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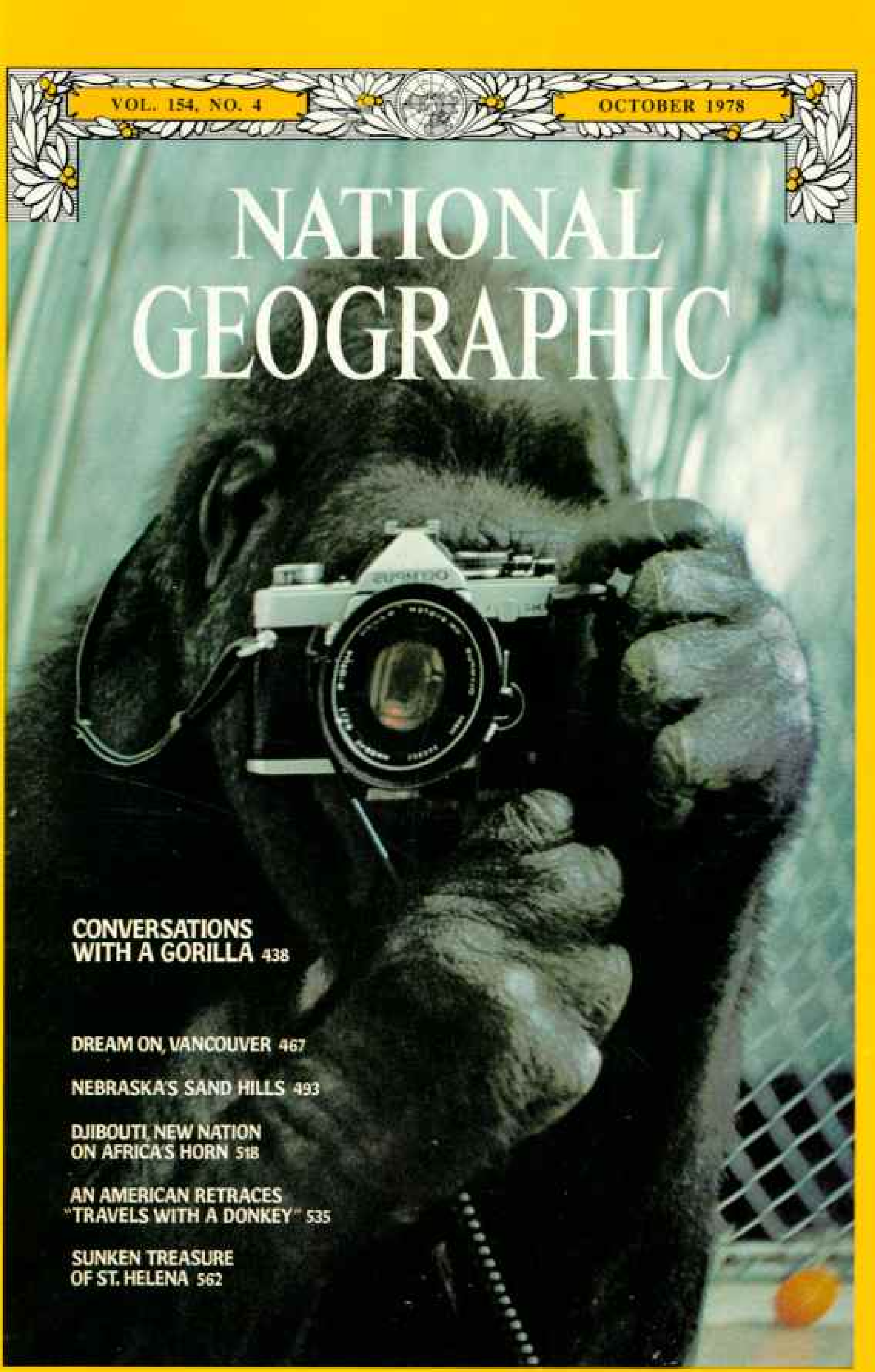

OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D.C.

IN THE PAST 15 YEARS, NATIONAL GEOGRAPHIC has presented the stories of a most unusual cast in the drama of modern anthropology: four brilliant, attractive women surrounded by fascinating primates.

It seems only yesterday that young Jane Goodall first walked out into the high forests of the Gombe Stream Game Reserve, on the shores of Africa's Lake Tanganyika, and entranced us with observations of wild chimpanzees we came to know well: Goliath and William and Mike, Mrs. Maggs and Figan and Fifi, young Flint and old Flo. Her description of the climactic moment when David Greybeard took her hand is one of the most moving we have ever published.

Her observations were stunning—chimps killing for meat and using stick tools to extract ants. (We will hear more stunning news from Jane in the coming year.)

In 1970 Dian Fossey took us with her into the Virunga Mountains of central Africa, last refuge of the mountain gorilla, where the great apes she called Rafiki and Uncle Bert and Icarus disproved the canard of the ferocious killer gorilla. She found them gentle, vegetarian, peaceful, and in mortal danger from poacher and herdsman.

From the Tanjung Puting Reserve in Indonesian Borneo, a third protégée of the late Dr. L. S. B. Leakey, Biruté Galdikas-Brindamour, wrote in 1975 about her life with the "people of the forest," the secretive orangutans.

Our knowledge of the way of life, social structure, capabilities, and shadowed futures of all these primates has been immeasurably increased by the work of these courageous women.

Now, in this issue, Francine "Penny" Patterson recounts her astounding relationship with Koko, a 7-year-old female gorilla who has mastered, by Penny's estimate, some 375 gestures of sign language. On a little-explored frontier of research already fraught with controversy, Miss Patterson's account of her life with Koko is certain to become a conversation piece among scientists and laymen alike.

Readers of the GEOGRAPHIC will not soon forget Jane and Dian, Biruté and Penny, of the keen mind, gentle touch, and endless patience, who have taught us so much.

Gilbert M. Grosvenor

NATIONAL GEOGRAPHIC

THE NATIONAL GEOGRAPHIC MAGAZINE VOL. 154, NO. 4

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COVER: *Photograph by Koko. A self-portrait in a slightly wavy Plexiglas mirror introduces the female gorilla who "talks" with scientists.*

Conversations With a Gorilla

By FRANCINE PATTERSON

Photographs by

RONALD H. COHN, Ph.D.

Vanity, vanity. . . . After making up with chalk, Koko, a 7-year-old lowland gorilla, admires herself in a mirror (**facing page**). At the same time, she touches her lip with an index finger, a gesture she often uses to mean "woman."

During the past decade researchers have successfully taught several chimpanzees to converse with signs. In a project partly funded by the National Geographic Society, Koko is the first gorilla to achieve proficiency.

After six years of study, author Francine "Penny" Patterson, a Stanford University doctoral candidate, evaluates Koko's working vocabulary at about 375 signs, including airplane, belly button, lollipop, friend, and stethoscope.

Koko responds to and asks questions, tells Penny when she feels "happy" or "sad," refers to past and future events, and has begun to give definitions for objects. She also shows an impish sense of humor, insults human companions —usually with good reason—and lies on occasion to avoid blame.

KOKO is a 7-year-old "talking" gorilla. She is the focus of my career as a developmental psychologist, and also has become a dear friend.

Through mastery of sign language—the familiar hand speech of the deaf—Koko has made us, her human companions, aware not only that her breed is bright, but also that it shares sensitivities commonly held to be the prerogative of people.

Take Koko's touching empathy toward fellow animals. Seeing a horse with a bit in its mouth, she signed, "Horse sad." When asked why the horse was sad, she signed, "Teeth." Shown a photo of the famous albino gorilla Snowflake struggling against having a bath, Koko, who also hates baths, signed, "Me cry there," while pointing at the picture.*

But Koko responds to more complicated motivations too. She loves an argument—and is not averse to trading insults.

At six o'clock on a spring evening last year, I went to the trailer where Koko lives to put her to bed. I was greeted by Cathy Ransom, one of my assistants, who told me that she and Koko had been arguing.

Lest I be alarmed at the thought of an altercation between this slight young woman, who is deaf, and a robust 6-year-old female gorilla, Cathy laughingly pointed to the notebook in which Koko's utterances in sign language are logged. The dispute began when Koko was shown a poster of herself that had been used during a fund-raising benefit. Manipulating hands and fingers, Cathy had asked Koko, "What's this?"

"Gorilla," signed Koko.

"Who gorilla?" asked Cathy.

"Bird," responded a bratty Koko, and things went downhill from there.

"You bird?" asked Cathy.

"You," countered Koko.

"Not me, you are bird," rejoined Cathy, mindful that "bird" can be an insult in Koko's lexicon.

"Me gorilla," asserted Koko.

"Who bird?" asked Cathy.

"You nut," replied Koko, resorting to another of her insults. (For Koko, "bird" and

*Aided by National Geographic Society research grants, studies of the first captive white gorilla, Snowflake, were described by Tulane University primate specialist Dr. Arthur J. Riopelle in the March 1967 and October 1970 issues of NATIONAL GEOGRAPHIC.

World's smartest gorilla? Koko hardly looked the part when mouthing a block at 13 months of age (**below**), just after Penny began working with her at the San Francisco Zoo. Her IQ on the Stanford-Binet test has recently ranged from 85 to 95, slightly below the average for a human child. But her scores are better than they look; asked whether she would choose a house or a tree for shelter from rain, for example, she naturally picks the tree, and the answer is marked wrong.

Because Penny talks to her while signing, Koko understands hundreds of spoken words and is an astute eavesdropper. "We have to spell out words like c-a-n-d-y and g-u-m in her presence," Penny reports.

"nut" switch from descriptive to pejorative terms by changing the position in which the sign is made.)

"Why me nut?" asked Cathy.

"Nut, nut," signed Koko.

"You nut, not me," Cathy replied.

Finally Koko gave up. Plaintively she signed, "Damn me good," and walked away signing, "Bad."

"When She Is Good. . . ."

I fully agree with Koko, if she meant that she is good even in a bad situation. I've come to cherish her lies, relish her arguments, and look forward to her insults. While these behaviors demonstrate occasional lapses from sweetness, they also provide reassuring benchmarks in the formal and controlled scientific testing that has monitored Koko's progress since I began to teach her American Sign Language in July 1972.

Of course such subjective behavior as lying is difficult to prove empirically, but when Koko uses language to make a point, to joke, to express her displeasure, or to lie her way out of a jam, then she is exploiting language the way we do as human beings. Certainly that is linguistic, though perhaps not moral, progress.

What makes all this awesome—even for me, after six years of witnessing such incidents—is that Koko, by all accepted concepts of animal and human nature, should not be able to do any of this. Traditionally, such behavior has been considered uniquely human; yet here is a language-using gorilla. (Two years ago she was joined by another of her species, a young male named Michael, who is the subject of similar study and training.)

Enrolling at Stanford in 1970 as a graduate student, I chose nonhuman primates rather than children for my research. In 1971, R. Allen and Beatrice Gardner came to speak. They were by then well-known for their success—it was an area where others had failed—in two-way communication with Washoe, a female chimpanzee.

The Gardners' breakthrough was to perceive that the chimp's difficulty in acquiring language might not be stupidity, but rather an inability to control lips and tongue. So they decided to try to teach Washoe American Sign Language—Ameslan for short—

used by an estimated 200,000 deaf Americans. The language consists of gestures, each of which signifies a word or idea.

Washoe endorsed the Gardners' choice by learning 34 signs during the first 22 months. This was more than eight times the number of spoken words that the chimpanzee Viki, the subject of Keith and Cathy Hayes's six-year effort, learned to utter. After four years of Project Washoe, by 1970, Washoe had acquired 132 signs, and she used these signs in combinations similar to those employed by children during the first stages of learning to talk.*

Hearing the Gardners tell their tale persuaded me that attempting to teach a chimp sign language would be to pursue the ultimate question with the ultimate animal. At that time I held no brief for gorillas.

Scientist Meets "Fireworks-Child"

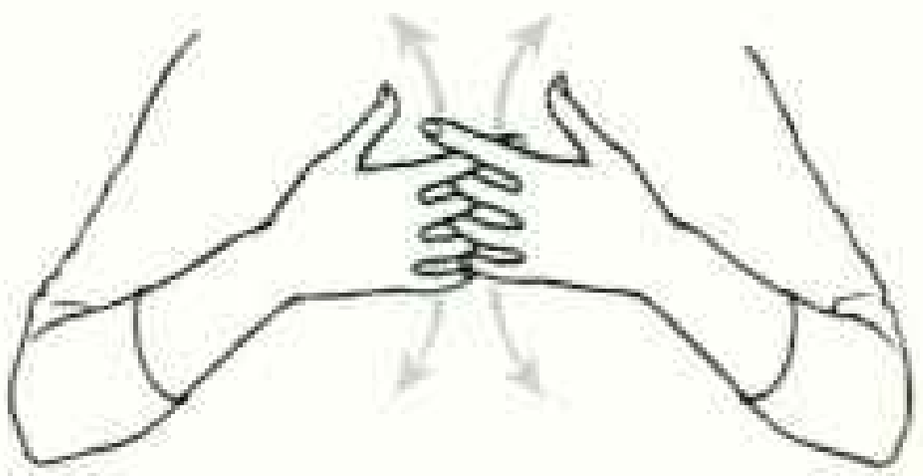
My initial preoccupation with chimps changed suddenly on the day I accompanied Dr. Karl Pribram, at that time my research adviser, to the San Francisco Zoo to talk with Ronald Reuther, then the director, about using a computer to try to communicate with the zoo's adult gorillas. We walked over to the gorilla grotto.

While Dr. Pribram and the director chatted, my eyes were drawn to a tiny infant clinging tenaciously to her mother. The infant was named Hanabi-Ko, Japanese for Fireworks-Child (she was born on the Fourth of July), but she was nicknamed Koko. Brashly I asked the director if I might try to teach Koko sign language. He said no, and quite rightly, too. Koko was only 3 months old, and Mr. Reuther did not want to separate her from her mother. Undaunted, I began to learn Ameslan, confident that one day I would have the chance to use it.

Nine months later, on a visit to the zoo, I ran into Martin E. Dias, an ebullient and sympathetic keeper. I asked about Koko. It seemed that Koko's mother had not been producing sufficient milk. As if this were not enough, the gorilla group had been afflicted with an outbreak of dysentery.

Suffering from malnutrition and dehydration, Koko had lost most of her hair, and her tiny body, *(Continued on page 449)*

*Project Washoe was supported in part by a research grant from the National Geographic Society.



All attention, Koko watches as Penny molds her hands (**top**) into the sign for "machine." Penny then makes the sign (**middle**), executed by moving the hands up and down (**above**), and Koko imitates it. The language is called Ameslan, short for American Sign Language.

Inspired by a grinning chimp, Koko enthusiastically signs, "Teeth," before a Plexiglas mirror in her trailer home on the Stanford campus. (She broke her original glass mirror.) She thus demonstrates that she recognizes not only the picture as something related to the real world, but also her own imitation of the

picture. On entering adolescence, the gorilla developed a fondness for a young biologist—she named him "Foot"—who worked with monkeys in a trailer next door. "She had all the symptoms of a teenage crush," says Penny. "She was very shy and didn't know what to say. She didn't want him to get too close, or too far."

Tea-for-two party begins as Penny offers Koko a wrapped present. Penny signs, "Present," and Koko replies, "Box" (**right**). After removing the paper, the gorilla inspects the plastic tea set (**middle**).

Koko gives the teapot to Penny and signs, "Sip?" (**below**). Invented by Koko, this sign is a combination of "eat" and "drink" and is inflected as a question by Koko's looking directly at Penny and making the sign toward her.

"It is a special sign that Koko uses when she wants people to pretend," explains Penny, who replies with the sign for "Penny?" meaning, "You want me to sip?"

Koko enjoys pretend games; she will "smoke" a twig or pencil. She is toilet trained and helps Penny clean her room in the trailer, though she has to be prodded to pick up her toys. After sponging the floor clean, she usually tears up the sponge.

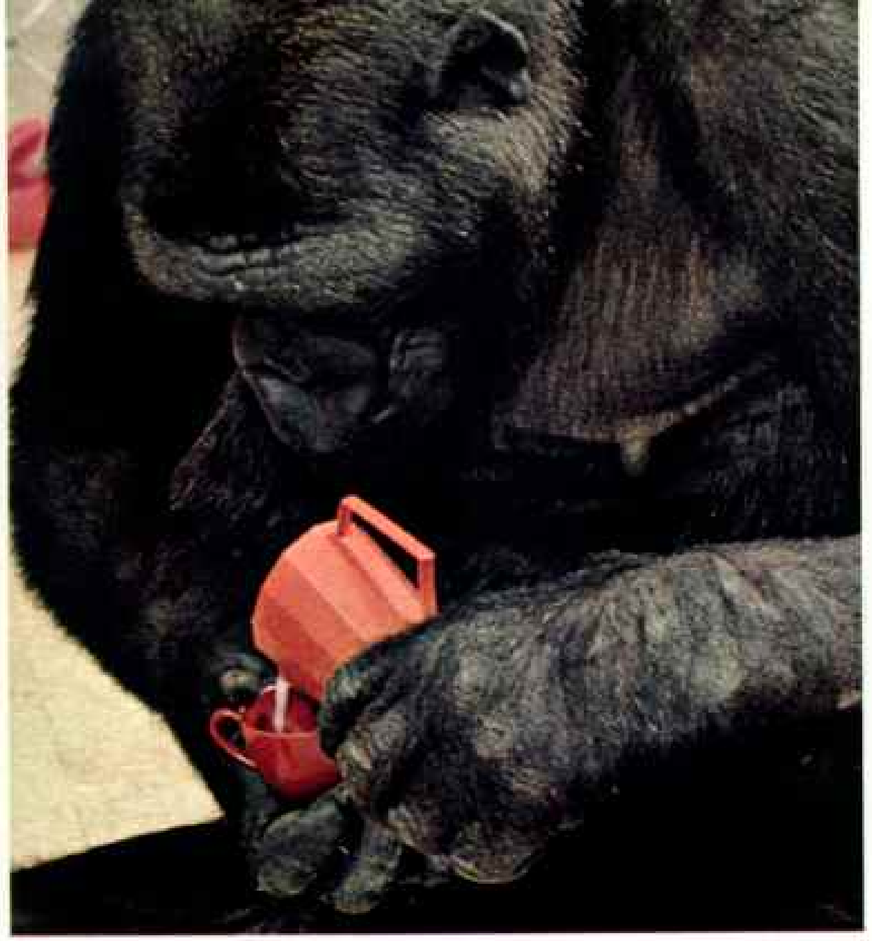
Koko makes attempts to talk and has even used the phone. A horrified operator traced the call, thinking it was either from an obscene caller or a dying man.

For more on the tea party, turn the page.

Continuing the game, Koko helps Penny drink the "tea" by gently nudging her hand (**left**). Since there is no tea in the trailer, Penny later prepares some powdered milk as a substitute.

Now the box becomes a table (**below**), and Penny offers a teapot full of milk. Koko responds by signing two words at once, "Koko love," a tricky procedure even for humans. Her right hand adds "Koko" to the two-handed sign for "love."

Responding to Penny's request to pour herself a cup of milk, the left-handed Koko does so with dexterity (**right**). Then she takes a drink (**right, lower**).



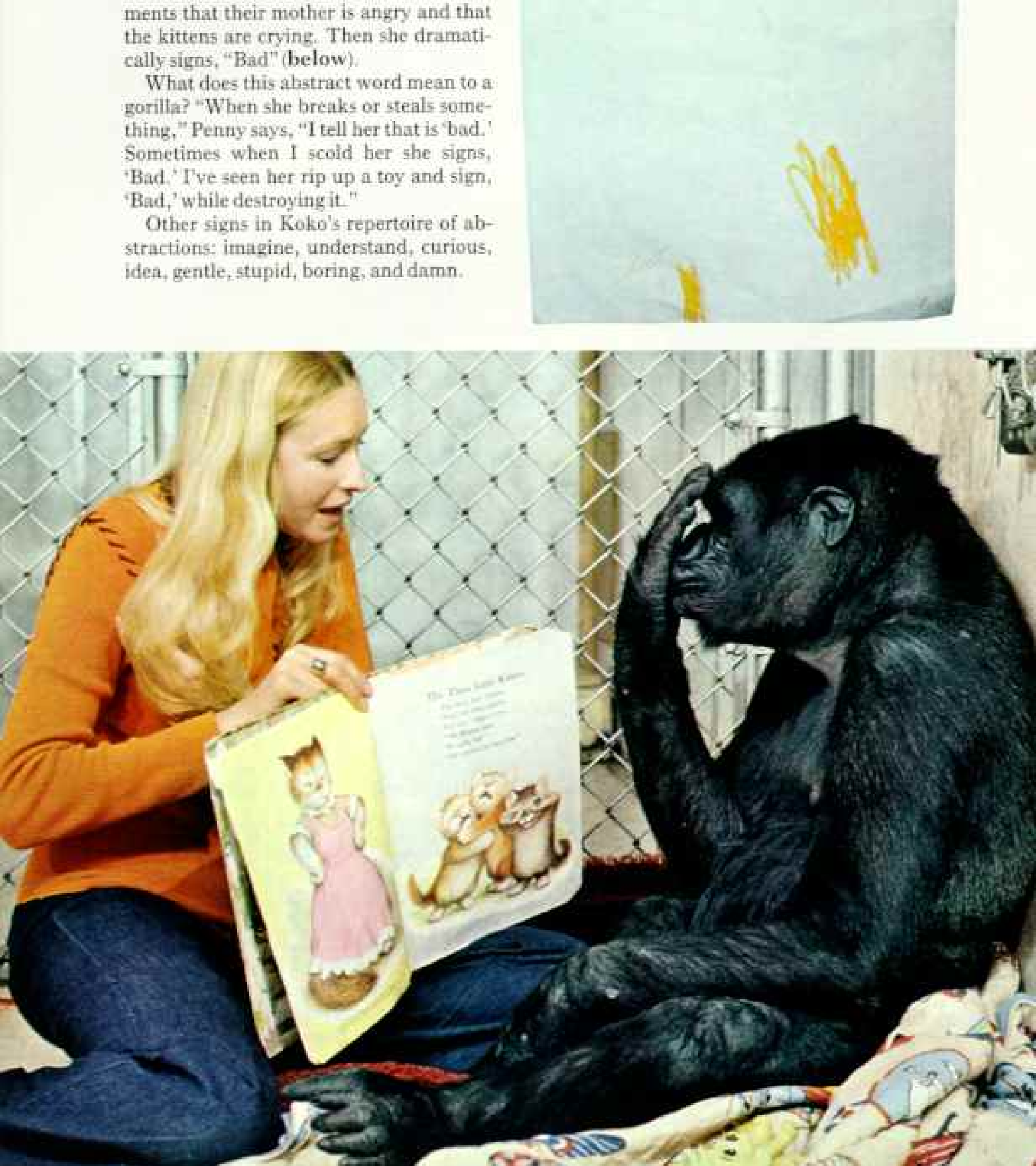
Enter a guest, a chimpanzee doll with a groovy smile. Penny suggests that Koko give the chimp a drink by signing, "Drink." Koko repeats the sign and complies. Two years ago Penny acquired a 3½-year-old male gorilla and told Koko a new baby was arriving. Seeing frisky 50-pound Michael, Koko signed, "Wrong, old."

Representational art. After a talk with Penny about spiders, Koko takes a pencil and draws black squiggles on a piece of paper (**right**). "Spiders," she explains. The orange scrawl, Koko says, portrays her drinking glass.

As Penny tells the story of the three little kittens who lost their mittens, Koko comments that their mother is angry and that the kittens are crying. Then she dramatically signs, "Bad" (**below**).

What does this abstract word mean to a gorilla? "When she breaks or steals something," Penny says, "I tell her that is 'bad.' Sometimes when I scold her she signs, 'Bad.' I've seen her rip up a toy and sign, 'Bad,' while destroying it."

Other signs in Koko's repertoire of abstractions: imagine, understand, curious, idea, gentle, stupid, boring, and damn.



(Continued from page 441) racked with diarrhea, had become emaciated.

But, moved to the Children's Zoo, Koko had recovered. Perhaps, Marty suggested, the director might now look favorably upon my request to work with and care for Koko. Mr. Reuther immediately acceded. I began to get to know Koko the next day. That was in July 1972.

Gorillas are tragically misunderstood animals. In fact exceedingly shy, placid, and unaggressive, they are conceived to be ferocious, slavering man-killers. In a recent poll of British schoolchildren, gorillas ranked with rats, snakes, and spiders among the most hated animals.

On our first meeting, Koko did nothing to advance the cause of gorilla public relations. Quickly sizing me up, the tiny 20-pound gorilla bit me on the leg. But I was undeterred. People often ask if I am worried about dealing with Koko when she reaches full growth, perhaps 250 pounds. The answer is no, though at 130 pounds she already outweighs me and is astonishingly strong. While many captive chimpanzees become difficult to work with as they mature, gorillas seem to be of quite a different temperament.

Soon after starting work with Koko, I met Carroll Soo-Hoo, the man who had donated Koko's mother to the San Francisco Zoo. Mr. Soo-Hoo brought out photos of himself, a slight man, romping with three 200-pound gorillas. That quelled whatever doubts I may have had about the danger of working with these immensely strong animals.

Pupil Begins to Learn—Reluctantly

Koko at first seemed to prefer men to women. While often contentious with me, she was beautifully behaved with Ron Cohn, my close friend and the photographer who has documented Koko's history.

Most bite attempts resulted from the method I used to get Koko to make signs—the "molding" technique the Gardners used with Washoe. The experimenter takes the hands of the subject and shapes them into the proper configuration for the sign representing an activity or an object while in its presence. As the animal comes to associate the hand movement and its meaning, the teacher gradually loosens his or her hold on the ape's hands until the animal is making the sign by itself. At first, every time I would take Koko's hands to mold a sign, she would try to bite me.

Another early problem—before we left the zoo for more satisfactory quarters—was distraction. I found it hard to keep Koko's attention while visitors to the glass-enclosed nursery stared, knocked, and commented on the curious tableau we presented. I grew weary of smirking people (who thought we could not hear them) saying, "Which one is the gorilla?" So it was with great relief that I moved Koko into her own trailer.

Are Apes Capable of Language?

My colleagues were not very sanguine about teaching Koko sign language. Some questioned the gorilla's dexterity as compared with the chimpanzee's. Others were skeptical about the animal's intellect.

In 1959 Hilda Knobloch and Benjamin Pasamanick had reported: "There is little question that the chimpanzee is capable of conceptualization and abstraction that is beyond the abilities of the gorilla."

My experience has been totally at odds with this assumption. While Koko certainly has been contrary at times, I believe that such brattiness may indicate intelligence rather than its absence.

In 1929 the great primatologists Robert and Ada Yerkes wrote: "It is entirely possible that the gorilla, while being distinctly inferior to the chimpanzee in ability to use and fashion implements and to operate mechanisms, is superior to it in certain other modes of behavioral adaptation and may indeed possess a higher order of intelligence than any other existing anthropoid ape." Now, fifty years later, Koko is bolstering evidence of the gorilla's intellectual primacy.

Initially my work with Koko used many of the techniques of Project Washoe. Experts in the new field of language development in humans—part of the discipline called psycholinguistics—found little agreement about what exactly language was, or when a child could be said to have it. Linguists, however, were virtually unanimous that Washoe did not have language. But by the time I began to publish data on Koko, many early critics of the Gardners had either recanted or softened their criticisms, in part

because of the mass of fresh evidence on the language capacities of apes.

At the same time as Project Washoe, Ann and David Premack established two-way communication with Sarah, a female chimpanzee. Sarah spoke and was spoken to through plastic symbols. The Gardners and Premacks were followed by Duane Rumbaugh, who installed yet another female chimp, Lana, at a computer console at the Yerkes Regional Primate Research Center in Atlanta. Lana gradually learned to communicate by typing out statements on an arbitrarily encoded keyboard. The computer was programmed to reject grammatically improper sentences.

The weight of all these experiments helped erode the doubts that an ape could be capable of language. Certainly, the pioneering work of the Gardners, the Premacks, and Dr. Rumbaugh has richly benefited me: I have been able directly to employ methods they discovered by trial and error, and have not had to refight the battle of credibility.

Once I had established that Koko performed at least as well as Washoe—learning the signs for "drink" and "more" within the project's first few weeks—I could probe new areas of the gorilla's potential for language and thought.

Koko Becomes a Star

From the start I have daily recorded Koko's casual signing, conversations, and self-directed utterances. I have also recorded her signing on videotape and film. Grants from the National Geographic Society and other private foundations have enabled me to meet the heavy costs—especially for equipment—to keep Project Koko going.

Vocabulary development is one of the best indexes of human intelligence. Koko's vocabulary grew at a remarkable pace. Over the first year and a half, she acquired about one new sign every month. After 36 months of training, Koko was reliably using 184

"Smile!" In vain, Koko signs for Michael to smile (**left**) for his picture. The gorillas regularly converse in sign language, and Michael has begun to teach signs to volunteer baby-sitters—such as the one for "chase," a favorite game.

With Penny at the wheel (**above**), the gorillas enjoy a drive. Koko knows just where her favorite soft-drink machines are on the Stanford campus. Once when a girl on a bicycle passed them, Koko pointed to the girl and signed, "Catch hurry hurry."

Trialogue. During an informal picnic on the campus (**above**) the following conversation occurs:

Penny: "Michael, do you want a cracker?"

Michael: "Eat."

Koko: "Don't."

Penny explains that Koko means, "Don't give it to him. Give it to me." As human parents can understand, the young gorillas have a hard time sharing.

"It can be a big deal who gets what first," says Penny. "Little wars erupt. They pound each other like you wouldn't believe."

In a mellow mood, Koko lies on her back (**center**) and taps her armpit—the sign for "tickle." Michael reaches over to oblige. Michael offers Koko the back of his hand (**left**), a gesture of submission among gorillas in the wild. Koko responds with a kiss.

When Michael does not want to be bothered, he can be quite aggressive—a mood that Koko respects. Fifteen years from now he will weigh some 400 pounds, nearly twice as much as she. Penny hopes the pair will mate.

signs—that is, she used each spontaneously at least once a day, 15 days out of a month. By age 4½, she had 222 signs by the same criterion. By 6½, she had used 645 different signs. This figure refers simply to the total number of signs she had ever emitted correctly, in my judgment, not signs qualified by frequency of use. Finally, I would estimate that Koko's current working vocabulary—signs she uses regularly and appropriately—stands at about 375.

Trailer Home Takes a Beating

Koko's mobile home, situated since 1974 on the Stanford University campus, came to us with normal accommodations—a kitchen, a living room, and a hallway leading to a small bedroom, bathroom, and master bedroom. Chain link panels now protect the living room windows and large sliding glass doors from Koko's enthusiastic pounding. The living room became Koko's nursery with the installation of her metal sleeping box, an exercise bar, and a trapeze. Familiar household items stock the trailer: toys, books, pots and pans, chairs, mirrors, a refrigerator, stove, sink, and bed.

After our second gorilla, the young male Michael, arrived in September 1976, we transformed the master bedroom into a second training playroom with dangling chain, swing, and bench. The bathroom became a separate kitchen for Michael.

Two solid-wood doors separate Michael's domain from Koko's. With these doors open, one large common play area is formed for daily exercise sessions and visits.

Because of her sharp teeth and endless curiosity about how things are put together, Koko has never had a bed with a mattress. Instead, she makes a nest using towels with a variety of underpinnings. Currently she has settled on a comfortable (I've tried it!) nest of two plush rugs draped over a motorcycle tire.

Koko rises at 8 or 8:30 in the morning, when my assistant Ann Southcombe and I arrive—that is, if she hasn't been roused earlier by Michael's morning antics. Following a breakfast of cereal or raisin-thick rice bread with milk and fruit, Koko helps with the daily cleaning of her room. She also thoroughly enjoys going over Michael's room with a sponge. Unfortunately, Koko usually rips the sponge to shreds when supervision slackens.

Then, most mornings, Koko sits before the electric-typewriter keyboard in the kitchen for a thirty-minute lesson in auditory English. (More about this later.) Wearying of this, Koko asks me, "Have Mike in."

About an hour is taken up with Koko and Michael's tickling, tumbling, wrestling, chasing, and playing games of hide-and-seek. I usually leave during a banana-and-milk snack; then my assistant gives Koko her regular sign-language instruction.

Koko has a light meal—an egg or meat, juice, and a vitamin tablet—at 1 p.m. and a sandwich (usually peanut butter and jam) at 2 or 2:30. Most days I return at 3 and either sample Koko's signing on videotape, invite Mike in for another play session, or take them out for a walk or a drive.

Dinner at 5 consists almost exclusively of fresh vegetables. Koko's top preferences are corn on the cob and tomatoes; her lowest, spinach and carrots. She also dabbles in gourmet vegetables, such as artichokes, asparagus, and eggplant. She absolutely abhors olives, mushrooms, and radishes. If Koko cleans her plate, she gets dessert—usually Jell-O, dried fruits, a cookie, or cheese and a cracker.

After dinner Koko may engage in private monologue as she relaxes with a book or magazine (fingering a picture, she signs, "There flower"), nests with her blankets ("That soft"), or plays with her dolls ("That ear," placing the doll's ear against her own). Some evenings she asks if she may visit Michael's quarters.

Following toothbrushing and application of baby oil, both gorillas settle down about 7 or 7:30 with a "night dish." This is a small fruit treat designed to make bedtime a more pleasant experience, for most nights Koko cries when I leave her.

"Go There. . . . Hurry Go Drink"

On weekends, and other times when campus streets are quiet, Koko, Michael, Ann, and I all pile into my car for a drive (page 451). So absorbed are the gorillas in the passing scene that they sit quietly in their seats. Other motorists rarely notice them. Koko will occasionally engage in a little backseat driving—signing, "Go there" (so that we

will not turn back toward home) or "Hurry go drink" (indicating a vending machine).

The Djerassi ranch, a 1,300-acre spread in nearby hills, is a welcome retreat on summer weekends. Here we can picnic without leashes or the threat of traffic and spectators. It's a joy to see Koko and Michael comporting themselves as free gorillas, frolicking in the trees much as they might in their natural habitat.

Visits to my home were a thrill for Koko but strained both my nerves and the household furnishings. She would dash from room to room, slamming doors behind her. The whole house shook. I found it hard to keep my composure watching a hundred-pound-plus primate scale the walls and dangle from the ceiling moldings. When her exuberant bouncing on the bed finally collapsed it for good, I declared the house off limits.

Students Do Well on IQ Tests

With Koko's physical well-being provided for, we have every opportunity to promote and observe her mental and social progress. From the start I monitored Koko's performance on human intelligence tests. In February 1975 Koko's intelligence quotient was 84 on the Stanford-Binet Intelligence Scale. Five months later, at the age of 4, her IQ rose to 95, only slightly below the average for a human child. By January 1976 the IQ was back to 85, which is not an uncommon fluctuation. Her scores on other tests confirmed the general range established by the Stanford-Binet scale.

Testing Koko's IQ has not been easy. There is, for instance, a cultural bias toward humans that shows up when tests are administered to a gorilla. One quiz asked the child, "Point to the two things that are good to eat." The depicted objects were a block, an apple, a shoe, a flower, and an ice-cream sundae. Koko, reflecting her gorilla tastes, picked the apple and the flower. Another asked the child to pick where he would run to shelter from the rain. The choices were a hat, a spoon, a tree, and a house. Koko naturally chose the tree. Rules for the scoring required that I record these responses as errors.

Koko has made numerous other "errors" that offer insight into the personality of an adolescent gorilla. One day my associate

A is for apple. After punching the key on a specially designed keyboard connected by a computer to a voice synthesizer, Koko hears the word she called for (**top**). Penny holds a banana and signs, "Fruit" (**right**), as Koko punches a response, sometimes a statement like "Want apple eat want."

Barbara Hiller saw Koko signing, "That red," as she built a nest out of a white towel. Barbara said, "You know better, Koko. What color is it?" Koko insisted that it was red—"red, Red, RED"—and finally held up a minute speck of red lint that had been clinging to the towel. Koko was grinning.

Another time, after persistent efforts on Barbara's part to get Koko to sign, "Drink," our mischievous charge finally leaned back on the counter and executed a perfect drink sign—in her ear. Again she was grinning. Sometimes Koko will respond negatively, but without a grin—leading me to believe her intent is not to joke but to be disobedient.

She seems to relish the effects of her practical jokes, often responding exactly opposite to what I ask her to do. One day, during a videotaping session, I asked Koko to place a toy animal under a bag, and she responded by taking the toy and stretching to hold it up to the ceiling.

With Koko in a contrary mood I can almost program her actions. For example, Ron Cohn got her to stop breaking plastic spoons by signing, "Good break them," whereupon Koko stopped bending them and started kissing them. On such occasions Koko knows that she is misbehaving, and once when I became irritated with her negativity, she quite accurately described herself as a "stubborn devil."

Koko's Pet Hate: Alligators

Koko reserves an equally expressive lexicon of insults—"rotten stink" and "dirty toilet," in addition to "bird" and "nut"—for people besides herself who are unmannerly. She has referred to me as "Penny toilet dirty devil" during a fit of pique.

One sign in Koko's vocabulary comes close to having totemic associations for her. That is "alligator," a sign made by snapping the two palms together in imitation of an alligator's closing jaws. Here, as in other instances, Koko modulates signs. For a large alligator, she makes a huge motion with her arms; for a tiny one, a small motion with her fingers. Although Koko has never seen a real alligator, she is absolutely petrified of toothy stuffed or rubber facsimiles.

In an intriguing exchange with Cindy Duggan, my assistant, Koko appears to have used the "alligator" sign as a threat.

"YOU"

"DIRTY"

"BAD"

"TOILET"

▲ "Trouble—again." After tearing up lilies of a campus flower bed for the second time, Koko gets a scolding from Penny and puts her hands to her head (**above**), the sign for "trouble." Penny continues the interrogation (**right, upper**), her uplifted palms signing "here," the last word in the question, "What did you do here?" Koko looks away and resignedly responds, "Again."

For major or minor infractions of the rules, Koko is banished to the punishment corner, a nook in her room in the trailer (**right**). "I tell her to go to her corner when she is bad," Penny says. "If it's just a trivial thing, she will excuse herself after a little while. But if it's been a severe scolding, she soon turns around, signs that she is sorry, and asks for a hug."

◀ **A gorilla wronged.** . . . After Michael bites one leg off a Raggedy Ann doll in the trailer, Koko removes the other. Penny puts both legs on a table in front of Koko and proceeds to reprimand her.

Aware that she is only 50 percent guilty, the gorilla retaliates with the worst insult in her lexicon (**left,** from top): "You [pointing] dirty [back of hand on chin] bad [hand moving down face] toilet [clenched fist over nose]."

"Who? Me?" With Penny's back turned, Koko removes a chopstick from a drawer, sneaks over to a window and tries to poke a hole through the screen (**right**). Discovered, she pretends to smoke the chopstick. Penny takes the chopstick and with an accusing glance demands to know what is going on.

All aplomb, Koko responds with the sign for "smoke" (**below**), followed with the sign for "mouth." Translation: "I was smoking."

