In the farthest reaches, in sand-swept villages less inviting even than Well Thirty, the daily sight is the same: children walking with book bags.

I went one afternoon to a secondary school where advanced students, forty boys and girls, talked about their career aspirations in passable English—after Arabic and French, an important third language for a country that looks westward as well as eastward. Engineer . . . agronomist . . . teacher . . . pilot. They had a sky-is-the-limit confidence. "Football player," one said, admitting, "I'm quite good."

I asked a question that touched off nervous murmuring—because of embarrassment, I suppose. How many of their mothers went to school? Finally one hand was raised. "My mother, for a few months." The girl who said this wants to be a biologist.

Before independence, tradition assigned women no role outside the family. Nor were there many opportunities for men. In 1956 Tunisia had only five men qualified to teach mathematics.

After School, a Hard Lesson Learned

In some fields the drive for education succeeded too well. "They told me that if I got an education I would have a job," said a bitter man in his 20s. The villainous "they" was undefined beyond being the educational system. He pursued a literary course at the university, then *really* learned something: that in a small developing nation (and one without big oil) only so many nonscientific jobs provide the middle-class status to which he felt entitled. Meeting friends in cafés for mint tea or *express* or *moitié-moitié*—half coffee, half cream—he joined the 15 percent or so who are unemployed.

That isn't a bad rate among developing nations. It would be worse if thousands had not gone abroad to work.

Having little experience with scientific applications, or even with plumbing, it was natural for Tunisians to pursue the liberal arts—with the result that today there are enough language scholars, lawyers, and social scientists to last until 1990, while any man with technical skill can take his pick of jobs. The message already had gotten through to some of the students in the secondary school I visited.

That school stands on a hill a few miles from Sousse (a Phoenician town, then a Roman town) on the eastern seaboard. Tunisia is in effect a two-coast country, with a northern shore looking toward France and Italy and, rounding Cape Bon, a long beach facing the sunrise.

South from Sousse on the sunrise side, I spent part of a day with Mohamed Nuri, a man having an affair with sulfuric acid. "It always *(Continued on page 197)*

TUNISIA

THIRTY CENTURIES AGO Phoenicians were the first to establish colonies on the coast of a land inhabited by a people who would later be called Berbers. Among those outposts Carthage grew to a rich and powerful city-state that traded with, then threatened, Rome.

"*Delenda est Carthago*—Carthage must be destroyed," was the unflinching aim of the Roman statesman Cato. And, despite the brilliant victories of Hannibal, it was destroyed in 146 B.C. Utterly. The conquering Romans built and rebuilt and improved the water supply with aqueducts, one of which is still in use.

In time and in turn others came to control the land: Vandals, Byzantines, Arabs, Turks, and French. Not until 1957 was the Republic of Tunisia proclaimed under the leadership of Habib Bourguiba, who has since been made president for life. With traditions from both the Islamic and European worlds, Tunisia has followed a nonaligned foreign policy friendly to the West, while concentrating on social and economic development. As with other developing countries, population has grown faster than jobs; many Tunisians work abroad, primarily in France and Libya.

AREA: 164,200 sq km (63,400 sq mi). **POPULATION:** 6,000,000. **LANGUAGES:** Arabic, French. **RELIGION:** 98% Muslim. **ECONOMY:** Agriculture, tourism, textiles, phosphate, fishing, modest petroleum reserves and processing. **MAJOR CITY:** Tunis, capital, pop. 1,000,000. **CLIMATE:** Temperate in the north; hot, almost wholly arid desert in the south.

***"We don't always agree** on a design project," says architect Farouk Ben Miled of his collaboration with his wife, interior designer Jelila **(above)**. But, he continues, "That makes the final product all the more interesting." Along the stall-lined main avenue of Tunis **(right)**, buildings reflect the kind of European influence the Ben Mileds hope will be replaced by something more intrinsically Tunisian.*

fascinated me," he said, making the reagent sound wonderful and mysterious. "When I studied chemistry, I loved to experiment with it. It is so complex . . . it demands so much intelligence to handle."

Gabes, where I met him, was dozing under its date palms when Tunisia committed more than one billion dollars there—much of it borrowed money. Two chemical plants convert phosphate, one of the few riches of the niggardly Tunisian earth, into fertilizer and other products. The process requires huge quantities of sulfuric acid. Mohamed Nuri is in heaven. And, as foreman of acid production, he earns $750 a month, nearly ten times the per capita average.

Gabes booms with 5,000 industrial jobs and the promise of more chemical plants. Where will more skilled workers be found? In the new Gabes engineering college and technical school.

Coliseum Recalls Roman Occupation

Go south as far as Gabes, and you get into sand and stubble. Only Tunisia's north is reliably watered. Cape Bon's orchards hang heavy with oranges, and the wheat harvest in the northwest is generous. In the midsection winter downpours gash the land—as at Kasserine—but in summer the fields bake.

Yet some who possessed Tunisia lived well. An hour's drive south of Sousse took me to El Jem—Thysdrus to the Romans. Here archaeologists have uncovered mosaic floors decorated with designs that testify to high good times: wine, women, sport.

And gore. Observe that poor man being prodded at spearpoint toward a leopard. The beast already has drawn blood; tiny red stones trail from the wounds.

One of the largest in the Roman world, seating 35,000, the Thysdrus coliseum survives in the center of El Jem, towering over everything except a minaret (pages 186-7).

A block brigade *fuels construction of an apartment building in El Kef* ***(left, above)****. With a chronic housing shortage and crowded conditions, Tunisia has given priority to multiple-unit dwellings.*

Tourism has increased demand for hotels. One of the newest in Tunis is the Hotel du Lac ***(left)****, spreading upward and outward like a ziggurat turned upside down.*

I went inside and sat on marble slabs where proconsuls applauded death. I descended into dungeons where men and beasts were penned until their rendezvous. The place puts goose bumps on Episcopalian skin.

When autumn comes, eight presses in El Jem begin extracting oil from olives. That old, old enterprise helps explain Thysdrus's good times. This provincial Sin City got fat sending oil to Rome.

Oil—*that* oil—is still exported. From El Jem south to Gabes the country seems solid olive: long rows of globular, silver green canopies on stubby, gnarled trunks. Some Tunisians own thousands of trees; others, a handful. In past years a man saved his money to buy one tree . . . and then another.

Some people say trees planted by the Romans 18 centuries ago still bear fruit. So I put a question to Ltaief Agrebi, owner of forty trees: How long can an olive tree live? An intense discussion began, ballooning to include Mr. Agrebi's son, a cousin, a visitor, and a neighbor who came by on his motorbike. "One hundred fifty years." "Two hundred if it gets water." "Oh, much longer."

Mr. Agrebi's trees were planted by his grandfather. He said they surely will be

To hear the sirens' song and live, *Ulysses had himself lashed to the mast. This third-century mosaic* ***(right)*** *is part of a collection at the Bardo Museum in Tunis* ***(above)****. St. Augustine, a Ulysses of the spirit, studied in Carthage and eventually served as a bishop in North Africa.*

there to benefit his grandsons—as much of a lifespan as seemed important.

Some of the Thysdrus building stones may have been carted seventy kilometers to Kairouan. But the Tunisian city that suffered most from borrowing was the greatest in North Africa. "The walls especially were robbed," said Dr. John Humphrey, leader of a University of Michigan archaeological team at Carthage. He stood beside an excavation that was checkerboarded with mosaic pavements and laced with trenches. "What the archaeologist gets," he said, "is this: islands of surface that were floors, and trenches where stone walls once were."

Carthage: Qart Hadasht, New City. Princess Elissa of Tyre, tradition holds, led a band of Phoenicians to this place in 814 B.C. Dominating the western Mediterranean, Carthage grew wealthy, her merchants trading afar.

Rome also grew in influence. Two Mediterranean superpowers became one too many. Hannibal led 59,000 soldiers and 37 elephants across the Alps, defeated Rome in three battles, and would have greatly changed European history had he not lost the fourth. In 146 B.C. Rome destroyed her


5 0
4 5

rival, pronouncing a curse on the city and ceremonially plowing the earth it stood on.

But a century later the Romans returned, and Carthage flourished once more, chief city of the north African province, Rome's breadbasket. Carthage was lost to the Vandals in A.D. 439, then taken by Rome's successor, the Byzantine Empire, and abandoned after the arrival of the Arabs.

Superpower City Survives as Suburb

But Carthage lives—as a Tunis suburb. Behind Dr. Humphrey's excavation a commuter train tooted. On one side a supermarket's lot was full of cars.

With the conservator of Carthage, Abdelmajid Ennabli, a slender, intense man with tufts of hair that take flight in a breeze, I stood atop the Carthage museum and looked out on a scene of great beauty. Carthage is a wealthy suburb, sprinkled with villas. Under those houses lies the past. Mr. Ennabli can be forgiven for not seeing the beauty.

Construction is officially banned in much of Carthage; the government intends to create an archaeological park on land that remains vacant. But right beside the museum a new house was going up. "We are doing everything in our power to stop additional construction," Mr. Ennabli said.

Even though some people manage to break the rules, he is sure that Carthage will become the great treasure it should be. In recent years, 13 archaeological teams have spaded, scraped, and sifted, helping to reveal the dimensions of that treasure.

Considering its fame and influence, Carthage has been a puzzle. Its visible Roman sites included a great bath complex and amphitheater. The principal Phoenician discovery was the Tophet, a ceremonial site that yielded a sad trove: the tiny charred bones of children sacrificed to the goddess Tanit and her consort, Baal Hammon.

What did the Phoenician city look like? Beneath four meters of rubble a West German team found an orderly rectangular street grid and evidence of grand villas.

Christians were martyred in Carthage in the early period of the Roman presence, but Christianity subsequently caught on and flourished. The excavation where I met Dr. Humphrey had disclosed a church, probably built early in the fifth century. "A very important church, I think," said Dr. Humphrey. "The marble used for its decoration came from Italy, Turkey, and Greece, as well as from other parts of North Africa."

Tons of ancient Carthage are today in Tunis. Walk through a keyhole doorway in the old city, the medina, and you may find Carthaginian columns supporting an arch.

Tunis long ago outgrew its original walled city. After the French claimed Tunisia as a protectorate in 1883, many new buildings went up beyond the strained confines. But the medina endures, a honeycomb of narrow passageways, a conservative bastion where women still modestly pull their billowy

***To sum up** social progress under Habib Bourguiba, here returning from medical treatment abroad **(above)**, two factors weigh heavily: education and women's rights. At a village whose name means Well Thirty, the son of a former nomad **(facing page)** has done his calculations correctly and builds his chances for a life beyond camels and goats.*

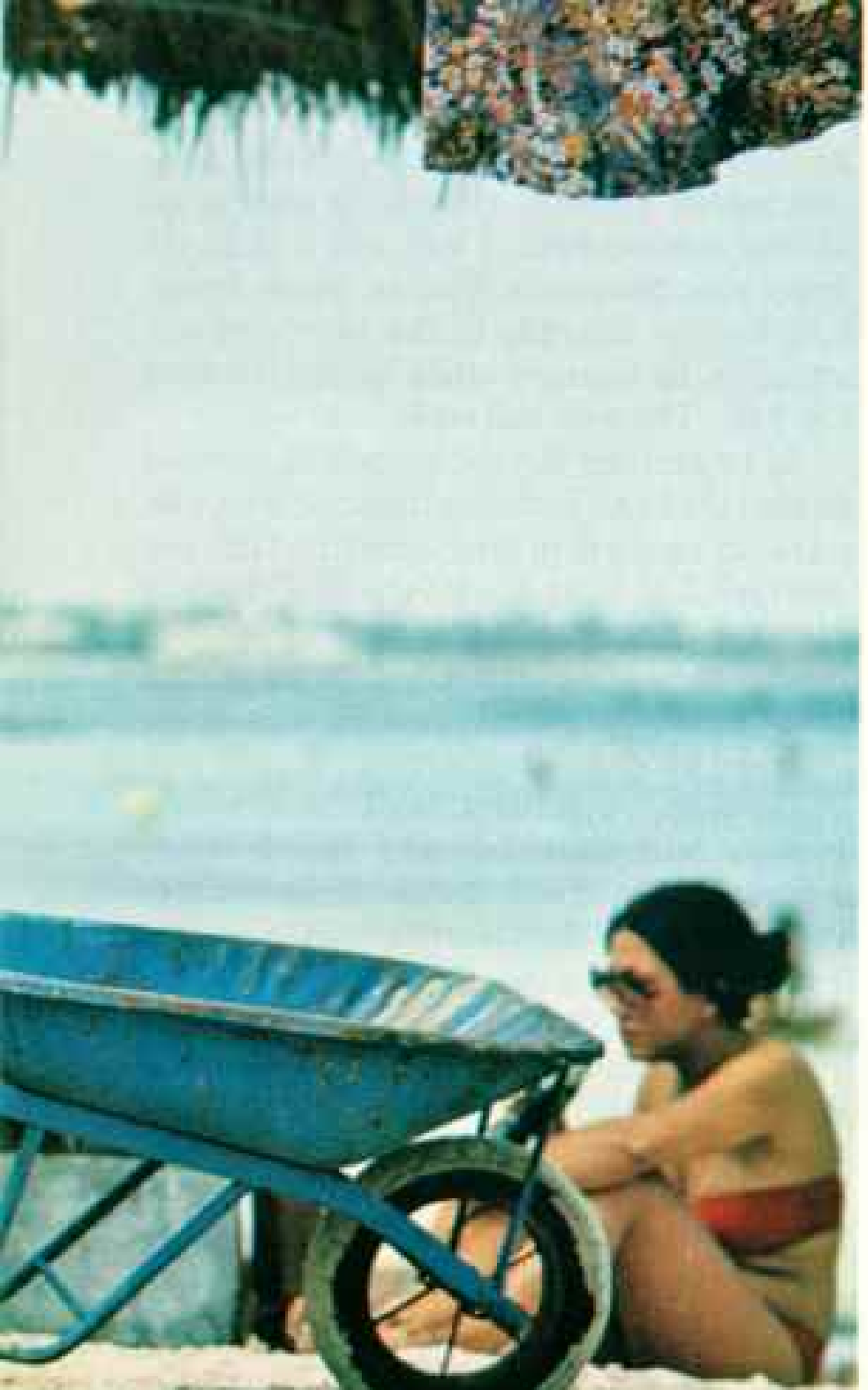
Skyscraping flamingos flock to the Lake of Tunis, a shallow and

noisome lagoon connected to the Mediterranean by a man-made channel.

More than veils *are lowered at beaches along the coast and on Jerba Island* ***(above)****, where European tourists swarm to the sun at still reasonable prices.*

At beaches frequented by Tunisians ***(right)****, a higher level of modesty is maintained.*

Most visitors come on group package plans and not only fill the sands but also rumble across the countryside in huge buses to view antiquities and village life. Tourism is an important source of hard currency; Germans, French, and English have been arriving in increasing numbers.



white *sefsaris* close against their faces.

"Rose water," a shopkeeper in a green jellaba said, touching my hand with the glass stopper of a bottle. "Jasmine," and he touched my other hand. "It is said that someone in my business has no problems with the blood. The scents take care of germs."

Abderrazak Ben Rachid has spent most of his 78 years in the Suq el-Attarine, the Perfume Market. His family has been there for five centuries.

On other streets, bright cloth, carpets, stacks of red pillbox headgear: big tarbooshes, half-size chechias.

Tunisians Bank On Family Jewels

And the jewelry market sparkles. Though for a couple of morning hours the action is not in the shiny shops but outside.

Everyone seemed nervous there. Women peered anxiously from behind their drawn curtains. A slump-shouldered little man went through the crowd with a tray. He held up a heavy gold necklace. "Four dinars one hundred millimes!" The price had been bid up to $10.25 a gram. (That price has since more than doubled.)

For many Tunisians, banks are still a novelty. The heavy earrings adorning rural women may represent family savings. The jewelry auction is a way for poor people to evade a big middleman's profit.

"That necklace belongs to my sister-in-law," a grizzled man named Ahmed said. The woman near him clutched her sefsari closer. "My brother bought a boat," Ahmed continued. "Now he needs nets. The necklace is worth at least five dinars a gram."

But not today. Ahmed's eyes begged the crowd, but the bid did not go higher.

Only 270 hectares (667 acres), the medina is jammed. Cubbyhole factories turn out furniture, cloth, clothing. There are 11 public baths. Antiquarians count 700 buildings of national import, including 140 palaces. Most of these were built by families that attended the Turkish beys who ruled Tunisia beginning in the 16th century. The palaces are lavish with exquisite tiles and delicate filigree. Some of them, anyway.

Where 100,000 once lived, there are today 140,000. Many once lovely buildings have been rented, one family to one room. Leaving a friend's tasteful fifth-floor apartment, I

came on a woman cooking on a charcoal brazier in the ground floor's central hall.

I left the medina and drove to the Tunis airport, where the faithful of the Constitutional Socialist Party had been waiting for two hours. Farm workers milled in the terminal, trailing banners. Ministers and party officials waited in a lounge. Soldiers fidgeted in ranks beside a block-long red carpet.

At last, the plane. It brought a short man who descended the ramp slowly. There was no sign of the broad flashing grin that once galvanized Tunisian crowds. It used to go on like a searchlight. I had seen it flash six years ago. Meeting a woman whose father had been a comrade in the independence struggle, he beamed while gently stroking her hair. The man had style.

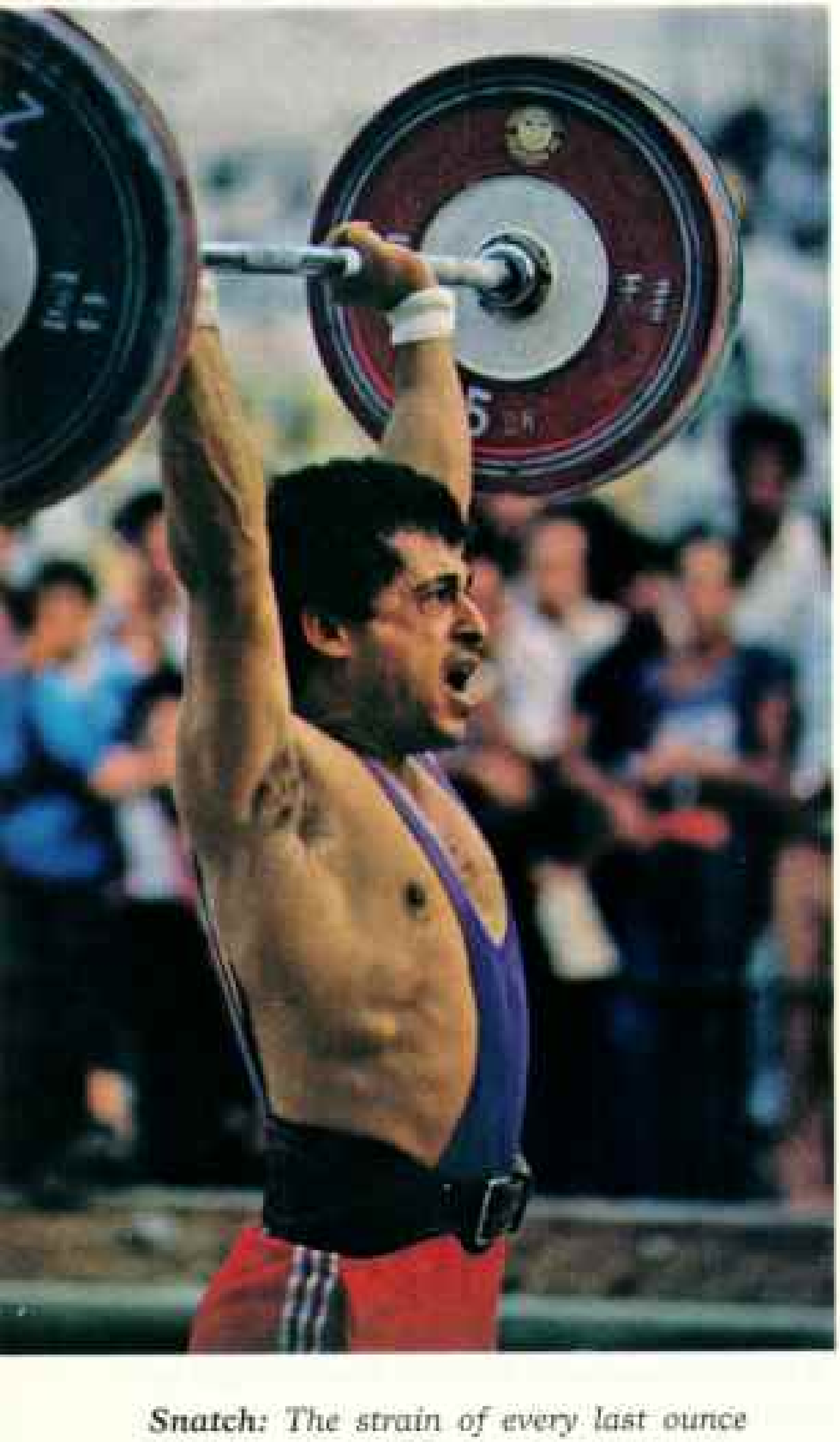
As he reached the red carpet, he seemed to hear the band's stirring music, the repeated rhyming chant of the spectators: "*Vah yea Bourgui-BA!* Long live Bourguiba!" Pulling his body straight, he strutted, saluted, bowed to his flag. For a few moments the great grin was back. Then he was gone, whisked away to his palace.

"Tunisia," a student said, "is a young country with an old heart." Habib Bourguiba, leader of the independence movement, leader of the Constitutional Socialist Party (the only party), first president of Tunisia, and president for life since 1974, is 76 years old. Seldom is he seen in public these days except as I saw him, as he returned from yet another trip abroad for medical attention (page 201).

Bourguiba became a nationalist in the 1930s, knowing both exile and jail. When France let Tunisia go in 1956, after a time of strife and agitation, he went among his people, infecting them with enthusiasm for hard work and change. Send your children to school. Let your women find a role in society. He ridiculed tradition with a story about a bride who was locked in a cellar by her family and fed only pasta so she would be light skinned and plump on her wedding day. He condemned the sefsari. He tackled the Ramadan fast as wasteful of strength—one battle he lost. It was a great performance; its intensity may have contributed to the insomnia he suffers today.

His government leaned upon France for help, especially for teachers. Others also helped. The United States has given or lent 900 million dollars, seeing Tunisia through droughts with food, helping build the airport where I saw Bourguiba land, building part of the university. West Germany contributed dams, Bulgaria a sports center. Chinese acupuncturists cured my friend Yusef's sciatica.

"I admire most of Bourguiba's policies," a man of middle years said. "I just wish he had more respect for human rights." This man



Snatch: *The strain of every last ounce shows in the face of a weight lifter demonstrating his skills in Tunis. Sports are stressed in youth development, and in 1968 Mohamed Gammoudi reached the pinnacle with a gold medal in the 5,000-meter run at the Mexico City Olympics.*

had spent 2½ years in prison, accused (wrongly, he says) of anti-Bourguiba plotting. He now holds a government job. "But in politics I must remain neutral."

Hundreds have gone to jail—anyone, it seems, who threatened the status quo. The partisan view is that a secure regime, rare in the Third World, made possible Tunisia's assault on backwardness. When a general strike erupted in rioting and looting in January 1978, the government opened fire. You can take your pick of tolls: 40 to 400 dead.

Power has been closely held in the Constitutional Socialist Party, and some say the party is stagnant. As editor of two small reformist newspapers, Hassib Ben Ammar has found himself in court time after time, accused of defaming the president, the army, the national assembly. "Tunisians were mature enough to get independence," he said to me. "Why aren't they mature enough to have free expression?"

In Defense of the One-party System

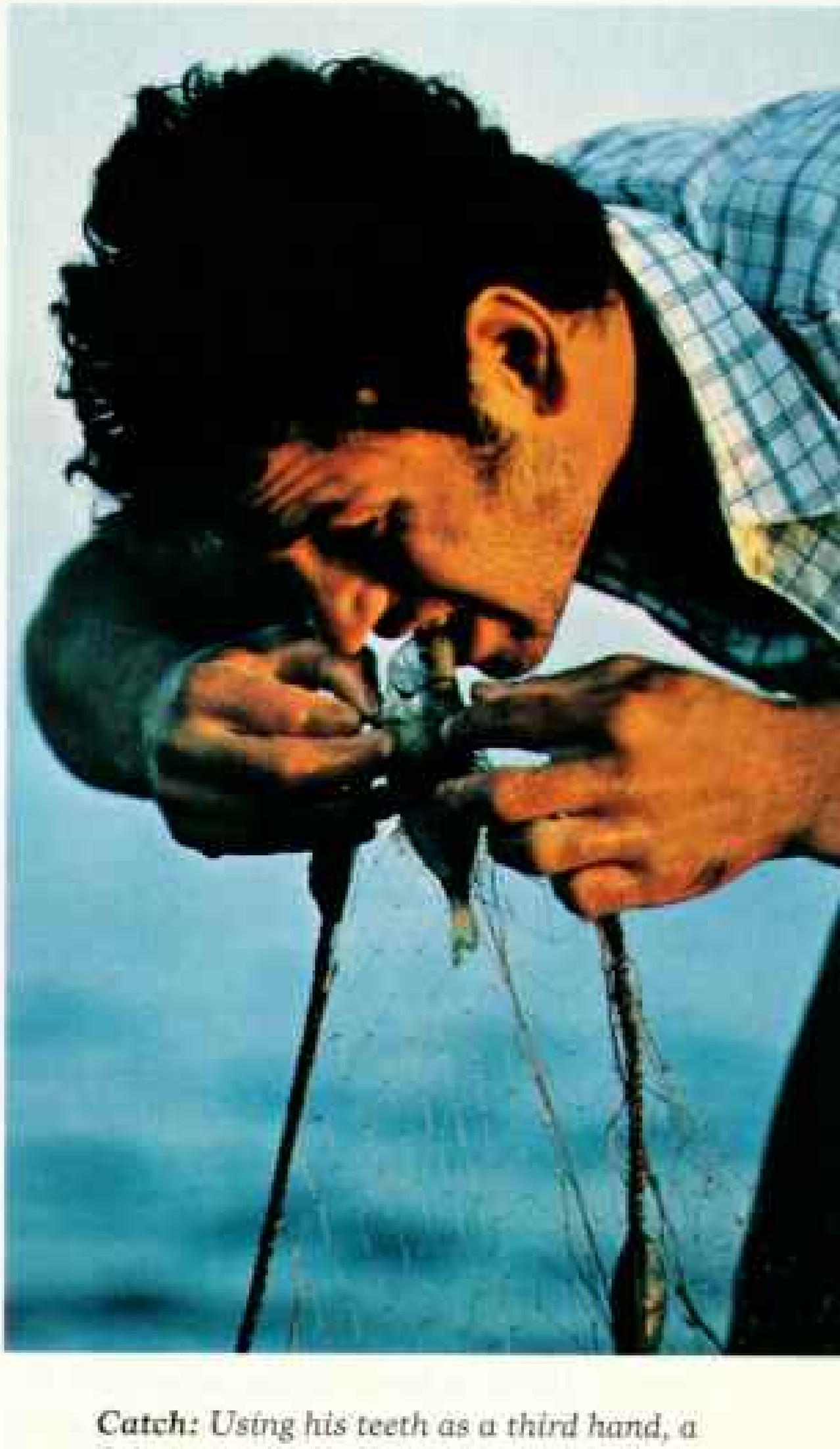
Day-to-day government business is in the hands of Prime Minister Hedi Nouira, who, like Bourguiba, was jailed by the French. He seemed stiff in an interview I had with him in the old bey's palace in the casbah, the seat of government, on a hill that commands the medina. What Mr. Nouira may lack in old-style Bourguiba charisma, he compensates for as an administrator.

There are accomplishments to be proud of in Tunisia, and Mr. Nouira spoke of them: a fifth of the population in school, a low inflation rate, per capita income growth of nearly 9 percent a year. "That growth," he reminded me, "places Tunisia among the top six nations of the developing world, ahead of some of the oil countries."

I asked if the government would someday permit other political parties. "Our priority is the creation of jobs," he answered. "Does one prefer to debate the future of the world or create jobs to feed the population and respond to its needs?"

Nevertheless, a window opened in Tunisia last fall. The party—which is to say, the government—decided that voters would have a choice in elections. In 1974 the candidates for the national assembly ran without opposition. In elections last November, at least two candidates sought each of the 121 assembly seats. All were under the Constitutional Socialist banner, but in philosophy they ranged from standpat conservative to liberal. Some Tunisians think a choice of more than one party cannot be far away.

From Tunis I traveled down the sunrise coast to the island of Jerba, where the word "group" means about three busloads . . . three busloads of tourists headed for the hotel where you hoped to spend the night. You'll be lucky to have a room.



Catch: *Using his teeth as a third hand, a fisherman removes his prize from a gill net to help supply fish for the domestic market. Commercial fishing in the Mediterranean for sardines and tuna, which has steadily expanded in recent years, finds a market in Europe.*

A farm boy in no hurry allows his donkey to browse on wild poppies

"Are you part of the group?" the desk clerk inquires. He seems puzzled if you aren't. Go to a hotel dining room and the waiter asks to see your group identification card. No card, no meal in this restaurant; it is reserved for "the group."

Most of the 1.3 million vacationers who chose Tunisia last year came on all-inclusive group tours. Jet after jet brought sun-worshiping French, Germans, Scandinavians, English, and Italians.

During Easter week, hotels in the oasis cities of Nefta and Tozeur were packed with Europeans who splashed in swimming pools three hours after boarding planes in chilly Paris and Frankfurt. Italian motorcyclists tramped around Gafsa in shiny imitation leather, taking a break from a trans-Sahara ride. In the town of Kasserine, fifty French septuagenarians filed into the Hotel Cillium late at night after a long bus trip. Kasserine is on no "must" itinerary; few come to see the

as they shamble along toward field work near Kairouan, a city holy to Muslims.

pass, and Kasserine's Roman ruins can't match, say, Sbeitla's. I suspect these tourists stopped at the Cillium because no other hotel in a hundred miles had room. Such is the success of tourism in Tunisia.

On Jerba I stayed in Africa's largest hotel, the 2,450-bed Dar Jerba. It also is one of Tunisia's handsomest, low and spreading, tastefully confected of arches and domes.

I wish the Dar Jerba did not run out of orange juice at breakfast and cold beer at lunch. But when one walks on the dazzling beach, wades into the Mediterranean, and observes the beach attire—usually monokini, occasionally nokini—vitamin C seems less important, and who minds hot beer?

Tunisians are confused about their free-spirited visitors. Many, I think, do not perceive the distinction between the shedding of inhibitions at the beach and the demands of decorum elsewhere. I've seen Tunisian shopkeepers grab at passing European

women with an aggressiveness they'd never dare display toward Tunisian women.

"Tourism corrupts," a tourist official acknowledged. Tunisians complain that hotel competition raises the prices of strawberries and fresh fish. But tourism provides 54,000 jobs that Tunisia badly needs.

By mid-May the grass of Jerba is drained almost to the color of sand. Jerbians adapted to a harsh life by becoming merchants, earning a reputation for shrewd dealing. "And for honesty," Chaabane Ben Taazayet added firmly. His brother is one of many Jerbians who own neighborhood groceries in France. Jerbians also have commercial toeholds in Algeria and Libya.

Chaabane worked as a tour driver long enough to save money for a small cloth shop in Houmt Souk, the island's main town. Like many Jerbians, he is not sure tourism will last. "What is here to keep the people coming? Only the sea and sand. I can't depend on tourism. But a shop. . . ."

Beyond the tourist zone, driving on narrow roads, I passed women who seemed like scurrying birds as the wind caught their gray *futas*. They hid their faces as I went by, making me feel guilty for looking. At a well a man filled two earthen jugs and put them on a donkey. Hotels have made a beachhead on Jerba—nothing more.

Life Among the Not So Barbaric

Berber. It still stings, that name, widely considered synonymous with barbarian, pinned by Arabs on the indigenous people. Sheikh Said M'sahli, leader of the 2,000 people of Chenini, brought it up. "When people are settled, they have stability, they have culture," he wanted me to know. "We have never been nomads. We have always respected the customs of others. Does that sound barbaric?"

Berbers dwell not so much in as *on* the sharp naked mountains that divide Tunisia's harsh southern coastal plain from the harsher desert. Chenini's stone houses rise layer after layer against a ridge. Berbers retreated to such fortress locations when Arab tribes swept into Tunisia 13 centuries ago.

Arabs now live in these villages too, but my Berber-speaking interpreter, M'henni Borji, easily distinguished. "You are a Berber . . . and you . . . and you," he would say

A singing drummer *leads a march to a sub-Saharan beat through the streets of*

Nefta to honor a Muslim saint. Descendants of slaves add another thread to the national fabric and its tolerant traditions.

to children—always with accuracy. M'henni's clue was a roundish head instead of the long Arab one.

Barefoot women labor up Chenini's hairpin pathways with water jars. Villagers descend to get to their flocks, olive trees, and bits of cultivable land.

"The world goes fast and our life is slow," the sheikh said. "The people yearn to move off the ridge." Who can blame them? But Tunisia would lose a living museum.

My hotel in the Berber region was a *ghorfa*, a complex of a hundred rooms strung along another mountaintop in the village of Haddada. We might call a ghorfa a granary; it stored grain and other goods for the community. Mindful of security, its builders provided only one entrance, through heavy doors of split palm logs. The ghorfa also was a community center, with alcoves where men could trade or talk.

Low arched doorways and precarious stairs led to apartments of several connecting rooms. Whitewashed walls, elementary plumbing, naked lights: nothing fancy. But I liked it. You can always stay in a Dar Jerba; there aren't many ghorfas.

Desert Region Intrigues Geologists

"We are lucky we didn't find much oil," a businessman said. "Otherwise we wouldn't have worked so hard to develop our people."

Still, even the slim chance of a strike brings oil companies running today, and the Tunisian Government is only too happy to have them try.

Southwest of the mountains where Berbers live, a vast chunk of desert has intrigued petroleum geologists for years. Two of Tunisia's small fields produce in this area.

A jarring two-hour ride across stubble, and I stood beside tawny dunes. They rose hard edged, as if walled. In fact, they are advancing. Beneath them were tents, trailers, trucks, and big-tired dune buggies.

This was the camp of Compagnie Française de Prospection Sismique. CFPS is a subsidiary of Seismograph Service Corporation of Tulsa, Oklahoma, owned by Raytheon, the electronics firm. Under contract to PECTEN Tunisia Company, owned by Shell Oil of Houston (this gets complicated), CFPS was blowing up the desert—in a systematic way.

Star Wars *fans* *have viewed a scene like this before; the movie's Skywalker homestead was one of the underground homes of Matmata* (**top**). *They were excavated for a down-to-earth reason: Surrounding soil keeps interiors comfortable year round. A pensioner of the French Army* (**left**), *his battles done, still lives with the threat of danger. Heavy rains can cause cave-ins of the pit homes.*

Blasting for clues to oil, *a truck loaded with seismic gear* (**following pages**) *resurveys the desert in hopes new equipment will reveal promising geologic structures.*

Explosive charges laid every 120 meters in a straight line sent seismic waves into the earth. Rebounding waves were picked up by sensitive geophones and sent to a truck stuffed with electronic gear (pages 214-15).

Played into a computer, the waves become visible lines on paper. Examining them, geophysicists can tell whether, deep down, there are rock structures of the sort that sometimes hold petroleum.

My French hosts enjoyed four-course meals and slept in air-conditioned trailers. The outside temperature was 112°F one afternoon, and 130° when I put the thermometer bulb in the sand.

Amid the dunes I spied life: a few struggling trees, a little grass, sheep, three men. The oldest, Belhassen, barefoot, in his 60s, lowered a rope into a hole. *Splash!* He drew up a piece of inner tube trussed into a bucket's shape. "You can get along out here if you know where water is," he said, passing the inner tube. The taste was brackish.

Belhassen, along with his cousin Ammar, about 50, and Ammar's nephew Ameur, 22 or so, had traveled nearly a hundred miles with their animals.

Trailers, intruders, explosions: What did they think of all that? "It won't make any difference to us if oil is found," Belhassan said, offering the inner tube again.

Nomadism is a wonderful life, Ammar declared. "You are free. You have a relationship only with your animals. The only relationship more important is with Allah."

Ameur nodded as the older men talked. Later, beyond their ears, he told me: "I wish I had gone to school. The only thing I know is being out here with animals."

Oil people sometimes get lost in the desert and must radio for a helicopter search. But the desert can be nibbled at.

On Tunisia's southwestern side a 75-kilometer elevated road starts across the Chott Jerid, a salt-crusted lake that in its middle reaches has snow's gleam. The light there was purplish gray, as if a storm were coming. Strange mirages appeared. Something that looked like a little midwestern U. S. city. That big building on one side: the community hospital.

I searched the road ahead and saw a black blob. Not on the road but above it, suspended and wriggling. It became a Land-Rover loaded with tourists.

They had been to Douz, an oasis with small hotels. I, too, went to Douz. It was market day, and merchants had spread cloths, from which they sold plastic bowls, spices, incense, cheap perfume, razor blades. Something was missing here: women. The Douz market is a man's world.

Tunisia Relies on Precious Resource

Southwest of Douz, on a track shouldered by white sand, I drove to El Faouar. A good well supports a village and a grove of date palms, figs, and pomegranates.

I camped by that grove, building a fire with sticks and palm fronds. It soon died, and I wrapped in a blanket upon soft sand.

Sometime after midnight I awoke, feeling wind. Sand pattered my face and hands, stuck in my teeth. It accumulated against the blanket. Stay in one place in the desert, and you too can become a dune.

I shook out at daybreak and observed the village. At about eight o'clock, small figures appeared. They trudged across the sand, lugging their book satchels.

There is a song that Tunisian children sing at school. It is a song about work, with several verses:

I am the joiner, my tool is the saw . . .
I am the nurse, I heal the wounds . . .
I am the master of the anvil,
striking the bars.