Many instances of such evasive behavior have convinced Penny that the gorilla deliberately lies. Once, when Koko had rambunctiously charged the walls during her absence, Penny asked her why. Koko countered that she had been "Good quiet me quiet."

Indicating the red part of a flower on her bib, the gorilla turns imp and asks Penny, "That pink?" Penny says: "Koko knows darn well it's red. She's known red since she was 2."

Cindy had prepared a snack for Koko, but was slow delivering it. Koko reacted by signing, "Alligator chase lip." ("Lip" is Koko's idiosyncratic term for a girl or woman.) A puzzled Cindy asked, "Alligator?" "Alligator do that hurry," replied Koko, indicating the plate of food. Cindy reflected, and then laughed—Koko seemed to be resorting to verbal scare tactics to expedite the treat.

I have exploited Koko's irrational fear of this reptile by placing toy alligators in parts of the trailer I don't want her to touch. Consequently, at first glance a visitor might suspect that it is the temple of some obscure religious cult.

Remembrance of Events and Emotions

A cardinal characteristic of human language is displacement, the ability to refer to events removed in time and place from the act of communication. To learn whether another animal has this ability, we try to find out if the animal uses its sign vocabulary merely to label the events of its world, or if it is framing propositions that re-create a particular event. Does the animal use its symbols to refer to events earlier or later in time?

Koko and I had a revealing conversation about a biting incident. My try at cross-examination—three days after the event—went much as follows:

Me: "What did you do to Penny?"

Koko: "Bite." (Koko, at the time of the incident, called it a scratch.)

Me: "You admit it?"

Koko: "Sorry bite scratch."

(At this point I showed Koko the mark on my hand—it really did look like a scratch.)

Koko: "Wrong bite."

Me: "Why bite?"

Koko: "Because mad."

Me: "Why mad?"

Koko: "Don't know."

The entire conversation concerns a past event and, equally significant, a past emotional state. It is not a discussion one would expect to have with an animal whose memories were dim, unsorted recollections of pain and pleasure. Of striking import to me was that Koko knew she could not remember or express whatever it was that had prompted the bite.

Koko Learns to Lie

Perhaps the most telling, yet elusive, evidence that a creature can displace events is lying. When someone tells a lie, he is using language to distort the listener's perception of reality. He is using symbols to describe something that never happened, or won't happen. Evidence I have been accumulating strongly suggests that Koko expresses a make-believe capacity similar to humans'.

At about the age of 5 Koko discovered the value of the lie to get herself out of a jam. After numerous repeat performances I'm convinced that Koko really is lying in these circumstances and not merely making mistakes. One of her first lies also involved the reconstruction of an earlier happening. My assistant Kate Mann was with Koko, then tipping the scales at 90 pounds, when the gorilla plumped down on the kitchen sink in the trailer and it separated from its frame and dropped out of alignment. Later, when I asked Koko if she broke the sink, she signed, "Kate there bad," pointing to the

sink. Koko couldn't know, of course, that I would never accept the idea that Kate would go around breaking sinks.

Some of Koko's lies are startlingly ingenious. Once, while I was busy writing, she snatched up a red crayon and began chewing on it. A moment later I noticed and said, "You're not eating that crayon are you?" Koko signed, "Lip," and began moving the crayon first across her upper, then her lower lip as if applying lipstick.

A Sense of Past and Future

Gradually Koko is acquiring signs that make reference to past and future. One day during a filming session she signed, "First pour that," as I was preparing milk for her. "First that yes!" I exclaimed, delighted that she had used the sign "first." Just as I began to sign, "Then you drink," Koko signed, "Later Koko drink."

More recently she has begun to use the sign "later" to postpone discussion of possibly unpleasant subjects. "Tell me about what you did," I demanded one day. "Later. Me drink," was Koko's reply. She understands other words referring to the future. One bright morning that followed weeks of rain, I told Koko that if it was still sunny during the afternoon, I would take her out. When I arrived at three o'clock, she looked out at the still-bright weather and collected her gear to go outside.

In sign-language experiments with chimps, the animals learned to draw on different gestures to describe a new object or event. Dr. Roger Fouts, at the University of Oklahoma, noted that chimps could describe objects for which they had no sign: Washoe, for example, once called swans

"THINK"

"THAT"

"MICHAEL" "ME"

Having a quiet chat—with herself—Koko signs, "Eye," while looking at a picture of a big-eyed frog (**left**). Such private musing is part of a pre-bed ritual.

Scanning the first issue of *Gorilla*, a newsletter of the foundation set up to provide financial support for the project, Koko points to pictures of Michael (**right**, from top) and of herself.

The Gorilla Foundation's mailing address for membership information is P.O. Box 2003, Stanford, California 94305.

"water birds." Koko, too, has generated compound names to describe novelties. She referred to a zebra as a "white tiger," a Pinocchio doll as an "elephant baby," and a mask as an "eye hat."

A memorable joke turned on one of Koko's cleverer associations. Last winter, Cindy Duggan was holding a jelly container when Koko signed, "Do food."

"Do where, in your mouth?"

"Nose."

"Nose?"

"Fake mouth," said Koko, opening her mouth and then licking the jelly container.

"Where's your fake mouth?" asked Cindy.

"Nose," repeated Koko.

The next day I asked Koko what was a fake mouth, and she said, "Nose."

Koko displays remarkable mental gymnastics in merging different signs to create compound or composite words. For instance, she has made the sign for "Coke" superimposed on the sign for "love." For grapefruit—which she doesn't like—Koko simultaneously made the signs for "frown" and "drink," executing "drink" in the position of the sign for "fruit."

A Lot Still to Learn

Having worked only with Koko and Michael, I'm not in a position to rank chimp and gorilla in sign-language ability. However, by such indicators as range of vocabulary, frequency of utterance, and mean length of utterance, Koko must be considered at least the intellectual peer of the chimp.

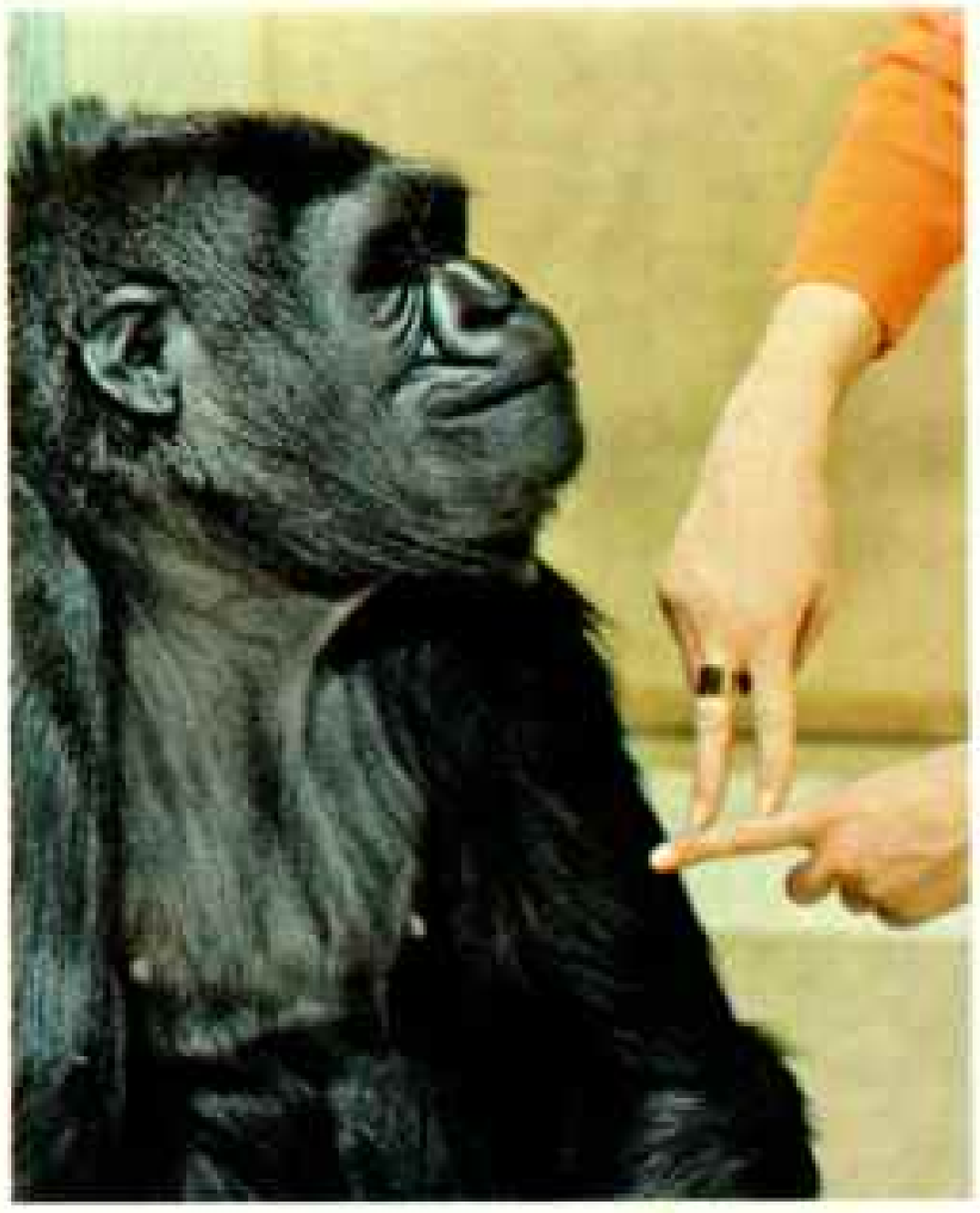
After meeting Koko, Eugene Linden, author of *Apes, Men, and Language*, commented, "Compared to the sign-language-using chimps, the gorilla is calmer and more deliberate. Koko seems to resort to the sign language more often to express herself, and she discusses a wider range of activities."

Even had I not come to know and love Koko as a witty, sweet, and trusting personality, I cannot foresee terminating Project Koko. Nothing indicates that Koko has reached the limit of her learning capacities. We have a great deal yet to learn from *her*.

Now there is the challenge of new areas of language use. Professor Patrick Suppes and his colleagues at Stanford's Institute for Mathematical Studies in the Social Sciences have designed a keyboard-computer linkup that permits Koko to talk through a speech synthesizer by pressing buttons. Simultaneously, all her utterances are transferred to a computer data file.

I noticed early that Koko responded appropriately to things I said in English, and often spontaneously translated spoken phrases into sign. For example, when asked in English, "Do you want a taste of butter?" Koko responded, "Taste butter."

Now with the auditory keyboard, which produces spoken words when she presses keys, Koko can talk back as well as listen. The 46 active keys bear the usual letters of the alphabet and numbers. But in addition, each key is painted with a simple, arbitrary



"Want to skateboard?" Penny asks Koko with a recently coined sign that represents two legs on a platform (**above**). Koko's tight-lipped grimace indicates mild annoyance at the request. Koko will sit on the board and scoot around the trailer, but she does not like to stand on it, perhaps because she has seen Penny fall several times.

Nevertheless, Penny maneuvers 130 pounds of unwilling gorilla to the skateboard (**right**). "She's wearing her devilish grin," Penny explains, "and she's trying to tickle me." Shortly after the picture was taken, Koko stubbornly collapsed on the floor, and that was that.


June
person
animal
talk

geometric pattern in one of ten different colors representing words for objects, feelings, and actions, as well as pronouns, prepositions, and modifiers (pages 454-5).

If I place, say, an apple before her, she may push the keys representing "want," "apple," "eat," and the computer-generated female voice speaks these words. Thus Koko can produce the spoken English for objects, ideas, and actions already banked in her sign vocabulary.

Typing usually with the index finger of her right hand, but always reserving one hand for signing, Koko can sign and speak simultaneously. As she signs, she can type out an identical or complementary phrase, and the synthesizer will vocalize her message. An ambidextrous and bilingual gorilla!

Koko responds to hundreds of spoken words independent of the auditory keyboard, but her vocabulary of spoken English that she can generate (it will surely expand) is now restricted to 46 words. A major objective is to evaluate the gorilla's sense of spoken word order.

Then there is Michael, the $5\frac{1}{2}$-year-old

An accomplished photographer with her own Polaroid, Koko also delights in manipulating the controls of a complex, motor-driven 35-mm camera and enjoys the flash of the strobe lights. Here she makes a

male gorilla we acquired in September 1976 as a companion for Koko. Michael has been receiving sign-language instruction from Ann Southcombe—and from Koko, who has taken it upon herself to coach Michael's execution of the signs for "Koko" and "tickle." So far, Mike's vocabulary is only about 35 signs, and he doesn't always sign fast enough for Koko.

Early this year Mike was fumbling for the right sign to convince Ann to let him in to play with Koko. After Mike signed, "Out," Koko, waiting in her own room, began to get impatient. She signed to Mike through the wire mesh, "Do visit Mike hurry, Mike think hurry," imploring him to come up with the right sign. Then she said, "Koko good hug," and it finally dawned on Mike to say, "Koko." A relieved Koko signed, "Good know Mike," and then, "In Mike."

Now the godmother of two gorillas, I weigh my responsibilities to this threatened species. I have set up the Gorilla Foundation to protect the future of Koko and Michael. My fondest hope is to establish Koko and Michael, myself, and my associates in a place set aside for the study of gorillas and for their preservation in circumstances of relative freedom. It is sad that the gorilla's best present prospect for survival is under the active protection of man. Yet it would be tragic should these animals disappear before we fully understand them.

self-portrait in the trailer's mirror. Viewing a copy of this picture, she identified herself and signed, "Love camera."

"Fine Animal Gorilla"

That understanding enlarges as Koko grows ever more flexible and sophisticated in communication. Her recent progress is nothing short of astonishing.

Koko is defining objects. "What is a stove?" I ask her. She points to the stove. "What do you do with it?" "Cook with."

"What is an orange?" "Food, drink."

I ask Koko, "Tell me something you think is funny." She signs, "Nose there," pointing to a bird puppet's tongue. "That red," showing me a green plastic frog we had talked about. When I put a stethoscope to my ears, Koko smirks and puts fingers over her eyes.

She perceives right and wrong, but is touchy about blame. During a videotaping session, when I turn away, she tries to steal grapes from a bowl. I scold her. "Stop stealing. Don't be such a pig. Be polite. Ask me. Stealing is wrong, wrong, like biting and hurting is wrong."

Then I ask, "What does Penny do that's wrong?" Koko says, "Break things, lie, tell me 'polite' [when I'm] hungry pig."

Koko is ill, a mild respiratory disorder. I ask her, "Where do you hurt?" Koko signs, "Underarms."

Finally, Koko is learning self-esteem. A reporter asks about Koko as a person. I turn to Koko: "Are you an animal or a person?"

Koko's instant response: "Fine animal gorilla." □

Dream On, Vancouver

By MIKE EDWARDS
SENIOR EDITORIAL STAFF

Photographs by
CHARLES O'REAR

"WE LOOK at the rest of Canada with amused pity," Allan Fotheringham said at lunch one day. In his column in the *Vancouver Sun*, Allan often roasts politicians, but when he talks about living in Vancouver, he is about as mean as a marshmallow.

"There aren't many cities where you can drop off your kids at a ski area and still be at the office in 25 minutes," he said.

On New Year's Day he and friends play tennis and then, turning toward frozen Toronto, drink a taunting toast. Isolated from Establishment Canada by expanses of plain and peak, Vancouver thinks itself a place apart in more than climate.

On a thumb of land that holds the downtown core, stunning skyscrapers symbolize the commerce born of the union of a deep-water port and transcontinental railroads. I like to view the city from those towers, from the 30th or 35th floors, where glassy executive suites look out on Burrard Inlet.

The water is speckled with ships loading coal, grain, forest products. Handling 48

Water born and mountain bred, Vancouver lights the sky as a Sea-Bus ferries commuters across Burrard Inlet. Canada's Pacific doorway matches genial livability with a striking setting.

Echoing the name of British explorer George Vancouver, who charted the coast in 1792, Vancouver took root as a sawmill settlement before incorporation in 1886. Today its metropolitan population of 1.2 million crowds between mountains and sea.

million tons or more each year, Vancouver is not only the busiest Pacific port of the Americas but is also one of the dozen busiest in the world. Commuter ferries shuttle between downtown and North Vancouver across the inlet, meshing with bus lines at both ends; three rides, one 35-cent fare. Floatplanes touch water to deposit passengers from Victoria, capital of British Columbia, and coastal fishing and timber towns.*

Beyond the inlet, in the Strait of Georgia, tugs nudge barges toward the Fraser River, a broad flowing avenue on Vancouver's south side, to load plywood or wood chips.

This is bustle embedded in scenery. At the end of downtown's thumb, other towers—western red cedars and Douglas firs—rise from thousand-acre Stanley Park, largest in the city. And beyond the proliferating tracts of North Vancouver and West Vancouver, 4,000-foot Grouse Mountain dons white for winter.

Mild Pacific breezes usually coax temperatures into the 40's in the winter months—though, truth be known, the

*See "Canada's Window on the Pacific: The British Columbia Coast," by Jules B. Billard, NATIONAL GEOGRAPHIC, March 1972.

clouds that dump snow on Grouse Mountain often bring rain to the city at its foot. "There *are* clear days," a professor reminded me. "But we don't tell outsiders. If we did, they'd all be here."

A smug city? Decidedly. And it hasn't even seen a century yet.

Port Moody's Loss, Vancouver's Gain

Along in the summer of 1885 unsettling rumors reached Port Moody, 18 miles up Burrard Inlet. These reports held that Port Moody would *not* be the terminus of the Canadian Pacific Railway, stretching 2,900

Dowager queen of the rails, the *Royal Hudson* recalls another era, when steam was sovereign. Sister to the train that bore King George VI and his queen across Canada in 1939, the *Royal Hudson* now steams along the coast of British Columbia. When Canadian Pacific general manager William Van Horne anchored the railroad's western terminus at Vancouver in 1885, he nailed down its fortunes as well. The city subsequently prospered as the rail-sea nexus between transcontinental and trans-pacific trade routes.

Cold slopes, warm seas: Skiers dangle above both. A scant 20 minutes from town, 4,000-foot-high Grouse Mountain entices the sports-minded for skiing in the morning

and releases them for sailing in the afternoon. The Kuroshio, or Japan Current, so placates winter that grass stays green year round, even as snow mantles the heights.

miles across the continent. "Cast-iron lies," the settlement's newspaper fumed. The *Gazette*'s editor foresaw a city of 100,000, and speculators were having a ball.

"There's a lot here that a man paid $15 for and sold for $1,000," said Port Moody's historian, alderman H. C. Flinn, who betrays his origin when he speaks of the "haahrd" life he left in Wales 56 years ago. "Everything fell flat after the railroad went to Vancouver." He pronounced it "Vancouvah."

William Cornelius Van Horne, the CPR's general manager, had looked at the hills crowded around Port Moody and concluded there was not room for the city he envisioned as second only to San Francisco on the West Coast. Fulfilling his prophecy, Port Moody today counts only 12,500 people and has little land left for development.

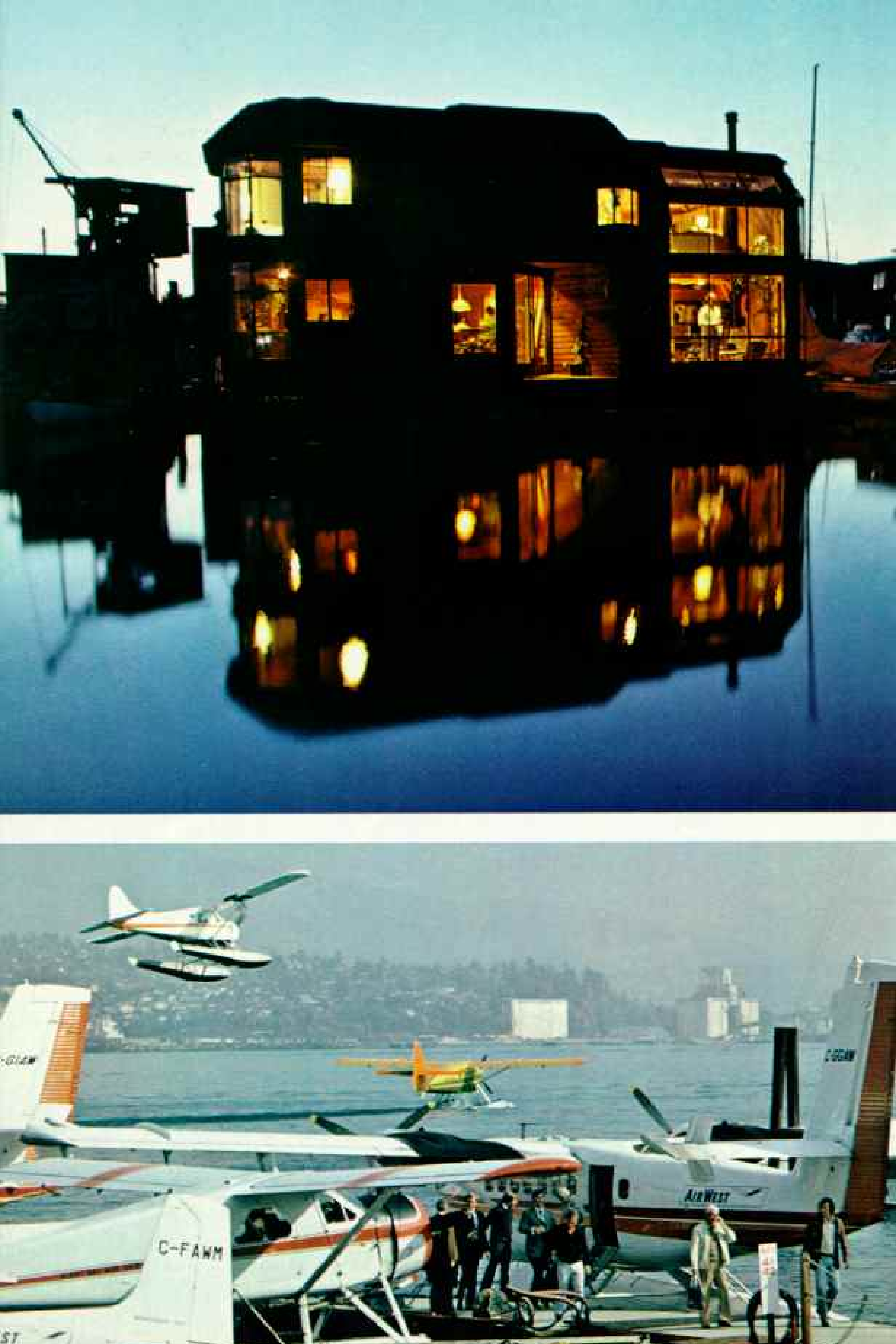
But the gentler land at the mouth of Burrard Inlet looked ideal. The railroad, said Van Horne, would "try to confer benefits where we have met with decent treatment, and the reverse where we are not." For extending tracks to their logical end, the CPR was treated decently indeed: 6,000 acres given by the government, several thousand more by local owners. Now, as then, the railroad is Vancouver's biggest landlord.

City Honors British Navigator

To Van Horne, the name of Capt. George Vancouver was worthy of the metropolis-to-be. Seeking a northwest passage, the British navigator entered Burrard Inlet in 1792—with no idea, of course, that a city honoring him would one day anchor a northwest passage of iron rails.

As the last spikes were driven in 1885, there was little around the inlet to suggest promise: a couple of scruffy sawmill settlements and the modest town of Granville—formerly called Gastown, owing to the "hot

The chips are down and bound on the Fraser River for a pulp mill north of the city. Vancouver's prime conduit—Burrard Inlet—forms a shipping corridor acclaimed the city's "most important business street," by author Eric Nicol. This largest Pacific port of the Americas last year funneled 34 million tons of Canadian exports, chiefly to Japan.


C-FAHM
AIR WEST

Living space or landing strip, water adds dimension to the city. Its beauty doubled by a luminous reflection, a float home (**above**) belonging to *Nanaimo Times* publisher Stanley Burke claims water as backyard and basement. His family traded life in a 13-floor high rise for the two-story, three-bedroom home, crafted of cedar planking and complete with fireplace and gracious expanse of glass. Some 700 Vancouverites call the harbor home and live aboard tugs, sloops, fishing boats, and other craft.

Floatplanes (**opposite**) shuttle businessmen to the provincial capital of Victoria and outdoorsmen to remote fishing and logging camps along the coast.

air" expelled by a garrulous free-booter, John Deighton. "Gassy Jack" arrived in 1867. The sawmill communities were dry and, as legend has it, he brought a keg of whiskey. There was no shortage of volunteer labor when he announced he would build a saloon.

Toots Tell Time to Steam Lovers

I was in Jack's old neighborhood as Ray Saunders worked on an unlikely gadget, a steam-powered clock (page 477). It rose from the sidewalk of Water Street, tapping a steam pipe beneath the pavement. "Jon Ellis in the city planning department asked me if I could build it," said Ray, who is both a metal sculptor and clockmaker. "Jon didn't know it was practically impossible to build a steam clock, and I was too stupid to know. He asked how much it might cost. I guessed at $25,000. We've spent $42,000."

Ray harnessed a steam engine to a clock works he commissioned in London and a drive mechanism of his own design. Above the four faces he added steam whistles that toot the "Westminster Chimes," the famous tune of Britain's Houses of Parliament.

Ray opened the mechanism and tinkered. Soon the whistles sounded, attracting a crowd. "Watch out for hot water coming down," he said. He tinkered again. *Toot, TOOT, toot, hiss.* "Needs a bit of tuning yet," Ray said. He turned to his admirers. "I don't think it's too loud, do you?"

"It's lovely," a man answered.

"Sounds pretty nice when all the whistles go off at once," Ray added, sending up a prolonged orchestral blast that drew applause.

He closed the works after replacing a sign that said, "Final adjustment will take a few days." The faces showed 10:10, as they had for a week. Time stood still in Gastown.

But little else has. In the turn-of-the-century buildings of its dozen or so blocks, boutiques and restaurants impart the flavor of Washington, D. C.'s Georgetown or San Francisco's Ghirardelli Square. Ray's clock calls attention to the renaissance.

Gastown slid downhill as other parts of the city developed. In his office in a renovated warehouse, Howard Meakin recalled that for the ten years before his company bought this building, its only occupants were pigeons and derelicts.

Howard was only 23 when he and three equally brash partners purchased a Gastown building for $19,000—with only $1,000 down. That was in 1967. They bought 13 more at fire-sale prices.

"My grandfather, who had been in real estate for years, thought I was crazy," Howard said. In the 1960's it wasn't Vancouver's style to renovate. The city was promoting grand schemes: more office towers, demolition of older neighborhoods, a freeway plan that would have doomed Gastown.

"Really, what spurred our interest was the freeway," Howard continued. "We thought these old buildings ought to be saved." Preservation was profitable. "The $19,000 special," as Howard calls that first purchase, recently fetched $285,000.

Hippies lit in Gastown in the 1960's—and lit up. One night a near-riot ensued when police broke up a mass "smoke-in." Gastown's fragile new image nearly went up in the pall. But Howard is grateful to the youths for their labor. "This is how we renovated Gastown," he said, showing me a photo of a bearded young man shoveling debris. "Gastown was so messy nobody else would come down here to work."

Outside I gazed at a statue of Gassy Jack standing on a barrel: Gastown's first hippie, holding forth above his own poison.

A Bleak Life on Skid Road

What surely are the fiercest eyes in all Vancouver blaze behind Bruce Eriksen's spectacles as he views the less than perfect world of Skid Road, hard by Gastown.

"How'd you like to live *here?*" he demanded as we approached a shabby hotel on East Cordova Street.

Upstairs we found rheumy-eyed Vincent in a tiny room. "I was a cook," he said, eyeing my cigarette and gratefully accepting one. "I'd like to go back to it. I ain't forgot. Once cooked for 85 men in a lumber camp." He paused. "But I'm a chronic alcoholic, see?" It was not really a question—only an admission.

A storefront church sees to it that his welfare check goes for meals and rent. "You found me here, sittin' here—this is where I spend my time. I had a radio. That was real nice. But somebody stole it."

"I've got an extra one at my office," Bruce said. "I'll give it to you."

"Oh, I'd appreciate that!" Then, a flicker of defiance across the worn face: "I ain't cryin', you understand."

Former Resident Leads Cleanup

On the street Bruce made a proud confession. "I used to be one of those guys." The police pulled him from the gutter one day and took him to a sanatorium, where he stayed three months. "It gave me a chance to see what I was doing to myself."

He returned to Skid Road with a reformer's zeal. Alcohol was a problem for some people, but many were merely poor and old and had sought this neighborhood's cheap refuge. Bruce organized them into the Downtown Eastside Residents Association. Soon city councilmen, barkeepers, police, and slumlords felt the blue burn of his glare.

Stop selling rubbing alcohol to drunks, he demanded. Stop selling derelicts too much beer in the bars and then throwing them into the street. Enforce fire and health codes in the hotels and rooming houses.

"See that hotel?" Bruce said. "It's been completely remodeled. Same with the one over there." A little farther on, another scowling nod. "We got a nonprofit group to take over those two hotels and fix 'em up. We've got a way to go, but this place is a hell-uva lot better than it was."

In a city of 420,000, the hub of a metropolitan area of more than a million, his may seem a small achievement. But in my mind it adds to Vancouver's luster; this is not only a handsome and vibrant city but also a place where things get fixed.

Like U. S. transcontinental railroads, the Canadian Pacific employed Chinese laborers. After the work was done, many crowded into a ghetto that lapped into Gastown

Time runs on, full steam ahead. Horologist Ray Saunders adjusts his steam clock, whose whistle marks the hours in Gastown. Formerly a shabby low-rent district, the downtown section has been refurbished by merchants into a gracefully landscaped stretch of red-bricked streets, boutiques, and restaurants.


Seven
Seas
imports
THE GASTOWN STEAM CLOCK

and Skid Road. I remember seeing an architect's drawing of a spacious home built about 1912 in another part of town. A cubicle sketched in the basement bore the legend "Chinaman." Not "servant's quarters" but *Chinaman*. That legend defined the status of Chinese in Vancouver for many years.

"Sure you could get an education, but try to get a job as a teacher or a lawyer," said Frank Lew, whose grandfather came from Canton. Frank's sister found the doors closed in the late 1940's when she applied for a job in the city schools.

But Frank *is* a lawyer, in a busy office above a bank. Beneath his window Chinatown spreads in abundant life. Bright signs beckon pedestrians to restaurants, to shops displaying ivory and jade, to markets hung with dressed chickens. It isn't a ghetto now but a business district; Vancouver's 70,000 Chinese—after New York's and San Francisco's, the largest Chinese community in North America—live all over the city.

"The changes began when Chinese were given the right to vote in 1947," Frank told me. Just then his phone rang: a friend with a legal question. "No," I heard Frank say, "I won't send you a bill. Just drop me a check for $25 for the Liberal Party."

That brought up mention of Art Lee, member of Parliament. "Our party didn't think it had a chance to unseat the New Democratic Party in Vancouver East," Frank said of the Liberals. "Just the same, we wanted to put up a candidate."

I had lunch with the MP. Only 31, wearing a turtleneck shirt, he seemed far from the traditional image of a politician. "Right, nobody thought I'd win," he said. "But I got in by 56 votes." His victory is another indication of how far Chinese have come.

Chinese continue to arrive in Vancouver, especially from Hong Kong. But Hong

Verdant mast sailing skyward, a giant western red cedar 21 feet across its base (**right**) towers over lesser trees in Stanley Park. Polyporus, a fungus (**left, above**), stairsteps up a hemlock; a sapphire stream slides down a hill (**left**). The wilderness that envelops Vancouver provides its greatest treasure: Forests generate fifty cents of every dollar in British Columbia.

Dream On, Vancouver

First residents and earliest sportsmen, Canada's native Indians have carved out an enduring legacy. The rugged game of lacrosse (**above**), descendant of an Indian game called baggataway, pits the New Westminster Salmonbellies against the Vancouver Burrards. An Indian boy (**facing page**), framed by the portals of a living past, sketches at the University of British Columbia Museum of Anthropology. These posts, carved with snake and seal motifs, once supported the home of a Kwakiutl, a member of an Indian tribe north of Vancouver, which like other tribes is experiencing a revitalization of spirit.

Kong, a financial center of the Far East, has sent more than people. "I am probably responsible for seventy or eighty million dollars coming in, in cash," said another Lee, real estate dealer Bob. (There are 15 columns of Lees in the Vancouver phone book.) "These were the down payments for about 300 million dollars' worth of real estate."

That canny Asian bankers deemed it worthwhile to own a third of a billion dollars' worth of Vancouver vouches for the city's potential. "Weather—that's another reason the money came here," Bob added, strumming a familiar theme. "People like to put their money where they'd like to live."

Environment Versus Development

The boom that raised and broadened Vancouver's skyline began in the 1950's and, as Bob said, "in the 1960's it just went wild." Office space doubled, apartment buildings soared, new hotels opened.

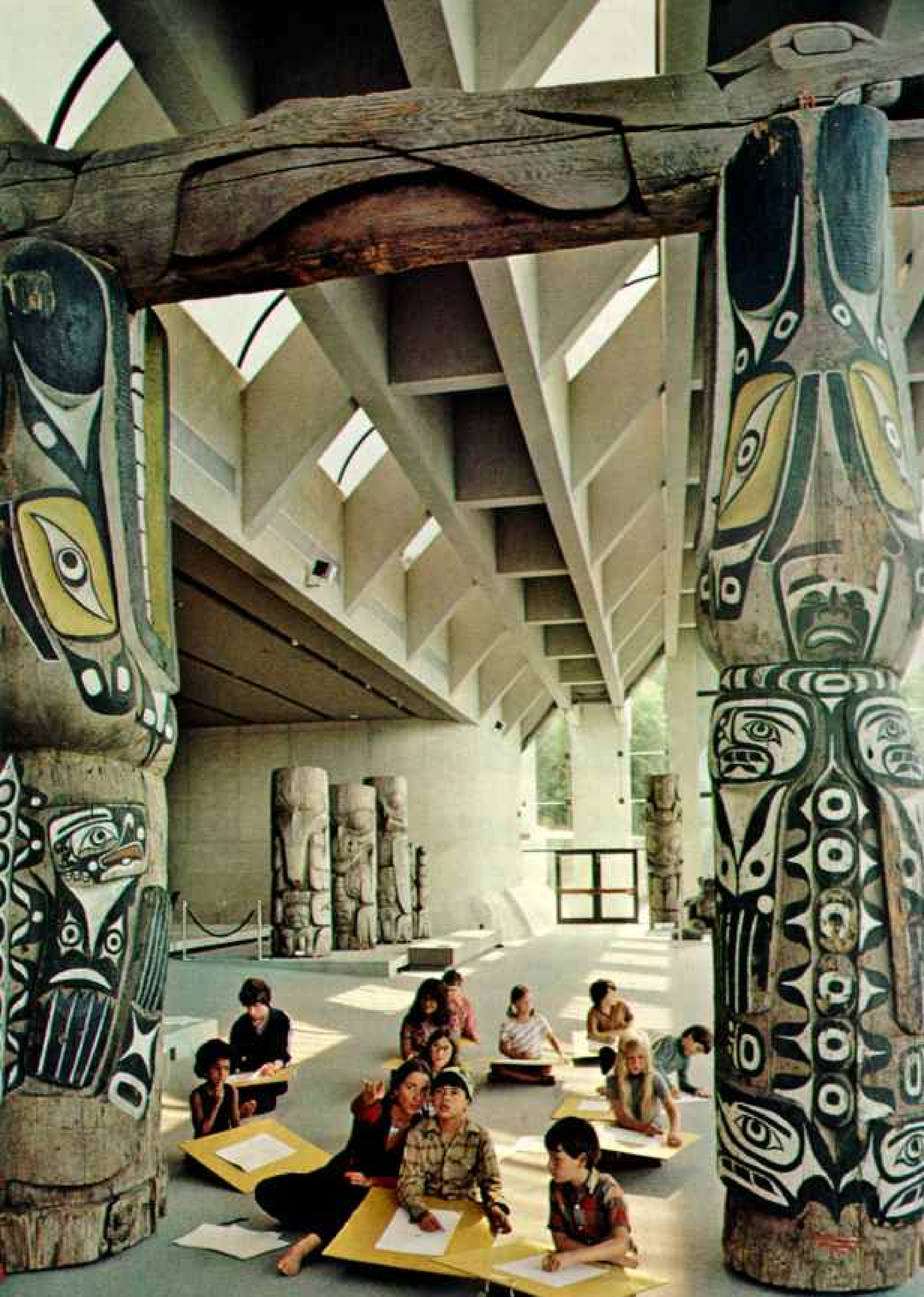
The market has cooled. "But this city is going to boom again," Bob said. "I can see it coming." Still, Bob is distressed by stricter zoning regulations and opposition from environmentalists. "Some people don't seem to realize that development creates jobs."

Perhaps Bob had in mind the views of city councilman Michael Harcourt, who told me at City Hall: "Before the next boom I want to have a total review of downtown zoning so that we are sure new construction is attractive, that views aren't blocked, and that if we put 50,000 more people downtown there will be parks and pedestrian ways."

Harcourt types versus Lee types: It could be quite a battle. The Harcourts have had the better of it recently, winning zoning changes that assured more open space and also, as the councilman said, decisions that "brought a change from the disasters of urban living in North America."

He meant the saving of Gastown and the junking of an urban-renewal plan that would have wiped out hundreds of houses. Demolition was supplanted by government grants and loans for rehabilitation.

In still another battle, neighborhood versus shopping center, Jack Volrich came to the fore as a spokesman for neighborhood integrity. I walked across City Hall to a large wood-paneled office to meet Mr. Volrich, now Vancouver's mayor.



Color-splashed steps distinguish look-alike houses (**right**). A federal program helps underwrite renovation of old homes to ease the tension between an increasing housing shortage and the maintenance of neighborhood integrity. The high-rising of Vancouver in the fifties and sixties left the West End denser than any urban sector in Canada and prompted rigid zoning to ensure livability. Emigrants to suburbia may find more home for less money in one of 17 municipalities. Largest of these is Burnaby, whose mayor, Tom Constable, gets spiffed up for parading (**below**).

He confessed that a small cloud hangs over his lotus land. "The city is only 44 square miles; we're hemmed in by water and other municipalities. We have very few areas where we can develop more housing. And the population has actually decreased by twenty thousand or so in the past few years. There are more households but fewer people; families are smaller and the city is attracting more single occupants." Many newcomers find more house for less money in the suburbs: New Westminster, Surrey, Burnaby, Delta, North Vancouver, Richmond.

"More households demand more services," the mayor continued, "but if you've got fewer people, you've got fewer taxpayers to pay for the services. I'd like to see a healthily increasing population; that adds to the vitality of the city."

Like as not, people who move to Vancouver are foreign born. In fact, as I was reminded by Mayor Volrich—himself the son of a Serbian miner—more than half of the population might be termed "ethnic."

Vancouver has large Italian and Greek neighborhoods and counts some 40,000 people of German heritage, the result of liberal Canadian immigration policies. When the Hotel Vancouver canvassed its staff for persons who could double as interpreters, it found speakers of 21 languages.

New Caste Fills the Same Old Roles

There always has been someone at the bottom of the ladder. Witness the Indians—Squamish, Musqueam, and other bands—pushed onto small reserves, and the Chinese. Today the man who pumps your gas or clears your table in a café is likely to be East Indian—from India or Pakistan, or perhaps a merchant-refugee from East Africa.

In a plywood mill I was attracted by the blue turban and full beard of a Sikh who grabbed sheets of veneer from a fast-moving

conveyor. A few nights later, after excellent curry prepared by his wife in their modern two-story home, Budhsingh Dhahan told me why he had left India 18 years ago: "I did not feel there were good opportunities for my children in India, and I wanted them to have an education."

Mr. Dhahan earned a university degree in India, specializing in the Punjabi language; in Vancouver no jobs required such scholarship. "Manual labor was my only choice; I had five children to feed."

But he has seen his goal largely realized; three children have graduated from the University of British Columbia, and a fourth is studying there. Their education was paid for in part by Mr. Dhahan's second job, part-time house construction.

"Newcomers work harder than other inhabitants, you know," he remarked in the formal English of his schooling. "They must, to become established. That is the reason we have some discrimination."

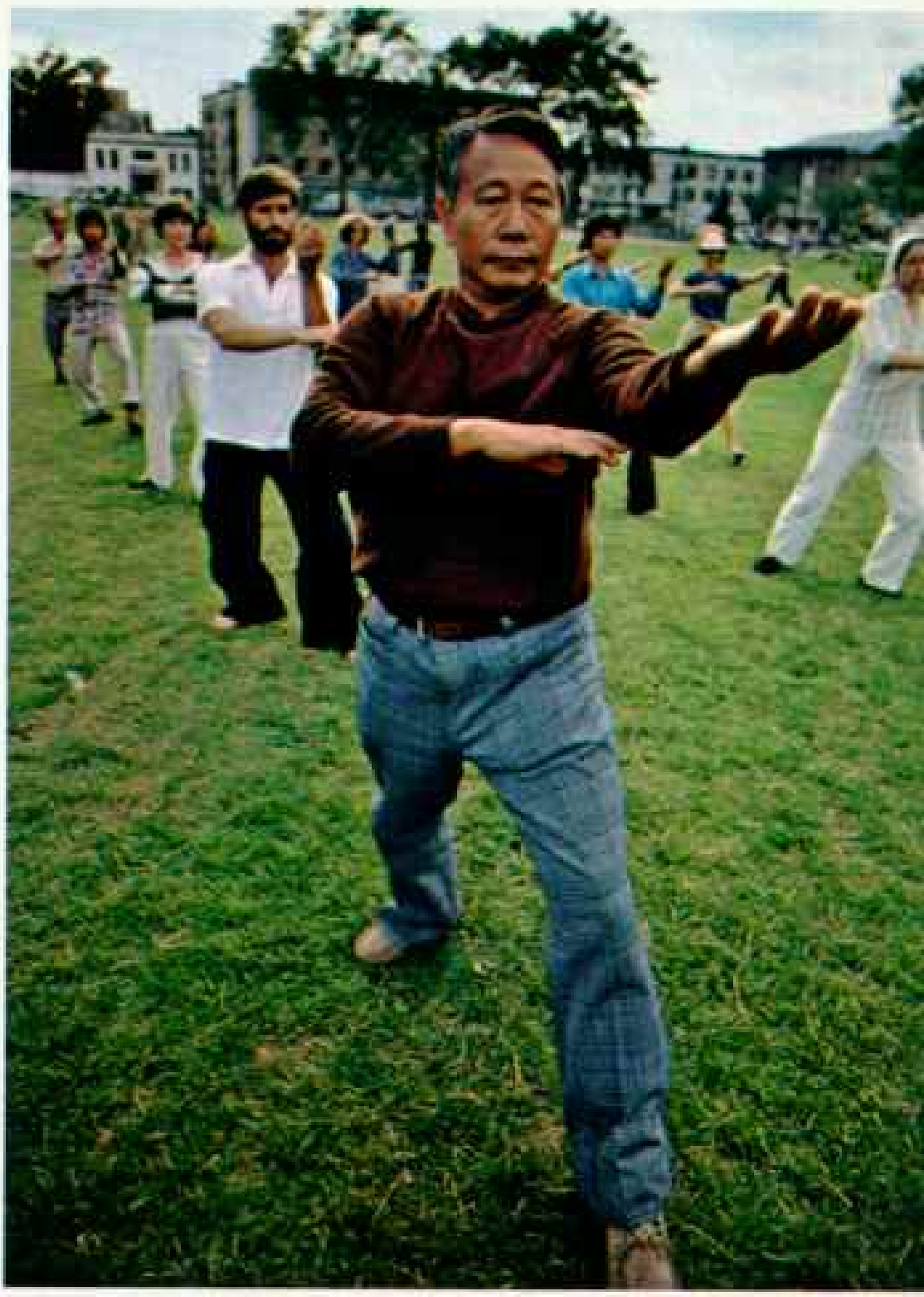
There are occasional complaints of East Indians being unable to buy houses and of vandalism against their property. But Mr. Dhahan is satisfied that the East Indian community of some 13,000 people is progressing. "Many are not poor. There are wholesalers, professional people."

Restaurants Spread a Gourmet Feast

Vancouver's diverse population lends marvelous variety to its cuisine. One night I dined on kebabs in a small café run by a Turk. His wife was the cook, his 12-year-old daughter the waitress. Another night it was venison in Il Giardino, one of three elegant restaurants standing side by side, each with a different menu, operated by Italian-born Umberto Menghi.

Just 32, Umberto came to Vancouver as a waiter, started a delicatessen, tried a café in Gastown. I asked *(Continued on page 487)*

Baubles, bangles, and belly dancing help cash and ouzo flow at the Kozmas (**left**), a restaurant owned by two Greek families but staffed by a Malaysian, a Jamaican, and an Australian—all representative of Vancouver's rich ethnic mix. Logging attracted the first settlers in substantial numbers from the United States, Britain, and eastern Canada. The railroad's influence followed, when 15,000 Chinese were brought over in the late 19th century as laborers and went on to build an enclave of culture exceeded only by the Chinese communities in New York and San Francisco. Ta Tchen Tcheung (**below, right**) teaches part of that culture—the centuries-old calisthenics of *T'ai chi ch'uan*. As years passed, Japanese, Italians, Greeks, and eastern Europeans flowed in to form distinct communities. The most recent influx has been East Indians, such as Kartar Singh Hayre (**below**), who—as is usual with new immigrants—often occupy the lowest rung on the employment ladder. More than half of Vancouver is of non-British origin. "We are a city of many countries," says Petro Gardy of Poland (**above, right**), who arrived 19 years ago.



how he found the necessary capital to launch himself as a first-class restaurateur. "I lied to the bank," he answered with an open-palmed shrug.

Ethnic restaurants flowered along with the city. For years Vancouver's only Greek restaurant was the Greek Village. "But," said owner John Cavadas, sitting with me one night while I put down snails laced with garlic, then a fluffy moussaka, "all the while the big restaurants in town were Greek-operated. They had English names, like the Piccadilly, and served roast beef."

Now John counts his competitors—15 authentic Greek restaurants—and moans.

As in years past, the Greek Village is the port of call ashore for Greek sailors who dance sensuously to bouzouki music and, in home-country tradition, smash glasses on the floor. While John and I talked, I heard crashing in the bar adjacent. John smiled as if the breakage itself were music; the sailors spend enough to pay for it.

Timber Fuels City's Growth

Vancouver draws much of its sustenance from the natural wealth of British Columbia, which includes copper, silver, zinc, lead—and timber.

One October afternoon I climbed into an amphibious plane, joining four robust men for a 500-mile journey northward over fleets of forested isles. At sundown we eased into Shannon Bay in the Queen Charlotte Islands and boarded the *Haida Monarch*. The *Monarch* is big enough—423 feet long—to carry 15,000 tons of timber, which she dumps from her deck by taking on water ballast until she lists 30 degrees to port.

Logs are loaded by two cranes with 106-foot booms. The four men I flew with—specialists in the employ of MacMillan Bloedel Ltd., the Canadian timber giant—operated those cranes. From a lofty cab where Jim Lockhart worked a set of levers, I watched the big crane's jaws grabbing and hoisting logs of hemlock, spruce, and balsam fir.

Jim went to work "in the woods," as loggers say, after World War II. He remembers it as a time of big men and big trees. It is less an adventure today, he feels, because machines do much of the work. But the efficiency is one reason Vancouver remains one of the world's biggest lumberyards.

Three days later the *Monarch* eased into a cove north of Vancouver and, listing majestically, dumped her cargo with a mighty whoosh. Small boats began to sort the logs for pulp, plywood, or sawtimber. Many would reach the mouth of the Fraser River on Vancouver's south side, giving employment to Neil Perrault.

"Only 16 sections behind us," remarked Neil, a young man in a thick black turtleneck sweater, when I boarded the tug *Naskeena 4* from a water taxi. "Usually we pull about 32." That's nearly half a mile of logs.

A section is a tidy way of hauling timber: forty or fifty logs bound fore and aft with other logs called "head sticks" and "tail sticks," hemmed in with "side sticks," and laid over with "swifters"and "riders"—the whole chained together.

Light rain pebbled the river's surface as we slowly churned upstream to deliver the logs to the timber company's storage grounds. Along the shore, mills made clouds of steam. A cedar sawmill sent fragrance across the water. We passed barges laden with wood chips.

River Employs Huge Work Force

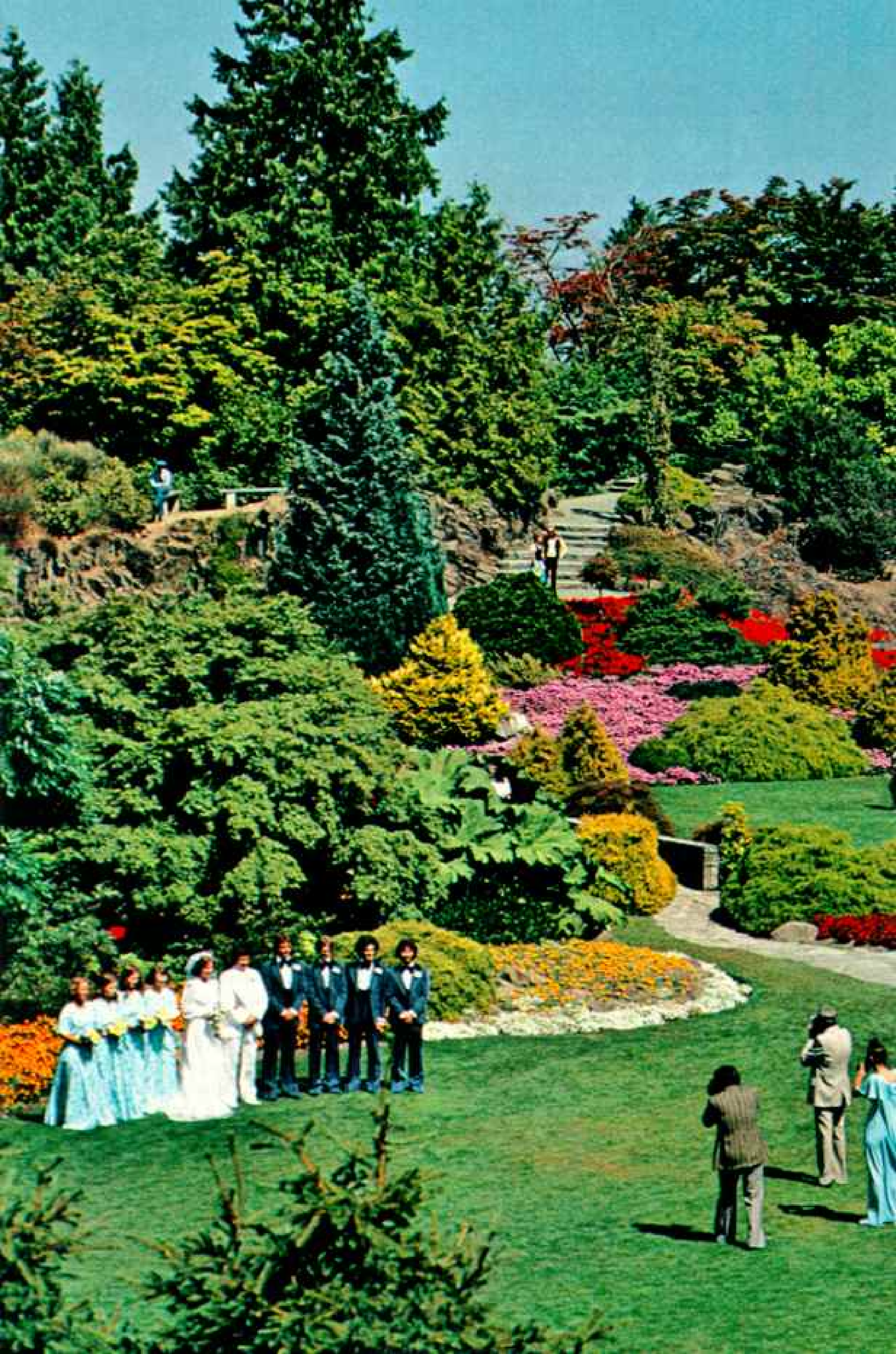
Opposite Coquitlam, twenty miles upriver, Barrie Northorp, the *Naskeena's* rangy deckhand, dismantled the sections, walking logs in nailed boots.

Back aboard, he poured coffee from the pot on the small stove and told me that both he and Neil had tried office jobs. "Spent eight months looking out the same bloody window at the same bloody thing," Barrie said. "No way! I just can't be cooped up."

Rivermen like these shuttle logs on the Fraser year round, with tugs sometimes breaking ice or dodging floes. Of the 85,000 people who earn a living directly from timber in British Columbia, a tenth are employed along the Fraser.

The river contributes to Vancouver's well-being in other ways. I remember

Fog, the magician, erases half of Lions Gate Bridge. The pervasive mist shrouds the city 62 days a year; rain pays court more than twice as often, leaving an annual 60 inches.



another day on its waters, when fog and water blended so perfectly that I could not find their joining seam, much less the city's towers rising a few miles away. Nearby but invisible, 225 boats waited for salmon.

There is tension in such times. But for Nancy Marshall this morning seemed an idyll. She steered her 34-foot *Sunshine* in an easy zigzag, paying out the net. She repeated my question: "Why do I like fishing? Well. . . ." Her arms made a gesture toward the whiteness that enveloped *Sunshine*, a cocoon that blotted out the world. What else need be said?

Nancy majored in English and tried various jobs in Vancouver. But for her the city was "too many people going too fast." Four years ago, at age 27, she invested in a boat. "I didn't even know how to put the net in the water. I got off where nobody could see me and just sort of taught myself."

The anticipated salmon run did not materialize this day. But the Fraser is a productive river despite development; salmon yield 32 million dollars to fishermen in an average season. "With luck there's one big day when you might make $5,000," said another fisherman, Leonard Hashimoto. "That's the glamour and excitement you wait for."

Innocent Victims Forced From Homes

Leonard's father, born in Japan, fished at a time when a third of the boats along the British Columbia coast were owned by Japanese. Many lived at Steveston, whose fish-cannery stacks emerged as the fog departed the river's mouth.

After Japan bombed Pearl Harbor, Japanese-Canadians were moved inland—much as Japanese-Americans were interned in the United States. In 1942, 22,000 people vanished from the British Columbia coast. Many were taken away with little warning, compelled to leave belongings behind. A government agency sold their houses, boats, and cars, usually for a fraction of their

Only memories are mined in this former quarry transmuted into a lush botanical garden within Queen Elizabeth Park, here being used by a wedding party. Vancouver's 144 parks range from pocket-size patches to thousand-acre Stanley Park.

Honkers meet honkers. Early morning rush-hour traffic awaits a file of Canada geese

worth. For the Japanese it was a wrenching, humiliating time.

Some—by no means all—Japanese returned to Steveston after the war, but few will talk of the experience. I called on a bespectacled elder and attempted an interview that, for both of us, was painful. From this old man, sitting rigidly in his chair as if my questions were the whine of a dentist's drill, I drew only the sketchiest information. After the war he had returned to his house, now owned by a stranger, to look for family photographs that had been left behind. They were not there.

Bitterness: Surely there was bitterness in this man. "It was war," he said opaquely.

Last year Vancouver shipped 19 million tons of Canadian products to Japan—forest products, grain, coal, potash, and sulfur—brought by rail from British Columbia, Alberta, and Saskatchewan. Forty percent of the port's traffic, the Japanese trade anchors Vancouver's premier place among Pacific coast ports.

Fred Spoke, a Dutch-born engineer who is the port's general manager, works in one of those high offices overlooking Burrard Inlet. "I can look at that mound of sulfur over there and know roughly how Canada's economy is doing," he said from the window. My eyes went to a yellow hill beside a wharf. Two ships were loading there.

Canada's economy is much on Mr. Spoke's mind. She competes with many nations in selling the products of her forests, mines, ranches, and farms, he reminded me. "If we're not on our toes here, if our facilities aren't efficient, the whole country suffers."

The tricky aspect of managing a port is to be ready for the future. "Who would have thought a few years ago that South Korea would be one of our big customers?" Mr. Spoke asked. "Singapore is now a dynamo economically, and Malaysia is becoming one. China is a sleeping giant, but someday she'll awaken, and we're in the perfect place to take advantage." Much of Mr. Spoke's time is spent planning facilities that will be needed as far away as the end of the century.

Symphony Draws Rave Reviews

But it takes more than planning to make a mature city in the relatively short time Vancouver has been around. "You have to dream," said Michael Allerton.

That it also is a gracious city is due at least in part to Mr. Allerton's dreaming for the Vancouver Symphony, of which he is the

in Vancouver, where the brisk pace of life defers to the enjoyment of nature.

general manager. Judged mediocre a few years ago, it enjoys critical acclaim today and receives invitations to tour abroad.

An emigrant from London—one more man for whom Vancouver's pastures seemed greener—Mr. Allerton remembers that in 1969 the symphony counted only 3,500 concert-series subscribers. "If we wanted more funds, we had to fill the hall," he said. Under Mr. Allerton the symphony has not shrunk from hawking seats like soap, and now can boast more subscribers (some 39,000 for a six-concert series) than any orchestra in the world.

Mr. Allerton and the governing board dreamed of a better hall for the orchestra—and in 1977 occupied the commodious Orpheum. Though renovated, this former movie palace retains the Moorish-style gingerbread of the 1920's. Dreaming on, they acquired a conductor with impressive credentials: Kazuyoshi Akiyama, who, like Seiji Ozawa of the Boston Symphony, studied at Japan's famous Toho School of Music.

I listened as the orchestra rehearsed *The Impresario* overture, by the maestro's favorite composer. "If you are on a desert island, what do you take with you?" Mr. Akiyama asked. "I take all Mozart scores."

The conductor, who is 37, seemed boyish despite hair prematurely gray. To the musicians he spoke quietly. "No," he gently corrected the brasses, "it goes like this: *pum, pum, pum, PUM.*" He has no need of bombast; raising his baton, he drew the strains he wanted with flowing movements.

Dream Ends on a Glad Note

Neither maestro nor general manager reckons it a disadvantage that Vancouver is far from established music centers. "We're not tied to tradition," Mr. Allerton said. "We can experiment." They do—even inviting Big Bird of television's "Sesame Street" to conduct a children's pop concert.

"We want to find ways to be useful to all of British Columbia," Mr. Allerton said. "One way is to take the orchestra to small towns. We've started a magazine to bring people news of music from all over the world." He began to talk of videotaping performances for schools and of ways to attract even more concert subscribers.

Michael Allerton was dreaming again. Yet I found no grounds for doubt. By now it seemed clear that in Vancouver—from Skid Road to symphony hall—men's dreams have a way of working. □

NEBRASKA'S SAND HILLS

Land of Long Sunsets

By JOHN MADSON

Photographs by JODI COBB

NATIONAL GEOGRAPHIC STAFF

FROM A THOUSAND FEET ABOVE, the great ridges of Nebraska's grassy Sand Hills had lost some of their height but had gained in breadth, billowing endlessly off beyond the horizon. Little valleys and hollows past numbering fanned out in the rough country—and now, in early November, these still hid a few cattle that hadn't made it down to the winter range.

Rancher Art Abbott and I had seen about forty head from his little plane when three horsemen appeared below us. Art put the Piper Super Cub into a tight turn and made a pass over the riders. Letting the plane fly itself straight and level, he penciled some sort of code on a scrap of paper, stuffed the note into a tin can, made another pass over the horsemen, and, sure of their attention, tossed out the can.

Below, his son Chris galloped to the can and waved up at his father. Now the cowboys would gather the isolated little bunches of cattle from those remote pockets of the big Abbott ranch and push them south into winter range. I leaned forward and yelled my congratulations on this highly sophisticated air-to-ground liaison system. Art refused to be needled, and grinned. "Well, it works, doesn't it?"

It sure does. Without the plane, some of those cattle might not have been found in north-central Nebraska's labyrinth of hills and ridges until spring; without the cowboys, they might still be there. It was somehow typical of the Sand Hills cattle business. A blend of transistors and saddle leather, a meld of new and old that pervades the Abbott ranch.

I'd driven to his spread, about thirty miles south of Merriman, in my old pickup truck, and it had taken some doing (map, page 498). From the main highway the road back to the ranch is nine tough miles of ruts and sand traps. The farther you go, the more you wonder where you made the wrong turn.

Suddenly, around the shoulder of a high ridge, there is ranch headquarters. The main house, in a grove of cottonwoods and box elders, is 67 years old, high-ceilinged and spacious (left). Nearby stand the bunkhouse and cookhouse, and set into the side of the ridge is a combination butcher shop, creamery, and commissary that can feed the ranch crew for two months if blizzards close the road.

Across the ranch yard, a blacksmith forge and machine shop are equipped to serve either horse or tractor. Beyond the pens, corrals, loading chutes, and dipping tanks lies a broad, sheltered valley with herds of wintering cattle. There is an ageless quality about a working ranch like this; it is a window into yesterday, with something unchanged since before the ranges were fenced.

Abbott himself is the *(Continued on page 499)*

Pride of place lights the faces of Arthur J. Abbott, his son Chris, and daughter-in-law Kim in front of their ranch house in the heart of Nebraska's little-known cattle kingdom. Drawing on a pioneer heritage of self-reliance, the Abbotts and their far-flung neighbors have cultivated a life of quiet plenty on one of America's most productive rangelands.

The largest tract of dunes in the Western Hemisphere, the Sand Hills are blessed with an abundance of groundwater. Southwest of Valentine their rich mantle of grasses rolls like swells on a windy sea (**following pages**).

Photo finish on a remote stretch of road highlights a day of games and races, as students from several Cherry County schools delight in the company of wide-ranging pals. Here, with only 900 grade schoolers in a county larger than Connecticut, the one-room schoolhouse is alive and well.

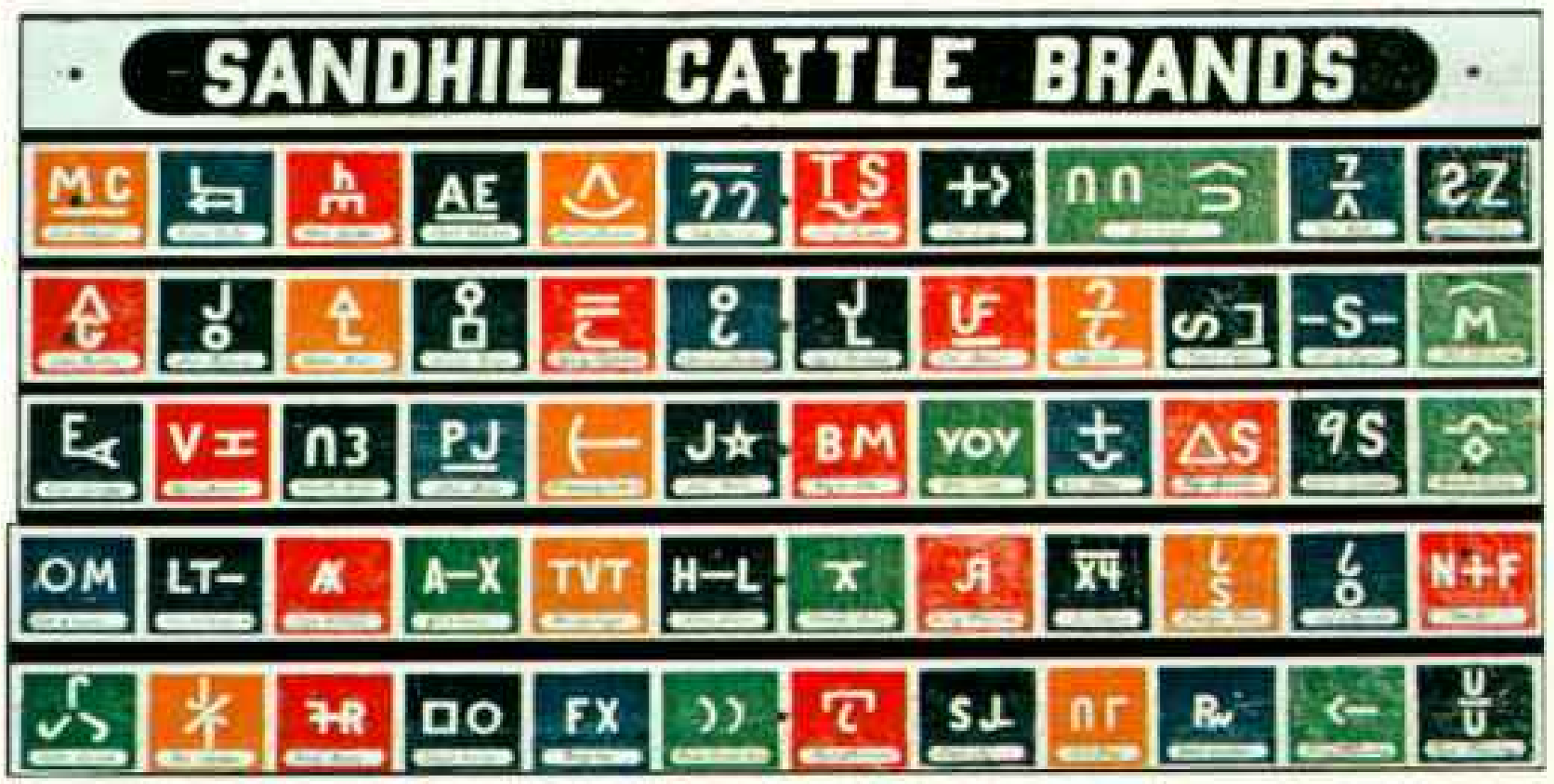
At School 100 (**below** and **preceding**

PAT CAULFIELD (ABOVE)

pages) flag raising starts the day. Inside, fifth grader Cory Powell signals for help (**below**), while her only schoolmate, third grader Geri Bush, knuckles down. Each has a parent who went to school here also. Says teacher Phyllis Pavelka, "You can put as much effort into two students as thirty, and with greater rewards."

Shunned as a wasteland by early cattlemen, the Sand Hills today help make Nebraska the nation's third largest beef producer, as reflected by a billboard display of brands in use around Merriman. Under some 19,000 square miles lie at least half a billion acre-feet of water.

SANDHILL CATTLE BRANDS



(Continued from page 493) grandson of a pioneer Sand Hills cattleman who rode up the trail from Kansas in the 1880's. A successful banker-rancher, Art has one boot in the present and the other in the past. That morning he had driven a four-wheel-drive pickup out to the hangar where he keeps his airplane, but not before telling Chris and two other cowboys to saddle up and follow him into the north summer range.

Pickups and planes are useful, saving time and effort, but must be kept in perspective. It's clear to most Sand Hillers that man was really designed to straddle a horse.

"We still do much of our cattle work with horses," Art explained. "Out there in the summer range you can tear up expensive equipment pretty fast. Horses are also self-supporting, and on this large a ranch you're a long way ahead by using them for much of the work with cattle."

Even at 40,000 acres, the Abbott ranch isn't the biggest in the area. Art has neighbors with cattle spreads of 60,000 acres or more, although Sand Hills ranchers commonly describe holdings in sections or square miles instead of acres.

Turning Riverbeds Into Ridges

Nebraska's Sand Hills cover about a fourth of the state and include some of the richest virgin grassland in North America. They were formed several thousand years ago, when winds blowing over the beds of dead rivers lifted incalculable amounts of sand and molded it into the most extensive dune formation in the Western Hemisphere—19,000 square miles of great ridges, mounds, broad hills, and angular little peaks. As a true dune region it has been compared to the Great Eastern Erg of the north-central Sahara.

I mentioned this late one afternoon to my friend Jim Van Winkle of Valentine, Nebraska, as we headed up a remote cow trail through the hills of Cherry County. Except that grass covered nearly everything, we could have been in the Sahara dunes.

"I wouldn't know," Jim said thoughtfully, "but I'm sure of one thing: Folks around here don't care to have it called desert. Can't say that I do, either."

I had that coming. It isn't desert, of course—except in the sense that an oasis is desert. The vast dunes of the Sand Hills lie atop great aquifers, in places almost a thousand feet deep, and the dunes themselves may serve as reservoirs. This is a grassland biome bursting with life, what the Sahara might be if it were blessed with more moisture.

Wind-sculptured sands give the hills their character. Water—and the land's ability to store it—gives them their quality. This is one of the few major dune systems in the world that lie in a temperate zone with significant precipitation. Snow and rain, falling on what are essentially great piles of quartz sand enriched with plant remains, soak swiftly into the highly permeable soils, and little is lost in immediate runoff.

High water tables jewel the land with lakes and ponds, marshes and wet meadows. The northern and western regions of the Sand Hills are strewn with lakes, some 1,300 of them.

It is a strange and unlikely region, teeming with ducks, geese, herons, wild swans, shorebirds, pelicans, and gulls, with sudden little creeks and half-hidden spring runs that support trout, pike, and beaver. In the river breaks and thickets are white-tailed deer and wild turkeys, in the subirrigated valleys are ring-necked pheasants and prairie chickens, and ranging across the grassy swells of the open country are mule deer, antelope, and flocks of sharp-tailed grouse.

It's a big country. Cherry County, of which Valentine is the seat, is larger than Connecticut. A part of Cherry County that is larger than Delaware is without a town of any size. Or even a post office.

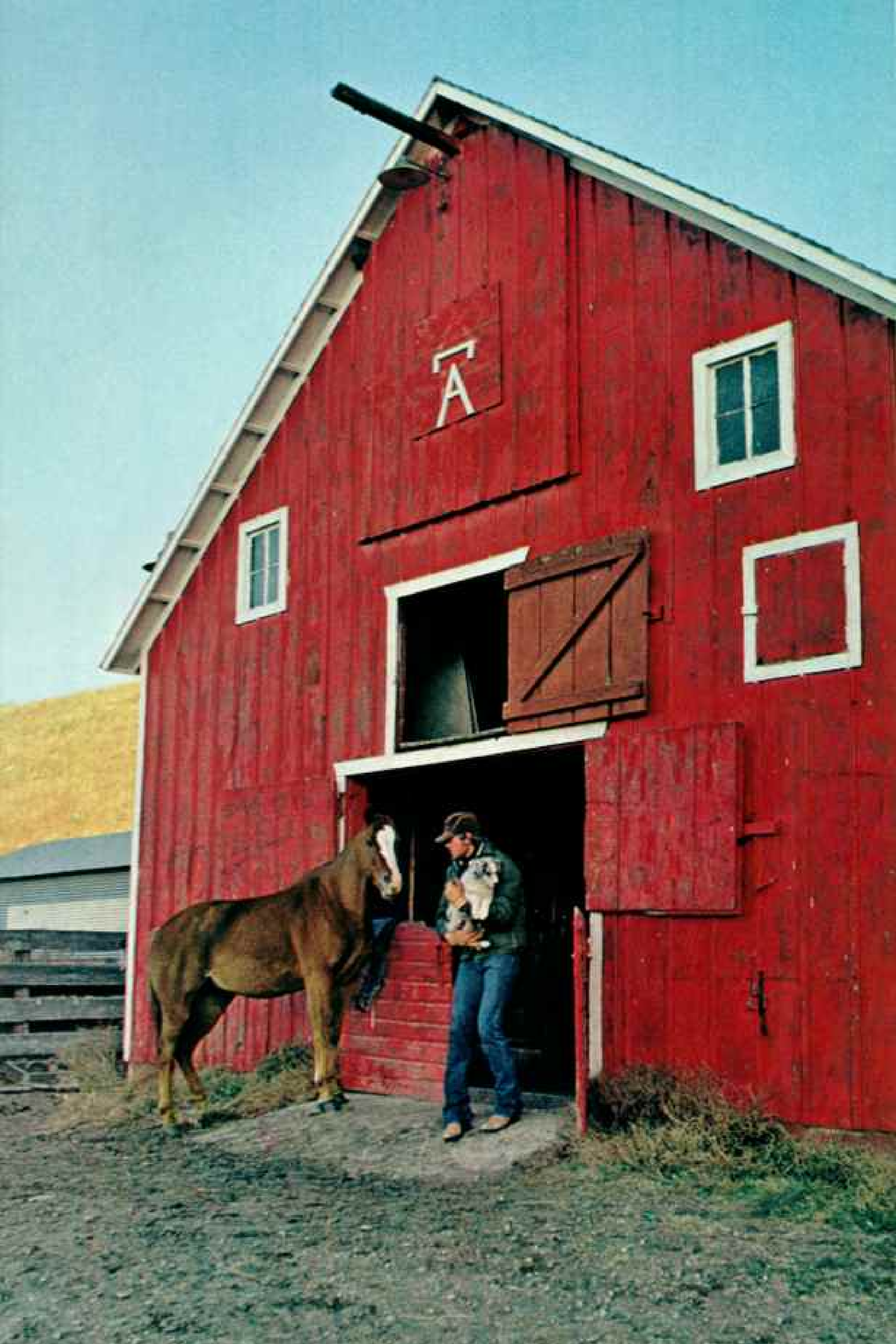
Talking About Weather and Old Times

The rare combination of low population and productive land has made for a warm and neighborly breed of people—men and women who cherish the company of others. When they get together, they usually talk land, cattle, horses, weather, and wildlife. All things worth talking about, and always salted with humor.

Late one blazing day I stopped at a crossroads establishment to rustle up something wet and cold. There were a couple of old ranchers at the bar, and we somehow got around to the subject of the old days and the hard outfits they (Continued on page 505)

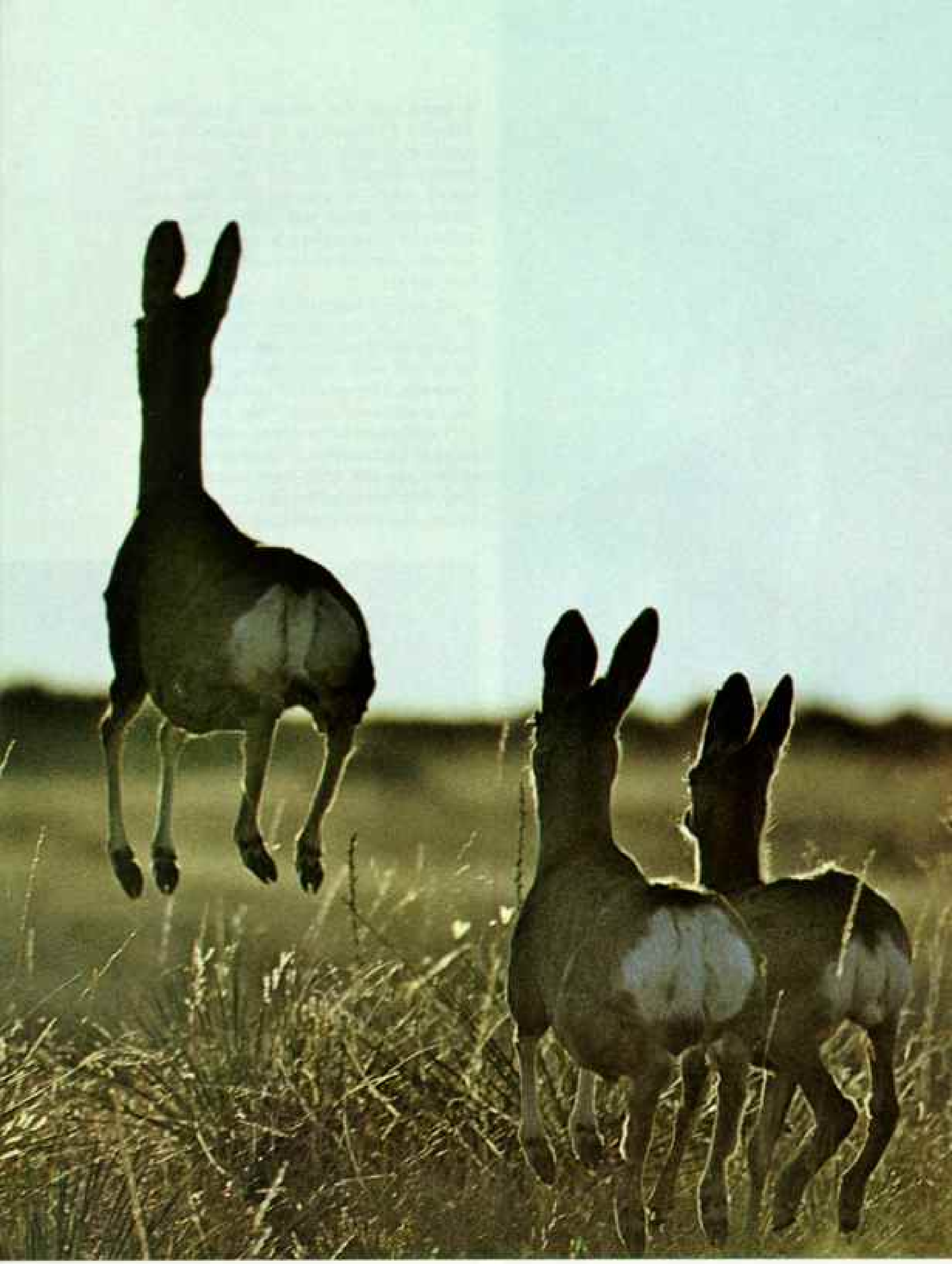
On a tawny October day in Nebraska's Pine Ridge region, cattle are rounded up for return home from Sand Hills rancher Don Forney's summer pasture. From a nearby

area, thousands of longhorns escaped into the Sand Hills during a devastating blizzard in 1879—there to grow fat in contrast to the many that died on their home ranges.



A word with the animals begins Chris Abbott's 12-hour day of dehorning and vaccinating cattle, a major fall task on his father's Cherry County ranch. Come spring, when he, with his wife, Kim, and his brother, Mike, will calve as many as 1,600 cows and heifers, he may perform a few cesarean deliveries—a skill he learned from his vet.