All join lustily in the chorus:

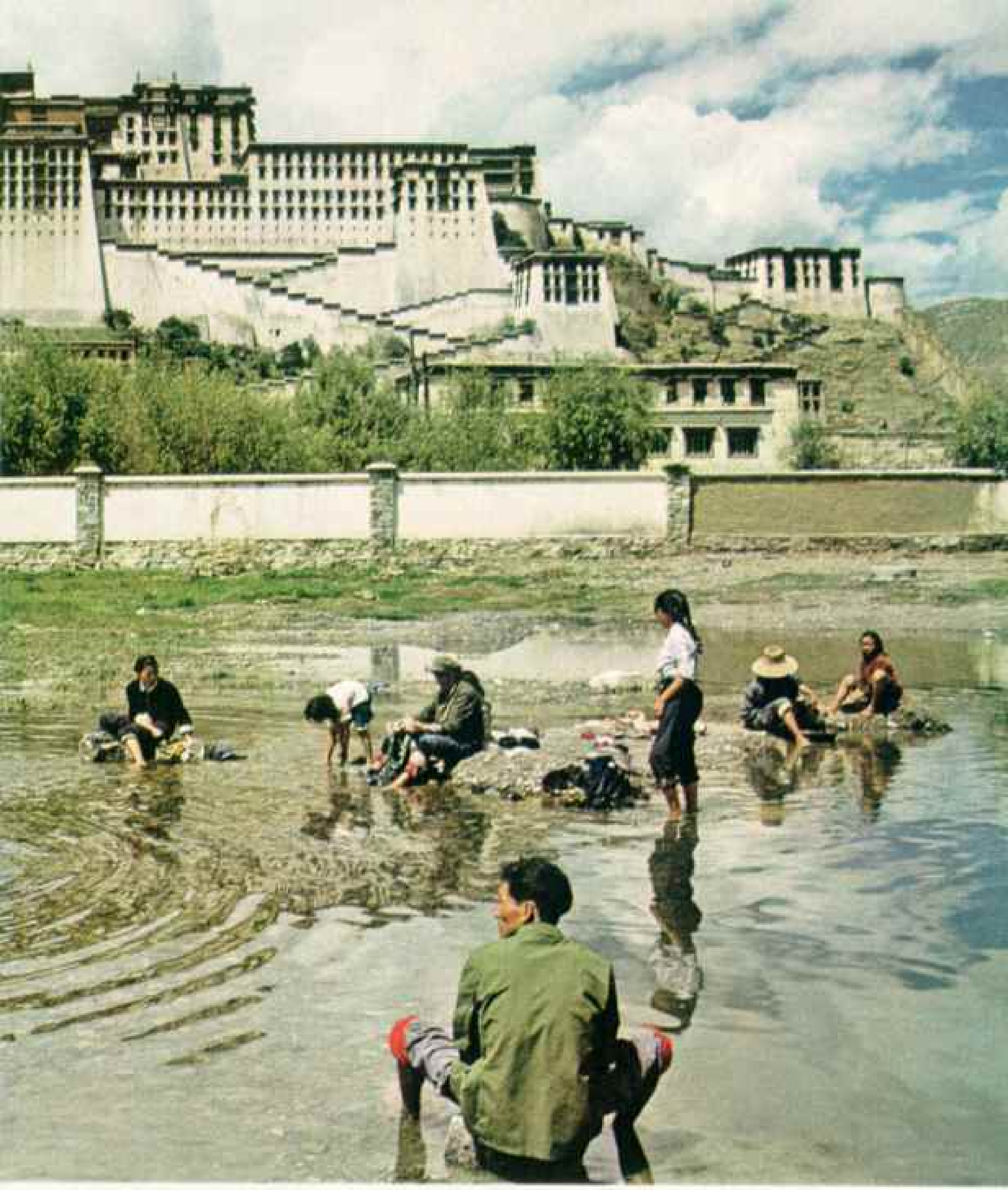
My job is the best job, and thanks to it,
my country can evolve.
It protects me from poverty . . .
my job is the best job.

Oh yes, easy-street gushers would be welcome in the desert wastes. But Tunisia knows where her real treasure lies. □

A moment for reflection: *Mahbouba Sassi glances in the mirror to tie her headband. A wife and mother in the village of Takrouna, she wears garb still typical of rural women in the region. Step by step, Tunisia has, by any standards, quietly but steadily brought herself into the front rank of developing nations.*

In Long-Forbidden Tibet

ARTICLE AND PHOTOGRAPHS BY FRED WARD, BLACK STAR



SLEEP WOULD NOT COME during my first night in Lhasa. Chinese hosts had predicted that insomnia would be caused by the altitude, almost 12,000 feet. But I recognized the problem as excitement. My childhood dream had come true. Spread before my guesthouse window was the outline of the magnificent Potala, the sprawling hilltop palace of the Dalai Lama. Above it, through the sparkling

***Citadel** of Buddhist rule and palace of the Dalai Lama for centuries, the Potala dominates Lhasa, capital of Tibet. The shroud of isolation that once hid this land is slowly parting, revealing changes wrought since China asserted control three decades ago.*

mountain air, I saw the Milky Way so vividly that it seemed to rest directly overhead, just beyond reach. I was finally in fabled Tibet.

The world's highest and most difficult terrain was sufficient to keep Tibet isolated for hundreds of years after rival fiefdoms began to be consolidated in the seventh century. Xenophobic policies prohibiting foreigners only heightened the mystery. During the 19th century outsiders were officially excluded. The very name Lhasa, which actually means "Place of the Gods," became synonymous with Forbidden City.

My trip in had few rigors of the months-long horse treks common to past Tibetan traders. With my friend former South Dakota Senator James Abourezk, who gained our admission through Chinese officials he knew in Beijing (Peking), I flew from Chengdu, China, for three hours in a Soviet turboprop, landing at Tibet's only civilian airport—little more than a three-mile-long concrete runway. Completed in 1965, it lies between two mountain ranges at an engine-straining 11,000 feet. And it is still 65 miles—another three hours by car over primitive roads—to Lhasa, the capital.

Today Tibet is an integral part of the People's Republic of China, comprising an eighth of that country's total area. Administered since 1965 as the Tibetan Autonomous Region (T.A.R.), it has more local rule than Chinese provinces, but real authority still rests with the Communist Party and the People's Government.

Over tea one night, Wangdui Zhaba, who is a Tibetan and director of the Foreign Affairs Office of the T.A.R., explained the system. He spoke through a Chinese interpreter: "The revolutionary committee that had governed this region since 1968 was replaced in August 1979 by the People's Government of the T.A.R., with a Tibetan, Tian Bao, as its chairman."

Would the change make any real difference to the people? "Major decisions must still pass through the [Communist] party committee, composed of five Chinese and three Tibetans," he said. "It sets policies, which the government carries out."

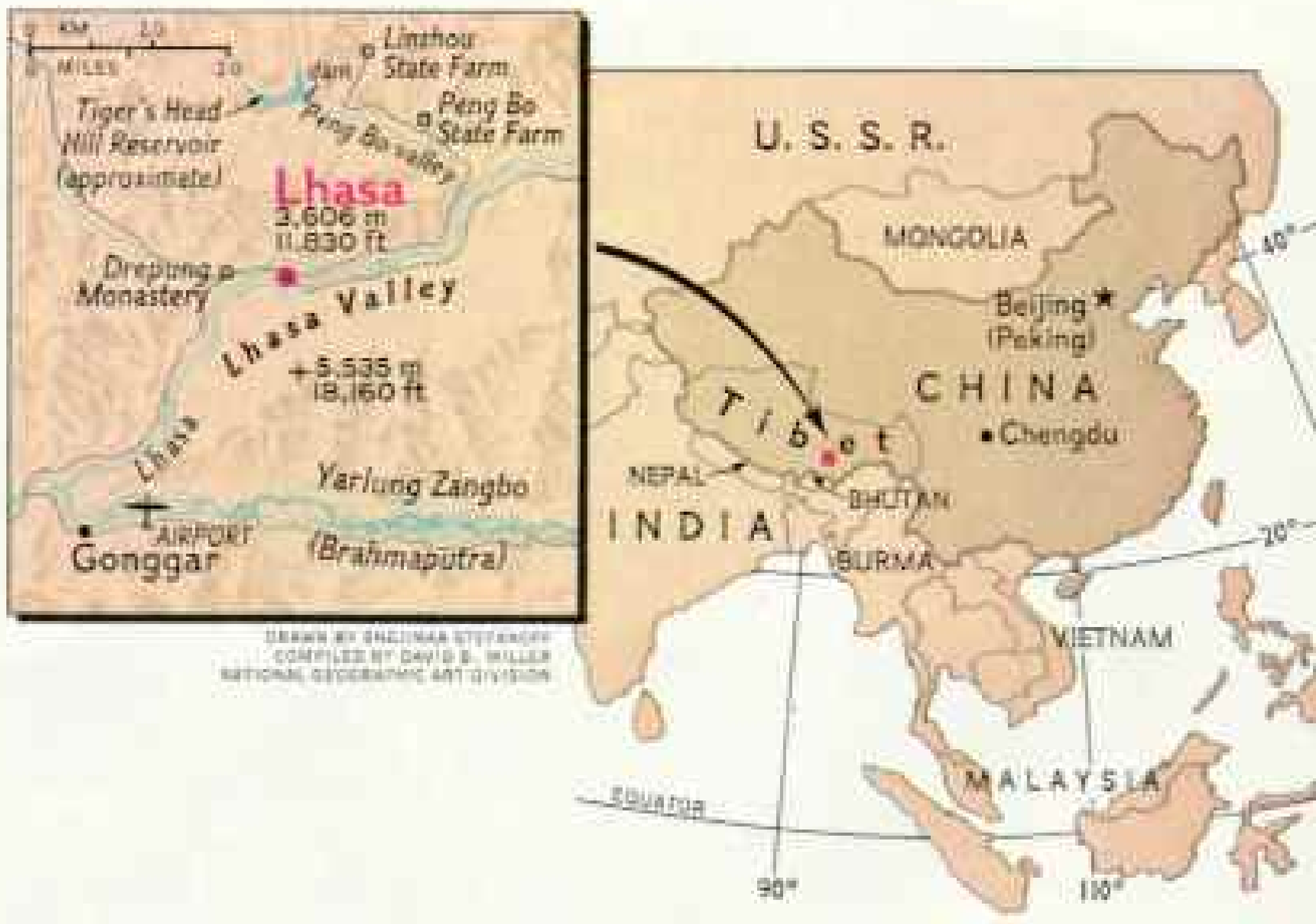
China Acts After Mao's Victory

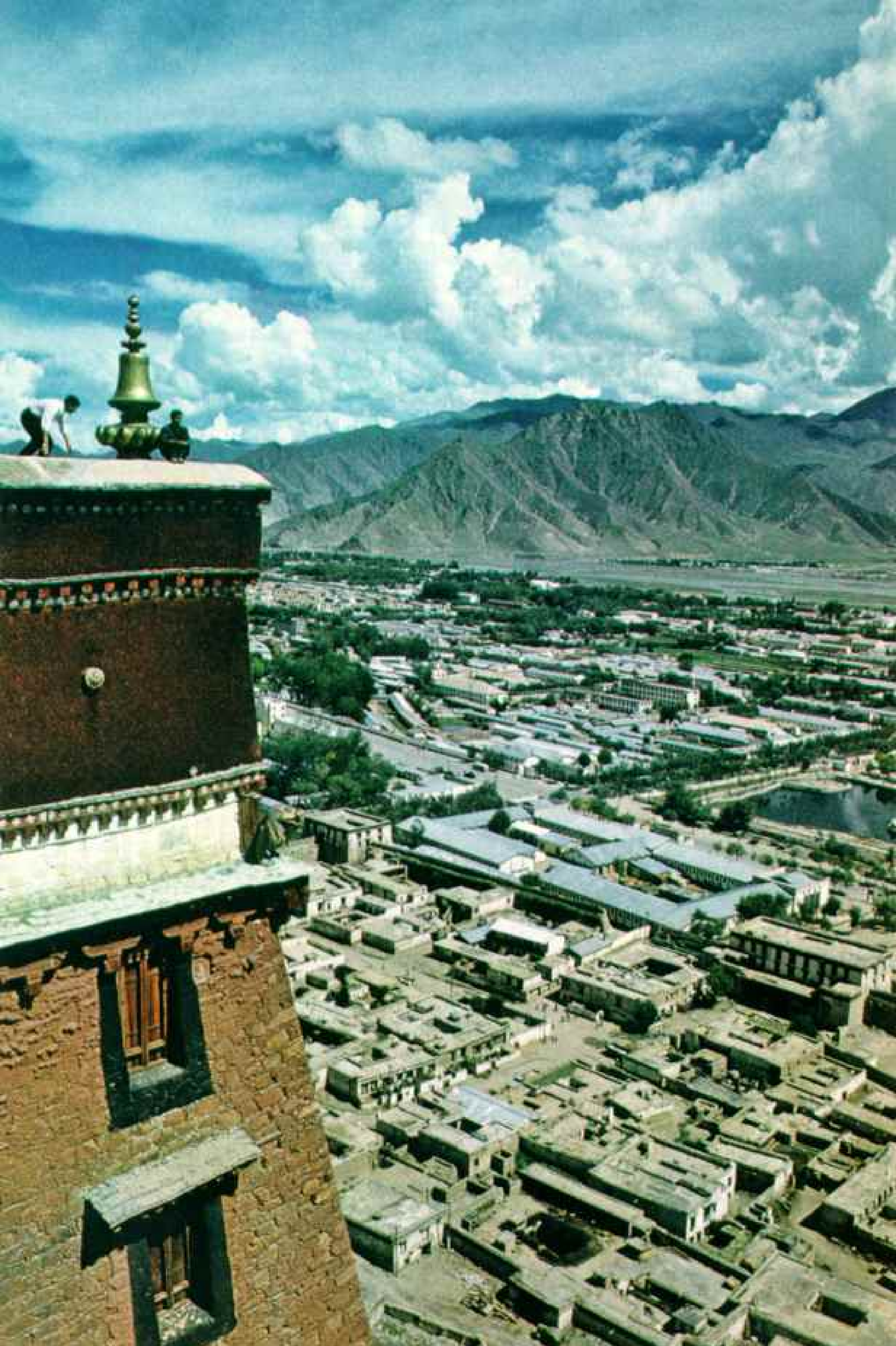
China, which has long claimed sovereignty over Tibet, acted directly soon after Mao's Red Army defeated the Nationalist forces of Chiang Kai-shek in 1949. Depending on point of view, the first units of the People's Liberation Army either liberated an oppressed people or invaded a free nation in 1950, meeting little resistance from a local militia unprepared to confront modern weapons. The 15-year-old Dalai Lama (though three years under the traditional age, he had been invested with full powers) slipped away with his advisers to the Sikkim border. Determined to seek accommodation with the Chinese, the boy ruler returned to Lhasa and in 1951 approved an agreement guaranteeing continued self-government, while giving China military control and the right to conduct foreign affairs.

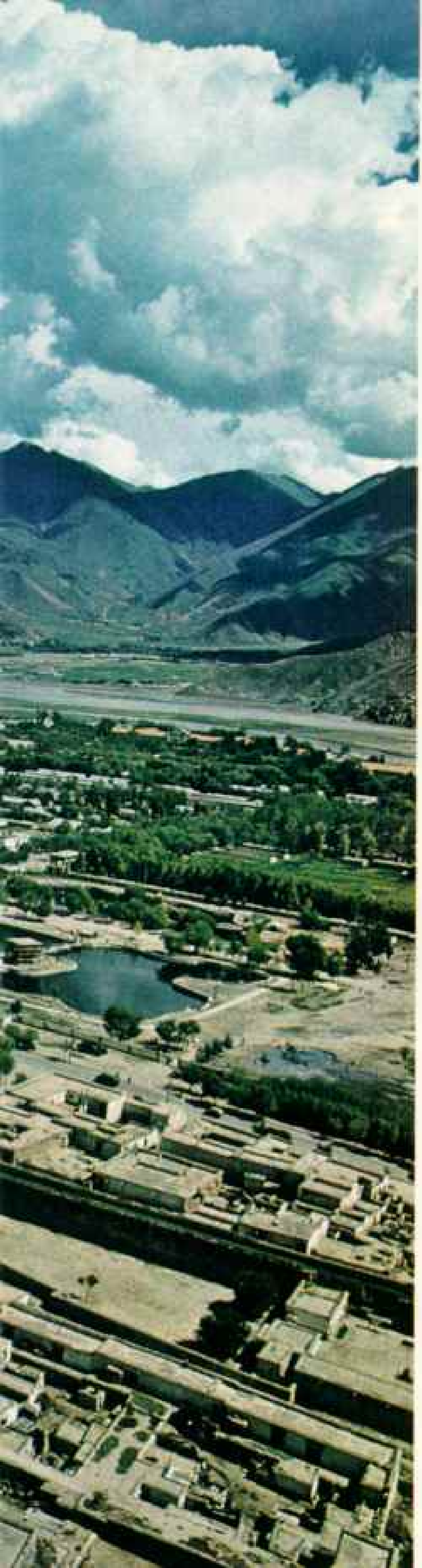
I asked Wangdui Zhaba how the Chinese justified the events of 1950. "China did not take over *(Continued on page 226)*

With extended tongue *a Tibetan gives a respectful greeting* ***(left)****.*

China took control of Tibet's military and foreign relations in 1951 and governed in full after a rebellion failed in 1959, sending nearly 100,000 into exile. Theocratic feudalism has been replaced by a socialist government intent on modernization.







Rapid march of Chinese construction, *here marked by metal roofs, has increased the area of Lhasa tenfold in 15 years. The Potala and adjacent hamlet were on the outskirts of town in 1955, when* NATIONAL GEOGRAPHIC *published this photograph* ***(below)****, which shows a workman cleaning one of the palace's golden lions. Visitors are rarely admitted to Tibet, and only by invitation from China—provided a physical examination shows that they can function in Lhasa, which lies 12,000 feet above sea level.*

About 120,000 Chinese civilians now live in Tibet, Chinese officials say. Most are in Lhasa where they at least equal the number of Tibetans. After recent political changes in China, Tibetans were granted greater home rule and freedom of worship.

KOSKOFF HARRIS

The grinning face of death *stands on its head in the Potala beside an ornate bell and a drum fashioned from two skulls, objects used in Tibetan Buddhism's elaborate rituals* ***(left)****. A container for ceremonial offerings, the skull symbolizes the impermanence of the body, viewed as one of the many houses inhabited by the spirit on its ceaseless journey of reincarnations. Believers worship a vast pantheon of gods, none more revered than the deity thought to be incarnated as the Dalai Lama, Tibet's spiritual leader and once its ruler. In his winter palace, the Potala, a rich golden robe* ***(above)*** *recalls his residency. During the revolt of 1959, the holy man fled to India. China has indicated that the Dalai Lama may return, but he has thus far declined.*

His world on a string, *a boy in Chinese dress reels in his kite. The old sport has a new hazard: webs of power lines strung to light houses in Lhasa's old section (**right**). Electricity, used in the Lhasa mint and the homes of nobles before 1950, is now available to 30 percent of Tibet. Another advance: Literacy, once the privilege of monks and the nobility, is rising. More than 280,000 students are in school.*

(Continued from page 221)

maintained. "Tibet is and has been a part of China since the seventh century. For more than a thousand years China approved local officials here and later the selection of Dalai Lamas; they even sent troops to aid Tibet during strife."

This view conflicts dramatically with Tibet's long tradition of independence. When I spoke with the Dalai Lama last September during his first visit to the United States, he viewed the Chinese presence differently.

The 44-year-old leader spoke softly—in English—of his lost realm. "There were many signs of de facto independence: a separate language, culture, borders, money, religion, and world acceptance of Tibet as a country. The Chinese ignore these and say that a slight association in the past justified the takeover. Quite simply, a big country bullying a little one."

The Dalai Lama is unique to Tibetan history. The name, given by a 16th-century Mongol ruler, has come to mean "ocean of wisdom." In the theocracy that evolved in Tibet during the past 600 years, religious and administrative power centered in one person, whose succession was assured by the people's belief in reincarnation. When a Dalai Lama died, the search began for the child whose body had received his spirit. Signs and prophecies helped point to a suitable prospect. Then he was challenged, first with questions, then with selecting the former Dalai Lama's personal objects from among skillful copies. If the boy chose the authentic

ones and fulfilled other requirements, Tibet's National Assembly heard the evidence and voted. Upon approval, he was declared the new Dalai Lama, carried to Lhasa amid much celebrating, and moved into the Potala for years of religious training before accepting power at 18 years.

The present Dalai Lama, the 14th, remained in Lhasa until 1959, when a Tibetan rebellion was crushed by the Chinese and the young ruler fled by night to India. He still looks sad when he remembers.

"The Chinese themselves admit to killing 87,000 Tibetans then. We estimate that starvation, labor camps, and later Cultural Revolution oppression raised that to 200,000 deaths. But 90,000 got out, and most live near me in northern India."

The Chinese insist the rebellion was an attempt to maintain a feudal society that held much of the million-plus population in serfdom or, in some cases, actual slavery.

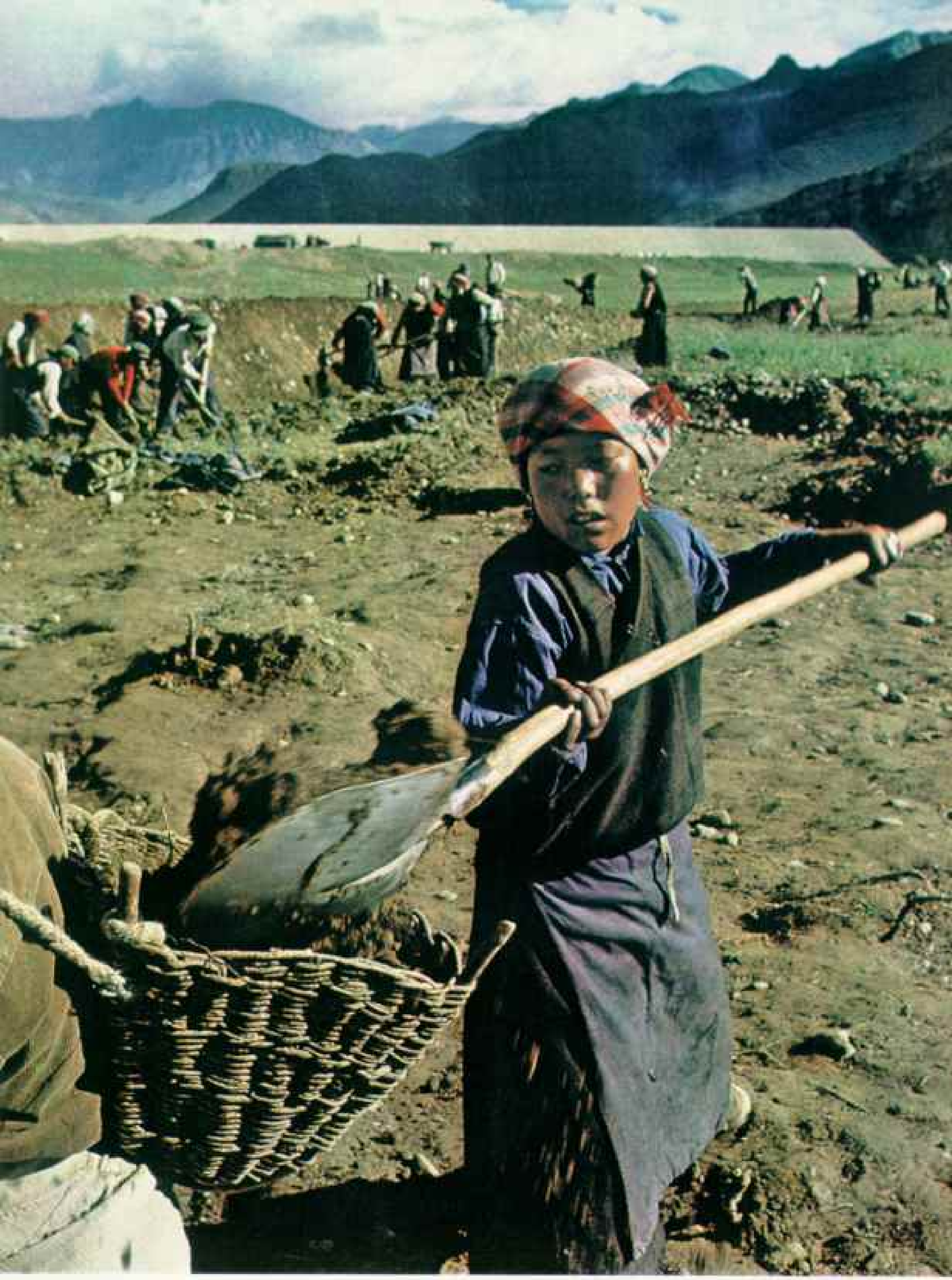
Buddhists' Shrine Still the Jokhang

One thing is clear: Religion totally dominated Tibetan life before 1959. I was eager to see what remained of the Buddhist faith. In the center of old Lhasa stands the holiest shrine in Tibet, the Jokhang. Since it was built around A.D. 650 for believers in Buddhism, the Jokhang has been Mecca to the Tibetan faithful. They would walk for years to reach the building, circle it while prostrating themselves at body-length intervals, then pray before each of the hundreds of statues inside.

I made my pilgrimage to the Jokhang on my first Sunday in Lhasa, when Jim and I, along with our Chinese hosts, were the only guests. Inside the iron gates, we passed a courtyard of flagstones polished and rounded over the centuries by the hands and knees of millions of suppliant Buddhists.

At the entrance I met 61-year-old Losang Phintso, robed in traditional maroon wool and wearing yak-skin boots with upturned toes. His hands in a prayerful attitude, he greeted each of us with a slight bow. Near four menacing stone figures, Lords of the Four Directions, the old man explained his life as one of the nine monks at the Jokhang. "I became a monk when I was 8 and entered Drepung, the monastery to the west of Lhasa. I spent my life there until last July, when

Muscle alone *opens a road on Linzhou State Farm, about a sixty-mile drive from*



Lhasa, where government land is tilled by salaried workers. The dam, background, was also built by hand. Though some trucks are used, heavy machinery is difficult to import over the rough roads.

I came here. This was not a residence monastery, but Tibet's most religious shrine."

In the central hall hundreds of flickering yak-butter candles illuminated the opulently painted Buddhist murals, great thirty-foot-high statues, and richly woven cloth hangings. Around every altar the accumulated pungency of 1,300 years of burning butter pervaded the air.

Losang Phintso explained the new policy allowing religious expression. "In March 1979 the Jokhang was opened for worship for the first time in twenty years. Now a thousand Tibetans come each of the three mornings a week when visits are allowed."

I wanted to see the shrine alive with worshipers, not just as a museum.

The next day the Jokhang was already crowded when I arrived with the sun's first golden rays. A monk was admitting only those who had bought ten-fen (seven-cent) tickets the day before.

A solemn procession of believers lined the Jokhang's north wall, shuffling toward the next altar station in cadence to softly chanted, ancient Buddhist prayers. Many carried either lighted butter candles or containers to refill altar butter lamps. Their unbroken queue reached now from the sunlit street, in and around every *lha khang*, or chapel, to the main focus of the pilgrims' attentions. Before Jorinpoche, considered the first and oldest statue of Buddha in Tibet (page 246), their most hallowed of objects, children and adults prostrated themselves. After twenty years of Chinese rule, religion has not died in the Tibetan highlands.

Most Monasteries Have Vanished

Under Tibet's unique form of Buddhism, monasteries wielded great power. Rising with the mountains west of Lhasa is Drepung, a gigantic array of whitewashed stone apartments surrounding central temples. This single institution—the world's largest *(Continued on page 238)*

Pride of Peng Bo State Farm, *a combine harvests winter wheat, a strain promoted by China to supplement Tibet's staple crop, barley. Introduction of new varieties of crab apples* ***(left)*** *and other crops has also increased farm yield. Before sweeping land redistribution in 1959, monasteries, the government, and the nobility owned 95 percent of the land. Today most of the acreage is organized into communes.*

High in the saddle on low-built Mongolian ponies, a militia troop at

Linzhou State Farm carries Chinese versions of the Soviet AK-47 rifle. Tibetan militias act as adjuncts to the People's Liberation Army, posted throughout Tibet.

Preserved as a museum, the Potala commands the heights some 700 feet above Lhasa. The palace reportedly contains more than 1,000 rooms,

10,000 altars, and the gilded tombs of eight Dalai Lamas.

(Continued from page 231) monastery —housed 10,000 monks and controlled 25,000 serfs and herdsmen working 185 estates and tending 200 pastures. As I climbed the narrow alleys that form Drepung's streets, I saw that the once grand center was falling into ruin.

Gendun Gyatso, an aging lama, showed me the statues of Buddha in the main temple and explained Drepung's decline. "About 3,000 of our monks fled to India and live near the Dalai Lama. Except for the 270 who live here mainly in caretaking roles, the rest returned to secular life or died. No new lamas are being trained, so I do not know what will happen to the monastery after we die." In fact, the Chinese ban against the training of new monks makes uncertain the future of Tibetan Buddhism itself, as well as its monasteries.

In 1959 there were about 120,000 monks in Tibet—fully a quarter of all males. Tudeng Danda knew many of them. As the Dalai Lama's secretary-general, he helped prepare the brief 1959 revolt. Unaware of the ruler's plan to flee, he was left behind and imprisoned for three years. Now 72, the former noble reflected on the role of monks today. "They are not allowed to live off the labor of others. There are no more than a thousand now, and they all must perform useful tasks in addition to being monks. Most work in the fields or orchards around the monasteries."

Kesang Wangdui was general manager of the Tibetan mint in 1959. His chiseled features and tailored robe suggest his noble lineage. Now he is a government functionary. "Most of the monasteries are gone. In 1959 there were 2,711, but many were destroyed during the upheaval because they were the centers of the rebellion. After the fighting other monasteries were razed for building materials. Then, during the Cultural Revolution, the Chinese Red Guards and the masses destroyed still more. Today nine monasteries with lamas remain."

Potala Boasts 200,000 Statues

Throughout its history the very symbol of Tibet has been the Potala. Actually a castle built on a fortress atop a mountain, the Potala, which the Dalai Lama told me means "high heavenly realm," rises 700 feet above Lhasa. Begun in the seventh century, with most construction between 1645 and 1694, it is said to have more than 1,000 rooms, 10,000 altars, and 200,000 statues.

I entered the building through the same rooftop door used by the Dalai Lama. Losang, a 57-year-old guide, met me for a tour of several ceremonial rooms. As he explained that he had lived in the Potala since 1963, we laughed over the realization that his was the sole light I had seen every night and morning from my guesthouse window in Lhasa.

In his blue Chinese-style clothes, Losang showed me the gilded funerary pagodas of the fifth and thirteenth Dalai Lamas, thrones, murals, hundreds of religious statues, and the last ruler's apartment. "We

Time stands still *in the Potala bedroom of the 14th Dalai Lama. A calendar and clock* ***(right)*** *have been left untouched since shortly after his flight on March 17, 1959. Now he lives in India among 5,000 monks who followed him into exile. At the Norbulinka, the summer palace in Lhasa, is a phonograph* ***(left)*** *inherited from his predecessor, the 13th Dalai Lama.*

have kept it just as it was when he fled," Losang said, although on seeing my photos, the Dalai Lama later noted many objects missing and others added. Floral and geometric patterns and mythical figures embellished floors, walls, and ceilings. Intricate Buddha figures filled the altars along several walls where the statues' rich costuming contrasted with the current Dalai Lama's simple bed.

While sipping jasmine tea in an airy reception room near the roof, Losang elaborated on the Potala's present status. "No longer a religious or administrative building, this is now more a museum, operated by the government's Cultural Relics Commission. It is really not open to the public as such, but groups are admitted with a letter of recommendation from the commission."

We lounged on low seats covered with vividly patterned new Tibetan carpets. Above us, each refurbished column and beam was painted with the bright blues, reds, and yellows that give Tibetan designs their colorful distinctiveness. When I commented on the Potala's fresh look, Losang told me that a hundred people work on maintenance at a cost of 100,000 Chinese yuan ($67,000) a year.

Income Low, but Rising

Conditions in Tibet are a matter of considerable sensitivity to the Chinese Communists, since it was the last area of China to be subdued. Wangdui Zhaba, the T.A.R.'s spokesman during my visit, spent two evenings discussing the people and institutions of the region.

"Compared with other parts of China, income in Tibet is still low, about sixty yuan [$40] per person a year in cash and 200 kilos of grain in agricultural areas and 100 kilos for workers in pastoral lands. This includes a 30 percent cash bonus paid in Tibet in addition to wages to help compensate for higher prices here. Before 1959 almost no money changed hands in rural areas, with 30 percent of the harvest being divided among the serfs on each farm."

When I asked about charges that China has turned Tibet into a colony, Wangdui Zhaba countered, "Tibet has 1.74 million people, and the number is rising because as an autonomous region we are exempt from China's birth-control policies. There are only 120,000 Chinese here, but you see a lot locally because half of them live in Lhasa, comprising at least half the population."

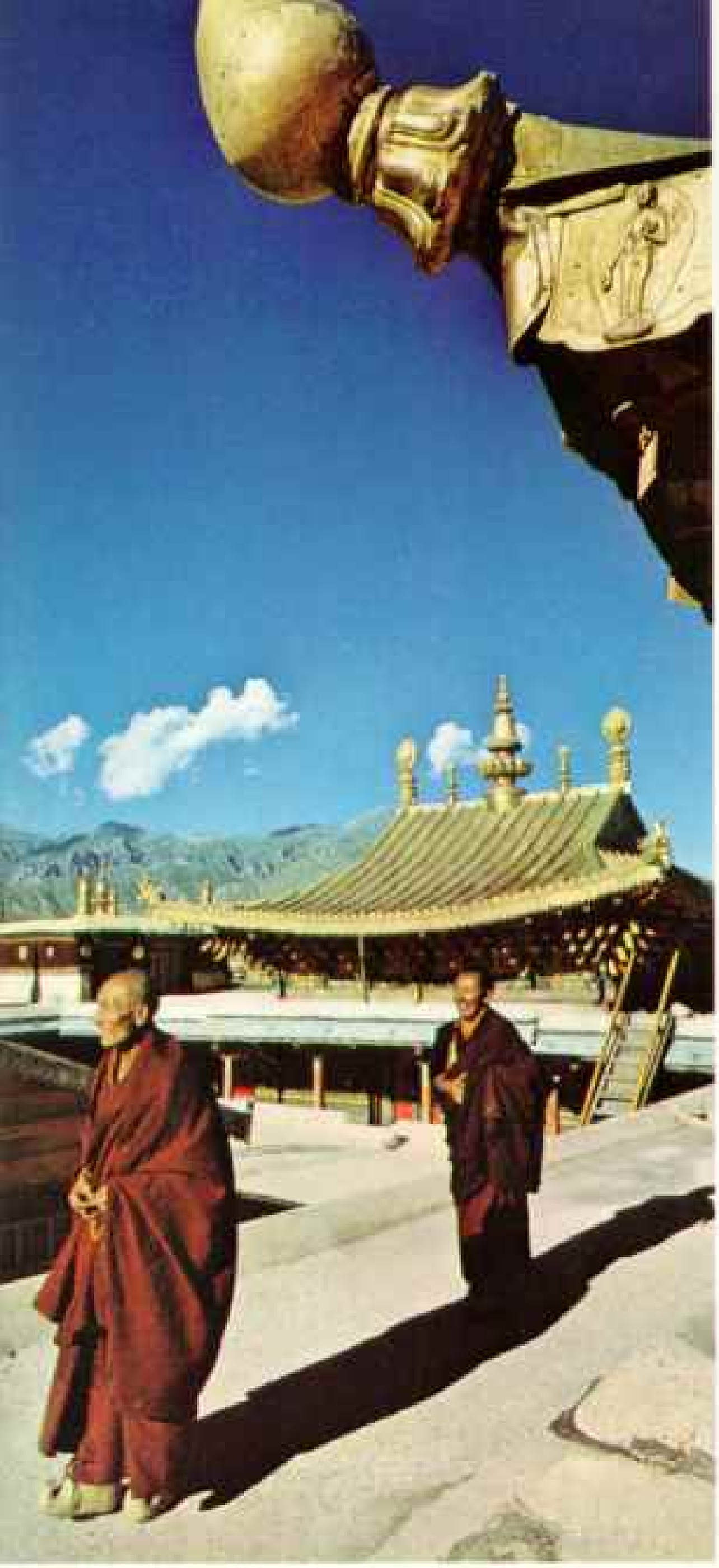
Wangdui Zhaba said he could not verify outside estimates that soldiers add up to 300,000 Chinese to the T.A.R. When I noted that Tibet now has more than 200 small factories and growing quantities of mechanized farm equipment, he said, "Yes, and all this modernization is being paid for by China. Tibet's annual budget is between 400 and 500 million yuan, 98 percent of which comes from China's central government."

Much of this modernization can be seen in Lhasa. As late as the 1960s the ancient city still consisted of a central core of homes and shops around the Jokhang, with great open spaces stretching a mile west to the Potala. Now the area is filled with new apartments and factories, usually metal roofed, in contrast to old-style stone and mud buildings.

Lhasa depended on isolation for protection and was relatively unthreatened over the centuries. Therefore, unlike many Chinese cities, it has no walls. Its traditional urban architecture looks very much like the temples and monasteries in the mountains: whitewashed stone walls sloping away from the street, brightly painted exposed roof beams, and decorated wooden doors.

Since fuel has always been scarce, homes are not heated, even though winter temperatures may drop below 0°F. Cooking is done over dried cow or yak dung. In the arid and relatively high Lhasa Valley, there are no trees for firewood. At Tibet's single guesthouse, where I stayed, wood for cooking and heating tea water comes from southern forests, a four-day, 500-mile round trip by truck. One other novelty in the facility was the oxygen tank beside my bed in case I had trouble with the altitude. Perhaps these

In the garden of the god-king, *Tibetans picnic and play* sbag, *a popular game similar to dominoes. After dismantling Tibet's centuries-old theocracy, the Chinese threw open to the people of Lhasa the grounds of the summer palace, where Dalai Lamas once strolled in strictly guarded privacy.*



Wine-dark robes *distinguish monks at the Jokhang, the most hallowed of Tibet's holy places (**above**). Before Chinese rule, one-quarter of all males were monks. Now, with no young men being trained, the future of Tibet's Buddhism is uncertain. Yet religious fervor remains high. Closed for years under the Chinese, the Jokhang reopened in March 1979, and today its gates are strained by crowds of Buddhists eager to visit the temple (**right**).*

services help explain the 375-yuan-a-day ($250) charge, with no hot water. One compensation is that the Chinese cook imports much of the food, and often meals include prawns from the Pacific, abalone soup, and Beijing beer.

With all its appeal, Tibet still is not ready for tourists. In fact, without a single hotel, restaurant, or transportation facility, tourism is impossible. And there are no apparent plans for the industry. Before 1950 the only

outsiders who made it to Lhasa were the hardy and the fortunate. Since 1950 fewer than 400 foreigners have seen Tibet, and those had to be invited by the Chinese and pass a heart and lung physical exam in Beijing.