Of Arthur Abbott's five children, only the sons are staying on, while all three daughters are pursuing their own careers. On a two-week homecoming from Vail, Colorado, 25-year-old Diane (**below**) still has "sand in my shoes," but says "there isn't a whole lot for you here, unless you're going to be a rancher." Content with that calling and the wide-open spaces, Chris finds that "even the Rockies start closing in on me after I've been there a while."



Like giant jackrabbits, mule deer bound through lush Sand Hills grassland. A friendly environment for wildlife, the hills are also ranged by white-tailed deer and antelope, while hundreds of lakes offer stopovers for migrating waterfowl.

(Continued from page 499) had ridden for.

One said: "I'll never forget a spread that I worked for in the early twenties. We were rode hard and put up wet. Boss would wake me up in the dark and say, 'I hate to disturb your beauty sleep, but it's time to roll out.' And I'd say, 'Aw, that's OK, because I only had one boot off anyway.' "

His friend grinned, adding: "Yeah, that's how it was. One time I turned off the coal-oil lamp and rolled into my bunk after a hard day. When the boss woke me up to start work, I reached for the lamp to light it and burned myself on the chimney. It hadn't even cooled off!"

Concerning Flies, Skunks, and Snakes

It's country where a man will take a minute to talk and enjoy it. Like the Labor Day afternoon in Valentine when I stopped by the Sand Hills Museum to get acquainted with G. M. "Morie" Sawyer (pages 516-17). It was a quiet day, with folks off fishing at the Merritt Reservoir or gone to Johnstown to the rodeo. Sawyer was reclining in an old chair near the open front door beside his brass cash register, a lanky jasper with brown stetson pushed back on his head, booted legs crossed, and flyswatter in hand.

I made a turn around the museum, taking in the antique cars and two-headed calves, and ended up at the front door where Sawyer was swatting flies.

"Well, are you hitting all of 'em?" I opened.

"Gittin' a tame one now and then." (Swat!)

"You overkilled that one. Reckon you're overgunned?"

"Doubt it. Many's the one I've had to kill twice. Set down and rest."

So I pulled up another chair and we sat, looking out into the long golden afternoon and sharing the flyswatter and talking of many things—whether a skunk has to set his feet in order to squirt, and how to get rid of the smell if he does, whether cats are any good or not, and how far up a man's leg a rattlesnake can strike.

After a while, John Van Horn drifted over from across the road to offer some general comments about September flies, and how they come indoors. He is an authority, having once run a café and saloon. We talked about oil prospects in the Sand Hills, and about the local man who'd bought into a Wyoming field and got a check for fifty thousand dollars and showed it to everyone in town until it was all wadded up and almost worn out, and then proceeded to lose it. We talked about who owned the most land but put on the least airs.

And the golden afternoon slipped gently away, with rich yarning—an exchange of things learned of and from the land, mainly, and which are the best things.

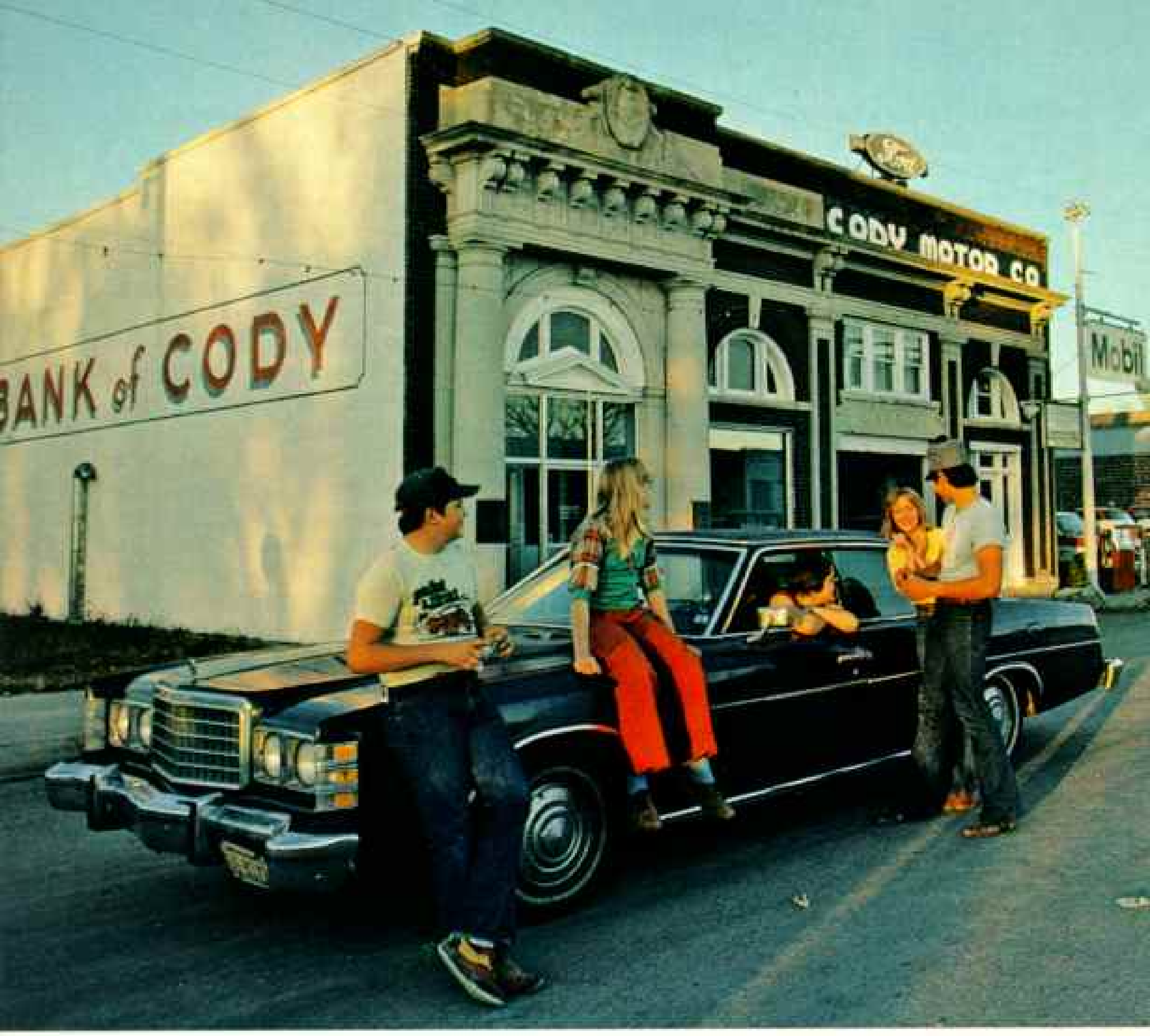
I had supper in Valentine at the Home Cafe—not dinner, but supper; you eat dinner at noon. People were beginning to return from the Johnstown rodeo—the little ones tired now, their mothers glad to be eating out, and their sun-darkened fathers with pale foreheads walking with the short, careful steps of men wearing riding heels. The young men high-shouldered and lean; the older, heavier men carrying their weight well above their trophy buckles as old riders do, with thick torsos and slim hips. Howdying and laughter filling the rooms.

I ordered my beefsteak well-done, and the waitress smiled. "Just the way I like it myself," she said. Which is one of the cultural features of the Great Plains that most Easterners deplore—but not as much as some old cowmen deplore rare beefsteak.

"Cultural Desert" Spawns Good Writing

Not long before, a man had told me how his eastern-bred wife longed for many things back home, voicing the poignant regrets that other women have felt in the Sand Hills. It was a cultural desert, she said bitterly, without theaters, concerts, salons, good books, or any appreciation for such things. She overlooked the fact that two of our noted American writers, Willa Cather and Mari Sandoz, were products of Nebraska grassland, Miss Sandoz of the Sand Hills, Miss Cather of the prairie farther to the south.

But if the Sand Hills country has gaps in one culture, it has surely filled them with a rich culture of its own. Superficially this manifests itself in rodeos, hearty steaks, pickup trucks with rifle racks, and bumper stickers reading "Goat Ropers Need Love, Too." But all that is underlaid with a heady sense of freedom in great vistas worth being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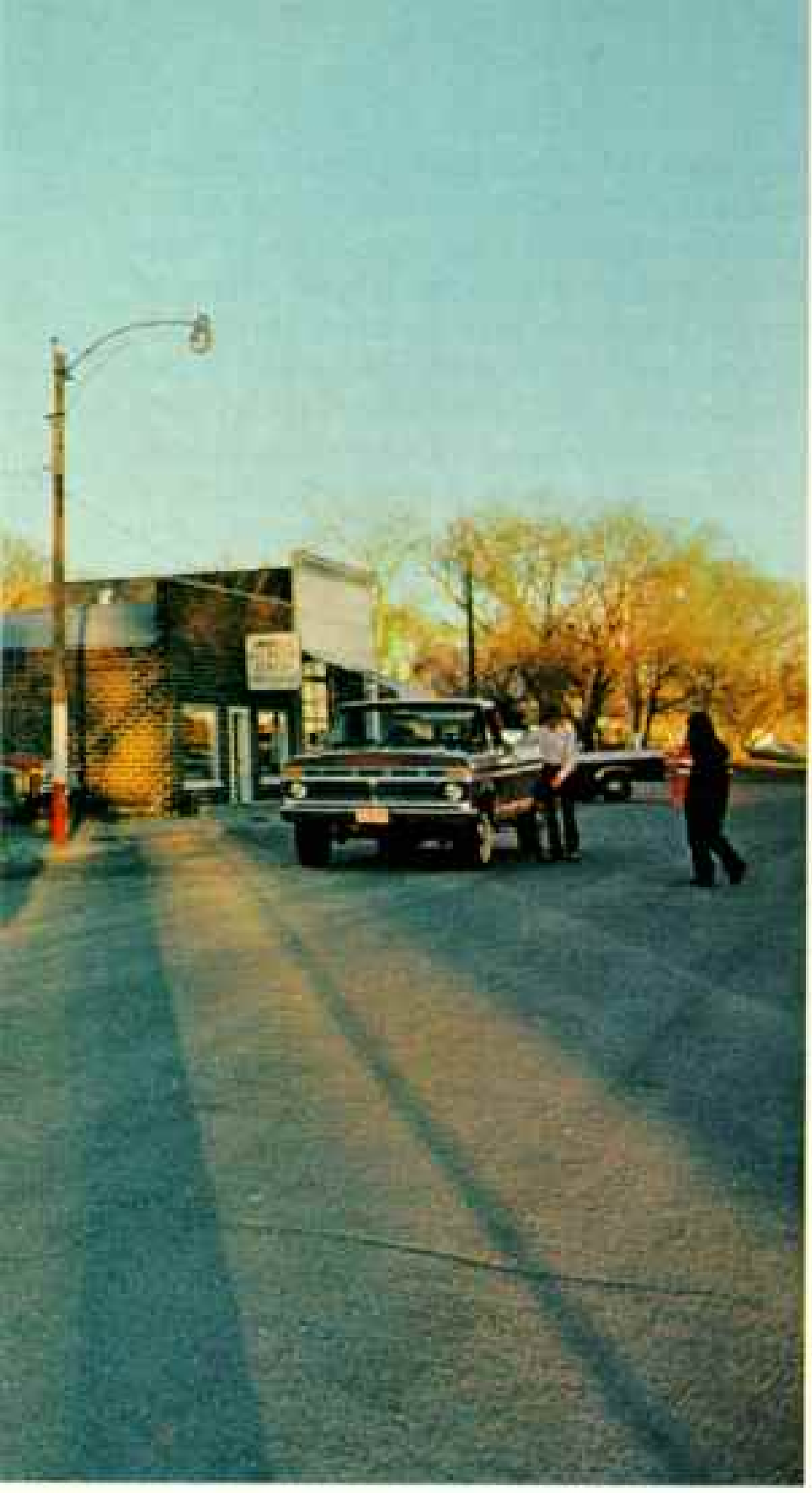
CODY MOTOR CO
Mobil



Call it Cow Town, USA. Nobody minds in Cody, where a mid-street gathering of teenagers disrupts traffic not a bit (**above**). Cattle, after all, are the lifeblood of the Sand Hills, and schools for ranch children are among the towns' major institutions.

At the Western Cafe in Hyannis (**left**), youths from outlying ranches mingle easily with elderly townsfolk. Shellie Herman (in white sweater) commutes 76 miles daily to the new million-dollar high school, while her friend Rosalie Ogier lives in town, a custom from early days, in a home owned by her rancher parents. In addition to businessmen, communities are populated largely by retired ranchers or their widows, like 85-year-old Hazel Hayward (with cane). One of her sons, Chuck Hayward, went to Hollywood in 1948 and became a stunt man for actor John Wayne.

free in, of close families, of good neighbors who need and are needed, and of faith in the purpose and quality of people and work.

Once an old cowman raised a toast: "To the improvement of the breed," and I asked him if he meant cattle. "Yes, and horses too," he replied. "But men, mostly." His was an old hope, shared by people everywhere, but in the Sand Hills it is hope susceptible of attainment.

One-room-school System Works

There is a special self-reliance among Sand Hillers, and they learn it young. For example, getting to the one-room schoolhouses that still serve many ranch families isn't just a matter of catching a bus at the corner. The children get there by themselves, and it is said that they start to school "when they're 5 years old or can drive a pickup, whichever comes first." It's not uncommon to see 9-year-olds who are experienced drivers—even though they can hardly reach the gas pedal. Most of their driving, of course, is done on isolated ranch roads.

Don and Olive Forney ranch between Lakeside and Rushville. All their children attended a one-room school south of their ranch—a little school that now has 12 pupils and eight grades.

When the five Forneys reached high-school age, they went to Rushville to board with family friends, coming home only on weekends. It's another one of those Sand Hills methods that works. Two Forney sons are now physicians, one has just finished law school, another plans to be a veterinarian, and the only daughter, married to a young rancher, is a college graduate.

I don't know if Don and Olive Forney are typical Sand Hills ranchers or not, but I like to think so. They own about 18,000 acres and lease another 10,000. They work hard and love ranching, but feel that the average family rancher has had a tough time of it—providing his labor free of charge, or receiving no interest on his capital investment, or both. Don points out that while labor unions may demand new contracts and management can adjust to higher costs, the cattleman can do neither. Don sells his cattle at auction, usually at nearby Rushville, with the cowman's lament that he must deal in a buyer's market rather than a seller's.

The Forney ranch is a cow-calf operation. Art Abbott, by comparison, sells many 2-year-olds, while other ranchers market mostly yearlings. But Don Forney prefers to sell the calves, and his two calvings each year spread the calf crop over the market a little better.

There is the usual March calf crop, and another in late August and early September. The second calving occurs while the cows are still on summer range and the annual coyote population is at its peak. Don flies the range almost daily then, checking on calving and watching for coyote trouble. Like many other Sand Hills ranchers, he's a superb off-airport pilot. He learned to fly in 1940 and stopped keeping a log at about 15,000 hours, and that was quite a while back. But he's a true Sand Hiller and has logged more time on horseback than in a cockpit.

Opportunity for Volunteer Cowboys

Several years ago Don and Olive bought a beautiful 6,000-acre summer range in the Pine Ridge country about fifty miles north of the home ranch. Don swears they bought it to run cattle—but friends wonder. With its rolling grassy parks, ponderosa pines, and wild turkeys and deer, it qualifies as pretty good people pasture as well.

Moving cattle to the new range poses a problem. They now truck them, and that's expensive. An alternative might be to trail cattle from the main ranch up into the Pine Ridge pasturage. But do they have enough cowboys? Olive Forney smiled: "That wouldn't be much of a problem. It would be a real old-fashioned drive, mostly cross-country, and there'd probably be plenty of help for a drive like that."

Beautiful as it is, their new Pine Ridge range is frosting on the cake. The Forney ranch itself is country enough. Don and his sons have planted thousands of trees by hand, fencing them against cattle. These stands of pine and cedar are nurseries for deer and winter shelter for pheasants, grouse, and other wildlife.

Being a wildlife biologist, I was keenly interested in Don's excellent patches of cover. He has fenced little seepages near windmills, letting each mini-oasis grow to lush stands of grass and forbs. The overflow of one stock tank has been diverted into a small fenced area with its own pond—and as we rode past the place in late fall, it teemed with ring-necked pheasants. Don and some of his family and friends hunt the ranch, but they crop the game lightly, and there is a 200-bird flock of sharp-tailed grouse that is never hunted at all.

Land of the Last Frontier

The Forney ranch lies near the western edge of the Sand Hills, where the greatest of the ancient dune formations occur. These are long, massive ridges that may be a mile across and as much as ten miles long, generally aligned along an east-west axis by the prevailing north and northwest winds. Some of these ridges are as straight as a buffalo lance; others curve like a strung bow. Many are high. Wild Horse Hill in Grant County crests nearly four hundred feet above its valley floor—and about 4,200 feet above sea level. Many of the area's ridges have an elevation of 4,000 feet or more.

In addition to these big dune systems, narrower ridges rise from forty to ninety feet and extend generally from northwest to southeast. A third type of dune, found almost everywhere in the Sand Hills, shows no particular orientation to the prevailing winds. Most of these dunes are less than thirty feet high, resembling little cusped peaks of stiff meringue. These are the "choppy sandhills" or simply "choppies"—abrupt little peaks that flank the main dune system in a tangled confusion of rough land.

The Sand Hills were among the last of the great American ranges to be settled. Pioneers thought the region too rugged, and too lacking in forage and water, to support livestock.

The first ranch along the northwestern edge of the Sand Hills was established in 1877 by E. S. Newman, who raised contract beef for the Pine Ridge Indian Agency. He

Second fiddle to her larger dreams, 17-year-old Lisa Rhoades's talent for bluegrass music will, she hopes, see her through college and law school. Here, with niece Tara Jane Estes, she warms up for an old-time fiddling contest at Thedford's high school.

and other ranchers avoided the hills to the south, believing them to be useless to cattle and dangerous to men. Yet, with almost every winter storm, some of his cattle drifted south into the dreaded choppies.

During the March blizzards of 1879, a line of Newman's N-Bar riders tried vainly to hold their herds north of the Niobrara River, on the edge of the Sand Hills, but failed. The cattle broke through the line of cowboys and vanished into the nightmare country south of the river. Newman refused to send any men after the lost stock, but a cowboy named Jim Dahlman—who would become the longtime mayor of Omaha—and 11 others volunteered. With remounts and ample grub, they set out on April 15.

To their great surprise, they found rich valleys and cattle that were fat in spite of the terrible winter. They recovered not only their own cattle, but also many others. Five weeks later they came out of the Sand Hills

Shinnying windmills, breaking horses, branding calves: Experienced helping hands on Elsie Roth's 5,000-acre ranch near Mullen, Helen Amsberry (**right**) and Betty Evans (**above,** with daughter Dori) can do it all. Women's lib? Says 59-year-old grandmother Helen, after repairing the windmill: "We've always had it, so we don't know the difference."

with 9,000 head—the N-Bar stock as well as 3,000 other cattle, some of which had been lost earlier. Hundreds of the recovered cattle had been in there for several years.

Texas Drovers Know a Good Thing

It was the birth of a grassland empire that drew men from many quarters—and for many reasons.

Some of the earliest Sand Hillers were Texas drovers who pushed trail herds north and never rode south again. They took a canny look at the open range, good grass and water, and lush winter pastures, and began to locate. Perhaps they swung a wide loop on occasion, or were a bit free with the running iron, but those are things that their descendants don't talk about much.

Those early Sand Hills days had their share of hard cases. Some were simply very tough cattlemen like the notorious Print Olive, who was *(Continued on page 516)*

Jury of prairie stalwarts turns out (**right**) to pass verdicts on the year's crop of bison and longhorn cattle at the Fort Niobrara National Wildlife Refuge near Valentine. Here, every October, the Federal Government auctions off 50 to 70 head of each historic breed, while maintaining stable herds for viewing by the public. Buyers from all over—most of them interested in breeding stock—become more agreeable customers after sampling blue-ribbon pie sold by a home extension club (**below**).

One of the Sand Hills' three federal wildlife reserves, the Fort Niobrara refuge was named for a military post established in 1880 to keep the Sioux across the border in the Dakota Territory's Rosebud and Pine Ridge Indian Reservations.

Rangy Texas longhorn draws heavy bidding at the Fort Niobrara auction (**right**). The beef-of-the-day in the 1880's, when cattle drovers moving north from Texas began settling in the Sand Hills, these strong-willed beasts were ideal for the unsupervised stock raising of the time. With fences came more docile British breeds, along with a war of nerves and bullets between ranchers and homesteaders; by the 1910's the latter had left after finding the hills unsuited for farming. Today the once nearly extinct longhorn is prized by some ranchers for crossbreeding.

PAT CAULFIELD (ABOVE)

To save the grass cover that holds his land intact, Elver Lord rotates pastures and trucks a portable corral (**above**) directly to his cattle for spring branding, instead of trailing them to the same site each year. While pickups and airplanes have eased the task of surveillance, saddle horses, like these on the Abbott ranch (**right**), are still used for moving stock.

(Continued from page 511) almost, but not quite, too tough to kill. But there were also bona fide gunmen like Doc Middleton, Luke Short (who outdrew Long-Haired Jim Courtright, shot off Jim's hammer thumb, and then killed him), and certain hard-eyed professionals who drifted over to the Sand Hills after the Wyoming range wars.

In 1892 there were already a few farmers in the hills trying to raise crops. And before the end of 1894, some newly arrived Wyoming outfits were trying to scare them out. Gunmen began to appear on some ranch payrolls—grim, soft-handed men who were avoided by the working cowboys. Within a few months three homesteaders were found shot at their plows, to make it clear that homesteading was a capital offense.

Learning About Drought and Dirt

Gunslingers, however, did less to convince settlers of the futility of dry farming than did the climate and the Sand Hills themselves. The coarse soils, often deceptively dark-colored, soon lose productivity under row-crop agriculture. Drought—and lack of understanding of the country—beat most farmers. Sooner or later their claims were bought up by cattlemen.

Although the Kinkaid Act of 1904

Shadows of yesterday fill the Sand Hills Museum in Valentine, where owner G. M. Sawyer relaxes outside with his mandolin. He gave up ranching twenty years ago to indulge a passion for collecting things—particularly antique cars, of which he now has 18. How many people drop by? "Not near enough," he says. Well . . . it wouldn't be the Sand Hills otherwise.

brought a new wave of homesteaders into the Sand Hills, a succession of dry years wiped most of them out. Today, even with big center-pivot irrigation systems producing crops in some places, most ranchers are interested in farming only as it complements cattle raising. The scale of values is still couched in terms of beef—as it was years ago when cattleman John H. Bachelor built the largest house in Valentine. It seemed appropriate to include a fine piano in his house, so he went shopping in Omaha, where a piano salesman showed him the best.

"How much?" asked J. H.

"That will be $1,500, sir."

J. H. exploded: "Why, there ain't *nothin'* worth $1,500 that can't have a calf!"

Unlike many other parts of the West, the Sand Hills region seems to be strengthening its role as a beef grower—a pastoral tradition set in a folding ocean land of grass that is a source of immense pride to Nebraskans.

It's also tourist country of a different kind—not a region where visitors can expect to be passively entertained. So far as I know, there isn't a dude ranch in the Sand Hills. But if people come here with active interests, the hills are a rich lode of recreation for the naturalist, rock hound, photographer, hunter, artifact buff, hiker, and horseman.

Coming Home in Day's Last Light

The Sand Hills are best seen from horseback. But for most people the best way is from north-south highways late in the day when the landforms are thrown into full relief by the long sunset. Highways such as State 27 between Ellsworth and Gordon, or State 61 between Hyannis and Merriman.

Still, I suppose that U. S. 83 is my favorite because that's the route I usually take out of North Platte after having been East too long. The road runs through open country, gradually rising but not doing much else. And then, abruptly, it drops into the breaks of the Dismal River through a wild tumult of soaring ridges, deep folds, and rough little choppies. This is one of the finest ways to come back to the hills, and early evening is surely the time, with the greens deepening and blueing and the sun lying flat and orange against the flanks of the ridges.

It's all as good as ever, just as remembered, and caught in the prime light of the coming-home time. We hit it just right. Full dark in about an hour, but by then we'll be in Valentine if this old pickup doesn't swallow a valve. And then—I'll have the big T-bone, ma'am, well-done. □

Djibouti, Tiny New Nation

PICTURE STORY BY

on Africa's Horn

MARION KAPLAN

THE TEMPERATURE soars above 100 degrees, and mugginess steams the senses. Yet nothing saps the energy of the crowd. Grinning men brandish spears, seas of children wave banners and balloons, bejeweled women flash curved daggers. June 27, 1977, brings independence to the French Territory of the Afars and the Issas, and the Republic of Djibouti is born. Its flag bears a symbol that adorns celebrators' caps (**left**)—"the star we shall follow in our hope and struggle," declares President Hassan Gouled Aptidon.

This new African nation faces a truly formidable struggle. The Massachusetts-size land has virtually no natural resources. Ninety percent of its quarter of a million citizens are illiterate; 85 percent unemployment plagues Djibouti town, its sole major city. And the country's population is split between two historically antagonistic peoples, the Afars and the Issas.

Yet the world's eyes are focused on Djibouti. The tiny nation is an oasis of neutrality among militant neighbors, Somalia, Ethiopia, and Ethiopia's breakaway province of Eritrea. Djibouti also overlooks the strait of Bab el Mandeb, or Gate of Sorrow, navigated by 70 vessels a day on the vital shipping route between the Red Sea and the Indian Ocean.

Although the French tricolor flies no more over the last true colonial outpost in Africa, about 5,000 French military and administrative personnel remain to keep the peace and buoy the economy. Meanwhile, Djiboutians look to their only source of livelihood—their location—to give them a trade lifeline and attract foreign aid to shore up their stabilizing influence in the war-ravaged Horn of Africa.

Djibouti, eye of the storm

Amid swirling political turbulence, Djibouti stands as a neutral gatehouse on the Red Sea. The recent Somali-Ethiopian war interrupted Ethiopia's trade via the port of Djibouti (**facing page**). Formerly French Somaliland, the colony in 1967 became the French Territory of the Afars and the Issas.

AREA: 8,494 sq mi (22,000 sq km). **POPULATION:** est. 250,000. Issas and other Somalis, 49%; Afars, 39%; Arabs, 6%; Europeans, 4%. **LANGUAGES:** French, Somali, Afar, Arabic. **ECONOMY:** Port and railroad, camels, cattle, goats, sheep. **CAPITAL:** Djibouti, pop. 160,000. **RELIGION:** Chiefly Muslim.

Colonization of the Horn, 1897
European colonization was spurred by the opening of the Suez Canal in 1869. Ethiopia repelled Italian invaders in 1896 and consolidated its territory.

Italian expansion, 1940
Fascist Italy attacked Ethiopia in 1935 and by late 1940 occupied all the Horn except for the French enclave. Britain defeated the Italians in 1941.

United Nations negotiations, 1952
Ethiopia was federated with Eritrea and had regained the Ogaden by 1952. In 1955 it assumed complete control of the disputed Haud grasslands. The former British and Italian colonies became the Somali Republic in 1960.

"DJIBOUTI is as helpless as a goat that two lions are waiting to pounce on. We guard the goat," a French naval officer remarked. Wary of Djibouti's neighbors—Somalia and Ethiopia—France bolsters its former colony's defenses. The gift of a venerable military transport plane (**above**) gets the republic's air force off the ground, and a French patrol boat changes hands to inaugurate its navy (**right**).

As Ethiopian and Somali forces fought it out in the Ogaden last December, Lt. Mohammed Abro Mohammed inspected a detachment of the Groupement Nomade Autonome at the fort of Assamo (**left**) preparing to patrol the southern border. Afars and Issas march side by side—a sign of cooperation between the two peoples that their leaders hope will spread.

Djibouti's Afars, who occupy three-fourths of the nation, are related through centuries-old sultanates to the Afars in Ethiopia and Eritrea. Within and without Djibouti, however, the Afars are politically fragmented. The Issas of the southern plains, a Somali group, are more urbanized than the Afars. Before independence, many Issas favored union with Somalia.

Both peoples are traditionally nomadic. Their enmity was born of fierce competition for scarce pastures and water holes amid Djibouti's barren landscape. For each, the tribe "is a small republic, a living and indissoluble cell . . . reinforced by Islam and a common language," wrote one observer. To help defuse tribal hostility, the nation's government is carefully balanced between Afars and Issas.

SEVERED umbilical cord, the train from Djibouti town (**above**) heads for the southern border, end of the line after Somalis cut the rails to Addis Ababa, Ethiopia's capital. Djibouti's economy was derailed, losing half a million dollars a month in customs duties from the railway, which carried 60 percent of Ethiopia's foreign trade. The railroad line has since been reopened.

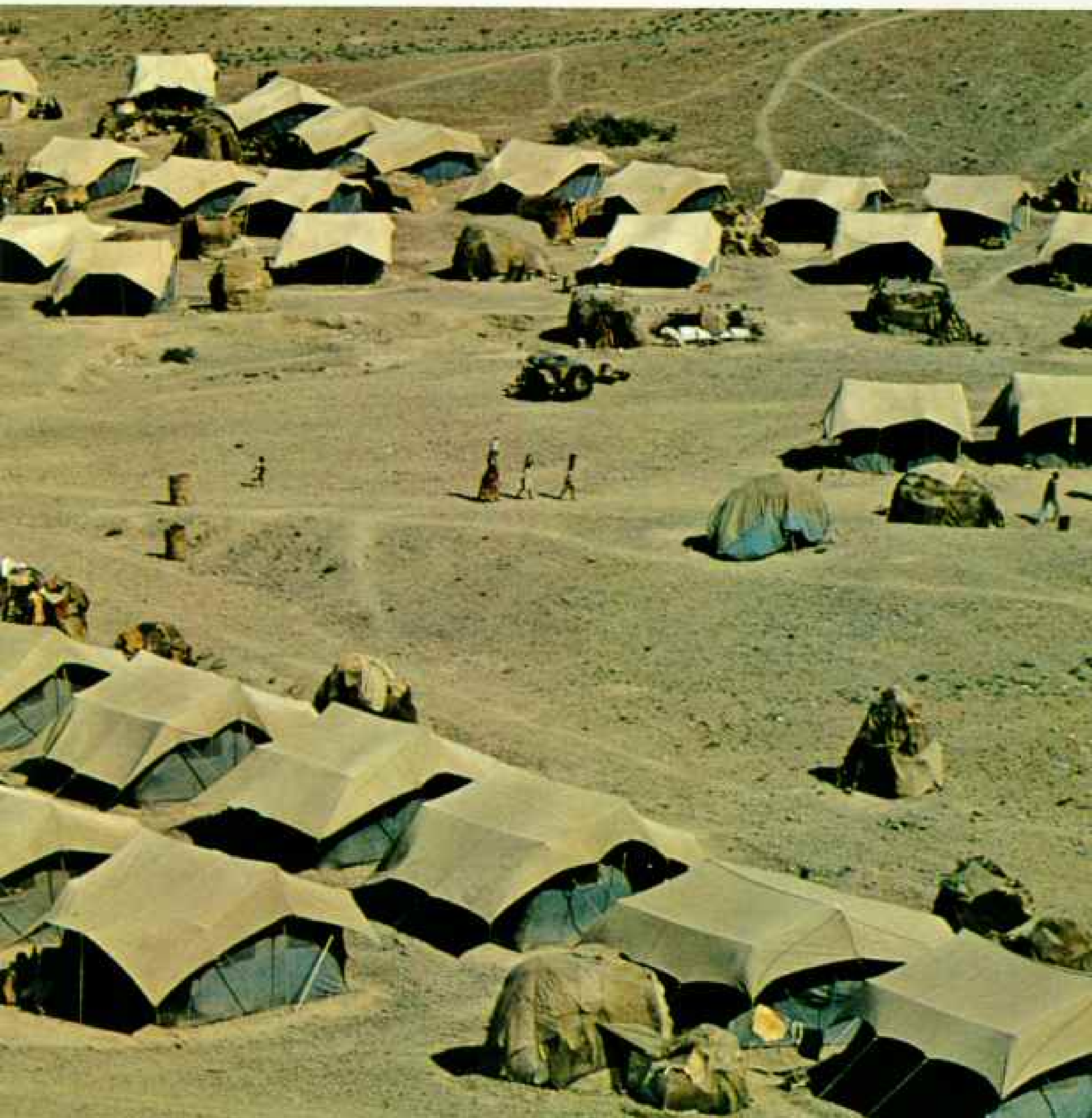
Born in the desert, President Hassan Gouled (**above**), an Issa, says, "We are a nation of shepherds, and proud of it. Unity of the people is integral to the solution of our problems. We have prepared many regional projects, but we will need help." In one development plan at Lake Assal (**left**), a salt lake 512 feet below sea level, two geothermal wells have been drilled to provide power.

"WATER DICTATES our routes, our lives." To that ageless refrain, a herdsman slakes his camels' thirst (**left**). Beneath the parched soil of Djibouti lie abundant pockets of water, but digging is costly and often fruitless. Planners hope to increase the number of permanent wells and convince nomads that the desert can bloom if they will farm it.

The dearth of agriculture contributes to malnutrition, which often breeds tuberculosis. Many people take the edge off their hunger by chewing *kat*, a euphoria-inducing plant. To nourish a healthier future, the Roman Catholic Social Home for African Women holds child-care classes (**below**). Parents and children alike often reflect a handsome grace, like this girl on Independence Day (**right**).

VIGILANT SILHOUETTES of French Foreign Legionnaires stalk the Somali frontier (**right**). The legion garrisons 1,500 men in Djibouti because, as one bragged, "Everybody knows we're the best."

From across the border, thousands of refugees fled into Djibouti during the Ogaden war, like those at Ali Sabieh (**below**). The United States rushed shelters, dubbed "Jimmy Cartair's tents," plus food and vaccines.



Like lunar sand castles, limestone spires sculpted by bicarbonate springs

rear from the shore of Lake Abbe, on the fringe of the Great Rift Valley system.

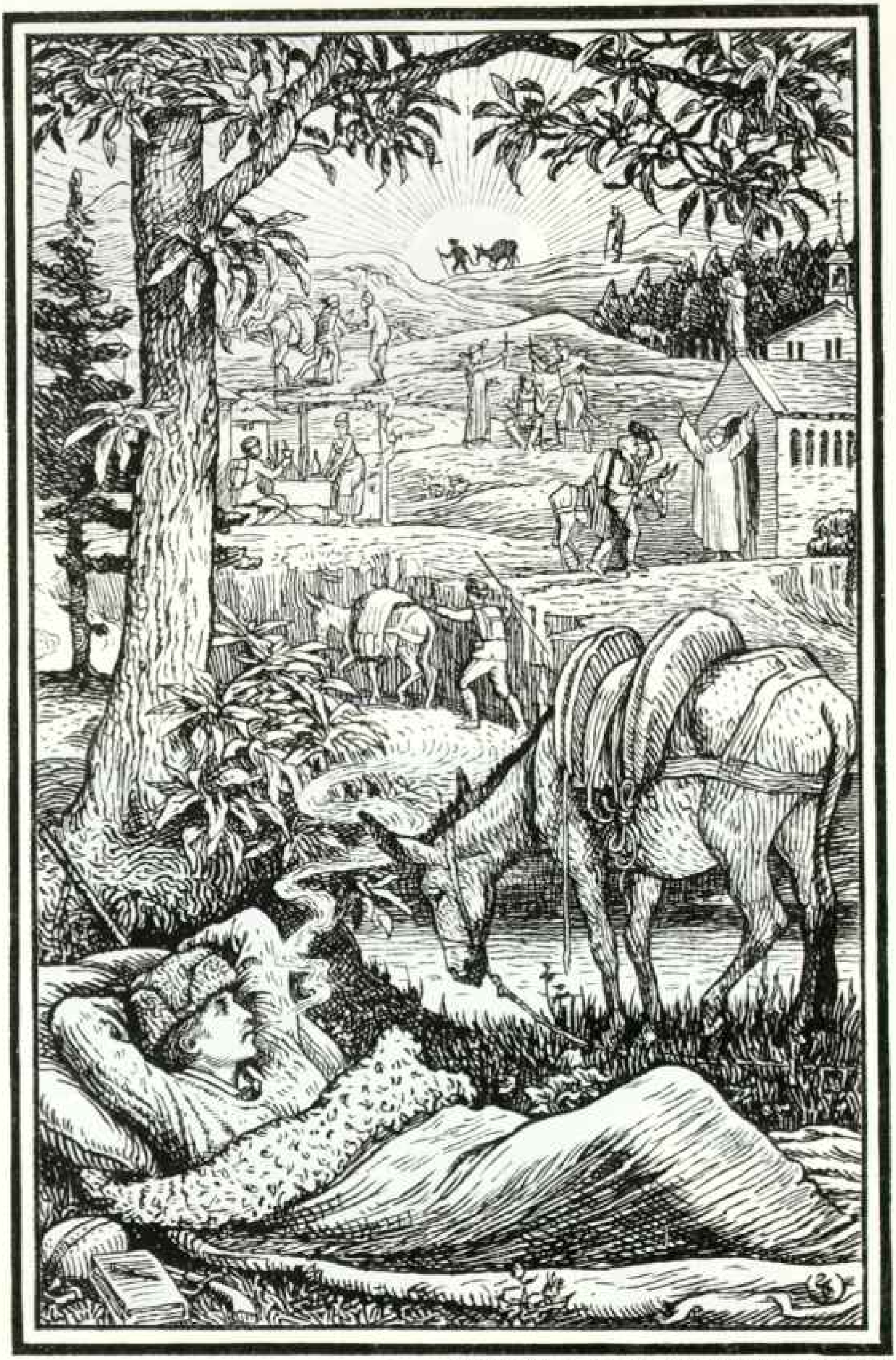
WITH JOBS harder to find than a cool drink, the Etablissements Coubèche firm is a magnet for workers, who bottle Coca-Cola (**right**) and deliver imported fruits, vegetables, and frozen meat.

Scarcer still are college graduates; Hassan Chehem (**below, right**), one of a handful of nomads who has made it, now teaches. Typically, he grew up in an extended family of 20 people, all dependent on their livestock herd. "It takes a lot of will to make it through school," he says. Beside him stands his father, an Afar herdsman who leaves his flocks once a month to visit his son. "I believe in the unity of our two peoples. Alas, many do not," he admits. "But I know we Afars *cannot* lose our identity."

Another family (**left**), one with Somali ties, shares such optimism. Thérèse Aden heads the administrative branch of

Djibouti's Education Department. Her husband, Luc, is director general of the Treasury.

"Think of our country as a baby born with a large head—the city of Djibouti—on a frail body," Luc suggests. "We must cure this. Then the baby takes its first steps, sometimes grabbing a hand to hold. But that child will walk on its own one day." □



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100 years later . . .

Travels with a Donkey

By CAROLYN BENNETT PATTERSON
SENIOR ASSISTANT EDITOR

Photographs by COTTON COULSON

"I *TRAVEL* for travel's sake. . . . to come down off this feather-bed of civilisation, and find the globe granite underfoot and strewn with cutting flints."

Brave words, these, written by Robert Louis Stevenson 100 years ago and published in his classic *Travels with a Donkey in the Cévennes*.

The words captured me as a youth and, forthwith, I was committed to a life of travel and writing. Now my ambition to follow in Stevenson's footsteps brings me to the mountains of southern France; to another donkey called, like his, Modestine; to the "travel for travel's sake"; and even, as Stevenson added in his original journal, "to write about it afterwards."

But what of "granite underfoot" and "cutting flints"?

Stevenson's route, from the town of Le Monastier to St. Jean du Gard, was 120 miles, and he walked it in 12 days with his Modestine carrying only gear. To remain faithful to Stevenson, I too will take 12 days for the walk, and with a donkey. Sounds easy. Yet, consider. . . .

Third day out: I stand on a high field of golden stubble. Around me as far as the eye can reach, ridge upon ridge of wild mountains, blue-green with fir and spruce, float on a sea of mist. It is raining and the clouds are gray and roiling. After four hours of travel we have arrived at nowhere, lost and walking in circles.

We are also in prison. Barbed wire—unknown to R.L.S., unexpected by us, and impossible for Modestine to cross—appears to surround every field. Night nears.

Tenth day out: Modestine and I are crossing an abandoned railroad bridge high over the gorge of the raging Mimente River. There are no guardrails, and I take care to steer the donkey down the middle.

Near the end of the bridge Modestine spies a line of see-through holes in the roadbed and stops dead in her tracks. Forced to turn back, I gingerly reverse her direction on the narrow span.

Then the donkey bolts and, with all the strength that terror can muster, I throw myself across her neck. She drags me along for endless seconds before slowing to a halt. I rate that one a "cutting flint."

Twelfth and last day out: We stand at the Col de St. Pierre and try to detect a path across the granite wilderness dropping steeply off the side of the highway. Everywhere huge boulders, myriad rocks, and sharp stones make chaos. It is the route of no return, so precipitous there can be no climbing back up should we fail to find the trail. We start down.

That one qualifies as "granite underfoot."

LADY STAIR'S HOUSE MUSEUM, EDINBURGH

"Glad did I live," Robert Louis Stevenson wrote in "Requiem," and nowhere did he embrace life more fully and happily than in his *Travels with a Donkey in the Cévennes*, written in his 20's (**above**). The book's frontispiece (**facing page**) depicts his adventures, relived by author Patterson a century later.

BUT TO START at the beginning of the story, at Le Monastier, where Stevenson "spent about a month of fine days" getting ready (map, page 538). . . .

"Monastier," he wrote, "is notable for the making of lace, for drunkenness, for freedom of language, and for unparalleled political dissension."

And the 27-year-old Scot loved it all, making friends easily with town officials—"great companions"—who helped him shop for camping equipment and a donkey.

On occasion he would travel with friends to nearby Le Puy, where he reported indulging in a "Gargantuan" meal—"a big slice of melon, some ham and jelly, a *filet*, a helping of gudgeons, the breast and leg of a partridge, some green peas, eight crayfish, some Mont d'Or cheese, a peach, and a handful of biscuits, macaroons, and things."

All for three francs a head.

I too find it easy to make friends in Monastier. My first, André Broggio, has located that now rare animal—a donkey—and bought her for my walk and the 1978 centenary celebration of Stevenson's walk.

On the side of change, I learn that the town has diminished from the 5,000 population of Stevenson's time to 2,000. Lacemaking is almost gone, and I see no drunkenness or excessive freedom of language or any unparalleled political dissension.

"Our differences are not as clear-cut as in the past, and people cross boundaries," says young Paul Dutang, the tax collector, who, for example, leads the choir at the Roman Catholic Church although he belongs to the left wing of the Socialist Party.

But some things never change, as Dutang explains

Crown of the Cévennes, Mont Lozère is a windswept citadel of rock, wild flowers, heather, and ferns. Here Stevenson "took possession . . . of a new quarter of the world."

"...we are all travellers in what John Bunyan calls the wilderness of this world...."

100-year-old footsteps retraced

Setting forth with his donkey, Modestine, Stevenson walked main roads, covering 120 miles. With those roads now paved and dangerous with motor traffic, author Patterson and her Modestine mostly trod back tracks and abandoned railroad beds, a route (in red) that added about 20 miles.

Le Monastier
START SEPTEMBER 22
Monastrians predicted that R.L.S. would encounter on his trek "many ludicrous misadventures . . . [even] sudden death."

Misadventures shared by Stevenson and Patterson included getting lost several times. The Stevenson Centenary Committee has now marked a route for walkers.

Our Lady of the Snows now attracts busloads of tourists, who taste and buy wine imported and aged by the monks.

Nation's largest, the National Park of the Cévennes covers 84,200 hectares (208,060 acres).

FINISH OCTOBER 3
"Civilised country," proclaimed R.L.S. of his last stop, a town of southern airs and graces.

FRANCE
ENLARGED
Paris
Loire
Le Puy
Grenoble
Alès
Marseille
Lac du Bouchet
St. Martin de Fugères
Costaros
Fugères
Goudet
Le Bouchet St. Nicolas SEPT. 22
LOST
Jagonzac
Pradelles
Langogne SEPT. 23
LOST!
Fouzilhac SEPT. 24
Cheylard l'Évêque
Mercoire
Luc SEPT. 25
Our Lady of the Snows Trappist monastery SEPT. 26
Allier
TUNNEL
497 meters + 1,911 feet
Chasseradès SEPT. 27
Montagne du Goulet
Les Alpiers
Le Bleymard
CAMPSITE SEPT. 28
Mont Lozère
Pic de Finiels + 1699 meters 5,574 feet
Le Pont de Montvert SEPT. 29
Tarn
La Vernède
Florac SEPT. 30
PARC NATIONAL DES CÉVENNES
ABANDONED RAILROAD
Cassagnas OCT. 1
Mimente
LOST
Serre de la Cam OCT. 2
St. Germain de Calberte
Col de St. Pierre 695 meters 2,280 feet
St. Jean du Gard
CÉVENNES
0 KILOMETERS 10
0 STATUTE MILES 10
PAINTED BY WILLIAM H. BOND
CONTRIBUTED BY MARGUERITE B. HUNSIKER
NATIONAL GEOGRAPHIC ART DIVISION

with a wry smile: "This is a town where people go to bed very early, but when you walk down the street at 1 a.m. all the curtains move back for better viewing."

The curtain peepers might have found food for talk in the spectacle of my repeat of the gargantuan meal in Le Puy. With the Broggio family as guests, I sit down to lunch at noon and rise from table at 6 p.m., a tribute to the skills of chef M. Gérard Antoine, who with his wife, Nöelle, owns and operates Le Bateau Ivre.

Under the beamed ceiling of a room built in 1750, on a round table covered with madame's own linen trimmed with antique lace, we feast on the same memorable succession of dishes that Stevenson enjoyed. The price—200 francs, or forty-five dollars, a head—reflects another kind of change wrought in the past hundred years.

"*MONASTRIANS*, of all shades of thought in politics," wrote Stevenson, "had agreed in threatening me with many ludicrous misadventures, and with sudden death in many surprising forms. Cold, wolves, robbers, above all the nocturnal practical joker. . . ."

No dire predictions come my way, but, curiously, no one expects me to make it in 12 days. For the most part, Stevenson traveled the main, most direct roads. Today those roads are major highways, with dangerous traffic and blacktop painful to donkey hooves.

Advisers counsel back roads, cattle and sheep paths, hiking and horseback trails, and abandoned railroad beds. All clearly marked, they say, and running through the villages and towns on Stevenson's route—but longer, much longer.

Trudging uphill from Cheylard l'Évêque, the author tugs at her donkey, an animal with opinions often opposite from those of her companion. Nevertheless, Patterson observed, "My Modestine is sweet, with warm brown eyes and a talent for listening." After an "uncouth beginning" Stevenson, too, grew fond of his donkey. "Her faults were those of her race and sex; her virtues were her own."

I set off with Modestine from Le Monastier at daybreak on September 22, 1977—just 99 years to the day after Robert Louis Stevenson. A band of well-wishers trails along for the first hour or so: the Broggio family and two Stevenson buffs from Edinburgh, Scotland—Robin Hill and Julian Wiltshire. Photographer Cotton Coulson walks with me this day, and every day.

Modestine steps briskly, a 14-year-old lady somewhat larger than Stevenson's "diminutive she-ass, not much bigger than a dog, the colour of a mouse, with a kindly eye and a determined under-jaw."

That Modestine gave her master infinite trouble on the first day, walking at a snail's pace, investigating every side path, continually browsing, and frequently shedding her ill-packed load.

AT *ST. MARTIN* de Fugères on a Sunday, R.L.S. found the church overflowing. Since I arrive on a Thursday, I pay my respects, instead, to the village war memorial, where a long list of names cut in stone testifies to the terrible toll of World War I—anguish enough for generations.

We detour by way of Fugères to pick up a leg of the Grande Randonnée, a network of farm and woodland tracks for hikers. And at Fugères we meet the nobleman.

At the beginning we have no way of knowing who he is. A farmer himself, he is talking to

other farmers at the village cross, dressed as they in rough country clothes.

We exchange *bonjours*, and he says, "Modestine? Stevenson?"

Ah, one who knows!

He elects to walk along to show us the way and, presently, his meager English grows and he tells his name, Albert du Lac de Fugères (page 544), whose noble family has lived here for eight hundred years. He sings and dances a few steps of the *bourrée*—a Cévenol folk dance—quotes Shakespeare in English, and reveals that he took his baccalaureate in Greek at Le Puy University.

We pause and he picks me fresh blackberries from bushes growing on his own land. Suddenly we are on a bare summit looking straight down on Goudet, nestled in a green valley beside the young Loire River.

With M. du Lac we sit down to luncheon at Goudet's Hôtel de la Loire, joined by Gordon Golding, a young North Carolinian who has married into a Cévenol family and who serves our little expedition as knowledgeable friend, ofttime translator, and general expediter.

As luncheon draws to a close, M. du Lac begins to speak to us in Occitan, the ancient language of southern France. The nostrils of his Roman nose flaring, his eyes bright with emotion, he declaims the opening lines of *Mirèio*, the epic poem written in Occitan by Frédéric Mistral, who won the Nobel prize for literature in 1904.

The theme of the poem is the

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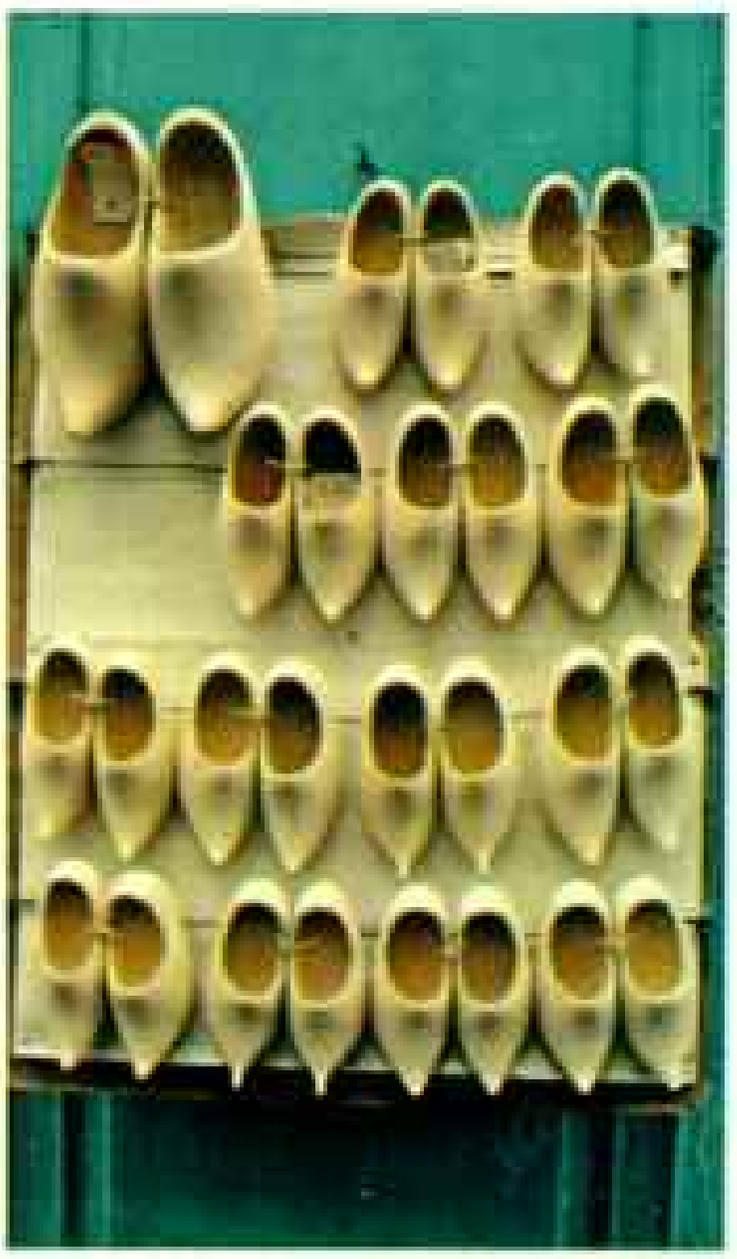
"Good ladies of Monastier," R.L.S. called the lacemakers, one of whom he sketched (**above**). An artisan of today—Rosine Exbrayat, 92—plies a skill fast disappearing (**above, right**). R.L.S. wrote that the lacemakers he met "were filled with curiosity," especially regarding the English language. The word bread "seemed to them frolicsome and racy." Other echoes from the past: wooden shoes on a Le Monastier street (**right**) and thatch roofs (**left**) on the farm of Louis Cortial.



unfulfilled love between a rich girl and a poor boy, but du Lac himself exemplifies his own fulfilled love—for his people, his land, his language.

My nobleman, it turns out, is a noble man.

THE AFTERNOON speeds faster than the miles, and I, like Stevenson, am still on the road as darkness gathers. I literally stagger into Le Bouchet St. Nicolas, having taken the longest walk of my life—14 miles.

Stevenson rose at five the next morning, and I follow suit, in a fever to be on the road since the distance to Langogne, our next overnight, is even longer than the first day's travel. We are to follow the orange blazes of the Horse Tourist Trail to the way-stop of Jagonzac.

We strike off across the sun-warmed plain, reveling in the far vistas of alternating pastures and hayfields. At first we walk along a fine wide dirt road that becomes a fine narrow dirt road, then shortly becomes a rough stony track rimmed by stone walls. Presently, where the map shows one track, there is a maze, with major intersections.

Cotton and I consult the map. We check the compass. We make a choice. The wrong one, it turns out. We are loose and lost in the French countryside, able to see for miles around. But where are we?

No living soul walks our way, or any way. Only the cows and horses speak to us, or rather to Modestine, who is such a curiosity that the animals run from great distances just to watch her pass.

Modestine has a natural passion for thistles, which she devours whole—prickles, blossoms, branches, and all. Our frequent thistle breaks give me time to take a note or two, putting into words my extraordinary new awareness of the land and animals, opened by the pace of walking. I feel that I am literally seeing everything for the first time. Cows? How fabulous they are, swinging bags of milk with little spouts, and kind eyes. . . . Horses? How was it I never saw before how aristocratic they look. . . .

We are running late, having taken the Great Circle Tour on the Lost Circuit. R.L.S. made Pradelles for lunch; we hope to get there for tea. By teatime we have yet to have lunch, and we're still far from Pradelles. So we stop under the shade of a tree, above which electric wires sing just as did the telegraph wires that Stevenson spied in this vicinity. I brew tea on my camp cooker and spread fruit, cheese, and crackers. We trudge into Pradelles at six and make it to Langogne by eight, having spent 13 hours walking a numbing 18 miles.

THE THIRD DAY brings me to the suspicion that Stevenson himself is taking a hand to ensure that I do the walk precisely as he.

For both of us the day is a catalog of almost identical troubles along the road, beginning with rain and, as he put it, "hurrying clouds—some dragging veils of straight rain-shower, others massed and luminous as though promising snow."

Like R.L.S., I first spend the morning writing. Then lunch in our hotel, the Bel Air, a modern version of his country inn. The hostelry appears to be utterly dependent on a lone woman in her middle age who moves from duty as chambermaid to desk clerk, to cashier, to bartender, to waitress, to bus girl, and all with the help or hindrance of an

Monday is market day for stockmen at Costaros. R.L.S. had the advice of such experts in the purchase of Modestine.

"... all the buyers and sellers came round and helped me in the bargain."

outsize population of resident animals.

Three large dogs and a puppy occupy all the chairs in the lobby except when escorting guests to their rooms, or at luncheon, when escorting them to the dining room. Two Siamese cats, two black cats, and a gray kitten sleep mostly on the dining tables until mealtimes, when they gather atop a table of their own where leftovers are piled.

We leave the Bel Air reluctantly.

The countryside is unchanged since Stevenson wrote: "Moor, heathery marsh, tracts of rock and pines, woods of birch all jewelled with the autumn yellow. . . . green and stony cattle-tracks wandered in and out. . . ."

Stevenson hiked on half lost until night fell, when he became fully lost. Stumbling through a "roaring blackness" onto a farmhouse at the hamlet of Fouzilhac, he was refused shelter or guidance and forced to camp without water or adequate food.

TRYING TO AVOID the main highway, clogged with Saturday traffic, we too become thoroughly lost following cattle tracks. Finally, with night about to descend, we are caught in a web of barbed wire, standing in a field of golden stubble, tired and confused.

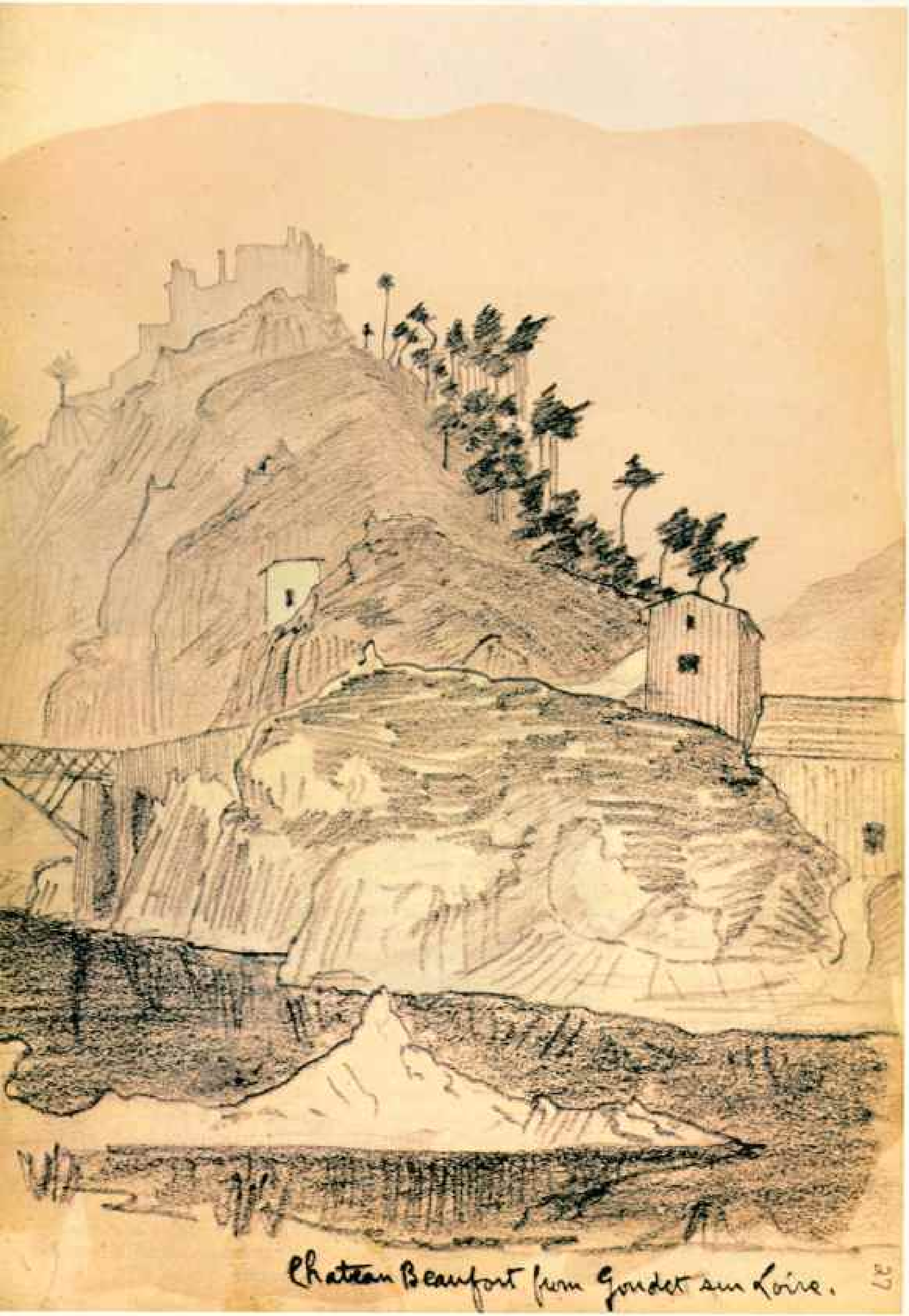
"Stay here with Modestine," Cotton counsels, "and I'll scout a route."

Finally Cotton returns and leads us through a farmyard onto the highway. Breaking out lanterns, ghostly beacons in the rain and fog, we walk on to Fouzilhac, where the shade of Stevenson relents.

The Mourgues, a farm family, welcome us warmly and offer a hay barn for our sleep-out. We also glimpse a way of life strikingly different from Stevenson's time. Electric lights, indoor plumbing, a large television set—and the four eldest of seven offspring have university degrees.

We crawl into our warm sleeping bags atop dry, newly cut hay, grateful to be under shelter, out of the weather for a change. The smell is of fields and sunshine and fresh clean air. I have welcomed contentment by the time sleep takes me by the hand.

Friend by chance, Albert du Lac de Fugères recognized the Patterson trek as Stevenson's and guided her over the hills to Goudet (**above**), beneath the ruins of Château Beaufort (**right**) sketched by R.L.S.



YALE UNIVERSITY, PHOTOGRAPHED BY CLAUDE PETRONE

"...ruins of the castle of Luc... carrying on a pinnacle a tall white statue of Our Lady...."

FRENCH FRIENDS from Langogne, René and Gaby Aurand, come to guide us cross-country to Cheylard l'Évêque and answer the question: What has happened here since Stevenson?

A fighter with the Maquis in World War II and now the alternate deputy to the French National Assembly from the Department of the Lozère, handsome, gray-haired René speaks with authority.

"Stevenson called this a 'naked valley,'" he says, waving his hand toward the path-rimming forest. "See, it is transformed."

It was denuded in Stevenson's day by animal overpopulation. Farmers and sheep raisers exploited the land and erosion set in. Butchery of World War I followed. Thereafter, with so many young men gone forever and veterans claiming rights to government jobs in the cities, the flight from the farms began and continues.

Between the wars Langogne—an important railhead—developed as a producer of wood, wool, and meat. Recently, uranium mining in the area has become lucrative.

"But Langogne is slowly dying," René says, expressing his belief that the future of the town of 4,300—indeed of the entire Cévennes—lies in a tourism that attracts special-interest travelers: horseback riders, cross-country skiers, hikers.

He smiles: "I'm talking about travelers who like to walk about with donkeys, meet the people, and admire the scenery."

Stevenson's description of Cheylard still rings true: "A few broken ends of village . . . upon a rattling highland river. . . ." We lunch with French hunters out for wild boar, rabbit, and game fowl, then begin an interminable climb up a long hill. At the top, rain begins.

This fourth day on the trail is a salad day for Modestine. Eating grasses and clover, she reminds me of a little old lady with false teeth, whose lower jaw rummages around in search of the bite.

Swirling mists shroud the sun as the author and Modestine set out on the fifth day of the walk. Stevenson happened by just after the huge 5,000-pound statue of the Madonna had been raised atop an abandoned medieval castle. Of Luc itself, R.L.S. wrote, "a straggling double file of houses."

As we push on, I begin to feel a sense of well-being, even achievement, in walking and discovering the land. At this point my 19th-century predecessor felt quite the opposite, calling his journey "a leaden business altogether" through "one of the most beggarly countries in the world. . . . scant of wood, scant of heather, scant of life. . . . the road was marked by upright pillars."

I pass the same pillars of stone, set there in medieval times to guide travelers, but I am struck by the beauty of the high plateau, all tall windblown grasses, glittery in the sunlight. The heather has returned too—a royal carpet of purple.

And so we come down to Luc and spy the blue-and-white statue of Our Lady, set atop the ruins of a mountain-crowning castle in the very year of Stevenson's visit. The fifteen-foot-high statue looks like an earth-free spirit floating on a wreath of clouds.

THE NEXT DAY, our fifth on the road, we climb up from Luc through pine forests, bound for Our Lady of the Snows, the Trappist monastery that struck "unaffected terror" in the Scottish Presbyterian heart of Stevenson. He called the monks—cloistered and pledged to the rule of silence—"prisoners of the iron mind" and "unsought volunteers of death."

The sun is setting when I look down from the mountain path to a cluster of large white buildings, all raised after 1912 when fire destroyed the monastery.

My room in the retreat house is large, light, and clean. But there is no heat to dispel the fall chill, no hot water, no baths or showers, and no private toilets. Everywhere signs command silence.

After dinner I go to Compline and *Salve Regina*, a scene unchanged from one Stevenson described: "A stern simplicity . . . . white-washed chapel, the hooded figures in the choir, the lights alternately occluded and

revealed, the strong manly singing, the silence that ensued, the sight of cowled heads bowed in prayer. . . . I made my escape into the court with somewhat whirling fancies and stood like a man bewildered in the windy starry night."

As for me, I walk out into a night brittle with cold and bright with a full moon. But I feel warm with the marvel that many of the men I have just seen speak only to God—and in voices of melting beauty as their songs so eloquently testify.

NEXT MORNING the abbot himself comes to welcome us—"as we welcomed Stevenson"—permitting himself the privilege of speech.

I had expected him to be austere, somber, taciturn. Quite the opposite! Abbot Claudius, with merry laugh lines about his eyes and a little dimple in his chin, reminds me of nothing so much as a jovial businessman. And that, as it turns out, is what he is.

The monastery is in the wine business, buying lowland harvests and aging the juice in vast vats. In the summer two to three thousand tourists a day arrive to taste and buy the monastery wine, and also its honey, cheese, and other products.

Abbot Claudius happily and knowledgeably discusses with me the business ventures of his establishment, as well as those of other Trappist monasteries, particularly the breadmakers in the United States. And I get the feeling there is a healthy—but, of course, holy—competition among the world's eighty Trappist monasteries.

As Modestine and I get ready to leave, two enormous tour buses arrive and disgorge passengers, whose shouts of greeting and screams of laughter shatter the quiet. I wonder how those men who speak only to God feel about fellow creatures who seem to speak only to one another—and loudly.

GOING SOUTH, Stevenson followed the Allier River, as does today's highway, but we elect the longer Grande Randonnée that, circling about, brings us to the village of Chasseradès at twilight.

Here we find haven at a small country inn set at the edge of the road. In its single public room we meet eyes and trade smiles with other travelers: the gregarious Taxi Driver with Wife and Dog from Grenoble; the big blond Lady Secretary and her Friend from Marseille; and the shy Single Gentleman, working as an itinerant woodcutter in the nearby forest.

Our innkeepers, M. and Mme Poudevigne, serve us all the same steaming dinner of boiled beef and vegetables, washed down with red house wine. And our disparate little party suddenly shares laughter, as if we were dining in our own homes with old friends.

Stevenson at his Chasseradès inn fell in with men surveying for a railroad. "They were intelligent and conversable, and we decided the future of France over hot wine, until the state of the clock frightened us to rest," he wrote.

I, too, go frightened to bed, for tomorrow, our seventh day, we must scale two mountains, Goulet and Lozère.

Climbing Goulet, R.L.S. heard a medley of "beautiful and interesting sounds"—sheep bells, a shepherd's horn, the crowing of cocks, a flute. "I was now done with rains and winds and a bleak country," he wrote. "The first part of my journey ended here; and this was like an

At Our Lady of the Snows, a Trappist ponders Holy Writ. Though fire destroyed the monastery that R.L.S. saw, the spiritual life abides: meditation, prayer, silence.

"A stern simplicity,
heightened by the romance of the surroundings,
spoke directly to the heart."

induction of sweet sounds into the other and more beautiful."

I can also testify to the charm of the sheep bells. Each with different tone and heard from a distance, they conjure enchantment. But on Goulet's sunlit heights, bare except for long golden grasses, another sound comes crashing down from the sky: the awesome roar of a weapon fired from a military aircraft too distant to be seen. The day, I learn later, has been given over to air maneuvers in practice war games.

The best way to make time on a walk, I have read, is to set a cadence and stick to it. Regrettably, Modestine and I do not think alike regarding cadence.

When I want to *move*, Modestine half-times it with snack stops. When I am drooping from a steep climb, she is raring to go. To bend her to my will, I have only a small pointed stick that merely gets her attention. And I have sugar lumps.

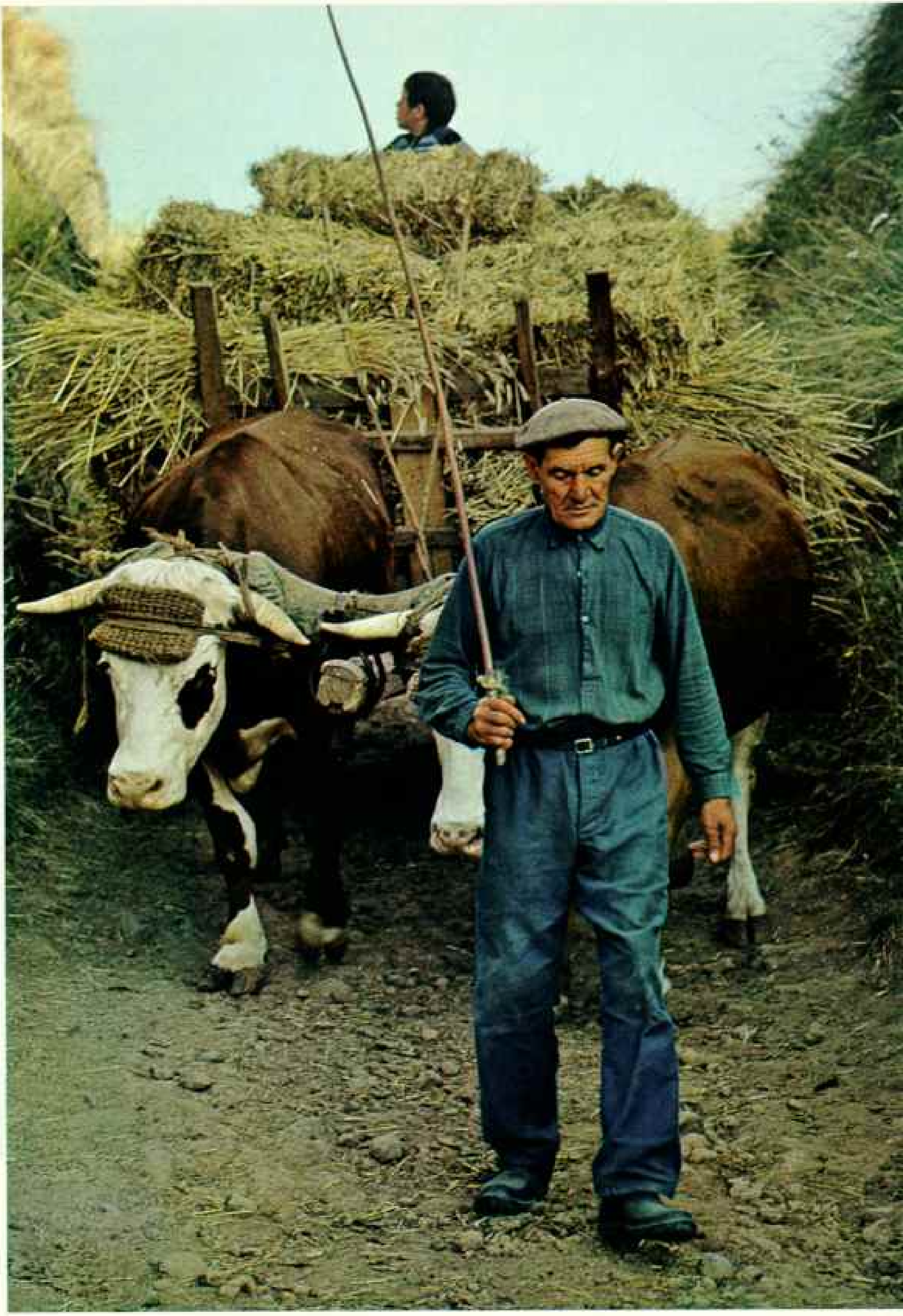
At the village of Les Alpiers we stop to allow three youngsters to admire Modestine close at hand. As the children crow in delight over this strange animal, I demonstrate her docility by letting her suck my fingers following a sugar treat.

Suddenly, Modestine's great jaws close, catching my little finger in their painful vise, drawing blood. The children, distressingly, are even more delighted.

Walking out of Le Bleymard after lunch, we pass row upon row of boxlike little houses, built as vacation retreats for low-income families. I recognize them as a portent. The beautiful mountains of the Cévennes, more and more abandoned by the farmer and shepherd, are now more and more drawing from the cities those on holiday or retirement—a reverse of exodus.

To help sustain the community, Father André of Our Lady of the Snows stitches clothing and sheets. Others work as gardeners, dairymen, apiarists, wine makers, and housekeepers.

"...each monk has an occupation of his own choice, apart from his religious duties...."



Stevenson led the way, finding in these mountains gifts to enrich the spirit. Take his description of camping atop Mont Lozère: "Night is a dead monotonous period under a roof; but in the open world it passes lightly, with its stars and dews and perfumes. . . . I have not often enjoyed a more serene possession of myself, nor felt more independent of material aids . . . . night after night a man's bed, it seemed, was laid and waiting for him in the fields, where God keeps an open house."

On the Mont Lozère field where we partake of God's open house, He forgets to turn down the lights. An enormous full moon so illumines our campsite as to deny sleep.

Nevertheless I rest, soothed by the sound of wind in the evergreens, like gentle surf rolling onto some distant strand. Then near dawn Cotton makes me a cup of coffee in his espresso pot and, as I sip the hot, delectable brew, I watch the burst of day. The rising sun stripes the sky in red, using the contrails left by jet fighters.

MONT LOZÈRE'S bald-pated summit, the Pic de Finiels, lies within easy walk of our camp, and shortly I stand atop its 5,574-foot height and look across the land Stevenson called "the Cévennes of the Cévennes." On a clear day, from where I stand, one can see across the "undecipherable labyrinth of hills" to the Mediterranean Sea, he said.

It is a land of the south and, like the southern states in America, filled with the romance of a lost cause. During the reign of the "Grand Monarch," Louis XIV, a few thousand Protestant mountaineers known as Camisards fought for three years against the troops of his Catholic majesty in a struggle for religious freedom.

THE WARFARE had come after years of persecution following the revocation in 1685 of the Edict of Nantes, which had given French Protestants the right to their own beliefs.

Many pastors were sent into exile; others went underground—the so-called Pastors of the Wilderness—preaching in caves, burying the dead, baptizing, and marrying in secret. When captured, they were broken on the wheel or sent into slavery in the galleys. At the Museum of the Wilderness near St. Jean du Gard, the names of those who gave their lives appear on the walls in gold.

I carefully make my way down the steep slope of Mont Lozère and follow Stevenson to lunch at Le Pont de Montvert and, like him, make plans to camp along the Tarn River.

My predecessor was forced to camp on an exposed ledge only big enough for himself, with Modestine tethered on another one. Learning from his experience, I pick my campsite at the very edge of the Tarn, on a parklike stretch within Le Pont de Montvert. And my riverine night is melodious with music of water dancing over stones (pages 558-9).

On the bridge crossing the Tarn I pause on my ninth

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"...*although these peasantry are rude and forbidding on the highway, they show a tincture of kind breeding when you share their hearth.*"

New appreciation for an old way creates a scene (**left**) that was familiar to Stevenson. Farmer Régis Besson saves tractor fuel by bringing in his hay with oxen.

morning to look at the riverside garden and foundation stones of the village house that belonged to the Camisard archenemy, the Catholic abbé du Chayla. In his zeal to stamp out Protestantism, the priest used the place as a torture chamber for the wretched prisoners he considered heretical.

One night in July 1702 a determined band of some fifty psalm-singing Camisards attacked, freed the prisoners, and set fire to the house. Du Chayla leaped from a top-floor window into his garden, breaking his thigh, and was taken captive.

Dragged to the town square, du Chayla was stabbed to death, with each Camisard delivering a blow and giving his reason: "This is for my father broken on the wheel. This for my brother in the galleys." Thus the Camisard War began.

LEAVING the bloody memories of Le Pont de Montvert behind, Modestine and I happily lose ourselves in the beauty of the walk to Florac, enhanced by the same chestnut trees that R.L.S. saw. "To see a clan of old unconquerable chestnuts," he wrote, "is to rise to higher thoughts of the powers that are in Nature."

Today his "noble trees," wearing dress of autumn gold, have fallen on hard times. There are few hands to give them the trimming necessary for proper growth and top nut production, and, in fact, the nuts are no longer in great demand—a far cry from the 16th century, when the chestnut was *the* crop in a one-crop economy.

In those days labor was paid

in chestnuts from the "tree of bread" and in baskets of soil to build terraces for growing the trees on steep mountain slopes. The chestnut was the staple diet of the people, eaten fresh in soups and stews and, when dried, ground into flour for bread. The tree's leaves went for forage for livestock; its pliable inner bark to make baskets; its wood, furniture. The chestnut was still an important source of food and income in Stevenson's day.

About lunchtime at La Vernède, the hamlet where the Scot had breakfast, our friend Gordon Golding turns up with luscious fresh strawberries and pears, an assortment of cheeses and sausages, French bread warm from the oven, and chilled white wine.

We are invited to picnic in the garden of Mme Turc, a venerable widow whose stone-and-stucco cottage commands a fine view of the mountains across the river. Pointing to the heights, madame speaks her first words to me: "Battlegrounds in the war," referring, of course, to the Camisard War.

As her treat Mme Turc serves coffee. And when I thank her, she replies, "You do not have to say thank you for so little." But it is more than she knows. She has also served a memorable portion of hospitality.

At Florac we follow Stevenson down the same alley of plane trees to his hotel, the Central Post, which is crowded with horse lovers and riders gathered for the start of an annual cross-country race, sponsored by the National Park of the Cévennes.

(Continued on page 560)

"... great-necked stolid oxen....
mild formidable servants...
who took a sudden interest
in Modestine and me."

In a stone stall, Henri Richard shoes an ox (**above**) that, as R.L.S. noted, will soon be "patiently haling at the plough." Woodcutters lunching alongside the road (**left**) remind the author of Stevenson's profound appreciation of the trees he saw in the area: "Oak-trees clung along the hills, well grown, wealthy in leaf, and touched by the autumn with strong and luminous colours." Even more important, the chestnut trees growing on the slopes of mountains here were once all-essential to the economy—"noble trees" wrote Stevenson.