The attention that our presence caused amazed us. Whenever Jim and I stepped from our government-provided Toyota, we were surrounded by dozens of short, sturdy, tanned, and curious Tibetans, always smiling and often exposing their tongues in the greeting still common in these highlands. Children wanted to hold hands and rub the arm hair that they found so unusual. After one day of our dispensing Polaroid prints, the word was out all over town, and during the rest of the trip people would appear from nowhere asking to pose for their free pictures. In the Jokhang, every monk lined up, not for a picture of himself, but of the most sacred Buddha statue, to hold and develop in his own hands.

Pilgrims progress *through the Jokhang under the image of the deity Chenrezi. According to Tibetan lore, Chenrezi took earthly form in the first Dalai Lama and was reincarnated in each subsequent holy ruler. When each Dalai Lama died, regents searched for the child believed to have received the deity's spirit. The present Dalai Lama was found at age 2 and brought to Lhasa to be educated and to reign.*

Public loudspeakers are a daily reminder that Lhasa is a part of China. Each summer morning at 6:50 an ever present anthem, "The East Is Red," echoes throughout rows of apartments and barracks as workers and soldiers begin a new day in the dark. All China is, by decree, in Beijing's time zone. Lhasa, which is 1,600 miles, or two time zones, farther west, has to adjust to a 7:30 summer sunrise that puts farm workers on a later schedule than those in other parts of China.

To see some of Tibet's new agricultural

advances, we drove a few miles east of Lhasa to the Vanguard Commune, a home for 229 families (1,066 people) on 504 acres (3,024 *mu*). About 97 percent of rural Tibetans now live on communes, laboring under a system that distributes a percentage of the grains grown, as well as cash. The pay is based on days worked multiplied by work points (up to ten per day depending on a vote by fellow commune members judging the vigor of the work).

Damba, a 45-year-old former serf with a large open face, brown jacket, green pants, and corduroy shoes, compared his present and past life. "We serfs had the right to work all year, but no rights to money. I was paid in grain, but I had to eat it, not sell it. If I had cashed it all in, it would have amounted to only about sixty yuan [$40] a year. I now have five children, and three of us work. Last year we received 1,111 yuan and 321 kilos of grain each for seven people."

Tibet's food staple continues to be tsampa, an odorous hand-mixed paste of

Adoration for Lord Buddha *reflects in jewels encrusting Jorinpoche, considered Tibet's oldest Buddha figure* (**above**), *now in the Jokhang. The statue was brought to Lhasa in the seventh century* A.D. *by a Tibetan king's bride, legend says. An all-seeing, all-embracing power is expressed in a rendering of compassionate Chenrezi* (**right**).

*An endless invocation spins from the prayer wheel carried by an old woman of Lhasa (**below**). Believing that prayers need not be uttered to be heard, Tibetans write chants on paper strips and coil them inside the cylinder. Spun with the aid of a weight, the devotions can thus be offered over and over. Use of prayer wheels, once found everywhere in Tibet, has dwindled during Chinese rule.*

*Homage is shown in another way at the Jokhang (**right**), where a girl emulates the piety of her prostrate elders.*

lightly toasted barley flour, yak butter, and tea, which I tried for Sunday breakfast. The ability of highland barley to grow during Lhasa's 140 frost-free days, coupled with its nutritional value, makes it the basis of local agriculture. At the Vanguard Commune I walked with a team of women as they slashed the stalks topped with ripened grain, working to a series of rhythmic songs. Arrayed across the entire field, the women continued working until the crop was leveled. Chinese food introductions, such as improved varieties of tomatoes and apples, are slowly being incorporated into Tibetan diets, along with the usual cabbages, turnips, and potatoes.

In contrast to communes, where technically the land and products are collectively owned, state farms operate on government land with workers receiving salaries. To see

one of these massive operations, I bumped northeast up the Lhasa Valley over 45 miles of unpaved mountain roads to Peng Bo State Farm. Under an entrance tree the farm's deputy director, Sonam Wangdui, offered our party sweetened warm milk and barley beer. On this perfect morning of purple-blue sky, fluffy clouds, and unlimited alpine clarity, he described Peng Bo. "We have 15,300 people growing barley, winter wheat, peas, rapeseed for oil, and sugar beets on 110,000 mu [18,333 acres]. Additionally, we keep 60,000 head of yak, sheep, and goats."

Still suffering from the four-hour thumping to reach the farm, I wondered aloud how the big red Chinese combines harvesting wheat in the distance had gotten here (page 231). Sonam Wangdui agreed that transport was the major impediment to development and expressed hope that Tibet would soon

have its first railroad. "Those combines were made elsewhere in China, disassembled, put on trucks for a ten-day journey from Sichuan [Szechwan] Province, and reassembled here."

A special foreign guest lunch included yak steak, pork spareribs, river trout, musk deer, omelette, cabbage, and beans. Afterward we drove to see the more typical hand cutting of wheat and an experimental project raising so-called plum blossom deer for their antlers, valued medicinally in China.

Before heading farther up the Peng Bo valley, I asked Sonam Wangdui about the area prior to 1959. "This land was owned by three county governments and had 10,000 serfs working it, almost all of whom are still here. Back then they had nothing, receiving grain for their year's pay." Now, he claimed, "Our farm workers average 29 yuan a month and can buy their grain at 29 fen [twenty cents] a kilo instead of the market price of 45 fen."

At the northern end of the valley, Linzhou State Farm typifies the dilemma of Tibetan development: The need for modern tools is apparent, but the chief resource is human toil. The farm's crowning achievement is a

Mortals mix with gods *in the Jokhang, where yak-butter candles glow beside grain offerings. Fearsome three-eyed deity* ***(below)*** *is a protector of Buddhism. Worshipers believe that adorning him with pins sharpens their mental powers.*

new dam and reservoir (pages 228-9), hand built by workers to control floods and provide year-round water for irrigation and power for a small electric generator.

On our way to see the kilometer-long stone dam, Yangchen, Linzhou's 38-year-old deputy director, explained how her father, who was once a slave in eastern Tibet, ran away after leopards attacked cows he was watching. After making his way to Lhasa, he met and married another slave and had three children. "Until I was 18, my father, my uncle, and I worked to get enough money to purchase my mother's freedom."

Even allowing for Chinese exaggeration, pre-1959 statistics on population distribution indicate that a large percentage of the people, most of them concentrated in central Tibet, were serfs tied to an estate by birth; others were tenant farmers and hired agricultural workers. In outlying areas, a nomadic culture prevailed. Ninety-five percent of the land was held by three groups: the fewer than 200 families comprising 10,000 nobles, the monasteries with 120,000 monks and 13,000 nuns, and the government, run by 333 lamas and 280 lay nobles.

It was a system where only limited social

JAMES KRUGER

Patches bring healing, *the Tibetans believe* ***(opposite)****. Soaked in herbal broth, they are a time-honored remedy for internal disorders. A neck swollen with goiter* ***(left)****, common in areas lacking iodine in the diet, formerly was blamed on an "excess of flesh in the constitution." In a society dominated by religion, doctors learned their medicine in Buddhist texts.*

Once uncommon, surgery is now routinely performed in Tibet. Improved hygiene and diet are also being introduced, along with acupuncture. But folk medicine continues to be practiced and studied at Lhasa's Hospital of Traditional Medicine, where a patient arrives on a wheeled cart ***(above)****. "We have the best of both worlds," said one doctor.*

movement was possible. A noble's children were nobles and a serf's offspring remained serfs. The only alternative was to enter a monastery; so many boys did that three-quarters of all Tibetan males worked to support the monastic one-quarter. With more than 100,000 celibate males unavailable for marriage, polygamy was accepted among nobles and merchants, who could afford multiple wives. In addition, among the families of landowners, merchants, and even peasants with small holdings, brothers shared a wife as a way of keeping the family estate intact.

It was Linzhou's former serfs who built the dam, which holds back the 12 million cubic meters of water in Tiger's Head Hill Reservoir. Now they are turning their shovels to another task, building a stone road connecting the dam to farm headquarters. As usual, men perform any function that is associated with machinery, driving, mechanical repair, even pushing wheelbarrows. Women do the hard physical labor of loading stones or shoveling dirt.

Hardworking Woman Has Rare Dream

For a quarter of an hour I watched one young woman wielding a shovel at a rapid-fire pace to fill backpacks with roadbed dirt. Her bronzed forehead was beaded with sweat. "My name is Baima Zhuoga," she said straightforwardly, without missing a shovelful. "I am 19 and have been here for four years. Some workers are collected regularly from each brigade for road duty. I work eight-hour days, six days a week, and earn 27 yuan a month, which is better than my parents. They were beggars."

When I asked Baima Zhuoga about her dreams for the future, she seemed confused, not understanding the question. Never having been to Lhasa, only a sixty-mile drive, or even out of this valley, she lives in a society where the people expect to do what they do all their lives. But after taking a few more shovelfuls of dirt, she decided that she did have *(Continued on page 259)*

***Gods loom as large** in art as they do in belief for pious Tibetans. Deities, inscribed and painted by monks, dwarf cattle at Drepung Monastery.*

Racing the rain, *harvesters reap barley on the Vanguard Commune, where 229 families farm 504 acres east of Lhasa. Group songs set a*

steady pace for workers, whose cash and crop allotment is based partly on individual effort as evaluated by fellow commune members.

an answer. "Someday, mechanized agriculture will be realized here. I want to work in that. I want to be a technician."

Despite the dreams of adventurers and novelists, Tibet is no Shangri-la, and never was. Nonetheless, the fascination that it holds on the imagination is deserved, for here has stood for centuries a unique and exotic culture in one of the most secluded and inaccessible areas in the world. Time barely moved in these valleys between the seventh-century struggles of King Songtsan Gambo and the assertion of control by the Chinese in 1950. Since then, development has whirled at such a dizzying pace that it is difficult for Tibetans to maintain balance.

Schools, Electricity Mark Changes

Before 1950 secular education in Tibet was virtually nonexistent; now more than 280,000 students are enrolled in hundreds of schools, including four colleges. In 1950 three cars comprised Tibet's entire fleet. Today trucks clear away foot traffic by incessant horn blowing as convoys of lorries ply their way up the gravel mountain tracks, every third vehicle bearing fuel for the others. Electricity was once limited to a small generator supplying the mint and the homes of a few nobles. Now 30 percent of Tibet has some access to power, with hydro projects under way everywhere. Factories, once unknown, now turn out such products as batteries, matches, carpets, cement, and shoes.

Is all this change beneficial? Certainly in material goods it is. And few would quarrel with bringing Lhasa into the 20th century by ending the despair of serfdom. Perhaps Tibet's old fear of foreigners was justified, for in a short period its people have been exposed to a whole new world of ideas. Only time will reveal the effects of China's revised policies toward self-government and religion. Tibetans must look now to Beijing for their future, for there the decisions will be made to reshape the Roof of the World. □

Witnesses to a changing Tibet *span three generations in the town of Gonggar. Under Chinese administration Tibet's cultural heritage is eroding, but a slowly improving material life offers new promise for Tibetans.*

THE APACHE

At Peace With the Past,

THE APACHE, it seems to me, have a special gift: the ability to endure. Our beliefs tell us that we were created in the land where we now live during an age when supernatural beings lived as people upon the earth. We were given a religion, language, and traditions to follow.

We have since seen much change. Newcomers have arrived in our land. Some have sought to destroy us. Others have desired to re-create us in their own image, to have us give up our language and culture. Our children were sent to boarding schools, and were punished for speaking in their own tongue. Much of our land was taken when it was discovered to be rich in resources.

Yet we have survived. Our Apache language and beliefs are respected by the

In Step With the Future

INTRODUCTION BY RONNIE LUPE TRIBAL CHAIRMAN, WHITE MOUNTAIN APACHE

majority. The Apache past is still dramatically verbalized in ceremonial song and taught to apprentice medicine men. Ancient puberty rites are still practiced by our daughters. One of them, Nita Quintero, tells of her experience in the article that follows.

We hold to our ways so we will know who we are, and to help us feel good about our existence upon the earth. We do not reject the modern technological world. We reach for it to improve the quality of our lives and to create a secure environment where we can safely pursue our Apache ways. We have begun enterprises that are turning our Fort Apache Reservation into a self-sufficient Indian community. Bill Hess, a white man who has come to live among us as a son-in-law, writes of our progress (pages 272-290).

BILL HESS

To strengthen myself, I spend time five days a week working out in a weight room that I built (*left*). I find the exercises to be a strain. My muscles hurt and I am sometimes forced to gasp for air. So it is with my people. As we advance deeper into the modern world, we stretch our abilities and it hurts. Some see us struggling for a deeper breath and think we are drowning. Yet, when I recover from a workout, I feel much stronger and am able to do even more than before. So it will be with my Apache people.

We of the White Mountain tribe on the Fort Apache Reservation are but one nation of the Apache. Others of us live on reservations scattered throughout Arizona and New Mexico (***map, below***), with more in Oklahoma. They, like us, desire to live in harmony with neighbors of all colors. We ask only to be respected and accepted for what we are—a people with conviction and our own unique way of looking at the universe: an Apache people! * * *

Apache Indian Reservations

PHOTOGRAPHS BY BILL HESS

Coming of Age the Apache Way

By NITA QUINTERO

WE CALL it Sunrise Dance. But it lasts through four days. It's the biggest ceremony of the White Mountain Apache—when a girl passes from childhood to womanhood. When my time came at 14, I didn't want to have one. I felt embarrassed. All my friends would be watching me. But my parents really wanted it. My mother—she never had one—explained it was important, "Then you will live strong to an old age." So I didn't say no.

My parents prepared for a year. They asked relatives, "Help us so our daughter's dance will be a good one." Older relatives—they know best—and a medicine man helped choose my sponsors, an older couple not related to us. I call them godparents. One morning my mother and father took an

eagle feather to Godmother Gertrude Foster and placed it on her foot, saying, "Would you prepare a dance for my daughter?" Mrs. Foster picked up the feather. "Yes."

We held the dance at the fairgrounds at Whiteriver. There was room for everyone to camp. On Friday evening Godmother dressed me and pinned an eagle feather on my head. It will help me live until my hair turns gray. The abalone shell pendant on my forehead is the sign of Changing Woman, mother of all Apache people.

The most important thing Godmother does in the whole ceremony is to massage my body (***above***). She is giving me all her knowledge. That night for hours around the fire, I follow a crown dancer (***upper left***), who impersonates a protective spirit.

SATURDAY is like an endurance test. Men begin the chants at dawn. They are really praying. Godmother tells me to dance while kneeling on a buckskin pad (***right***) facing the sun—the creator. In that position, Apache women grind corn. When the time comes for the running (***above***), I go fast around a sacred cane, so nobody evil will ever catch up with me. My Aunt Dolly, in the pink dress, runs behind me, followed by Godmother. Rain begins, and my costume, which weighs ten pounds, gets heavier and heavier. But I don't fall. I don't even get tired.

MY GODFATHER, Ambrose Foster, directs my dancing on Sunday with an eagle feather in each hand. Next to him, my father holds my sacred cane. When I'm old, I'll use the cane for walking. It's decorated with feathers of the even-tempered oriole to give me a good disposition. Aunt Dolly stays close to make

sure that no evil-thinking people touch me.

Medicine man Renzie Gordon, behind me in the white hat, leads the singing in the Apache language. I speak Apache—I didn't learn English until I was 4—but I can't understand all the words he uses. He is teaching his son Buster, in the red shirt, to be a medicine man. It takes many years to learn.

CATTAIL POLLEN is something holy to my people. We use it as a blessing. On both Saturday and Sunday, I am showered with the bright yellow powder. On Saturday in the rain all the people—perhaps a hundred—pick up a handful of pollen from a basket beside me and shake it over my head (***left***). Each says prayers—not out loud but in the mind, like a silent prayer in church. I am praying too, saying to the sun, "Thank you, and bless all these people to have a good life and be happy."

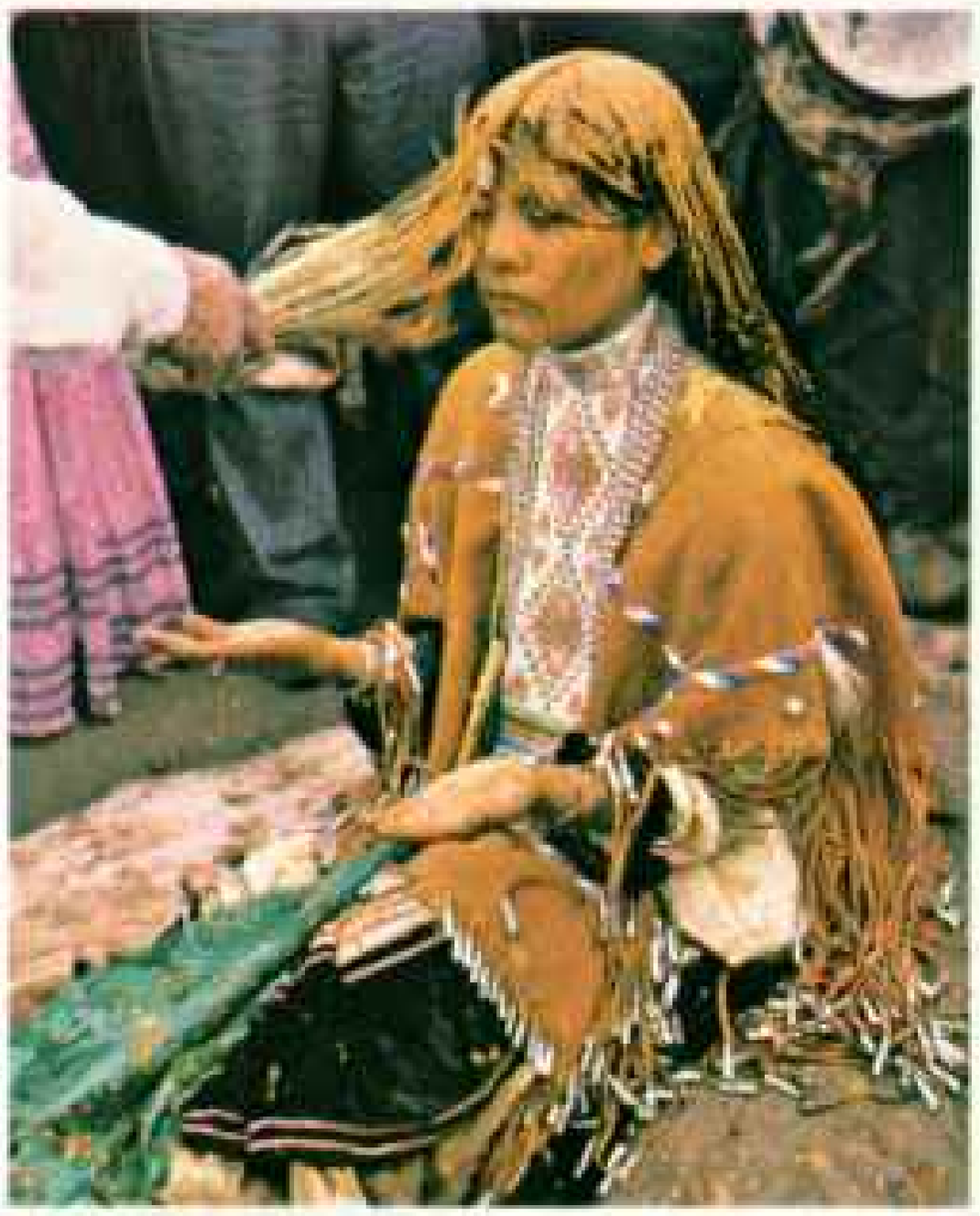
Dolly's daughter holds up her baby. Dolly tells me, "Blow in the baby's mouth." That's because during the dance I have power to keep evil spirits away. Next, my father pours candies and corn kernels over me to protect me from famine. My family passes out all the crates of candy and pop they have collected—this means the people will always have plenty of food.

On Sunday, Godfather paints me (***upper right***) from the top of my head to the bottom of my buckskin boots. I am blessed and protected from all four sides. Four is the most important number to the Apache.

The paint is a mixture of pollen, cornmeal, and ground-up stones of four colors. Later it brushes out of my costume. I can wear the outfit again at any Apache dance. I'm proud of it because a lot of people helped make it. My Aunt Minda sewed the buckskin top; my mother cut and rolled about 200 pieces of tin cans for the jingles; they make me sound like wind in the trees when I walk. Mom also beaded the necklace. Aunt Dolly made my velvet camp dress. Godmother fixed a neck string that holds a cloth to wipe my face and the traditional reed drinking tube and the body scratcher. For the four days I can't bathe, or touch my skin, or drink from a glass.

Earlier the men raised a tepee frame. I dance through it several times so I will always have a home. Here with my mother behind me in the shadows, I go through for the last time (***lower right***). The dancing is done.

On Monday morning there is more visiting and blessing. Aunt Dolly tells me I was really strong all the way; I didn't cry like some girls do. Among the Apache, people are most loyal to their mother's clan. So my mother's sister is a real important person in my life. Now Godmother is too.



WE SAY THANK YOU to godmothers in a big way (***above***). Our tribal chairman, Ronnie Lupe, in the cowboy hat, gave a feast and all these gifts to Helen Crocker for being sponsor to his daughter Carolyn, at upper left. Relatives helped make dozens of dresses, quilts, and blankets; Mr. Lupe bought the horse that Mrs. Crocker leads away. She invited her friends and relatives to the feast and to share the presents.

But whatever a godmother gets, she must give back—and more. Sometime in the next two years, Mrs. Crocker will call on her relatives to contribute the same kinds of things received, even a horse. She will give a payback to the Lupes. *That* will be the end. A giveaway depends on your parents; mine haven't had one yet. Everything takes time and a lot of hard work, and costs a lot too.

As for me, I'm finishing high school at Whiteriver. Right now, I don't want to get

married. I want to go away to college and then come back home. I love sports, especially basketball and volleyball. Just for fun I was quarterback in a powder-puff football game during homecoming (***right***).

I'm really glad I had a Sunrise Dance. It made me realize how much my parents care for me and want me to grow up right. They know my small age is past and treat me like a woman. If I have a daughter, I want her to have a Sunrise Dance too. * * *

THE WHITE MOUNTAIN APACHE

Seeking the Best

# of Two Worlds

ARTICLE AND PHOTOGRAPHS BY BILL HESS

APPREHENSION GNAWED at my heart as Margie and I turned off U. S. 60 and dropped down the lane leading to the tiny reservation community of Carrizo, Arizona. Margie Roosevelt and I had found love during a date at Brigham Young University in Utah, a few months earlier. Now it was Christmastime, and I was about to meet my future in-laws, full-blooded White Mountain Apaches.

"Margie! Margie!" sister Chy and brother Steven, ages 4 and 10, screamed as they mobbed their eldest sister, age 24. Silence replaced delight as their eyes caught sight of the strange *indaa*—white man—with her.

Lights twinkled from a decorated spruce as we entered the modern family home built with aid from the United States Department of Housing and Urban Development. Mother Rose greeted us quietly, then filled our empty stomachs with fried venison wrapped in thick, Apache-style tortillas. Father Randy was away, camping out while repairing fence on the reservation boundary.

Early next morning Margie, Chy, Steven, and I climbed into a borrowed pickup truck for a drive up Carrizo Canyon. We crossed the creek on cracking ice and followed a red dirt trail leading into Margie's childhood.

Near a cluster of peach trees stood the dark weathered poles of Grandmother's abandoned wickiup. Margie had lived there while her parents sought employment in far corners of the reservation. There her winters were warmed by tales of Mr. Coyote,

Cowboys and Indians *are one and the same as Edwin Machuse and Harvey Pina rope a calf for branding during fall roundup at Cibecue. The teenagers wrangle cattle for one of the Indian cooperatives that run 18,000 Herefords on rich grasslands of the Fort Apache Reservation in Arizona.*

as Grandmother instilled Apache values through timeless fables. Grandmother died in 1968, and the wickiup fell into ruin. Rising employment and mass construction of modern homes have largely relegated the Apache wickiup to history.

Not all Margie's childhood memories are pleasant. She remembers hunger, and depressing times when her parents sought escape in the bottle from the harsh realities of reservation life. She remembers when four of her sisters were temporarily taken away by missionaries who mistook poverty for neglect. She remembers that an infant sister died in her arms after her mother, Rose, was unable to find anyone with an automobile who would take the sick child to a hospital.

We stopped to slide on the ice. Chy and Steven and I were by now great friends. They spoke Apache, I English; yet our spirits touched and we communicated.

Christian Wedding, Apache Gowns

Father Randy returned for Christmas turkey dinner, and then took me round to meet countless relatives. It was never said, yet I knew the family accepted me 100 percent, and I them. In February Margie and I had a Christian wedding at which traditional Apache camp dresses freely mingled with gowns, suits, and ties.

Seven months later Randy, drinking at the wheel, died in a head-on collision. As rocks and dirt crashed over his coffin—and over his personal possessions, buried with him to ease the journey into the next life—I felt I could never again return to Apache land. But return I did, when on leaving college I learned the tribe needed an editor for its newspaper, the *Fort Apache Scout*.

"Self-sufficiency, that's our main thrust," tribal chairman Ronnie Lupe, a veteran of the Korean War, told me as we discussed my new job in his office in Whiteriver. There dwell a third of the 8,000 Apaches who live on the reservation. "We have endured as Apache through more than a hundred years of attempts to assimilate us," Lupe said. "It is our pledge as a tribal government that we will last hundreds more. We cannot do this by hiding. We must take the best of the white man's world and blend it with ours. We must develop our resources and become strong. Only then can we expect to retain our traditional ways. A strong man can make his own path."

I had an opportunity to view this blending of traditional culture with progress on a cold late-winter day. A strong wind ripped through the crowd, lashing at wooden crowns towering atop the masked heads and painted bodies of five representatives of the *gaan*, the Apache mountain spirits. Raising

Saddle-wise 8-year-old, *Phillip Dehose* ***(facing page)*** *works the Cibecue roundup for his third year. Rodeo, not roundup, fills the dreams of carpenter Leon Walker* ***(above)****, who practices on a mechanical bull. Hard-riding forefathers earned praise from Gen. George Crook—"each was an army in himself."*

Arizona's Fort Apache Indian Reservation

Mogollon Rim

2,210 m
7,250 ft

2,349 m
7,051 ft

2,033 m
6,671 ft

Cibecue

Carrizo

Cibecue Cr.

Carrizo Cr.

Canyon Creek

Salt

Cedar Creek

White

Whiteriver

Fort Apache

Big Bonito Cr.

Trout Creek

A-1 Lake

Hawley Lake

Sunrise Lake

Sunrise Ski Resort

White Mountains

Baldy Peak
3,478 m
11,403 ft

2,465 m
8,088 ft

Black

San Carlos Indian Reservation

Theodore Roosevelt Lake

0 KILOMETERS 20
0 STATUTE MILES 20

DRAWN BY JOHN R. TREIBER
COMPILED BY BRIAN H. MORGAN
NATIONAL GEOGRAPHIC ART DIVISION

The sacred mountain *draws a hundred pilgrims to its summit in a yearly trek to offer thanks for the beautiful land. To whites it is Baldy Peak* ***(map)****; to Apaches like Sarah Balish (****above****), it is Dzil Ligai—White Mountain—home of the wind and the gaan, or mountain spirits. Some walkers carry sprigs of spruce as offerings.*

This is a cherished land—from the deserts to the well-watered valleys and the forested mountain ranges, principal watershed for the Salt River. For centuries the region nurtured semi-nomadic Apache bands who gathered nuts and berries, hunted deer and turkey, and grew corn and squash. Horsemen raided livestock from Mexican ranches to the south.

Though forced to change their way of life when white settlement intruded, the White Mountain Apache were lucky, for their reservation lay within their homeland. Recently, tribal councils have turned this natural resource to profit with logging, fishing lakes, and a ski resort.

Creator sun *sends its power to an array of collectors that make the new hospital in Whiteriver a pioneer in use of solar energy for heating and cooling. High infant mortality, alcoholism, and tuberculosis shadow the tribe. Some sick people rely on the medicine man as well as on hospital care.*

swordlike wands to the east, the dancers set their buckskin moccasins prancing in steps imitating the deer. The chant of an accompanying medicine man rose over the howling wind.

The blessings of the gaan were being invoked upon a new, ultramodern shopping center built by the tribe.

The shopping center, a project that has cost 3.2 million dollars so far, was financed out of tribal funds, and is one of eight major tribal enterprises. Others, such as a ski resort and two timber mills, profit from the abundant resources on the 1.6-million-acre reservation. Success is reflected in a recent pay raise for all tribal employees.

Evidence of progress abounds: new homes, new office buildings, a new hospital. New pickups, many sporting CB antennas, flock like taxicabs in New York City.

Yet problems remain. Unemployment is very high, though some jobs go begging. Alcohol drowns the talents of many. Social programs must feed infants and elders. Still, the Apache have come a long way.

Related to Canada's Athapaskan tribes, the Apache probably reached the Southwest in the 1400s. The word Apache is said to be from the Zuni language, meaning "enemy." To themselves, they are *Indee*, the People. Never a closely knit tribe, they divided into separate groups. Several of these, comprising dozens of clans, occupy the Fort Apache Indian Reservation. While other Apache groups suffered devastation, plunder, and even removal to Florida and Oklahoma, these eastern Arizona Apache, who came to be known as the White Mountain tribe, managed to hold onto this substantial part of their homeland.

In search of Margie's history, I explored historic Fort Apache with William Major, lone survivor of an all-Apache group of U. S. Army scouts. "I slept there," he said, pointing to a U-shaped barracks, now a museum. He tapped a cracked, cactus-filled concrete trough. "I built this back in 1919."

By then, Fort Apache was already a military antique. Historical records say it was built to protect Apaches from outside intrusion. Many Apaches disagree. In 1869, 141 white soldiers, wrongly believing the White Mountain Apache guilty of raiding, entered their territory, killed two villagers, and burned a hundred acres of corn. They were met by Apache leaders anxious for peace, and asking that they be given a reservation.

The Army moved in the next year and built Fort Apache. Gen. George Crook enlisted four companies of Apache scouts to assist the Army against so-called renegade Apache bands. Without the scouts, the Army would have found it difficult, if not impossible, to defeat the Apache in their homelands. While some point proudly to the scouts—especially to Alchesay, who earned the Congressional Medal of Honor—others feel the scouts' service to the government is a black mark on Indian history.

"No fort was ever built on Indian land to protect Indians," declares Lupe, whose

great-grandfather was held prisoner by federal authorities. "The White Mountain Apache did not survive because of Fort Apache. The fort is not part of us. We survived in spite of Fort Apache."

Profiting by the White Man's Methods

The 20th century brought a more subtle war to Apache land—the struggle to maintain identity and increase prosperity amid an ever encroaching alien environment. But using the white man's free-enterprise methods—against the white man where necessary—the tribe has made economic progress without loss of its sovereignty.

In 1957 tribal councilmen had to flee the state to avoid subpoenas when they ignored an injunction to halt construction of a dam on Trout Creek. The reservation watershed is a major thirst quencher for dry Phoenix and Tempe, and these cities feared that, in a dry year, the tribe might hold water back.

The tribe placed armed guards at the site to ensure that construction would continue. The resultant Hawley Lake has justified the tribe's persistence. The lake and others are providing recreation for multitudes who lease homesites or rent summer cabins, fish the lake waters, and patronize Apache tourist facilities. Such bold steps have swelled the tribal economy by millions, though the council recently decided it was uncomfortable with a substantial non-Indian community on the reservation. It has decided not to make further homesite leases or to renew the present 25-year contracts. The decision has been very controversial.

The council set off another controversy by its strong position on wildlife management. It decreed that game quotas and fees would henceforth be set by the tribe, not the state. Sportsmen would need only reservation permits. Phillip Stago, Jr., director of the tribe's Recreation Enterprise, whose rangers patrol more than 400 miles of trout streams, 26 lakes, and 1,000 campsites, explained, "The United States guarantees our sovereignty. Now we're exercising it."

The fee for an elk-hunting permit was increased from $35 to $3,000, and the number of permits was cut from 450 to 32 annually. More revenue could be realized with less

cost to the environment. Every participant on the Apache-guided hunts could bag his limit of one bull without harming the herd. Unhappy state officials seized a trophy head leaving the reservation, and the tribe sued. A U. S. district court ruling affirmed the tribe's right to set its own fees and seasons and to regulate game, but also upheld Arizona's right to enforce state regulations on non-Indian hunters leaving the reservation. The tribe has appealed.

The tribe's Sunrise Ski Resort is a noteworthy capitalistic success. Built with an economic-development grant in 1970, it features a snaky slalom course high on 10,682-foot Sunrise Peak. Last season 145,000 customers brought the tribe an unprecedented 2.4 million dollars in earnings.

Despite the ski complex's overall profits, the 106-room ski lodge is just now approaching the break-even point. Billed as a year-round convention center in cool country, it is expected to turn healthy profits shortly. Apaches don't yet hold the best jobs, but are gaining. Two recently joined the ski patrol, and the assistant manager of the lodge is Apache. Eighty have less skilled positions.

These Cowboys Are Indians

Besides good snow, the reservation has rich grasslands, fostering another Apache enterprise—cattle. Hundreds of individual Apache cattle owners run 16,000 head in eight livestock cooperatives across the reservation. Apache cowboys are hired by each cooperative to look after the members' interests. A ninth herd, owned by the tribe, numbers some 2,000 head.

Cowboying for a century, the Apache resist all persuasions to lease their land to white ranchers. Determined Apaches sat fast in their saddles when the market faltered recently. It paid off. Beef is bullish, and profits are up.

Traditional cradleboards *still hold Apache babies in a comforting embrace. Rose Roosevelt, left, gathers desert plants—sotol for the boards, cholla cactus for the canopy—and assembles twenty carriers a year. Her daughter, Margie, the author's wife, likes the cradleboard as a safe car seat for their son Rex.*

Lynn Cody, bulldogger and trapper, was the Apache official responsible for protecting livestock before his election to the tribal vice-chairman's seat. Snaring a cattle-killing cougar in an iron-jawed trap, Cody lifted his gun, sighted, and dropped the marauder. "Bleeding hearts will scream." He shook his head as the cat lay in his pickup. "We've got more lions here than anywhere in the country. Most don't bother cattle. They're left alone." Then he voiced his deeper feelings. "It was sure a beautiful animal," he said. "It should be running happy and free right now."

Giving Trees Time to Grow

Such respect for nature is common. Timber has brought the tribe its greatest wealth, but the Apache have not ravaged their environment to get it. Their goal is strict conservation, a sustained-yield harvest that permits recutting every 120 years, and, with the help of the Bureau of Indian Affairs (BIA), they maintain greenhouses for reforestation and crews for fire fighting. When cutting, they protect both the watershed and the nesting grounds of birds.

Nicknamed FATCO, the Fort Apache Timber Company was begun with two million dollars of borrowed money in 1961, ending all outside cutting on the 685,000 acres of ponderosa pine, fir, and spruce that blanket the rugged Apache highlands. Initial efforts to employ untrained Indian workers proved disastrous, and when fiery red-haired Hal Butler took command in 1964, he was told that he could never succeed with Apache labor. Butler did not agree. "I told the men that here was their chance to make something of themselves, to prove that they were just as good as anyone else."

This encouragement, backed by a strong personnel policy—absences and tardiness were met with pay cuts and even dismissal—dropped the turnover from 25 percent a month to only 2.8. By late this year FATCO expects to rank among the top 100 timber producers in the United States and Canada.

Today, 322 of 339 mill jobs are filled by Apaches, with expansion about to open a hundred new positions. Another hundred Apaches work private contracts in the woods. Wages are good, some as high as $25,000 annually. The payroll, more than 3.5 million dollars last year, has catapulted the economy, and timber earnings support the tribal government.

"Our men are prosperous now. They own houses, color TVs, new pickups," Butler said. But to some elders, prosperity has its drawbacks. One told me, "Young people used to respect an old man. Now you come home, kids don't talk to you. It's that TV."

Chairman Lupe has a more sanguine view of the repercussions of progress. "When one Apache finds success, he will pull others along with him. FATCO money built the new shopping center, and it in turn is creating new jobs for Apaches."

DAVID HIGER

By sharing their wilderness, *the tribe earns millions of tourist dollars. Nathaniel Riley* ***(above)*** *serves on the ski patrol. A-1 Lake* ***(facing page)*** *is a reminder that government Indian agents once gave numbers to people rather than learn Apache names. They referred to revered Chief Alchesay as A-1.*

An example is Vina Minjarez, mother of seven and the Apache wife of tribal treasurer Marcelo, a Spanish American. She has opened a clothing store in the shopping center. "We're going to have the best-dressed Indians around!" she promised. Borrowing $3,000, she first purchased some clothes and began selling them in the street. Reinvesting her profits, she then moved into her allotted space. I noticed she had no cash register, few shelves, and no lights.

Three weeks later I returned. I heard the constant jingle of a second-hand register as customers tried on clothes from well-lighted shelves. Vina was keeping her promise.

Like Vina, many Apache mothers are going to work, and people like Edgar Perry, the tribe's cultural-center director, are worrying about the effects on the children. "Our young people are thinking more about success, money, and pleasure," he told me. "In 200 years our whole culture could die out."

The center, I learned, is working hard to prevent this. Employees record tales and

To purify both mind and body, men take a sweat bath, the Indian sauna. After setting up the canvas-covered frame beside a stream, medicine man Ryan Burnette sprinkles water on four heated rocks, closes the entry, and leads religious chants. A prescribed series is sung before the men run to bathe in the cold stream.

*With a medicine man's blessing, Ray Thompson (**below**) began his life's work, carving miniature crown dancers.*

history from the elderly, which are then transcribed into English and Apache. "Everything was passed orally with the old people," Perry explained. "If we don't get it now, it will die with them."

Other programs encourage the use of the Apache language, written and spoken. "It's simple. If our language dies, our culture dies," Perry said.

At the cultural center I noticed a fine set of bow and arrows made by Nick Thompson. I went to visit him at his small frame house in Cibecue, where he showed me an archery set he had just finished. An elderly man, sporting a cowboy hat and a flannel shirt, Nick said, "I don't speak English so good." He held up the new bow: "My father's father taught me how to make these long time ago."

Thompson gathers his materials (mulberry for the bow, "shiny stone" for arrowheads) straight from nature. He boasts of much game bagged in younger days with his primitive weapons.

"I get these up Salt River Canyon," he

said of the cane arrow shafts. "I used to get them here, along the river. Now the cows eat the cane."