"And I blessed God
that I was free to wander, free to hope,
and free to love."

Golden grasses wave on the treeless heights of the Cévennes. This scene on the trail to Chasseradès is repeated farther south on Goulet and on Mont Lozère. The last-named prominence represented to the Protestant Stevenson an open door to a region "illustrious for stirring events," where in Louis XIV's reign French Huguenots rose against Catholic prohibitions to their freedom to travel at will, to advance their fortunes, to love God as the spirit willed.

"MARVELLOUSLY clear, thrillingly cool," wrote Stevenson of the waters of the Tarn River, where the author makes camp at Le Pont de Montvert. She, too, found refreshment wading in the astringent stream, and now (**right**) treats Modestine to a sugar lump while heating water for tea.

You can't even lead a donkey to water, much less make her drink, the author discovers at a fountain at Florac (**below, left**). When R.L.S. stopped at Florac, he met "a young man, intelligent and polite"—a Protestant pastor. That pastor's grandson, the Reverend André, lives at Florac today and met with author Patterson.

Wearing a celebratory crown of carrots (**far right**), Modestine stops with the author for a visit with well-wishers at the finish, St. Jean du Gard.

It had been hard, with some daylong hikes of 15 miles or more. But the land had been a glory and the people met along the way a revelation in friendship.

As with Robert Louis Stevenson, the author concludes: "I had the best of luck to the end."

(Continued from page 555)

The race, promoted to encourage horse trekking, crosses 79 miles of rugged countryside. We see the horses and riders, 35 in all, get off at first light the next morning in a scene curiously reminiscent of medieval times, with many of the riders in stocking caps and jerseys.

STEVENSON departed Florac late in the afternoon of October 1, "a tired donkey and tired donkey-driver." My Modestine and I are also in that condition, precisely because of that Scot who appeared incapable of spending any two nights in one place.

R.L.S. planned to camp because the weather was fair, as warm as May. But my weather is different, belonging wholly to windy October. In a continual swirl of golden leaves dropping from chestnut trees, Modestine and I walk an abandoned railroad track, rocky underfoot but with easy grades, convenient tunnels, and no traffic.

I begin to appreciate what a winter in the Cévennes can be like because the day turns wild and stormy, with sullen black clouds spitting a frigid rain.

Since Modestine bolts rather than cross a hole-pocked bridge on the old railroad bed, we must chance the traffic of twisting mountain highways. On a height near Cassagnas, the donkey moves in slow motion as I lean into the battering wind.

And with twilight upon us, I give up on camping and choose a nearby stable for Modestine and a roof over my own head for the night.

Modestine must have been glad for the shelter, for the next morning she greets me with an appreciative bray that is truly impressive. It begins with the baring of teeth and a kind of squeal. Then she gulps great breaths of air and lets loose her cries—harsh, gutty, labored. They can be heard far and wide. In the end her stomach heaves with the effort and the bray disintegrates to a groan, as if death itself is nearing.

Cotton and I begin the day walking into limbo. Looking for a sheep trail that goes straight up the mountain, we take a path that disappears in a forest of towering broom. We try vertical bushwhacking. Another failure. Then we retrace steps and set out on a different track that finally leads to the mountaintop. Two hours lost.

The rest of the day we walk through a majestic forest of spruce and pine, set atop the high world of a ridge. Piles of freshly harvested logs lie on either side.

In Stevenson's time many of the mountains had been ravished by transhumance, when enormous flocks of lowland sheep moved to lofty summer pastures. Bare of trees, with soil and stones loosened by thousands of hooves, the heights were being shorn of all but bedrock when, in 1875, Georges Fabre, a government official, set out to reforest. His success is everywhere.

For horse lovers, another success is the gray fieldstone resort of Serre de la Cam, where bungalows, stable, and covered riding ring survey forested ridges that reach to infinity. Equestrians bring horses or rent high-spirited animals for rides along scores of trails.

AS DAWN ARRIVES on October 3, we leave, and by breakfast are walking through St. Germain de Calberte, once a "little Catholic metropolis, a thimbleful of Rome" in "a wild and contrary neighborhood"—Protestant country.

The region is full of caverns where the Camisards forged and stored their weapons, made gunpowder, and tended the wounded.

Many of these caves provided havens for the Maquis, as I learned from Jacques Poujol—Gordon's father-in-law—who spent World War II fighting with the underground in the Cévennes. I even visited the chill, dank hole in a mountain wall—the Cave of Sorrows—that had been his refuge, just as it had for the Camisards. Having traveled so many back tracks of the region myself, I feel a special camaraderie with the valiant French freedom fighters who, being persecuted and hunted, lived on the very cliff edge of life.

Now, as in Stevenson's day, St. Germain de Calberte dwells serenely amid chestnut groves on a mountainside. Putting the town behind me, I push on just after lunch to begin my ascent of the hill of St. Pierre. It is "long and steep," as R.L.S. said, but it is the descent from Col de St. Pierre to St. Jean du Gard along a Grande Randonnée that is almost our undoing.

We drop off the side of the highway and pick our way down a steep and shifting rockscape where a single misstep can be disaster. But here, near the end, Modestine shows bravery. And we make it.

WE WALK DOWN out of the wilderness into a garden of chestnut trees and the refreshment of cool water and a welcome from Mme Léon Van de Putte-Latham, whose country property sits astride the path.

We rest for a while beneath a grape arbor and talk Stevenson, then religion. In a warm, husky voice, madame reveals that she is, indeed, a Protestant, with a

vibrant, searching faith in pursuit of universal harmony.

Showing me a book she is reading in English, *A Course in Miracles*, by the Foundation for Inner Peace, madame asks that I explain the meaning of atonement. As I find the words, her eyes are understanding. Then she explains that as a part of her gift to life, a kind of personal atonement, she is devoting her time to the elderly, helping them find contentment in their old age.

I am yet an hour from the finish of my walk at St. Jean du Gard, but, curiously, I feel that here in this rustic garden I have reached a kind of spiritual goal, like Christian in *The Pilgrim's Progress*, having caught a glimpse of the Celestial City.

For Modestine and me, St. Jean du Gard turns out to be Festival City, with a parade about town, friendly sidewalk-café encounters (page 559), a visit to the Museum of the Cévennes, a reception by the mayor, and a gala luncheon at the Hôtel Moderne's L'Oronge, with all the delicacies at the command of its chatelaine, Mlle Monique Berthier.

If I had come off the "feather-bed of civilisation" for the walk, I am not unhappy to return to it now that it is over.

And yet, amid the "granite underfoot" and "cutting flints," the walk had given me time to discover how full of news the earth is. I had been witness to eternity's endless parade of events—a leaf turns yellow, a stone falls and breaks, a pine bough sighs—and felt the renewal of wonder.

Also by walking I had had rare meetings with such as the nobleman, the Mourgues, Mme Turc, and Mme Van de Putte-Latham, whose *Course in Miracles* only reminded me of the one I had just taken. □

OIL PORTRAIT BY JOHN SINGER SARGENT, TAFT MUSEUM, CINCINNATI

Robert Louis Stevenson

FROM THE BEGINNING he was an explorer, probing both past and present and discovering the far reaches of the human spirit.

Filled with tales of Scottish and Protestant history, R.L.S. set his compass for voyages in the long ago. And, fueled by winds of imagination, those passages became his most famous novels, *Treasure Island* and *Kidnapped*.

Exploring his present, Stevenson chose a pace that would give him extraordinary vision, canoeing through the canals of France for *An Inland Voyage* and walking its southern mountains for *Travels with a Donkey*. His voyage to the United States—to marry the American woman he loved, Fanny Van de Grift Osbourne—resulted in *The Amateur Emigrant;* his train trip from New York to San Francisco, *Across the Plains*. A sojourn in a rugged California mining camp inspired *The Silverado Squatters*.

Stevenson, his widowed mother, wife, and stepson ultimately set sail across the Pacific, described in *In the South Seas;* island life was realistically depicted in *The Beach of Falesá*.

But time never made R.L.S. captive. "It was part of his genius," wrote his friend Sidney Colvin, ". . . to be child, boy, young man and old man at all times," as Stevenson's *A Child's Garden of Verses* reveals. Moreover, the writer "learned to recognize the . . . duality of man" and opened the human heart in *The Strange Case of Dr. Jekyll and Mr. Hyde*.

Plagued all his life with illness, Stevenson finally settled on Samoa, where devoted islanders called the way to his home "The Road of the Loving Heart." The 44-year-old writer died of a stroke on December 3, 1894. He was buried atop Mount Vaea beneath words from his own "Requiem":

Home is the sailor,
home from sea,

And the hunter
home from the hill.

The Sunken Treasure

WHEN HE RECOGNIZED the hated banners, when he heard the coarse shouts of impending battle amid the roll of drums and the blare of enemy trumpets, Capt. Dom Geronimo de Almeida hoisted the standard of Our Lady of Nazaré and commended his ship to the mercy of her guardian saint.

The odds were against him: four heavily manned Dutch vessels to his two Portuguese carracks, or armed merchantmen. Still worse, he had been surprised at anchor. Riding peacefully in a small bay of the remote island of St. Helena in the South Atlantic, de Almeida had had no warning until the enemy ships rounded a nearby headland. Now, as the Dutch East Indiamen bore down on him in triumph, he readied his gun crews for unequal battle.

The Dutch triumph was brief. Though unable to maneuver, the Portuguese quickly found the range and opened fire with terrible effect. "Our men," a Portuguese chronicler later wrote of the battle, "fought in such a way that one of the largest enemy ships was sent to the bottom, another was most marvelously battered and had to leave the fighting, her forecastle shattered, the others so ill treated they had to flee, leaving to our people a total victory. . . ."

The year was 1613, and the victory another episode in the bitter struggle between the Netherlands and Portugal over the rich East Indies trade. On the long route around Africa's Cape of Good Hope, St. Helena had become a favored stopover for repairs and provisioning by vessels en route home to Europe (map, page 564). The ship whose voyage ended so abruptly in a hail of Portuguese fire was a Dutch East Indiaman named *Witte Leeuw*—White Lion. Over the past three years I have come to know her well.

My acquaintance with *Witte Leeuw* came about through my research into other historic wrecks. From time to time I came across references to her in records of the Dutch East India Company, early correspondence, and narratives of marine battles and disasters.

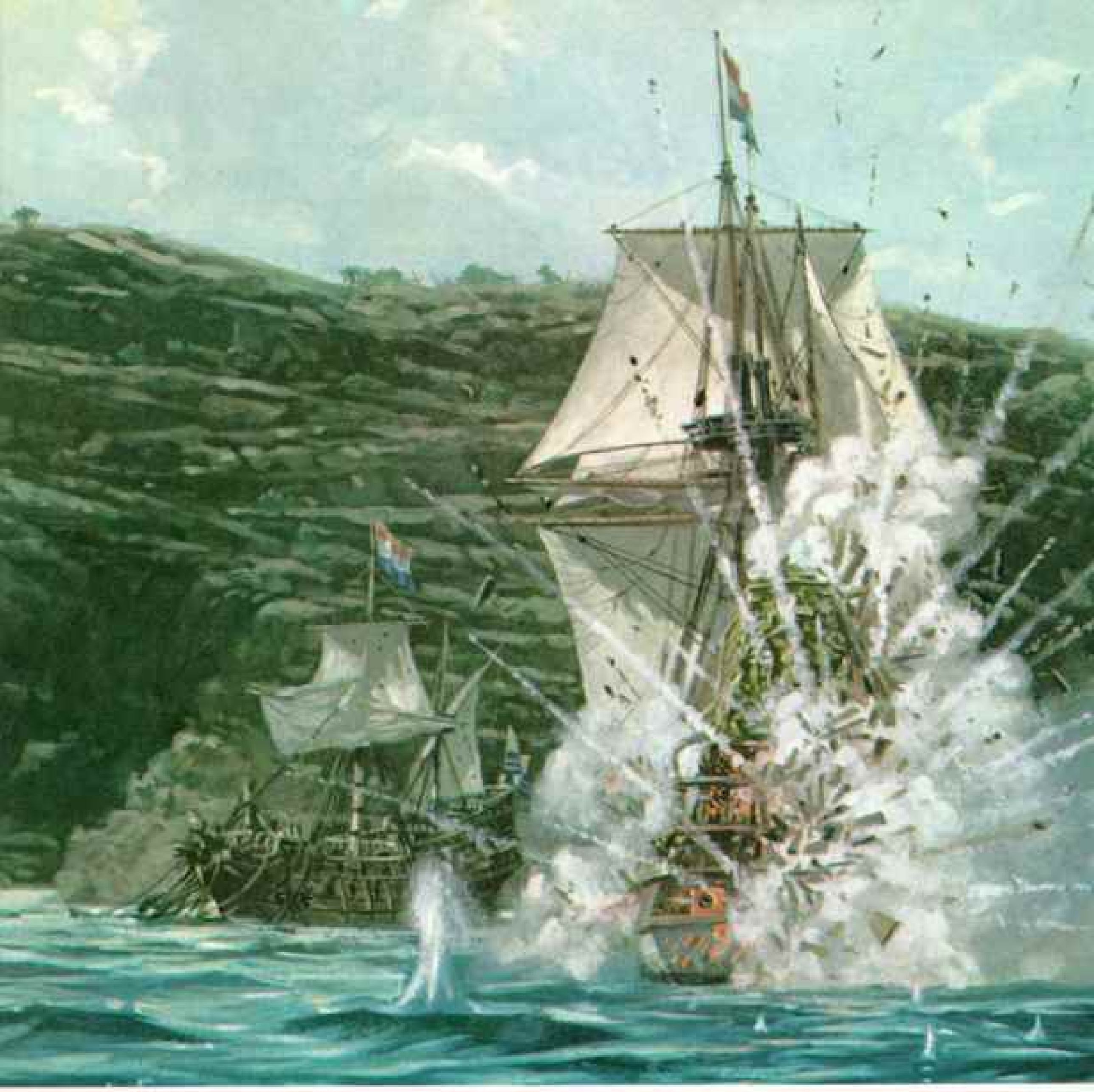
Precious porcelain from China's Ming Dynasty rises after centuries of burial in

of St. Helena

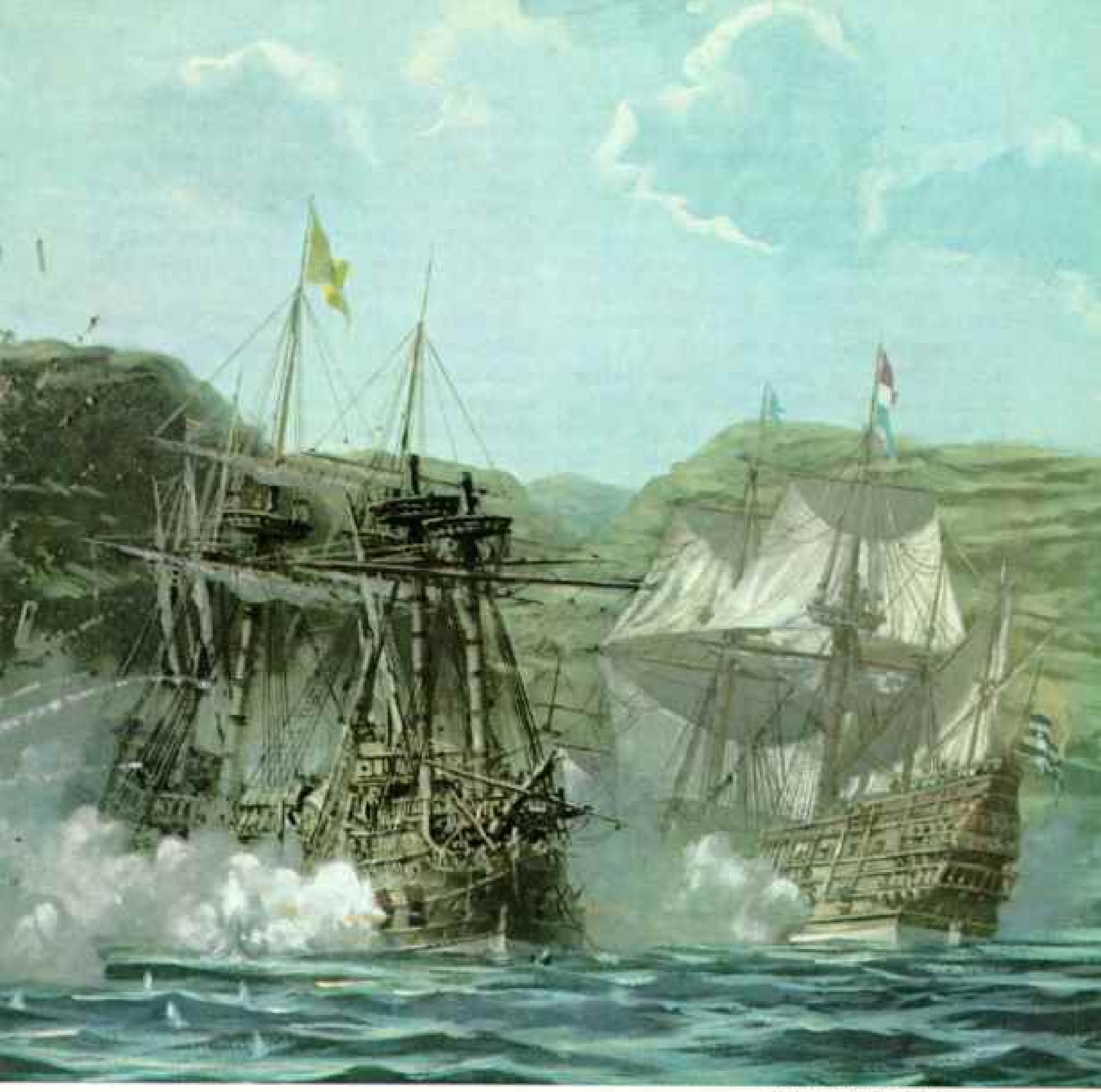
By ROBERT STÉNUIT

Photographs by
BATES LITTLEHALES
NATIONAL GEOGRAPHIC STAFF

the sea. A rich cargo of china, diamonds, and spices sank in 1613 with the Dutch East Indiaman *Witte Leeuw* (White Lion) during a battle with Portuguese carracks.



Death-dealing blast shatters *Witte Leeuw*, returning from the Orient with three other Dutch ships. Surprising two Portuguese carracks at anchor in St. Helena's James Bay (**right**), they started—and lost—a fight. It was but an incident in the long struggle to break a Portuguese trade monopoly that began with the 1497 Africa-rounding voyage of Vasco da Gama. But accounts of the battle inspired author Sténuit's search for the wreck.



PAINTING BY RICHARD SCHLECHT

Gradually my file on *Witte Leeuw* grew until I felt I knew her as well as I ever would from mere documents. Three years ago I decided to go in search of her.*

Support for the expedition came from two generous sources: the National Geographic Society, and Henri Delauze, president of a prominent underwater engineering firm, COMEX, in Marseille, France. Before making a reconnaissance at St. Helena, I contacted my diving partners: Louis Gorsse, Michel Gangloff, Alain Fink, and Michel Tavernier. If I managed to locate *Witte Leeuw,* and she proved salvageable, they would join me in the attempt.

Bound for Home With Spices and Gems

On the three-day voyage from Cape Town, South Africa, to St. Helena I reread my file on *Witte Leeuw.* Several things intrigued me about the ship, among them the fact that she had been lost on her return voyage from the East Indies. The only other East Indiamen fully salvaged had been outward bound from Europe. Such ships carried European manufactured goods and silver bullion, whereas *Witte Leeuw* was returning with the exotic treasures of the East.

I thought I knew what those treasures were, almost down to the last item. In the Dutch National Archives at The Hague I had found a copy of *Witte Leeuw*'s cargo manifest, doubtless carried by one of her sister ships. She had gone to the bottom with a full cargo of spices and 1,311 diamonds, probably along with personal jewelry belonging to the ship's officers and passengers.

The Dutch East India Company had considered *Witte Leeuw* a major loss. In a letter from Amsterdam dated 1614, one of the company's officers had written: "The loss of the ship *Bantam* [another East Indiaman]. . . . Also the loss of the ship the *Witte Leeuw* near St. Helena while fighting two Portuguese Carracks laying at anchor there . . . are mighty blows for the Company to take in one year."

By today's standards *Witte Leeuw*'s cargo was immensely valuable, and I knew exactly what I wanted to do with it: pour it back into the ocean in the form of further undersea research. Five years ago I helped found an organization known as the Groupe de Recherche Archéologique Sous-Marine Post-Médiévale—Group for Post-Medieval Undersea Archeological Research. Since that time our study of 17th- and 18th-century East Indiamen has shed light on a period when two totally different cultures, those of Europe and Asia, were beginning to exchange not only goods but also ideas that shaped the course of history.

Aside from the addition of five thousand inhabitants, St. Helena has changed little since its discovery in 1502 by the Portuguese navigator João da Nova Castella. In his journal, da Nova wrote of the island's fair air and water, a description I found accurate though incomplete. The fairness applies not only to St. Helena's air and water but also to the beauty of its mountainous landscape and to the hospitality of its people.

St. Helena's most memorable contact with the outside world occurred in 1815, when the British exiled the French emperor, Napoleon Bonaparte, there. Bonaparte lived in enforced isolation on St. Helena until his death in 1821.

His Excellency Sir Thomas Oates, British Governor of the colony comprising St. Helena, Ascension, and Tristan da Cunha, welcomed me to the small capital of Jamestown and offered me the assistance of his government. We were to call on him often in the months to come.

Key Phrase Aids Search

During my initial search for *Witte Leeuw,* I was guided by a single phrase in the account of her long-ago battle with the Portuguese. The *Witte Leeuw* had closed with one of de Almeida's ships in an attempt to board and, according to one chronicler, "*immediately sank, there and then.*"

Since James Bay is the historic anchorage for St. Helena, the wreck must lie on the bottom somewhere inside it; she had had no time to drift out to sea. Moreover, modern British hydrographic charts warn sailors of two "foul anchorage" areas in the bay. Could either obstruction be the sunken remains of *Witte Leeuw?*

My reconnaissance failed to answer the question, but it proved that a full-scale

*The author described his discoveries of two other historic wrecks in the NATIONAL GEOGRAPHIC: "The Treasure of Porto Santo," in August 1975, and "Priceless Relics of the Spanish Armada," in June 1969.

ROBERT STENUIT (ABOVE)

Cannon solves the mystery of *Witte Leeuw's* **position.** Exploring the bay floor, divers find several heavily encrusted cannons. After wrenching one from the mud with inflated air bags (**right**) and sandblasting (**above**), the elated hunters spy the good news—the logo of the Dutch East India Company (**below**). The bay's mud bottom, clear water, and gentle currents prove a help, but 110-foot depths pose hazards.

ROBERT STENUIT (RIGHT AND ABOVE)

Bones of the *Witte Leeuw*—timbers and rusted iron—ring an excavation as divers probe for treasure with an air lift (above). The search is for the trove of 1,311 diamonds listed on the ship's manifest along with a cargo of spices. Shortly they find such curiosities as a silver whistle on chainlets (left) and a gimbaled brass oil lamp (right). But no diamonds appear, having long been scattered by the explosion that shattered the vessel's stern. Instead, a surprise: Broken bits of rare porcelain alert the divers to wonders unlisted on the manifest. Finally they uncover piece after piece of exquisite porcelain, insulated and preserved by tons of pepper from the ship's spice cargo.

search was feasible. With the single diving tank I had brought to St. Helena, I briefly explored the bottom of James Bay. The results were promising: a seafloor consisting largely of mud, visibility extending to eighty feet along the bottom, and almost no current. I was sure we could find the wreck.

Success Is a Six-gun Salute

Returning to Europe, I rounded up my diving team and set off for St. Helena again. An old friend, Ed Wardwell of the American firm Seaward, Inc., offered us the loan of a sonar-scanning device that could survey wide areas of the bottom from the surface. Ed promised the sonar would arrive at St. Helena soon after we did. On a June morning we set out into James Bay aboard a local charter boat, and the search began.

Within three days it yielded results—in the form of a tantalizing puzzle. Beginning with one of the "foul anchorage" areas, we laid out grid lines along the bottom for a search by pairs of divers tethered to each other with eighty-foot nylon cords.

During Michel Gangloff's and my turn at a depth of 110 feet, I was swimming a line due south when Michel suddenly gave three familiar tugs on the cord, meaning, "I've found something; come have a look."

It was undeniably a cannon—large, cast iron, partially buried, and so encrusted as to be unidentifiable. Within minutes we found three more cannons, then another two, all similarly encrusted.

Michel's and my diving time ran out, and we surfaced with the news as Louis Gorsse and Alain Fink were preparing to dive.

"Look for other evidence," I told Louis as he started down. "There must be an anchor, timbers, lead sheathing, perhaps pottery—something we can date by. I can't tell whether the guns are the right year or where they came from. They could be from *Witte Leeuw* or a later ship that either foundered or jettisoned its batteries. We must find out."

But we didn't. Subsequent dives revealed a scattering of 18th-century jugs and bottles lying on the surface of the mud near the cannons, but these obviously dated from long after *Witte Leeuw*'s time. There was nothing to identify the guns or to indicate whether a major wreck lay buried beneath them. At that point Ed Wardwell's sonar arrived with

one of his finest engineers, Dick Bishop.

Equipped at last for a broader search, we set out to survey the entire floor of James Bay. Hunched beside the sonar for ten hours a day in our boat's tiny cabin, Dick proceeded to draw a detailed electronic portrait of everything that lay on the bottom: several shipwrecks, anchors, oil drums, a sunken barge, and a variety of rubbish deposited by generations of St. Helenians. But nothing suggesting the wreck of *Witte Leeuw*, except our six guns.

Cannon Packed in Pickled Pepper

To make doubly sure, we dived on everything of interest that Dick's sonar picked up, but the answer was always the same—wrong ship, wrong century. In the end we came round to the original question: Could the six cannons belong to *Witte Leeuw*? In my view there was only one solution. "Let's bring up a cannon," I said, "and ask it."

Excavation with a vacuum device called an air lift took two days, but we finally managed to run a heavy strap around one gun, which on closer inspection proved to be bronze rather than iron. Louis went down with three stout neoprene bags and some air tanks and inflated the bags. With a tremor the cannon broke free of its centuries-old matrix and floated majestically to the surface, leaving a dark plume of mud behind.

We towed the prize to shore still suspended under its flotation bags, and a local crane operator lifted it onto the concrete quay. It was even more heavily encrusted than I had realized, not only with concretion but also with a substance I was later to be profoundly grateful for—pepper. *Witte Leeuw*'s manifest had listed 15,171 bags of that familiar spice, all of it unground and in the shape of minute corns. Unlike other spices the ship had carried, such as nutmeg and cloves, the pepper had withstood centuries of immersion in seawater and, as we were to discover, made superb packing material!

Slowly I chipped away at the cannon until at last part of an inscription emerged. In bold block letters I read "... REENICHDE . . ." and all at once our search was over. De Vereenichde Oost-Indig Comp—The United East India Company. Somewhere beneath the cannons lay *Witte Leeuw*'s remains.

Success quickly led to complications. Further diving on the cannons revealed that only the original six were grouped together. We discovered a seventh gun some 170 feet from the others, and an eighth about 80 feet in an entirely different direction. *Witte Leeuw*, as I well knew, carried roughly thirty guns in a hull stretching more than a hundred feet. Obviously her remains were scattered over a wider area than accounts of the battle suggested. We decided to concentrate on the original group of six guns.

Beer Bottles, Bones, and . . . Bonanza

We turned a raft of empty oil drums into a diving platform by reinforcing it with lumber, then towed the platform to a mooring site directly above the group of cannons and set about finding what lay beneath them.

Practically everything, as it turned out. Once past an initial layer of mud we came on a stratum of dead coral mixed with an incredible assortment of refuse—beer bottles, tin cans, old shoes, dinnerware, and even scattered bones that were likely those of St. Helena's wild goats. Then, on a memorable day, fragments of fine porcelain began to appear amid the rubbish.

We had reached a depth of ten feet below the floor of the bay and encountered a section of wooden decking above a mass of lead cakes, old bricks, and rounded riverbed stones. Plainly the latter were *Witte Leeuw*'s ballast, and the decking, part of the lowest hold, was all that remained of her timbers. We would find no well-preserved hull such as that of *Vasa*, the famous 17th-century Swedish warship *(Continued on page 574)*

Mixing fun with fantasy, Chinese potters of the 16th and 17th centuries achieved high artistry, as demonstrated by this bulbous-eyed frog eyeing an insect dinner. Most of *Witte Leeuw*'s porcelain probably came from the city of Chingtechen, where a visiting Jesuit priest reported in 1712 that 18,000 potter families kept 3,000 kilns burning. Cobalt-oxide pigments went into the creation of the distinctive ware, ultimately imitated by Dutch artisans in their famous delft pottery.

ROBERT STENUIT (LEFT AND ABOVE)

MONSTER MASKS PEER *at a grasshopper from the rim of a plate (left); tusks form the pouring spouts of an elephant-shaped* **kendi**, *or drinking vessel (below); and stylized floral designs adorn a pitcher (above). Dated by the wreck, these pieces prove valuable in tracing the development of Chinese ceramic art.*

raised almost intact from Stockholm harbor in 1961.* But other intact treasures were not far away.

We found them buried amid tons of pepper that lay strewn over a wide area under the guns in a dense layer as much as two yards thick. As we manned the air lifts to remove the layer, we literally "peppered" the ocean floor with tiny granules.

Underneath, as though carefully stored against the wear of centuries and the restless sea, we found more fragments and then whole masterpieces of exquisite Ming porcelain. As each new find emerged, we gazed with wonder at the miracle of porcelain—so fragile yet eternal.

Delicate Treasure of a Mighty Empire

Through my years of research into the Dutch East India Company and its trade with the Orient, I knew the history of what we held in our hands. This particular style of porcelain had been produced in the late 16th and early 17th centuries primarily at the city of Chingtechen, in China's southern province of Kiangsi. Fired during the reign of Emperor Wan Li, it represented one of the last flowerings of ceramic art under the great Ming Dynasty.

And it had taken Europe by storm. In the early 1600's the Dutch captured two Portuguese trading ships. Much of their cargo of lacquer ware, silks, and Ming porcelain, which the Dutch named *kraak* for the carracks that bore it, was auctioned at Amsterdam, where the good burghers and their ladies were dazzled.

Ultimately the Chinese use of cobalt oxide became known, giving rise to the Dutch blue-and-white pottery called delft.

But what of the diamonds, 1,311 of them, that had gone down with the porcelain? Obviously they lay somewhere among *Witte Leeuw*'s remains, though doubtless separate from the other cargo. Such valuables were often stored aft in the safekeeping of the captain's quarters. If we could locate that section, we might add an even greater treasure to the one we had found.

To me, however, the thrill of recovering a unique work of art from the sea is perhaps greater than finding something as precious but familiar as diamonds. As I vacuumed away mud with the mouth of an air lift, my heart would begin thumping, for there would be the edge of a beautiful bowl or dish, as if suddenly created by the touch of a magician's wand.

Putting aside the air lift, I would excavate with my fingers, probing as delicately as a surgeon. Often the treasure was heavily embedded, requiring extra work, while my diving watch told me I should already be at my first decompression stop.

Ah! At last I had it, almost free. No breaks so far; perhaps it's intact. Then suddenly it would drop into my outstretched hands and the crack or chip, if there was one, would reveal itself, always hidden until the very last.

In such a way we recovered not only porcelain but also items of a more personal nature: a silver boatswain's whistle, a brass oil lamp complete with gimbals, perfectly preserved eggs, a collection of exotic Indonesian seashells, and the humble tableware with which *Witte Leeuw*'s crew had perhaps eaten their final meal. We also found two beautiful bronze bow-chaser cannons, each weighing more than two and a half tons, with the name of the Amsterdam maker and date of casting inscribed on them: *Henricus Mevrs me fecit 1604*.

And still no diamonds. Gradually the evidence indicated that *Witte Leeuw* broke in two as she sank, and though we ran exploratory shafts all around and into the mud, we could not locate the missing stern section.

In other respects *Witte Leeuw* was an ideal wreck to work. On many a diving project we have had to contend with icy water, strong currents, heavy seas, and bad weather, but *Witte Leeuw* presented no such difficulties other than depth. Located inside James Bay in the lee of St. Helena, the wreck lay in calm water, and the surface weather generally was mild.

Wreck Site Yields Tasty Trove

One particular type of find needed only a kettle of boiling water and Alain Fink's genius with butter, cream, sauterne, and grated cheese. From an underwater cave near the wreck, we occasionally extracted half a dozen sumptuous lobsters and brought them ashore for one of Alain's superb thermidors.

*Anders Franzén described the historic raising of *Vasa* in "Ghost From the Depths," NATIONAL GEOGRAPHIC, January 1962.

Gifts from the sea are cataloged by Sténuit midway through the seven-month expedition. Bowls, dishes, wine cups, stem cups, drinking pots, pitchers, and jars, valued from $100 to $1,000 each, now grace Amsterdam's Rijksmuseum and private collections.

Seven months passed, and we finally concluded that our search methods had taken us as far as we could go. The job now called for a magnetometer to locate the remainder of *Witte Leeuw*'s buried cannons, her shot lockers, and other iron fittings that register on a magnetic probe. In that way we might find the ship's all-important stern section, with the diamonds, the officers' and passengers' jewelry, and most likely the very finest pieces of porcelain. Packing up, we said good-bye to the St. Helenians and returned to Europe to plan another diving season and to assess what we had so far recovered.

Document Explains Missing Diamonds

In the midst of those preparations I received a stunning surprise. Mr. Charles Kendall, the government secretary who had been of great help to us, forwarded a letter to me in Brussels that had been sent to him by a South African historian interested in the English East India Company. The letter contained a document that was totally unknown to me: an account of the 1613 battle as told by an English officer whose ship had witnessed the fight.

There was no mistaking the document's authenticity. Every detail matched the Portuguese and Dutch accounts of the battle, with one glaring exception—the manner of *Witte Leeuw*'s end. Where others had reported the ship merely as "sunk," the Englishman had been more explicit.

Of the *Witte Leeuw*, he wrote ". . . his men still plying his lower Ordnance . . . one of his Peeces brake over his Powder Roome, as some thought, and the shippe blew up all to pieces, the after part of her, and so sunke presently."

Blew up all to pieces, the after part of her. . . . Suddenly it became clear why we had failed to find *Witte Leeuw*'s stern section: It no longer existed. Nor did the fine porcelain, while the jewelry and the diamonds obviously had been scattered far and wide by the explosion. If we spent years at it, we would find no more than a handful of the gems. The search for *Witte Leeuw* was over.

I felt no regret. We had been the first to find, study, and thoroughly salvage the wreck of a Dutch East Indiaman homeward bound from the Orient. Many of the items recovered, including the Ming porcelain, had not even appeared on *Witte Leeuw's* manifest. Other ships in the returning Dutch fleet that year had listed cases of china among their cargoes, but none gave a detailed description, much less even mentioned a different type of coarser ceramic, a stoneware known as Swatow, that we had also recovered from *Witte Leeuw*. And of course the personal items were absent from the manifest.

Thus, if one had tried to reconstruct the cargo of *Witte Leeuw* and her importance in the East Indies trade from documents alone, the picture would have been not only incomplete but misleading.

As to the porcelain, experts find it extremely difficult to date 16th- and 17th-century styles precisely. Chinese ceramists, although they developed different styles in different periods and dynasties, always did so gradually and with considerable overlap among styles. To make matters worse, they frequently copied early styles centuries afterward. The *Witte Leeuw* collection, known to have been fired prior to the year 1613, provides an important baseline from which to analyze and date other contemporary Chinese porcelain.

Lasting Window on the Past

Today, after a delay of some three and a half centuries, much of the collection is on display in Amsterdam's renowned Rijksmuseum, where scholars and experts the world over may study it for new knowledge and perspective on a culture that once had sizable impact on our own.

There, too, many Dutch citizens will find fresh and dramatic evidence of the triumphs, the failures, and above all the courage of their seafaring ancestors. Perhaps that is *Witte Leeuw*'s greatest treasure. □

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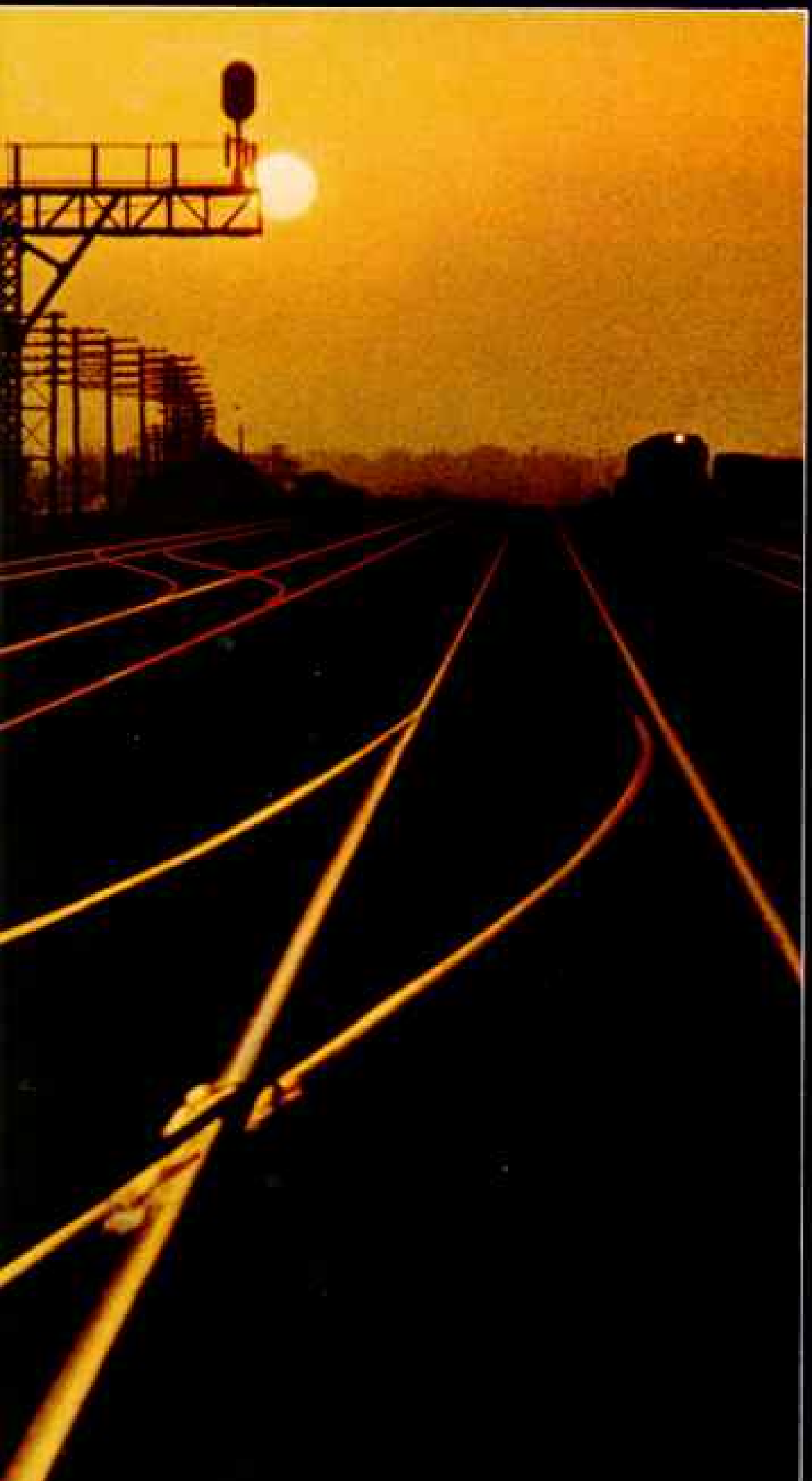
Myth:
Trains still go "clickety-clack."



Fact:
Modern, welded track is quiet and smooth.

There are those who like that rhythmic sound—but not most railroaders. That "clickety-clack" means wear at the places where rail is joined. That's why some 60,000 miles of today's railroad track are jointless welded rail—and more is being laid each year to provide a smoother and safer ride.

Last year, the railroads spent record amounts of money for capital improvements and maintenance—$9 billion for improvements to track, facilities and equipment—up 40 percent over 1975. Rail and tie installations are at the highest levels in 20 years.

The railroad industry is looking ahead to a growing freight load—especially coal. Railroads already are the nation's largest coal carriers and President Carter has called for a two-thirds increase in coal production by 1985. When it comes, the railroads can carry their share—and more, if needed.

Bigger cars, more powerful locomotives and modernized operations mean railroads are able to handle bigger loads with far fewer trains. And these improvements also mean there's a lot of additional capacity already available to handle the nation's future transportation needs.

In most cases, those needs will be met with much less fuel than is needed by other forms of transportation—an important consideration in this time of rising energy prices.

Asssociation of American Railroads,
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STEVE BOWERMAN (LEFT) AND AL GIDDINGS (RIGHT), BOTH SEA FILMS INC.

The humpbacks' sea symphony

UNEARTHLY MELODIES fill the hydrophones of Dr. Roger Payne (**above**) as he records the songs of humpback whales (**above, right**). Aided by a National Geographic Society research grant, the New York Zoological Society scientist has discovered that these giants are "irrepressible composers," improvising sequences of sounds and constantly changing their songs. The January 1979 issue will feature Dr. Payne's report and another by Dr. Sylvia A. Earle, who dives to rendezvous with humpbacks—sometimes eye to eye.

You can hear the humpbacks' songs in a detachable sound sheet included in that issue. Produced by the Geographic's Audiovisual Services Division, the sound sheet compares a speeded-up whale's cry to a bird's song and reveals differences between the songs of humpbacks near Bermuda and those in Hawaiian waters. It also includes one whale's soliloquy carried by spacecraft into the cosmic ocean as a greeting to extraterrestrial ears. Send your friends the humpbacks' messages by completing the form below.

NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP

$9.50 **CALENDAR YEAR 1979 MEMBERSHIP DUES INCLUDE SUBSCRIPTION TO THE NATIONAL GEOGRAPHIC**

ANNUAL DUES in the United States and throughout the world are $9.50 U. S. funds or equivalent. To compensate for additional postage and handling for mailing magazine outside the U.S.A. and its outlying areas, please remit: for Canada, $14.12 Canadian or $12.00 U. S.; for all other countries, $13.80 by U. S. bank draft or international money order. Eighty percent of dues is designated for magazine subscription. Annual membership starts with the January issue.

EIGHTEEN-MONTH MEMBERSHIP: Applicants who prefer delivery of their NATIONAL GEOGRAPHIC to start with the July 1978 instead of the January 1979 issue may upon request become members and receive the magazine for 18 months from July 1, 1978, through December 1979. Upon expiration, such memberships will be renewable annually on a calendar-year basis. For 18-month membership check here ☐ and remit: for U. S. and its outlying areas, $13.75 U. S. funds or equivalent; for Canada, $20.29 Canadian or $17.25 U. S.; for the British Isles, Australia, and New Zealand, $20.20; for all other countries, $20.00 by U. S. bank draft or international money order.

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Mail to: The Secretary
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Post Office Box 2895
Washington, D. C. 20013

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(FILL IN NAME AT LEFT.)

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PLEASE PRINT (MR., MRS., MISS, MS.)

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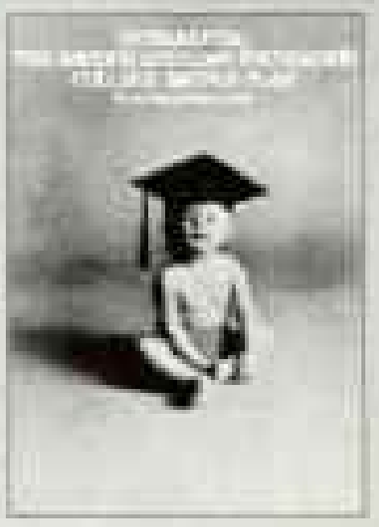

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We have a toll free telephone service called Cool-Line® service. Its only function is to help you with any problem or question you might have. Just try it: (800) 253-1301. In Michigan (800) 632-2243. You'll see.

We have a nationwide franchised service known as Tech-Care® service. It's made up of service technicians who have been trained for years to do one thing. Help you, whenever you need them. They're right in the Yellow Pages.

We realize that by doing these things we're not going to change the world. But we'd like to think of it as a beginning. A beginning that might help us to realize our dreams without forgetting our standards.

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Free. How to get a grip on your business travel problems before they get out of hand.

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The comprehensive Beechcraft Business Flying Kit. Having it in your hand can be the best way to keep business travel problems from getting out of hand.

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Get the kit that has already shown hundreds of companies how to control their travel costs. Write on your company letterhead to: Beech Aircraft Corporation, Dept. A, Wichita, Kansas 67201. Ask for our free Beechcraft Business Flying Kit, and please mention if you're a pilot.

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The Royal Dutch Horticultural Society invites you to acquire

The Flowers of Holland Thimble Collection

For just $9.75 each—twelve exquisite collector's thimbles in fine porcelain, hand-decorated in 24 karat gold, portraying the best-loved flowers of The Netherlands.

Strictly limited edition.
Subscription deadline: October 31, 1978.

The flowers of Holland are admired the world over for their color, beauty and vigor. And, through the centuries, the great Dutch painters have created some of the loveliest of all floral art.

In this tradition, The Royal Dutch Horticultural Society has authorized from Franklin Porcelain, Amsterdam, a unique new series—*The Flowers of Holland Thimble Collection*—twelve collector's thimbles of fine porcelain, created by the internationally renowned artist Ronald Van Ruyckevelt.

The beauty of flowers—in fine porcelain

Each thimble is small enough to cradle in the palm of your hand. And yet even the tiniest, most delicate features of the flowers portrayed are captured in the living colors of nature. The botanical name of each flower—in elegant script—will be incorporated into the design. The finishing touch will be a 24 karat gold border—skillfully applied by hand. This extraordinary collection thus represents a veritable gallery of flower art in miniature—still further enhanced by the delicate translucency of fine porcelain.

Yours to arrange as you like

Merely to touch one of these graceful thimbles is to sense with subtle pleasure the rich smoothness of finely-glazed porcelain. To examine one with a careful eye is to see the familiar thimble transformed into an object of true beauty. As a subscriber to *The Flowers of Holland Thimble Collection*, you will be able to set out the thimbles one by one (or in small groups) on an occasional table, in a china cabinet—or in the special display frame provided—where you may enjoy their charm to the full.

Timeless loveliness in limited edition

These beautiful thimbles are available *only* as a collection—and *only* in limited edition. Each subscriber will receive a Certificate of Authenticity, attesting to the edition limits, and an informative folder on the flowers portrayed.

The Flowers of Holland Thimble Collection is available exclusively through Franklin Porcelain. The price of each thimble will be just $9.75. The thimbles will be issued at the rate of one per month, beginning in December.

The application below must be postmarked no later than October 31st to be eligible. When all eligible orders have been filled, no more of these beautiful thimbles will ever be created. So the number of collections in existence will never exceed the number of valid applications received postmarked by the official closing date.

This elegant wall frame will be provided to every subscriber.

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Valid only until October 31, 1978
Limit: One collection per subscriber

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Franklin Center, Pennsylvania 19091

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I understand I need send no money now. I shall be billed for the full price of the first thimble when it is ready for shipment. I agree to pay the same amount for each subsequent thimble when it is ready to be sent to me.

*Plus any state sales tax

Signature _____
ALL APPLICATIONS ARE SUBJECT TO ACCEPTANCE.

Mr.
Mrs.
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PLEASE PRINT CLEARLY

Address _____

City _____

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Also available in Canada at $12. per thimble. Mail application to Franklin Porcelain, 70 Gateway Boulevard, Rexdale, Ontario M9W 4Y7.

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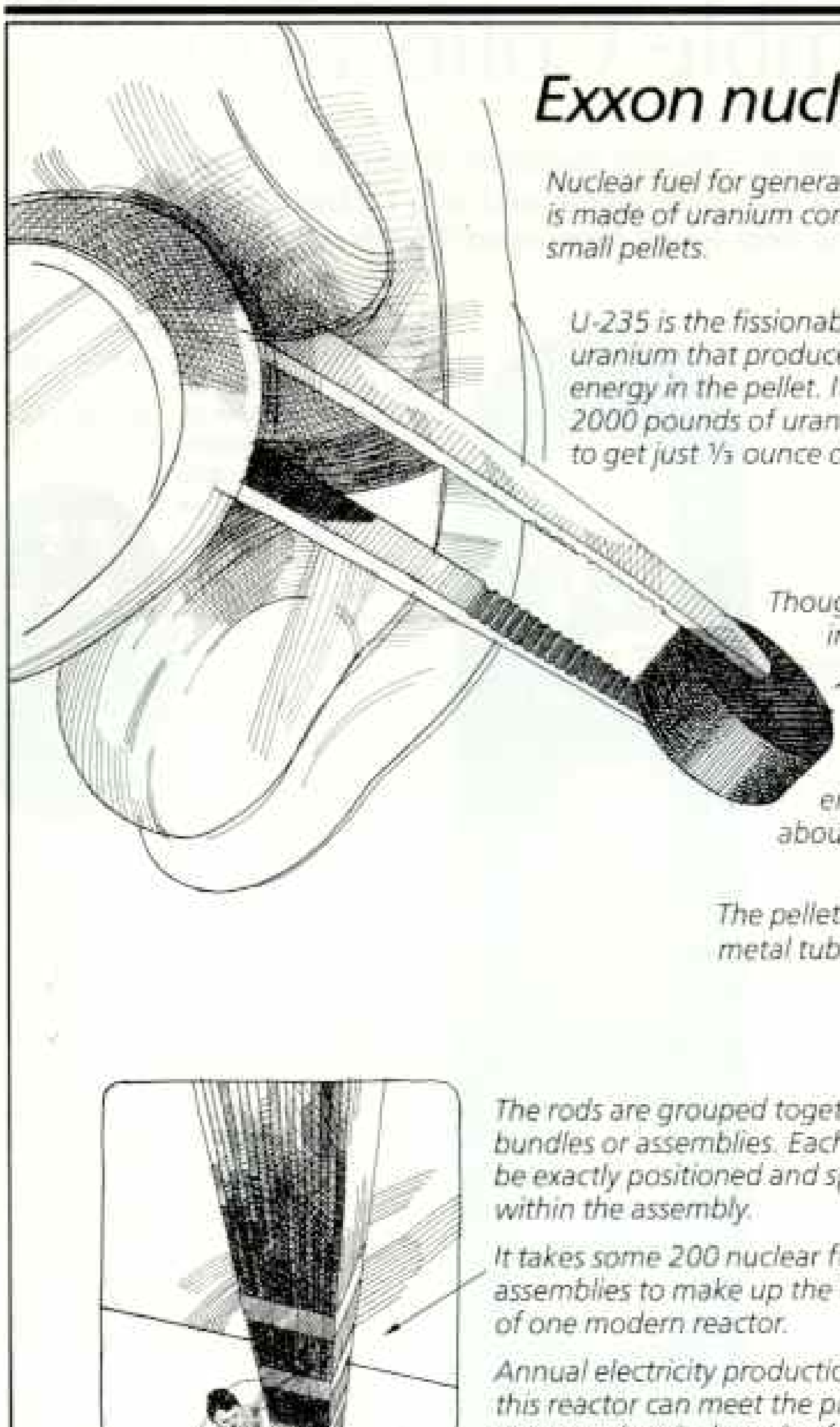
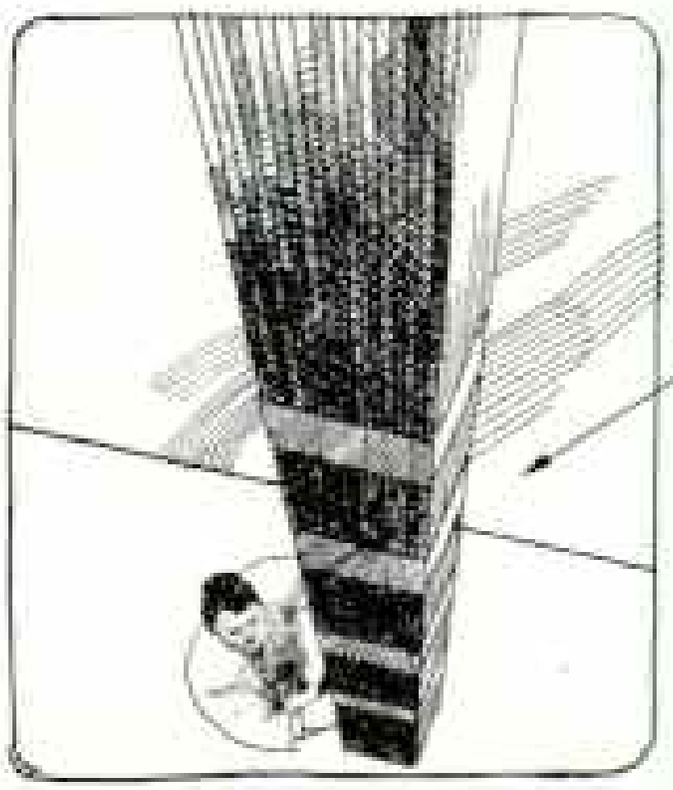


Though less than ½-inch in diameter, nuclear fuel pellets are power-packed. Each pellet contains the energy equivalent of about 100 gallons of oil.

The pellets are sealed in long metal tubes or fuel rods.



The rods are grouped together in bundles or assemblies. Each rod must be exactly positioned and spaced within the assembly.

It takes some 200 nuclear fuel assemblies to make up the core of one modern reactor.

Annual electricity production from this reactor can meet the present average electrical needs of over 750,000 American homes. If generated by fossil fuels, this amount of electricity would require 10 million barrels of oil or 3 million tons of coal.

By 1990, nuclear fuel could provide about 30% of total U.S. electricity demand.

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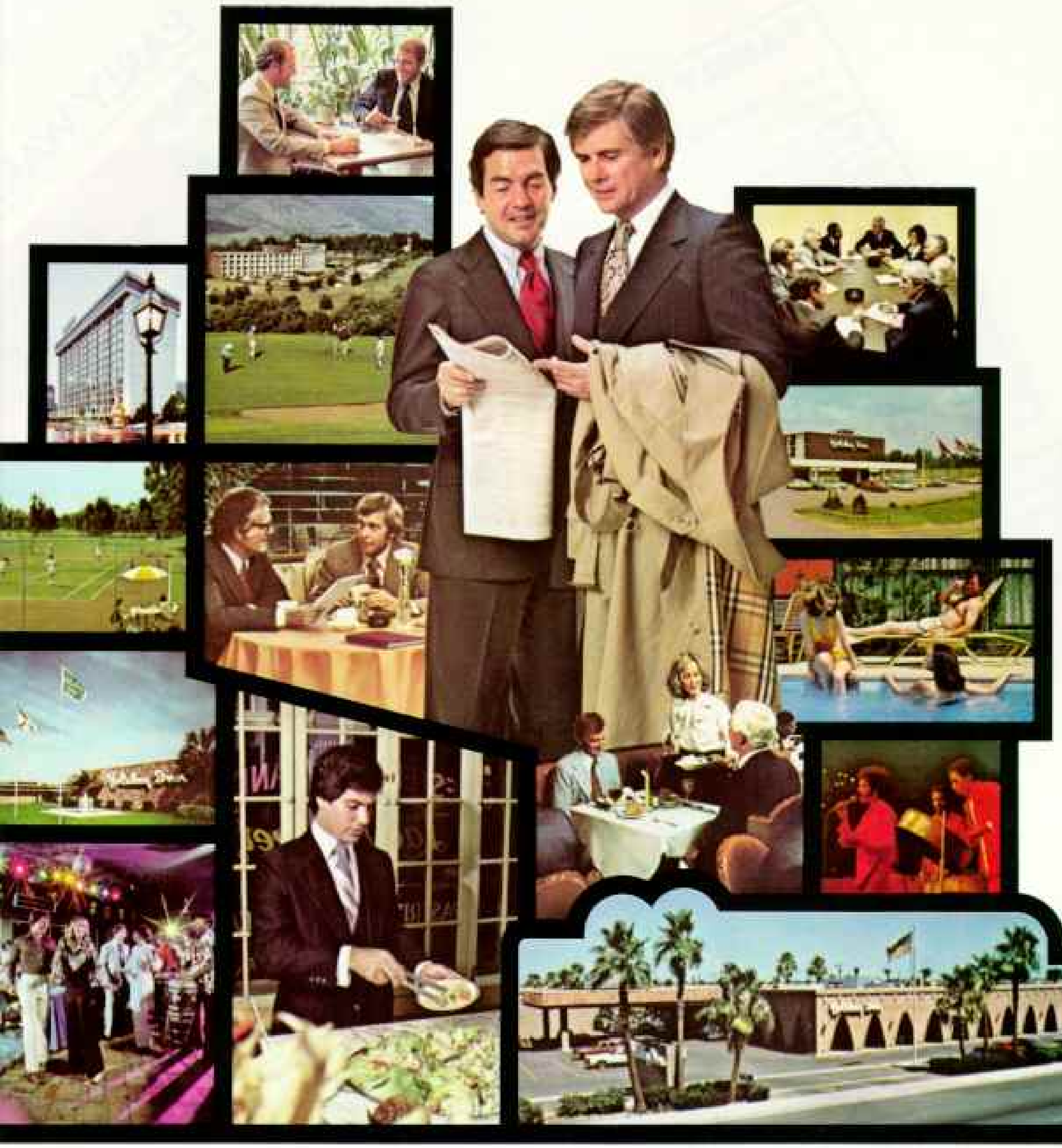

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- DIPHTHERIA
- TETANUS
- WHOOPING COUG...

One immuni... each date... all three...

CHILD'S NAME ▶

AT AGE —

- POLIO

One oral ... each date

- MEASLES
- MUMPS
- RUBELLA (German measles)

EMERGENCY MEDICAL CARD

Date

Name

Address

Telephone

Date of Birth

Religion

Native Tongue

In Emergency, Call

Telephone

My Doctor is

Address

Telephone

EARLY WAR

PAIN

almost al... attack. ... one of ... severe, ... ing, like ...

EMERG... PHONE NUM...

- FIRE
- PO...
- A...
- H...

Lea... of Life S...

Emergency first a... of breathing and h... cardiopulmonary resuscitation (C...

A · Airway

Turn victim on back and quickly wipe out mouth. Place one hand under victim's neck and lift, tilting head back as far as possible with other hand. This provides airway.

B · Breathing

If victim is not breathing, pinch his nostrils shut. Place your mouth tightly over his mouth and blow. Remove your mouth to exhale. Give 4 quick breaths (see C). Check pulse briefly. If still no breathing, blow armings k victim.

Between ... and bladder

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There's a time in life when you owe yourself a little something extra—when luxury and comfort are rewards you have earned.

As in the Brougham interior, now available in our Delta 88 Royale. Textured velours. Elegantly tufted seat backs. Pleated and plush comfort that rewards you every mile.

With it comes a great American road car with a reputation for quality. Engineered for impressive space efficiency—trim shape, full-size room for six, and over 20 cubic feet of trunk space.

Look at it this way. You want a car to keep for a long time. So that rich Brougham interior is a smart investment in luxury you have earned. Think about it as you take a long test drive—soon.

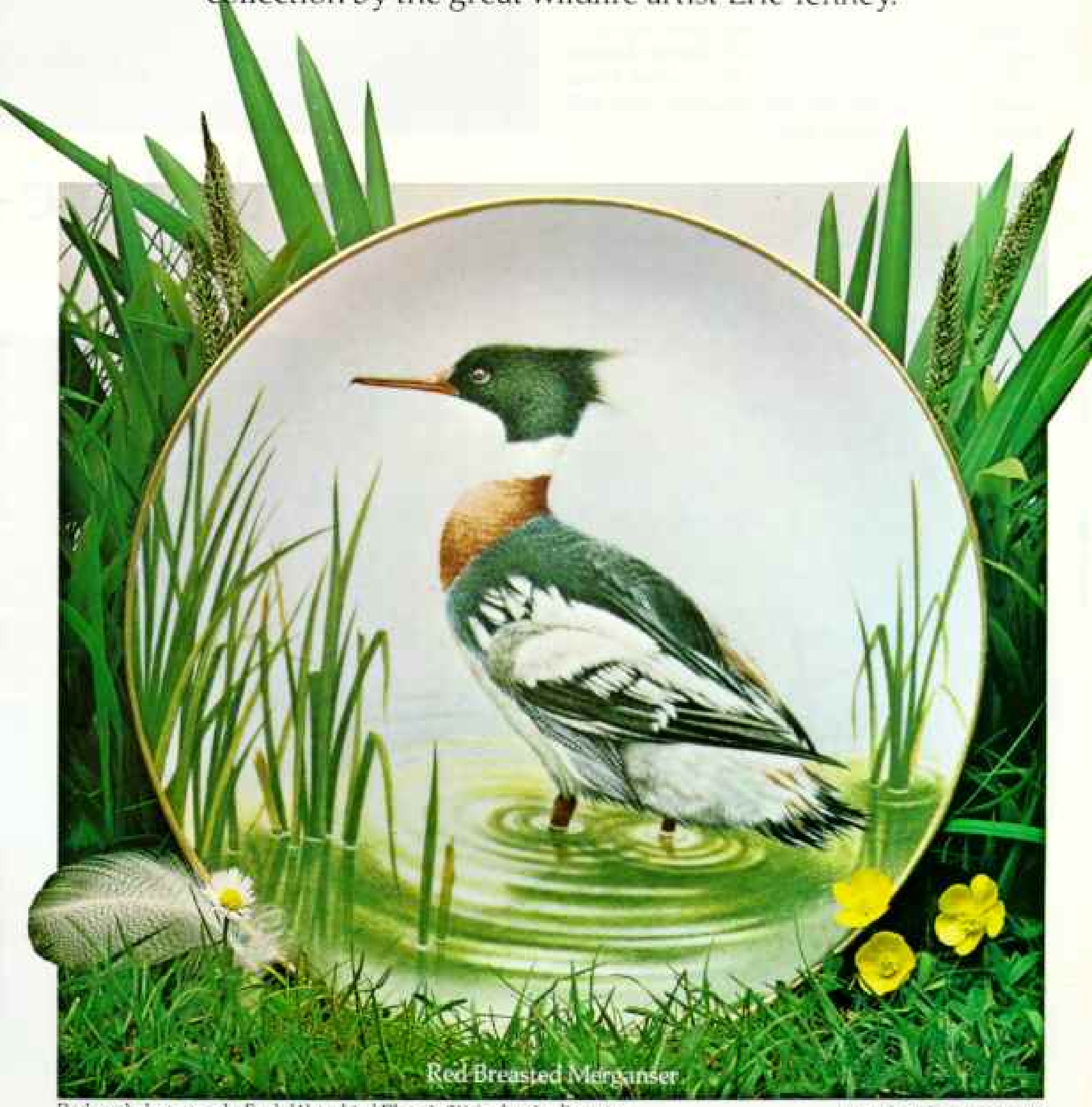
Oldsmobile

Delta 88 Royale
Have one built for you.

GM

The Waterbird Plates

12 superb original works of art have been painted exclusively for this collection by the great wildlife artist Eric Tenney.



Reduced photograph. Each Waterbird Plate is 9½ inches in diameter.

(continued on next page)

(continued from previous page)

Announcing a magnificent limited edition of fine porcelain hand-decorated with 24 karat gold

Of all nature's creatures, birds surely are among the most appealing. And waterbirds in particular hold a special place in the hearts of bird lovers because of their distinctive grace and beauty.

Now, twelve of the world's loveliest waterbirds are portrayed for the first time in an exquisite collection of fine porcelain plates.

Outstanding Original Paintings

Each of the twelve Waterbird Plates depicts a work of art by the internationally-known English wildlife artist Eric Tenney. He created these paintings *exclusively* for this collection; they will never appear anywhere else.

Oyster-catcher

In the time-

Reduced photographs. Each Waterbird Plate is 9½ inches in diameter.

honored tradition of fine porcelain

THE WATERBIRD PLATES will be crafted of fine Bavarian porcelain, which is greatly esteemed for its translucence, whiteness, and strength. The tradition of Bavarian porcelain is among the oldest in the Western World; indeed, it was in Saxony that the first true porcelain was developed in Europe, over two and a half centuries ago.

The Waterbird Plates continue this tradition of inspired artistry and painstaking skill. It can take years to create a series of plates of this supreme quality, and it would be impossible without the specialized knowledge and craftsmanship that only a few master porcelain makers possess.

Each Waterbird Plate will measure approximately 9½ inches in diameter, a size that makes it possible to show each bird in precise detail in its natural habitat. *To add to the splendor and elegance of the collection, a border of 24 kt. gold will be hand-applied to each plate.*

A Limited Edition at a Guaranteed Price

Because the original paintings are so exceptional, the Waterbird Plates are expected to have enduring collecting importance. This truly is a collection you can acquire with confidence and display in your home with pride.

The Waterbird Plates are available in the U.S. exclusively from the Danbury Mint; none will be sold in museums, galleries or stores. The U.S. edition of this magnificent collection is *limited to the number of orders postmarked by October 31, 1978*, and then will be closed forever. As a subscriber you will receive a certificate of registration authenticating the limited edition status of your collection.

Despite the fact that collector plates of comparable size and quality are being widely offered at $45. or $50. and more, the original issue price for the Waterbird Plates has been set at just $35. each. Moreover, this original issue price is guaranteed to each subscriber for the entire collection.

Guaranteed Satisfaction

Before each plate is approved for shipment to you, it will be individually inspected to assure it meets our exacting quality standards. But should any plate fail to satisfy you in any regard, you may return it for replacement or refund. Naturally, you may cancel your subscription at any time.

Prompt Action Required

All you need do to reserve your Waterbird Plates is return the attached reservation application. You need send no money now. You will be invoiced for each of the 12 plates as they are shipped at a rate of a new plate every other month.

Because these plates are so beautiful, collector demand is expected to be high. So, it is suggested you order without delay, today if possible, to avoid disappointment.

ERIC TENNEY is one of the finest wildlife artists of our time. So great is the worldwide demand for his art that he will undertake only those commissions he considers to be of unusual merit. He devoted many months to these waterbird paintings. The result is a collection of masterpieces—original art which is authentic and striking, capturing each waterbird in vivid lifelike detail.

RESERVATION APPLICATION WP-6

The Danbury Mint
47 Richards Avenue
Norwalk, Conn. 06856

Must be postmarked by October 31, 1978
Limit: one set per person

Please accept my reservation application to **The Waterbird Plates.** I understand this is a collection of 12 fine porcelain plates each depicting an original work of art by the great wildlife artist Eric Tenney. The collection will be issued at a rate of one plate every two months at a guaranteed price of $35.00 per plate (plus $1.30 for postage and handling).

I understand that I need send no money now. I will pay $36.30 for each plate as billed at two-month intervals. I may cancel my subscription at any time, and any plate that I am not completely satisfied with may be returned for replacement or refund.

Name_____

Address_____

City_____

State_____ Zip_____

Signature_____

☐ Check here if you want each plate charged, as it is shipped, to your ☐ Master Charge ☐ VISA

_____

Credit Card No. Expiration Date

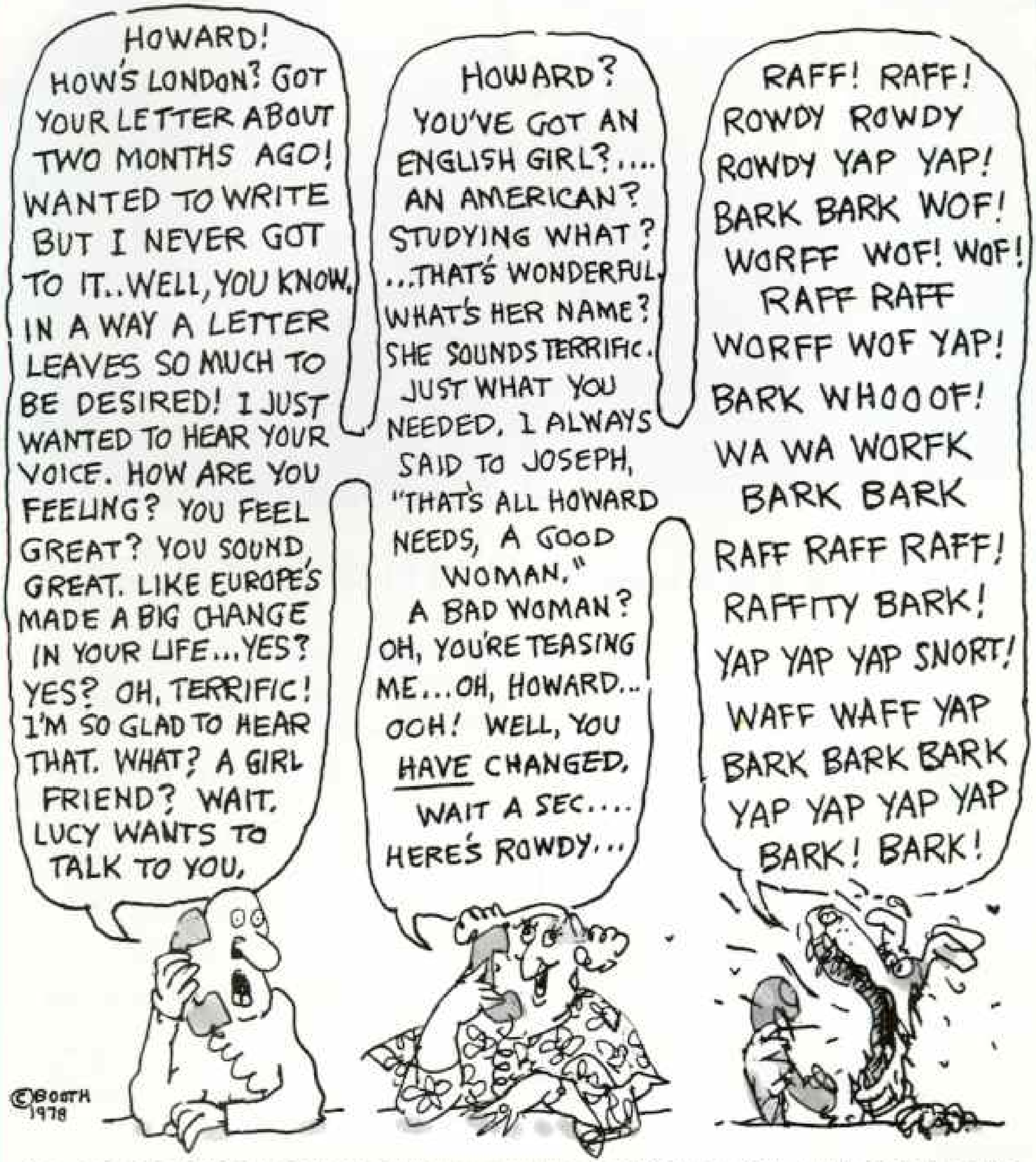
National Geographic

Flamingo

White Pelican

Mallard

Lift flap here

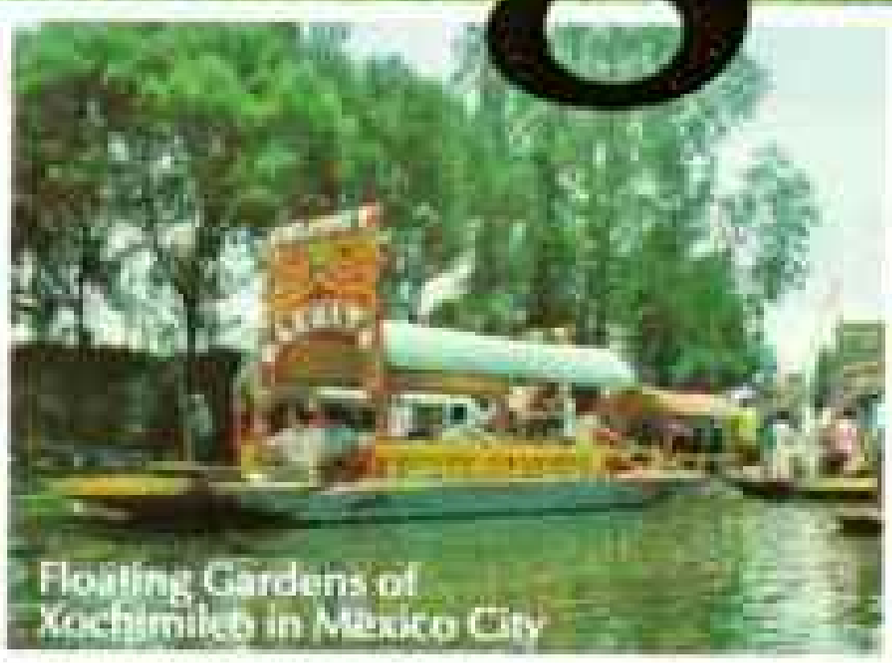


Archaeological treasures of Tulum, near Cancun

All you need for the perfect vacation is the perfect place.

We've got it!


Taxco


Floating Gardens of Xochimilco in Mexico City


Acapulco

Mexico has so many perfect places. Cities that move to the rhythm of old folkloric tunes one moment . . . and disco vibrations the next. Smaller towns, that spring to life on market day. And unbelievably luxurious resorts, where the sound of the surf and the glow of evening stars begin and end the day. Mexico has everything to make your vacation an unforgettable one. Crafts and clothing at bargain prices. Fabulous food in beautiful settings. Great museums. Huge parks and jewel-like plazas. And the still-mighty ruins of ancient civilizations.

Mexico . . . it's more than just another trip. It's an experience you'll never forget.

MEXICO
THE Amigo COUNTRY

Secretaria de Turismo • Consejo Nacional de Turismo

See your ASTA Travel Agent or mail coupon to

MEXICO: THE AMIGO COUNTRY. 16-10/75

MEXICAN GOVERNMENT TOURIST OFFICE
9701 Wilshire Blvd. — Suite 1110
Beverly Hills, Calif. 90212

Tell me more. Please send me your "Wonderful Mexico" brochure.

Name _____

Address _____

City _____

State _____ Zip _____

(Please print)

Duane Stern is the answer to all the Andersons' insurance questions.

"Duane doesn't take your money and forget about you," says Steve Anderson of Rockford, Illinois. "He's there to help. Like updating our life insurance when little Todd arrived. Or reviewing the coverages on our house. Or simplifying the handling of an auto claim for us. It just seems like he's never too busy to give us his time."

"When we go over our insurance," says Sheila Anderson, "Duane talks with us, not at us. We like that."

If you'd like an insurance agent who's as enthusiastic about giving you service as selling you a policy, check your Yellow Pages for the State Farm agent near you.

STATE FARM INSURANCE

Like a good neighbor, State Farm is there.

STATE FARM INSURANCE COMPANIES Home Offices: Bloomington, Illinois

PPG believes windows should become working parts of your home's energy system.

Whether your home is in the south or the north, PPG has an energy-saving environmental glass for your windows and sliding glass doors.

Where the climate is blistering, you can save air conditioning costs by as much as 17 percent by letting your home wear windows and patio doors made of Solarcool® Bronze reflective glass instead of clear glass.

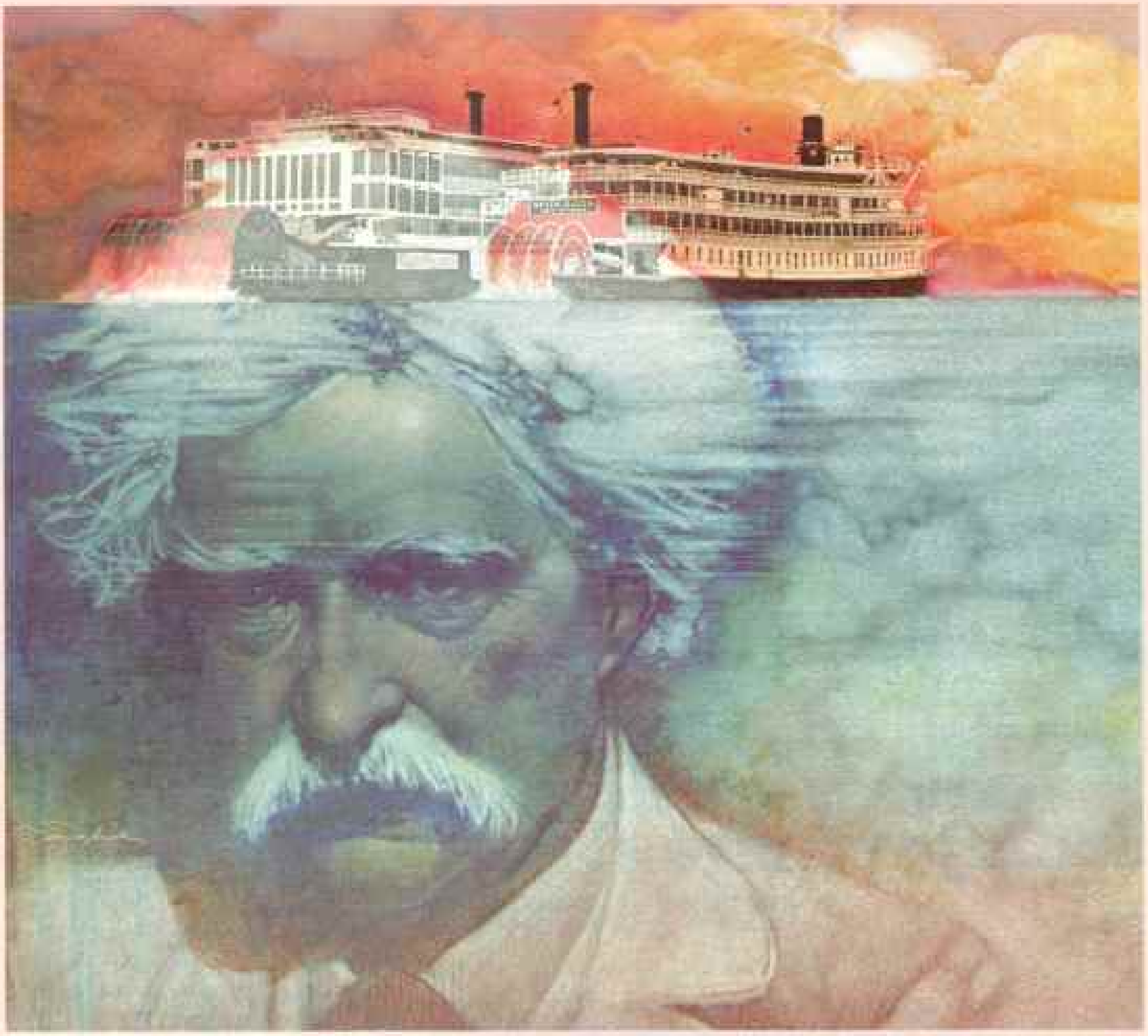
Newest in the PPG line, Solarcool cuts way down on ultraviolet light, too, which is a major cause of fading. Its beautiful mirrored face provides comparative privacy, and by reducing glare makes it a lot nicer to look out on a summer's day.