Another ancient craft for which Apache are famous is basket weaving. I watched Alice Declay fashion a burden basket at her home in Cedar Creek. Alice uses only native plants, which she spends days gathering. "It is strong," she boasted of her basket. "It will last for years." A large, well-made basket may sell for several hundred dollars, but a hundred hours may go into its making.

A more modern form of art is the carving of dolls patterned after the crown dancers and named for the elaborate wooden headgear they wear. "When I finish, I sing crown-dance song," Ray Thompson said as he whittled on a chunk of cottonwood. "I sprinkle with yellow powder and pray." Crippled below the waist, Ray was admirably dexterous as he added paint, tiny feathers, and a buckskin skirt, bringing a miniature crown dancer to life (page 285). Ray, who had to receive a medicine man's blessing before taking up his craft, toils on his dolls seven days a week, often beginning at 3:00 a.m. and continuing until midnight.

Opening a Door to Better Health

Ray overcame his handicap, but poor health blocks the path of self-sufficiency for many Apaches. "It's disgraceful and intolerable," chairman Lupe told me. "Our infant death rate is almost twice the national average." Tuberculosis, diabetes, and ear infections plague the People. But a better day may be coming soon. After an intensive lobbying campaign by tribal leaders, a new 14.5-million-dollar hospital opened on August 18, 1979 (pages 278-9).

There are no White Mountain Apache doctors. But a career health program run by the Tribal Health Authority is working to place more Apaches in medical positions, and Apache field nurses visit reservation homes to teach preventive medicine. High-school students attend health-oriented classes and work in the hospital. And plans are being studied to convert the old hospital into a nursing home, eliminating the need to send many elderly to Phoenix centers, where they die as strangers in a foreign land.

Even as modern medicine grows, spiritual healing continues. Violet Zozpah told me of an extreme case of traditional healing that she had witnessed years ago. The patient had been in a coma for two weeks. The medicine man bound her legs and arms with yucca stems. Then he and several helpers sang over her for many hours. Crown dancers beseeched the spirits to help. Ten hours later, the patient rose and danced with them. "To me, it was really a testimony," Violet, who had been involved in the prayer

Prized possessions *accompany carpenter Emmett Cosay, Sr., to the grave. Years ago he helped build the Lutheran chapel in which his funeral was held. Now relatives bury him the Apache way with his tool chest, clothes, and food. Other deaths often come in alcohol-related auto mishaps, marked by roadside crosses* ***(above)****.*

Nightly television powwow: *When Gilbert Childs, wearing a headband, received a portable set for Christmas, he and his friends journeyed on horseback to high ground amid the mountains that block reception in low-lying Carrizo.*

Poverty, a culture gap, and problems with English caused many teenagers of earlier generations to drop out; now their sons and daughters are more likely to complete high school. Graduate Gregg Dazen expresses his thanks to science teacher Tom Ensman ***(left)****.*

ceremonies, recalled. "I saw the strength of my culture."

I'm certain that today any Apache in a coma for two weeks would be hospitalized. But spiritual healing on a lesser scale still goes on.

Medicine men are specialists. Some heal; others preside over sacred ceremonies. I journeyed to Cedar Creek to meet the patriarch of the Sunrise Dance, the puberty ceremony for girls. A rising sun stepped with me into the doorway of a shack. "It's too early!" shouted an old man at a table, his back to me. Bacon sizzled over a cedar-fired stove.

"I have eagle feathers," I enticed. Margie had sacrificed these sacred objects, which only Indians can own, especially for the occasion. Medicine man Renzie Gordon accepted the feathers together with four turquoise stones. He was convinced of my sincerity.

We talked of the rigors of becoming a medicine man. There had been years of sacrifice; there had been daily six-mile runs. His father, also a medicine man, had revealed to him the mysteries of life as they sat within the scalding blackness of a steam bath. Ritual-induced trances brought him visions, and he learned prayers and songs. After three years, Gordon was qualified to preside over the Sunrise Dance.

"Two hundred years from now, there will

be somebody doing Sunrise," Gordon promised. "Young boys, they can learn the prayers, how to sing. My boy Buster, he'll be a good singer." Gordon advised all interested apprentices to present their teacher with turquoise and feathers. "It feels good to the Apache people," he explained.

I would have the opportunity to witness Gordon in action as he presided over the Sunrise ceremony of Nita Quintero, Margie's first cousin. (Nita has given her own version of this event on pages 262-71.)

Although Nita follows the tradition of the gaan, she, like many Apaches, is also Christian. I was reminded of this religious duality when I visited painter-medicine man Ryan Burnette in his home. There, hanging proudly among crown-dance scenes, was the Christ praying in the Garden of Gethsemane, lovingly painted by the hand of the shaman himself!

Cultural director Edgar Perry, who is also a Baptist Sunday-school teacher and gospel singer, told me, "In our culture we have many stories like those in the Bible. For example, a crown dancer parts a large body of water, and the People escape a pursuing enemy. It was easy for us to understand the Bible."

Regardless of spiritual concerns, material resources promise changes in White Mountain life. Iron ore, asbestos, and uranium wait to be mined. A power plant burning sawmill wastes is under construction.

"We're not afraid of change," tribal chairman Lupe told me. "Soon it will take a Ph.D. to sit at this desk. But to see our people shopping in their own center, to see our timber industry go from a struggling business to what it is today, to make our own mistakes and not have the BIA or some other agency make them, and then to learn—this feels good. This is Apache identity!"

I suspect the Apache will be as modern in the 21st century as anyone. Yet, if I could peek into the future, I would not be surprised to see a beautiful, buckskin-clad descendant of Nita Quintero—or perhaps one of mine—dancing the Sunrise Dance to the chant of a medicine man. □

Horsepowered tow, *courtesy of Rennie Antonio, gives a ride to skateboard novice Dwayne Johnson. They play on the paved streets of Whiskey Flat, a low-cost, federally assisted housing project in Whiteriver.*

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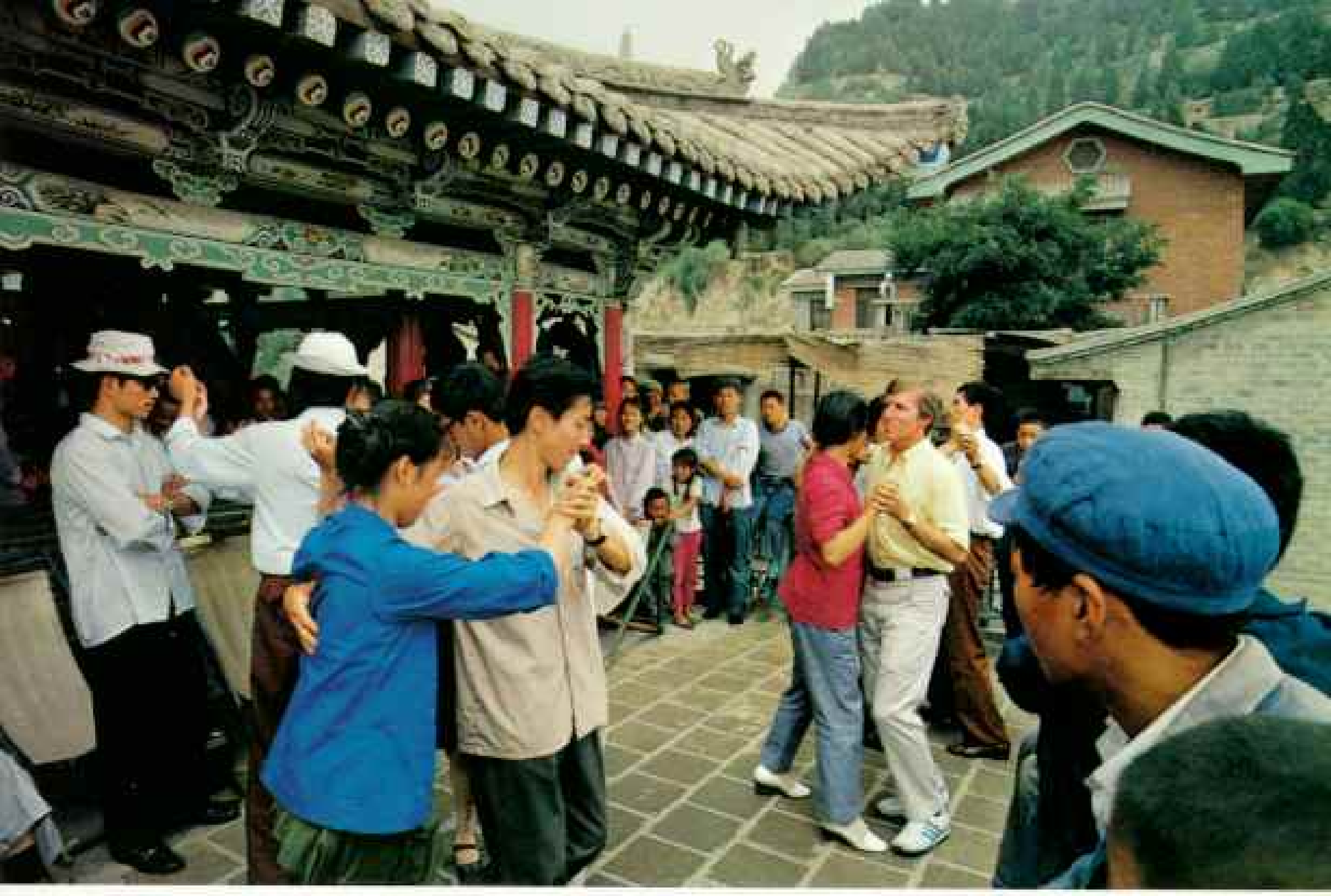

NATIONAL GEOGRAPHIC PHOTOGRAPHER BRUCE DALE

NOT LONG AGO, foreigners in western China were unheard of. Yet last summer a cordial reception (**left**) greeted a Society-sponsored team of desert specialists and staff writer Rick Gore, who found himself dancing in a park at Lanzhou (**above**). An account of their journey will appear in the March 1980 magazine. Share the unexpected world of NATIONAL GEOGRAPHIC by nominating a friend for membership.

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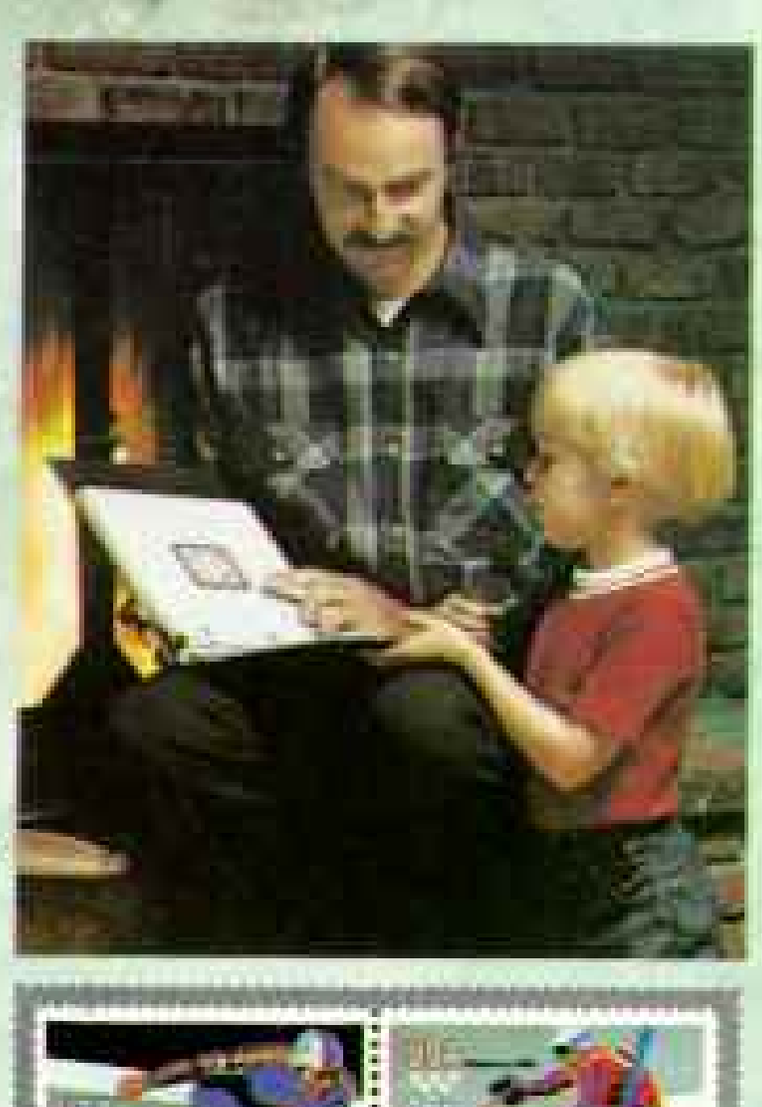

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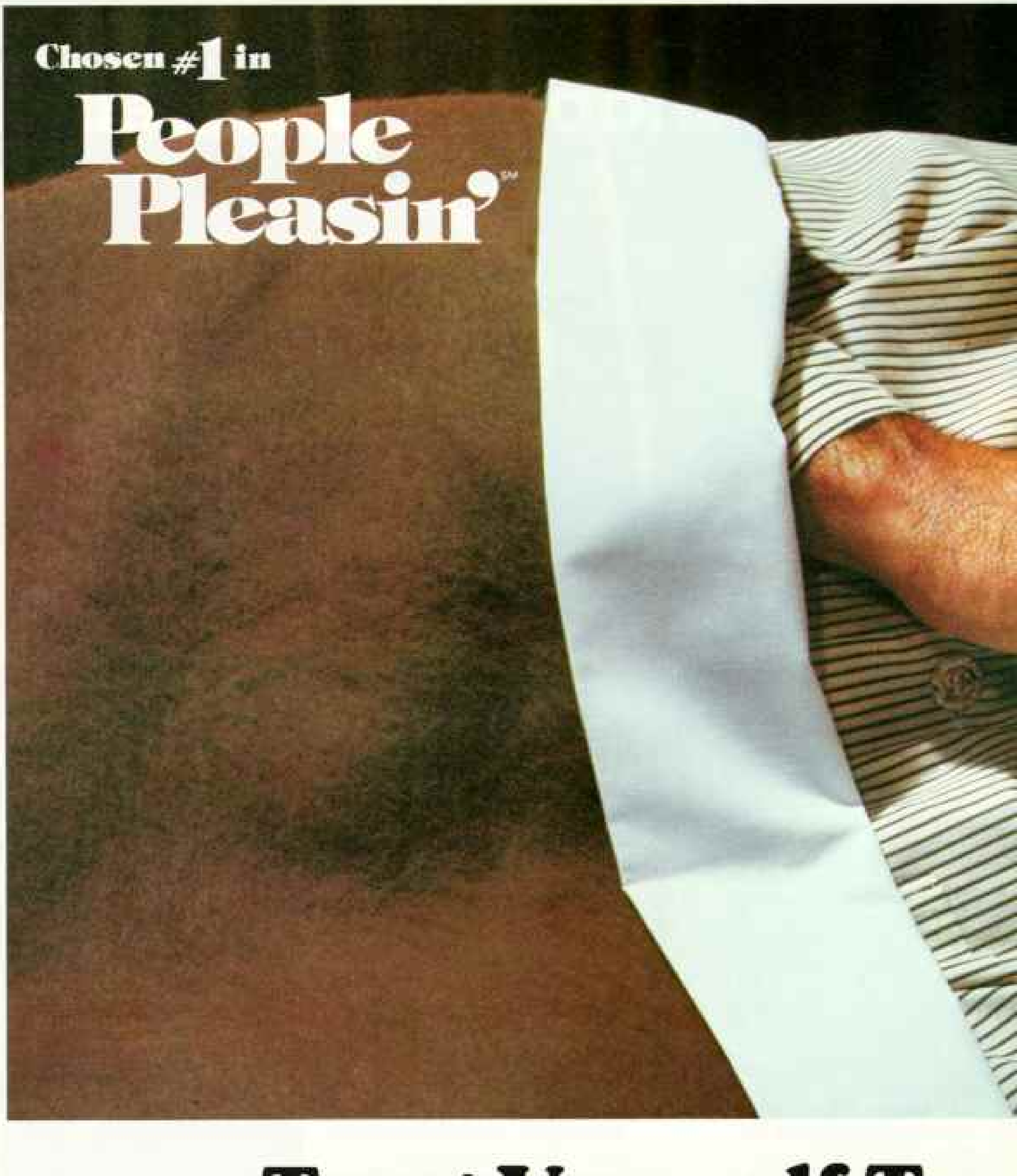

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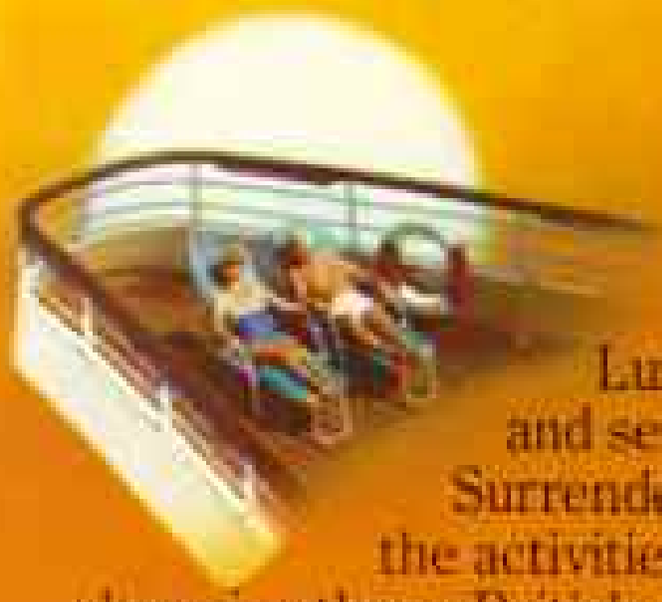

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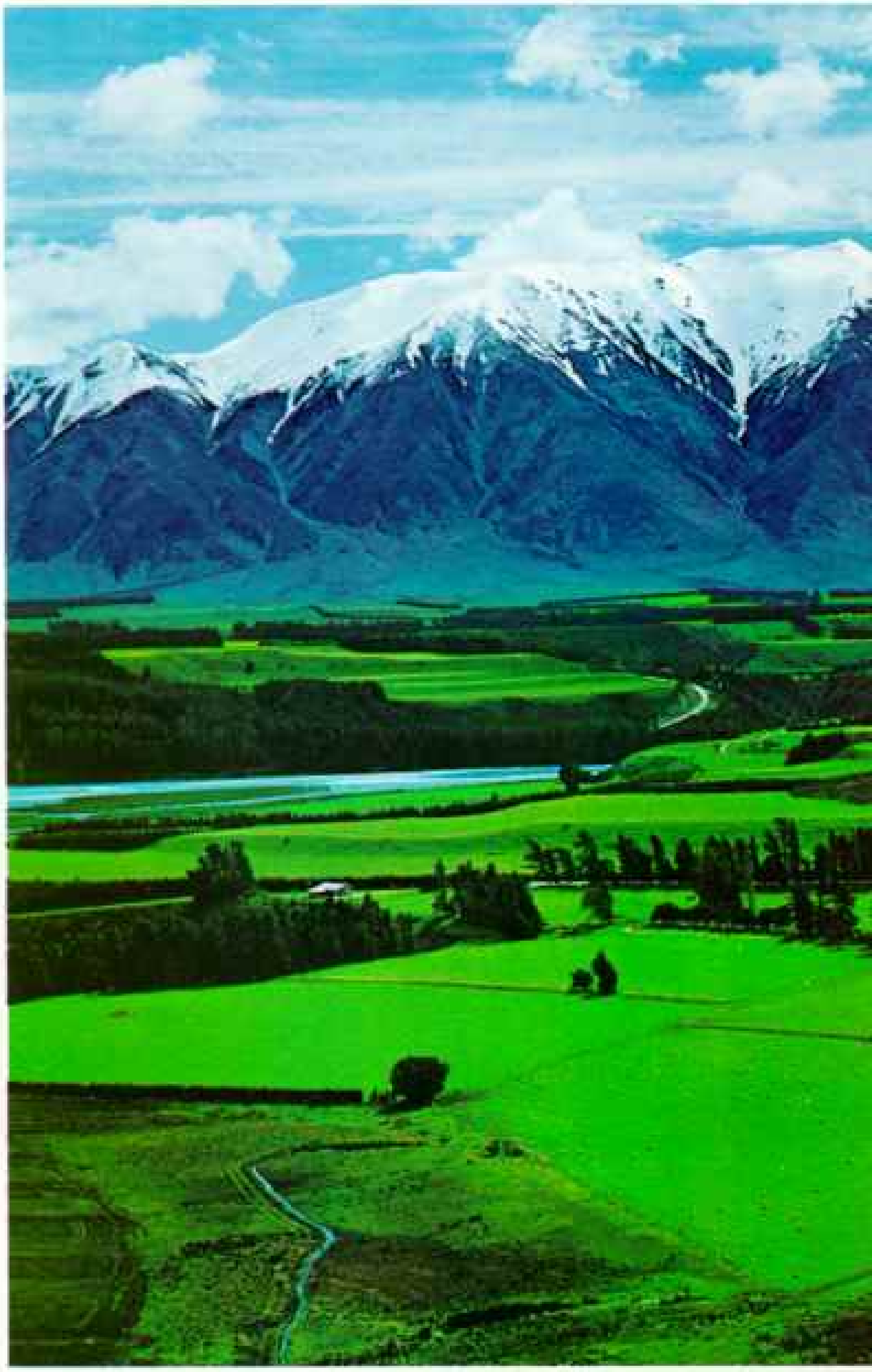

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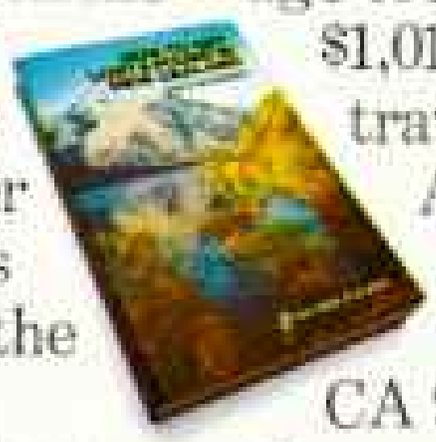

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Kalo [Taro]

Hawaiians terraced and irrigated both mountain slopes and lowlands to promote taro cultivation. The large crops were sheltered from salt by carefully-engineered seawalls. Other major stone works included shallow fishponds where fish were raised on baked taro and poi.

Mele Hula [Chant Dance]

Hawaiians developed no written language, but instead relied upon their tremendous memories. Their legends, genealogies and beliefs were set to music and dance called *Mele Hula*. See the exciting dances of seven South Pacific island groups in the evening performance of an "Invitation to Paradise." It's the most authentic dance revue in the Pacific.

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Polynesian Cultural Center

For reservations and information, contact a Travel Agent.
Or write our Waikiki Sales Office: 2222 Kalakaua Avenue, Suite 915, Honolulu, Hawaii 96815.
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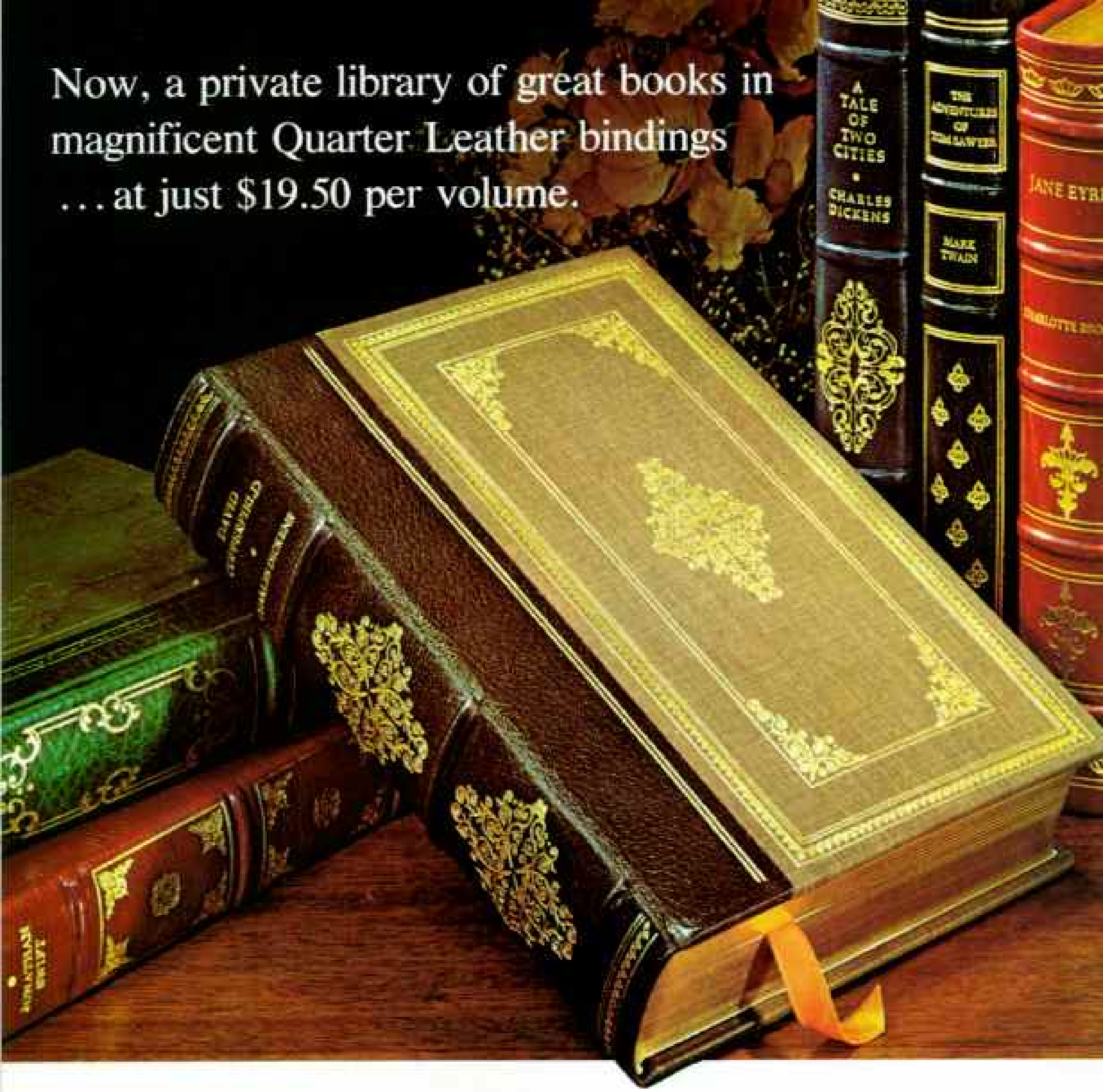

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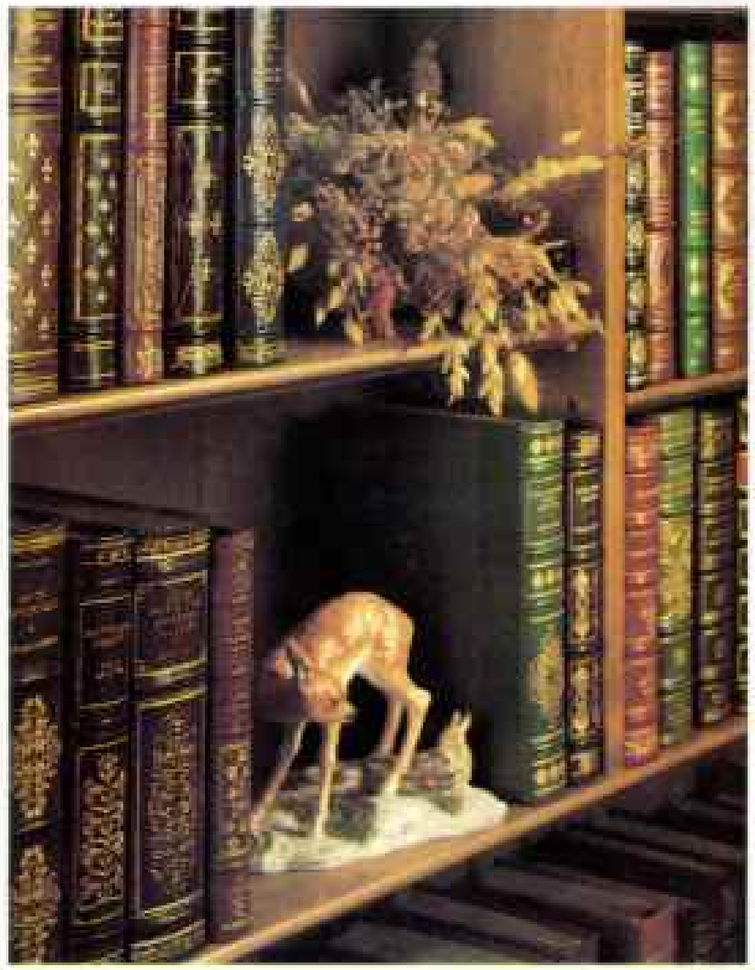

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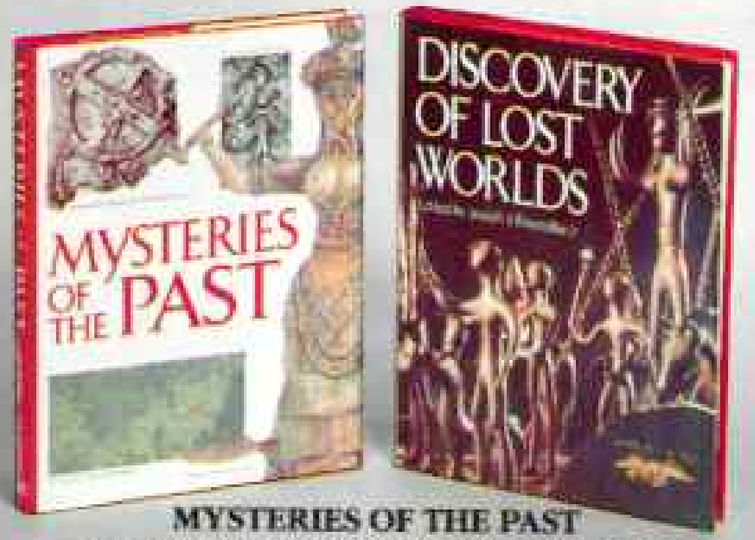

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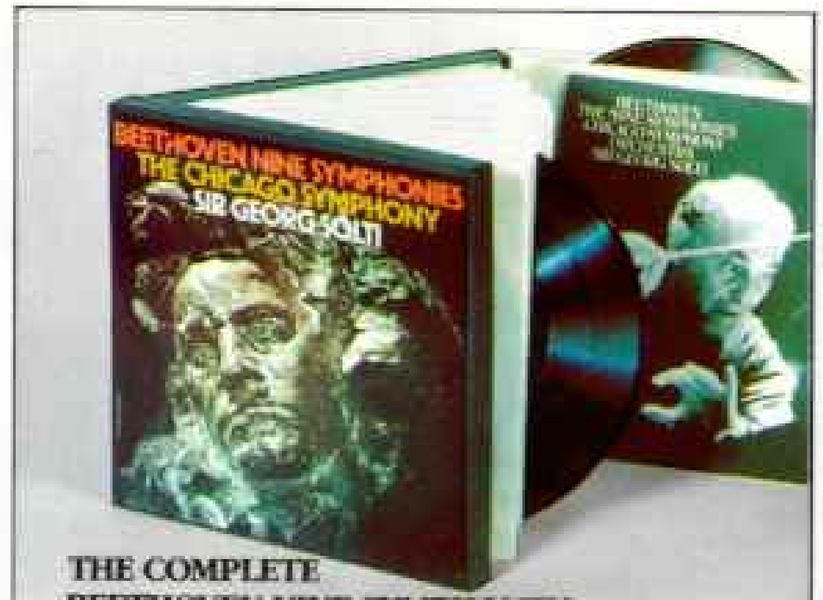

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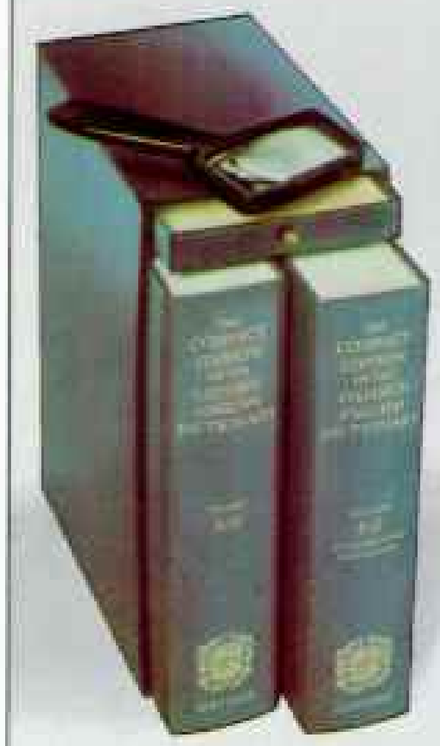

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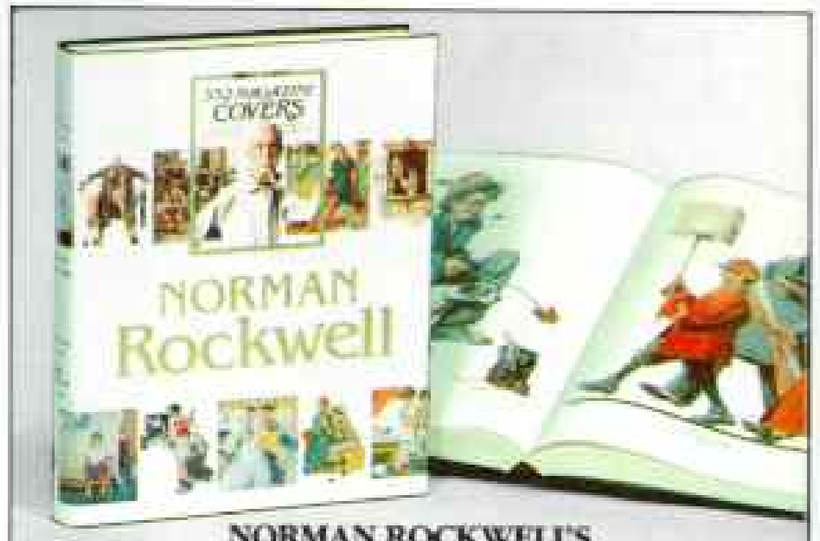

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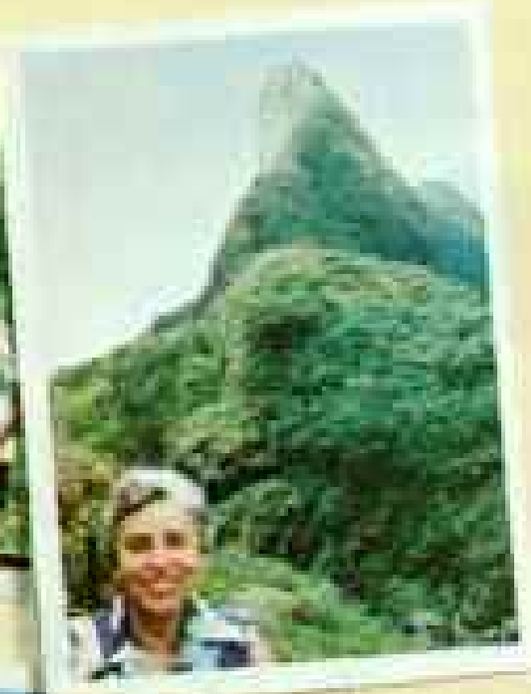

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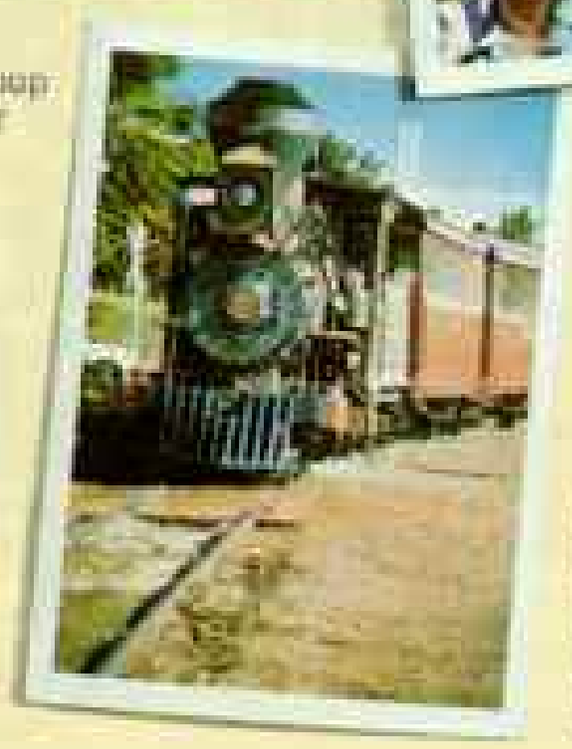

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A

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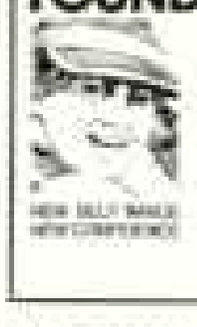

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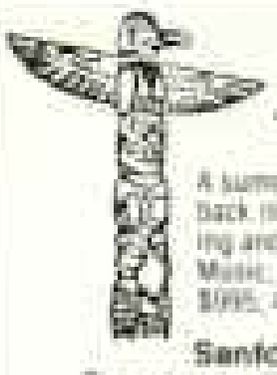

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Mrs. Joyce Whatley was skeptical when she got her Maytag Dryer in 1973. "I will let you know in 5 years if your product is as good as your advertising," she wrote from Irving, Texas.

True to her word, she has written to say her dryer has made a believer out of her. With a young family, the laundry never seems to end. But her Maytag keeps drying away, and it's only had one repair through the years.

Left to right: Jon, 15; Jeff, 16; James, 14; Mrs. Whatley; her husband, Jerry; Jason, 19; Julie, 12; and Jake, the family dog.

She was so impressed that about a year after purchasing her dryer, she got a Maytag Washer and a Maytag Dishwasher, too. Both are delights, states Mrs. Whatley.

My Maytag Dishwasher does a super job of getting dishes clean, and it's so easy to load, states Mrs. Whatley.

We don't say all Maytag Dryers will equal that record. But long life with few repairs is what we try to build into every Maytag product.

Maytag is the Official Dryer of the 1980 Winter Olympic Games.

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