Up north, PPG Twindow® insulating glass uses two sealed panes to bring breathtaking winter scenes indoors while you breathe in comfort. Since it reduces heat loss through the glass more than 40 percent, it obviously saves energy. It cuts messy condensation. And if you want to save even more, add storm windows for triple glazing.

Let PPG glass become part of your energy-saving system. Ask your builder or architect. Either one will be glad to help you. PPG Industries, Inc., Dept. N-4108, One Gateway Center, Pittsburgh, Pa. 15222.

PPG: a Concern for the Future

PPG
INDUSTRIES



"The Mississippi! It was with indescribable emotions that I first felt myself afloat upon its waters . . .

. . . the great Mississippi, the majestic, the magnificent Mississippi, rolling its mile-wide tide along, shining in the sun.

The moment we were under way I began to prowl about the great steamer and fill myself with joy. She was as clean and as dainty as a drawing room; when I looked down her long, gilded saloon, it was like gazing through a splendid tunnel . . . she glittered with no end of prism-fringed chandeliers."

(Excerpted from Mark Twain's "Life on the Mississippi")

A vacation on the Delta Queen® or the Mississippi Queen® is a cruise through Mark Twain's America. With a view that changes around every bend.

Magnificent gardens. Historic landmarks. Stately plantations. Sleepy, little river towns. Bustling, cosmopolitan cities.

Not to mention delicious food. Great entertainment. And a nice, smooth ride through a place you've only read about.

Until now. That's Steamboatin'™ And it all happens aboard America's only overnight passenger steamboats, the legendary Delta Queen and the luxurious Mississippi Queen.

So if you're looking for a vacation that's unique in every detail, see your travel agent or fill in the coupon and send it to us.

The Delta Queen Steamboat Co. Dept. NG01, P.O. Box 2000, Addison, Illinois 60101.

We offer three to fourteen days of steamboatin' on the upper and lower Mississippi and the Ohio. And when we say, "Welcome aboard," you'll begin an experience no other vacation can match.

Who knows? Maybe you'll even see Mark Twain prowling about our Grand Saloon, filling himself with joy all over again.

Let us take you back to a time when steamboatin' was the only way to travel.

It still is.

DELTA QUEEN

Please send me your 1979 Delta Queen and Mississippi Queen Deluxe Cruise Schedule.

The Delta Queen Steamboat Co.
Dept. NG01, P.O. Box 2000
Addison, Illinois 60101

Name_____

Address_____

City_____

State_____ Zip_____

The Delta Queen and Mississippi Queen are steamboats of U. S. registry with an American crew.

New Maytag Jetclean™ Dishwasher out-cleans 'em all.

Gets the dishes you wash most *cleaner* than other leading brands.

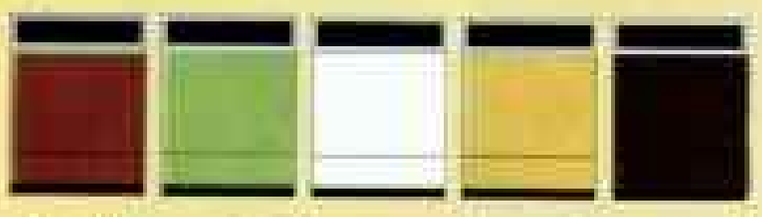
New styling adds a smart touch to your kitchen.

We believe the new Maytag **Jetclean™** Dishwasher could be the standard by which all others must be judged. Here are some of the reasons why:

1. Cleaner dishes for your family. In the regular cycle, this new Maytag gets dishes cleaner than other leading brands. Also unsurpassed for pots, pans, even casseroles.

2. New Maytag **Powerdry** dries dishes better than ever with forced air. Most models let you dry with or without heat, saving electricity.

3. Its new styling and smart colors can sparkle up your kitchen. You can also personalize your Maytag by buying a Custom Trim Kit that lets you cover the front panel with fabric, wallpaper, plastic, wood, even stainless steel.



4. We put 10 pounds of sound-absorbing insulation all around the new Maytag Jetclean™ Dishwasher.

5. Maytag gives you cycles for every dishwashing job. Take your choice—built-in or convertible.

6. Loading is so easy, because we've still got two deep racks, top and bottom. Exclusive Maytag **Dual Deep-Racking** lets you put 10" plates in both racks.

7. The capacity is huge. You can probably wash a whole day's dishes for a family of 4 in one load.

8. The new Maytag Jetclean™ Dishwasher has the tested, exclusive Maytag **Jetwash** spray. Compare above. See? Smaller holes in Maytag Jetwash mean high-velocity water jets with tremendous dish-cleaning power.

9. You also get the tested, exclusive Maytag **Micro-Mesh™** Filter. The small holes in Maytag's filter trap even tiny food particles . . . won't let them get back on your dishes.

10. The new Maytag Jetclean™ Dishwasher is built as only the dependability people build 'em . . . to take it, and keep on taking it. Buy now and save $25 with the certificate below.

MAYTAG JETCLEAN™ DISHWASHER

$25 Maytag Cash Refund Certificate

Buy a new Maytag Jetclean™ Dishwasher now, and get a $25 refund directly from The Maytag Company. Mail this certificate, plus a bill of sale from your Maytag Dealer showing date of purchase, model number, and serial number, to: **The Maytag Company, Box 69, Newton, Iowa 50208.** Offer good only on new models WU900, WU700, WU500, WU300, WU180, WC700, WC300. This certificate may not be mechanically reproduced and is not transferable. Good only in U.S.A. and Canada. Void where prohibited by law. Limit: one refund per dishwasher purchased, regardless of certificate source. NC

Your request for $25 refund must be postmarked no later than January 31, 1979.

Your Name _____
(Print clearly; proper delivery depends on a complete and correct address.)

Address _____

City _____ State _____ Zip _____

Cash value 1/20 of 1¢

The Maytag Company, Newton, Iowa 50208

Special peppers are aged in oak barrels until the passing of years mellows them to the savory aroma and flavor of TABASCO® sauce.

VISIT

EXPLORERS HALL

NATIONAL GEOGRAPHIC SOCIETY

You and your family are the explorers here. Discover exciting, one-of-a-kind exhibits that talk, move, light up. See your Society's treasures of discovery, records of scientific achievement, and relics of ages past. Watch educational films. Only six blocks from the White House. Open daily.

NATIONAL GEOGRAPHIC SOCIETY
17th & M Streets N.W., Washington, D. C.

By Authority of the Government of Canada

The Royal Canadian Mint announces

THE 1978 CANADIAN $100 22 KARAT GOLD PROOF COIN

A special mintage, limited to 200,000, of the 1978 $100 22 karat gold proof coin has been struck by the Royal Canadian Mint for world-wide sale.

The coin has a diameter of 27mm and weighs 16.965 grams of which 15.551 grams (½ Troy oz.) are fine gold. This precious metal legal tender coin contains 91.66% fine gold and 8.34% fine silver.

The obverse bears Arnold Machin's effigy of Queen Elizabeth II, the reverse depicts a wedge-shaped flight of Canada Geese, designed by Canadian artist Roger Savage, representing the ten Canadian provinces and two territories. It is symbolic of Canadian unity.

This 1978 coin is only the third $100 denomination ever issued by Canada.

Luxurious genuine leather presentation case

On acceptance of your order, your $100 22k gold proof coin comes to you in a handsome black genuine leather case which is embellished with a maple leaf and has a blue suede-finish lining. It will be accompanied by a Certificate of Authenticity signed by the Master of the Royal Canadian Mint certifying that your coin is a $100 22k gold proof coin, of legal tender, authorized by the Canadian Government. The case fits into an attractive book-like 'sleeve' for elegant exhibition in your home. This magnificent coin and case would make a thoughtful and valuable gift.

Royal Canadian Mint / Monnaie royale canadienne

RETURN TO: Royal Canadian Mint
P.O. Box 457, Station 'A', Ottawa, Ontario, Canada K1N 8V5

Please send me (Qty) _____ $100 22k Gold Proof Coin(s) at $150 (Can.) each . . . . $_____

*Canadian residents add Prov. Sales Tax where applicable . . . $_____

Total . . . . . $_____

*Prov. Tax not applic. in P.E.I., Quebec, Alberta, N.W.T., Yukon.

Sales Tax Exempt No. _____

METHOD OF PAYMENT
(check only one)

☐ Enclosed is my certified cheque/money order made payable to The Royal Canadian Mint. **OR**

Please charge my Credit Card Account, as indicated:

☐ Chargex/Visa ☐ Master Charge ☐ American Express

Credit Card Number

Expiry Date of the Card

Signature _____
(Application must be signed to be accepted)

Name _____

Address _____

City _____

Province/State _____ Postal Code/Zip Code _____

Orders accepted on a first come first served basis, to a maximum mintage of 200,000. Please allow 6 weeks' delivery.
Orders must be postmarked no later than 1st December, 1978.
This order form is valid in Canada and the U.S.A. only.

UI-01

The man who simplified housing bought a Honda Civic.

You can imagine our feeling of satisfaction when we discovered that R. Buckminster Fuller had walked into Darling's Honda in Bangor, Maine, and bought a Honda Civic® CVCC® Hatchback.

Buckminster Fuller is, after all, one of history's most original and prolific thinkers. As an architectural engineer, philosopher, mathematician, and educator, he has spent over half a century finding simple, economical ways to improve our lives.

What's more, he knows a good deal about automobiles, having owned 43 different cars over the years.

Of course, you may know Bucky Fuller best for his masterpiece of simplicity, the geodesic dome. This ingenious structure is one of the strongest and most efficient means of enclosing space yet devised by man. More than 150,000 geodesic domes have been built, ranging in size from small dwellings to a railroad roundhouse big enough to cover a football field.

Which brings us back to the subject of automobiles. In 1933 Bucky Fuller designed and built the Dymaxion Car. It rode on three wheels and steered by a single wheel in the rear. This design made it highly maneuverable and easy to park. It even had front-wheel drive. Sound familiar?

Here's what he told us about his Honda Civic CVCC: "Its handling feels better to me than any other car I've ever owned – except my Dymaxion."

There. Isn't that nice? And isn't it wonderful when someone like Buckminster Fuller appreciates what we've done.

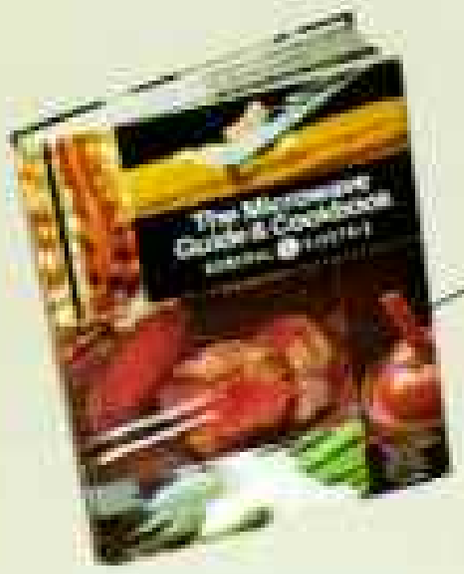
HONDA

We make it simple.

YOU CAN COUNT ON GENERAL ELECTRIC FOR GREAT IDEAS IN COOKING.

THE GENERAL ELECTRIC MICROWAVE COOKING CENTER.

At General Electric, we know what makes America cook, as you can see from all the cooking versatility we've built into one superb appliance. The Microwave Cooking Center combines the speed and convenience of microwaving with the traditional benefits of conventional cooking, and fits comfortably in your current kitchen space.



General Electric's "Microwave Guide and Cookbook" that comes with the Cooking Center is much more than a recipe book. It's a complete how-to guide that takes the mystery out of microwave cooking with simple step-by-step lessons, recipes and 450 color photographs.

The upper microwave oven features the General Electric Micro-Thermometer™ control. Just insert and set the desired temperature and the oven shuts off automatically when it's done. It also has digital time control and gives you the cooking flexibility of multiple power levels.

The surface units are engineered to give you an infinite choice of heat settings. The range is also available with ceramic glasstop cooking surface. The controls are conveniently placed at eye level next to the upper oven.

The conventional oven not only gives you the convenience of General Electric's P-7™ self-cleaning system, but an automatic oven timer. There are also settings for bake, time bake, broil, and clean, in addition to temperature control.

THE APPLIANCES AMERICA COMES HOME TO.

GENERAL ELECTRIC

Get the sharpest picture in Zenith history.
Our new Tri-Focus picture tube has three focusing actions—two more than ordinary tubes.

Get rich, real color. Automatically.
Our exclusive Color Sentry automatically corrects the color thirty times a second.

Get the TV designed to be the most reliable Zenith ever.
Our Triple-Plus chassis is all new. It's 100% modular, with far fewer component interconnections. And it runs cooler at critical points.

THIS IS A BREAKTHROUGH. THIS IS THE BEST ZENITH EVER.

SYSTEM 3

ZENITH®
The quality goes in before the name goes on.®

Shown: the Puccini, SK2537P. Pecan color with front and base of simulated wood and select hardwood solids framing the top. Simulated TV picture.

Introducing the Kodak Ektramax camera.

It shoots just about anything your eye can see.

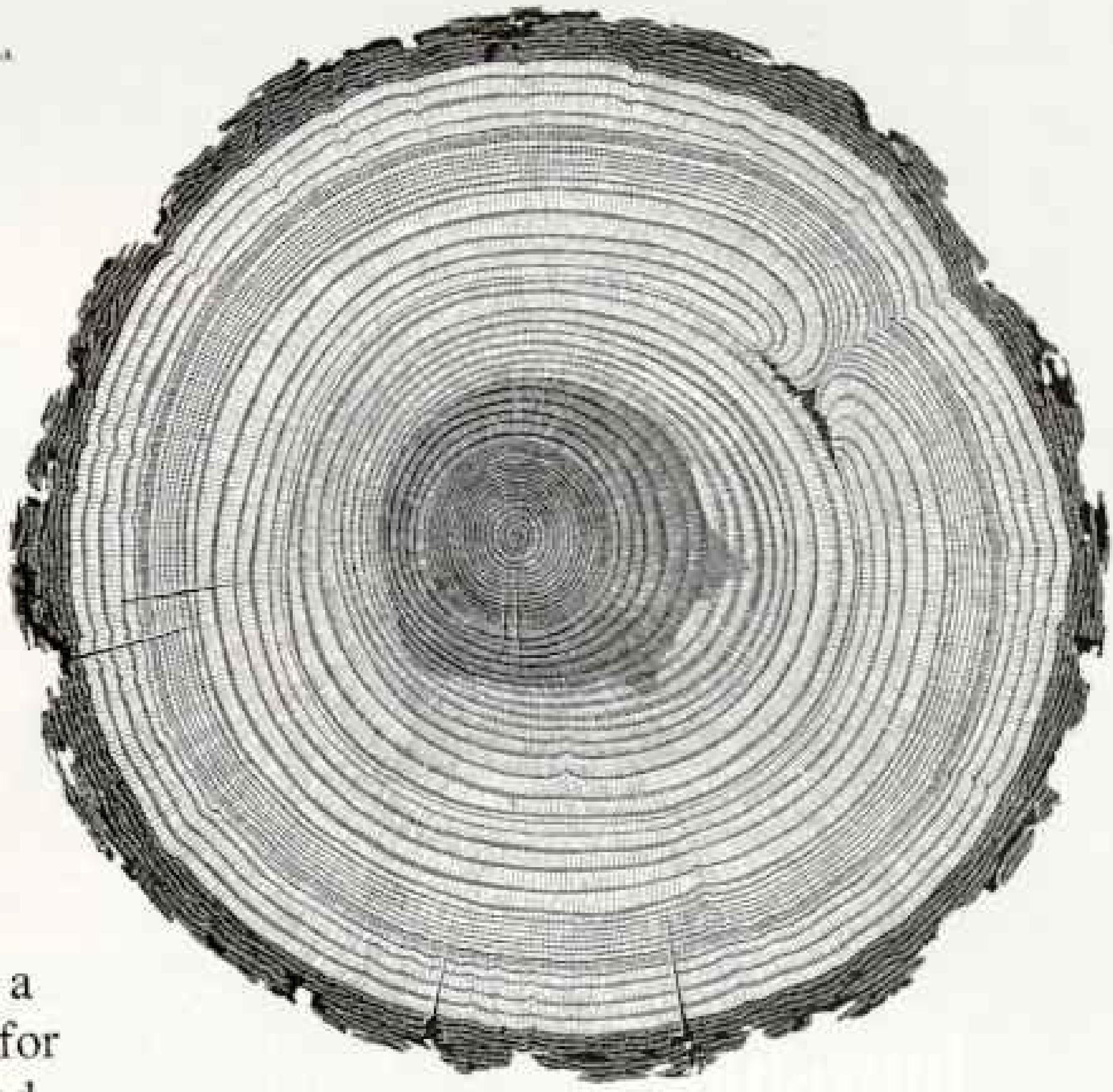
Imagine taking indoor pictures of someone who's beyond the range of a flash. Or capturing the bright lights of a city at night. It's not a dream. It's Ektramax, the remarkable new Kodak Ektramax camera. Without flash, its f/1.9 lens and 400-speed film can shoot just about anything your eye can see. Even by candlelight. Flash pictures? Of course. The Ektramax camera has a built-in electronic flash that stops action cold. Ask your photo dealer about the new Ektramax camera, the ultimate "Can-Do" camera from Kodak.

Built-in flash pictures

Sunset pictures

Candlelight pictures

CROSS-SECTION OF PINUS PONDEROSA



This tree kept a lifelong diary for all of us to read

Each year a tree grows a new layer just inside the bark. Early in the season, fast-growing, light-colored cells form. Then growth slows, leaving a thin line of darker cells to mark the passing year.

This cracked and drying stump of a ponderosa pine reveals in its annual growth rings much about its 53-year life.

Its center rings, evenly-spaced, show 14 years of steady, normal growth. Then came four years of drought, indicated by crowded, narrow rings.

Fire crackled through the forest, searing one side of the maturing pine, and leaving an open wound that took seven years to heal.

As neighboring trees competed for sunlight, the tree's rings narrowed, until in its 46th year a series of very narrow rings tells of perhaps more drought, an insect blight, or a period of heavy cone production. By studying nearby trees, experts can pinpoint the cause.

Scientists study tree rings to find ways of improving timber growth, to gain greater understanding of the weather, and even to date archeological ruins.

Around 1900 astronomer Andrew Ellicott Douglass turned from his study of sunspots to examine tree stumps. Douglass thought that if he could link ring width to weather he would find a chronology of climatic changes written in the wood of fallen trees.

His studies gave us a valuable history of weather going back many hundreds of years. It also gave archeologists a unique tool for dating ruins.

Experts had long puzzled over the age of the pre-Columbian ruin of Pueblo Bonito in northwest New Mexico. Douglass, working under a National Geographic Society grant, drilled cores from the house timbers at this long-deserted site, matched sequences of thick and thin tree rings with his "yardstick" of ring patterns, and was able to date positively the pueblo's earliest construction at around A.D. 900.

In establishing a relationship between tree ring variation and climate, Dr. Douglass pioneered a new science now known as dendrochronology. He also founded the Laboratory of Tree-Ring Research at the University of Arizona, where today's dendrochronologists, by cross-dating living and dead specimens of California's bristlecone pines, have pushed back a continuous chronology of over 7,000 years. They have precisely dated hundreds of archeological sites, and have vastly improved our picture of the paleoclimate of western North America.

Not every reader shares the dendrochronologist's enthusiasm for reading tree rings. But many do share the scientist's enduring curiosity about the wonderful world around us. And to help satisfy that curiosity, they turn each month to the pages of NATIONAL GEOGRAPHIC.

"THE NEW POTSCRUBBER® III IS THE BEST DISHWASHER GE HAS EVER MADE. WHO COULD ASK FOR ANYTHING MORE?"

– Debbie Reynolds

IT WASHES DISHES CLEANER.

The Potscrubber III dishwasher features the new exclusive Multi-Orbit™ Wash Arm, engineered so that it directs a constantly changing pattern of water up through the

dishes. This arm, combined with a Power Shower on top and a Power Tower in the middle, gives you 3-level washing action to get your dishes and glasses cleaner than ever before.

And the special Power Scrub® Cycle, while it may not do everything (such as remove burned-on soils), is designed to remove heavy dried-on and baked-on foods from pots and casseroles.

IT SAVES WATER AND SAVES ENERGY.

Almost 80% of all the energy used in a dishwasher is in the hot water it consumes.

The new Potscrubber III dishwasher has been specially designed to use less hot water. In fact, your family could save hundreds of gallons a year.

You can also save energy by letting the dishes dry naturally, simply by pressing the Energy Saver button. And you can cut down on the number of washings you do because the new Super Racks hold more dishes.

AND IT RUNS QUIETLY, TOO.

Our PermaTuf™ tub is not only tough (it won't chip, crack, peel or rust in normal use), but it's actually an effective sound-dampening material as well.

And we didn't stop there. We even surrounded the PermaTuf tub with a blanket of sound insulation.

The Potscrubber III dishwasher from General Electric. Who could ask for anything more?

THE APPLIANCES AMERICA COMES HOME TO.

GENERAL ELECTRIC

At last!
A children's atlas that's informative and *FUN*...

For that special child whose future—whose early self-confidence—means a lot to you, here is good news. Your Society, world-famous for its map-making skill, is proud to announce the National Geographic Picture Atlas of OUR FIFTY STATES.

Once you open this volume, you'll know this is no ordinary atlas. Here is a delightful book to read for pleasure...a learning adventure that's extra helpful in school assignments.

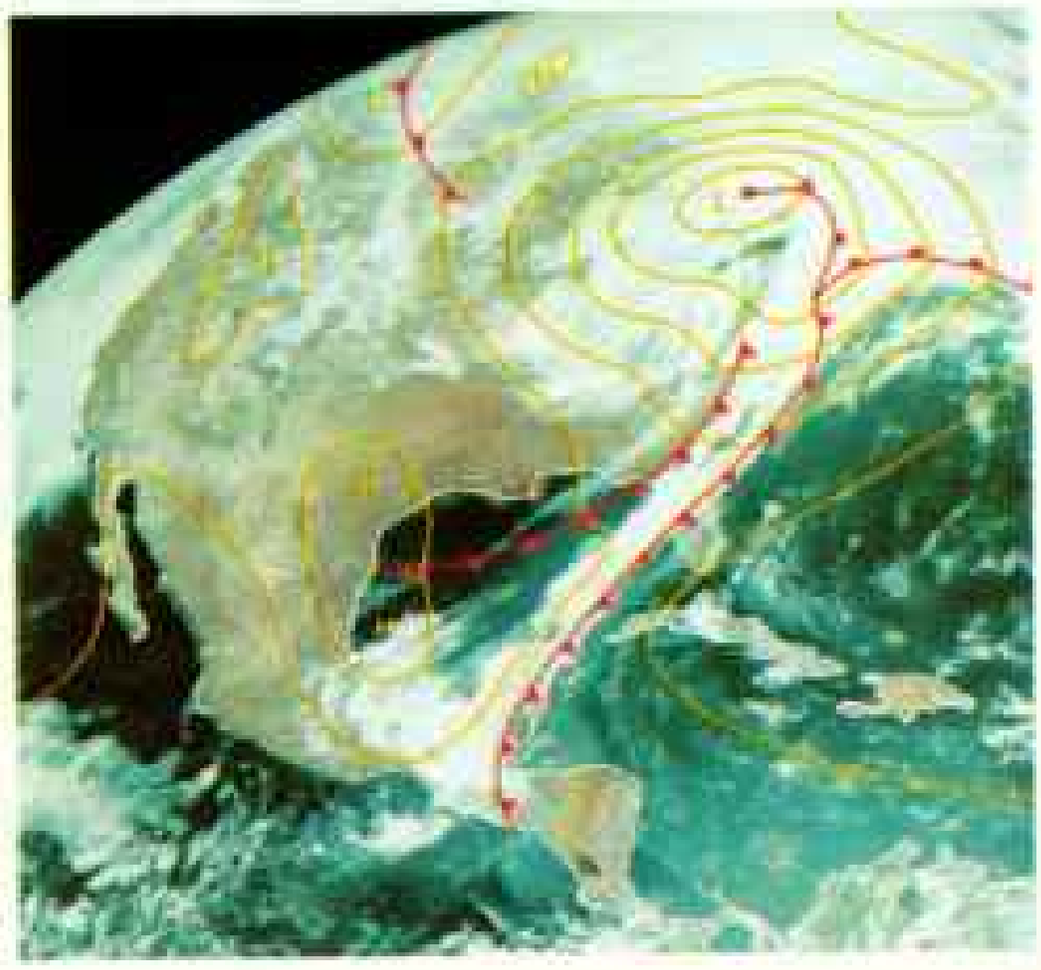
Today's bright, inquisitive young minds need a book like this: a remarkably clear, thoroughly enjoyable, word-and-picture guide to OUR FIFTY STATES—an atlas that really makes U.S. geography fun!

FUN-FILLED ILLUSTRATIONS

EASY-TO-USE CHARTS

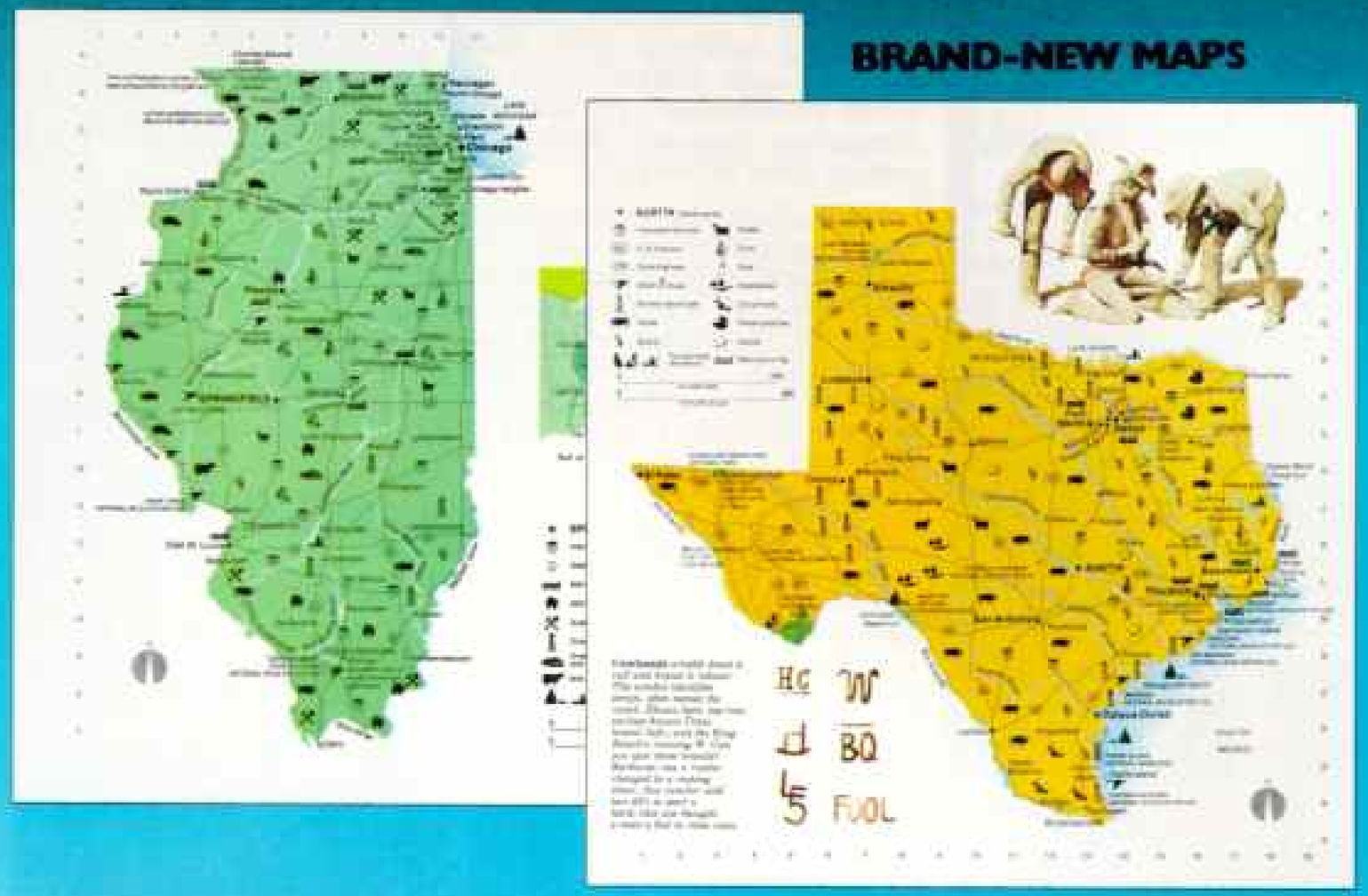
UNIQUE MAPS

HANDY REFERENCE TABLES



Children take an exciting close-up look at the U.S.A. In addition to **four fact-filled pages on every state,** kids explore the many different ways energy is used in the home... discover the wonders of agriculture...learn to read weather maps.

Other special sections provide timely insights into America's many faces...how our land is being used...where Americans live and work...and much more!



BRAND-NEW MAPS

...just what a child needs to explore our 50 states!

Savor in-depth sections on each state—packed with these vital features:

Informative, eye-catching photographs.

Concise, easy-to-read maps—showing just the right amount of detail for a child.

Special map colors and keys—to help youngsters quickly locate state capitals, major cities, principal highways, industry, waterways, agricultural products....

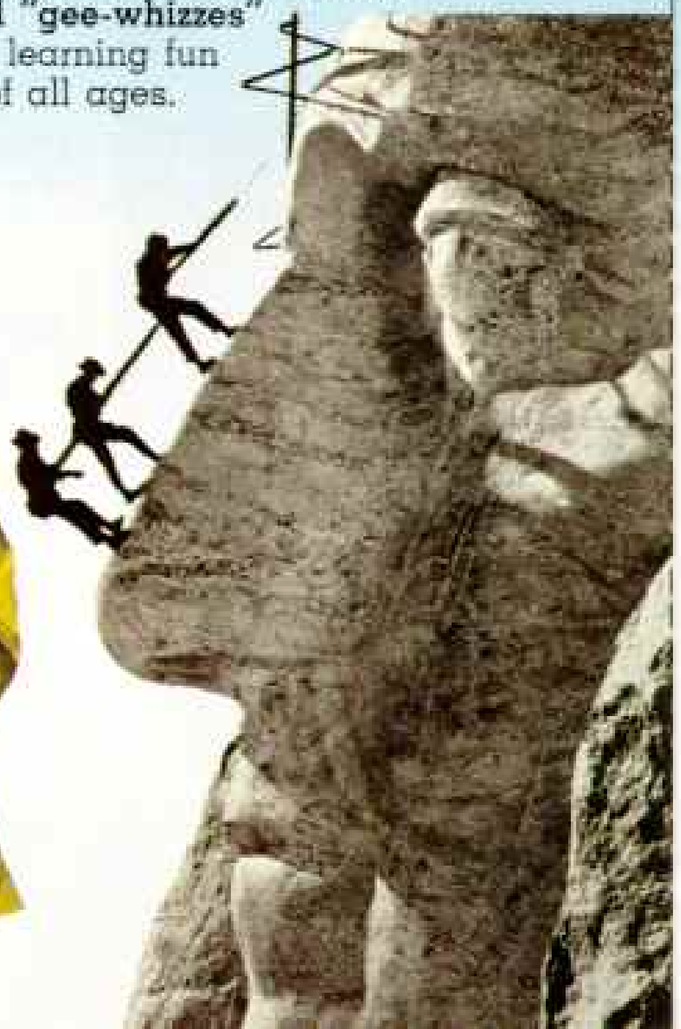
Absorbing stories about each state.

Useful state fact-boxes—answering hundreds of important questions.

State birds, flowers, and flags.

Special "gee-whizzes"—making learning fun for kids of all ages.

Did you know that you can stand in four states at once?



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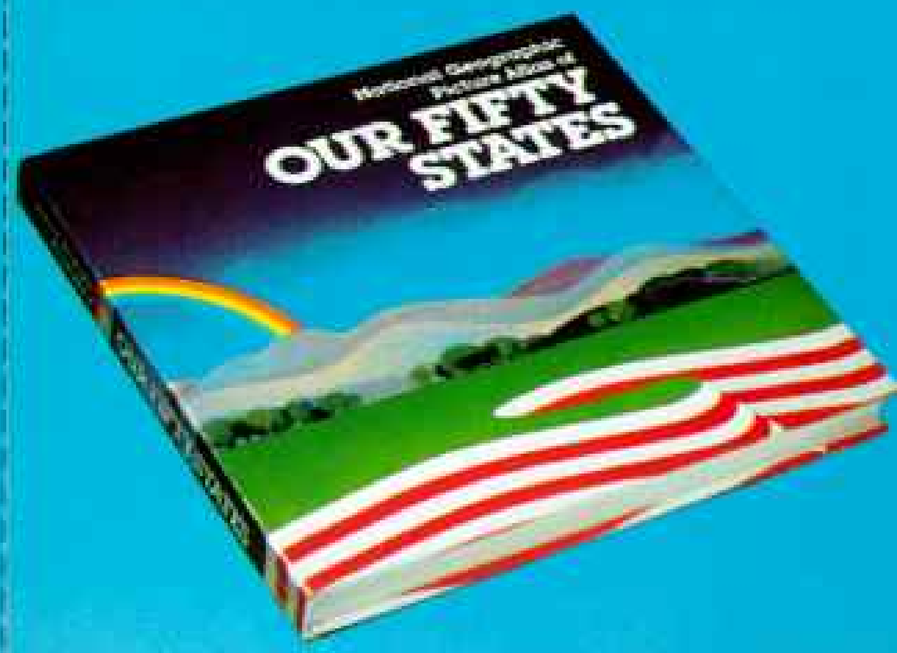

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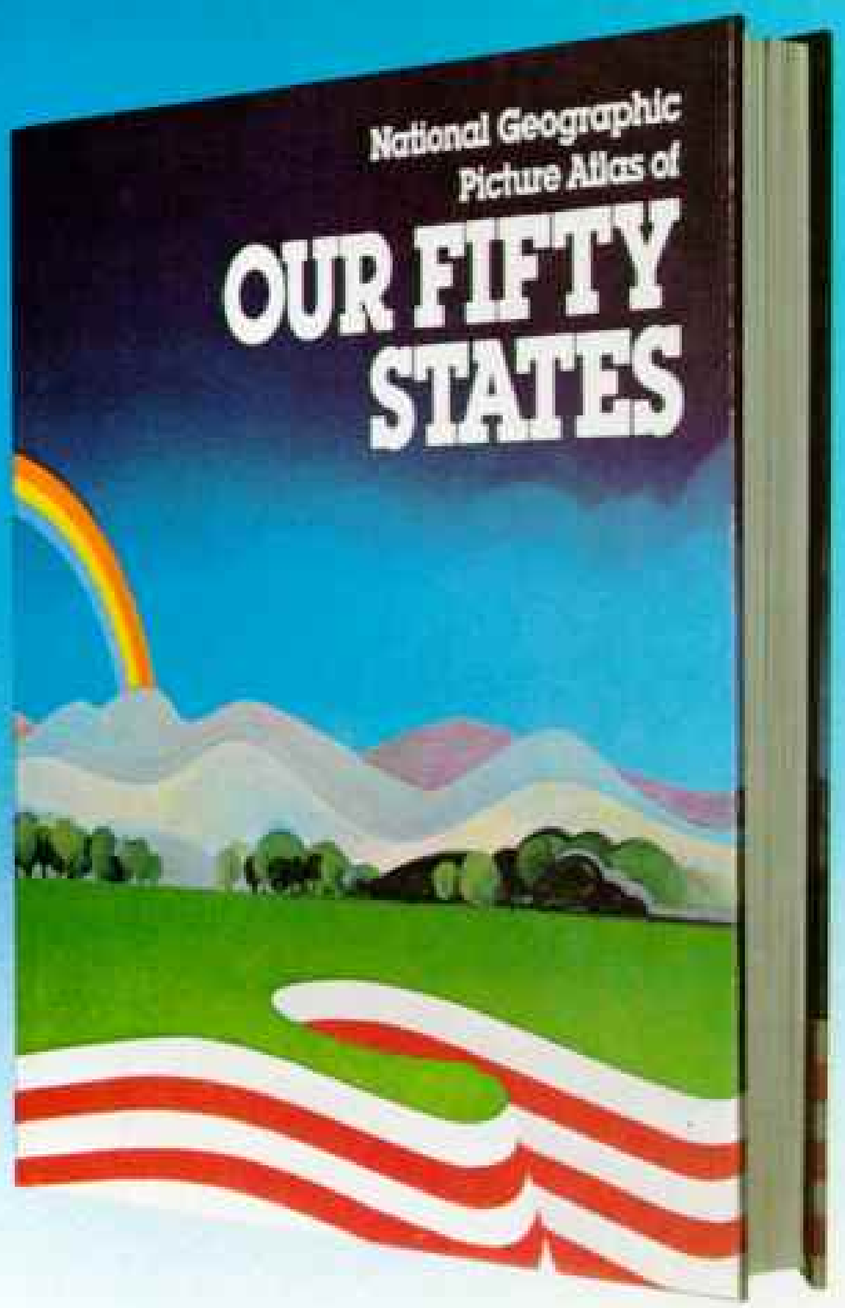

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NATIONAL GEOGRAPHIC, OCTOBER 1978

"Highway spending is highest in history!"

Some look at the dollars spent on roads: $31 billion in 1977. They say, "Enough!" Others look at the roads. Frost-heaved, pot-holed, in dangerous disrepair. They want action, now! Who's right?

Expenditures for road construction, upgrading, maintenance, repair, and traffic services are indeed massive. And they keep increasing. The outlay in 1965 was $14.3 billion. In 1977 more than twice that, a record $30.6 billion. No wonder some say, "We're spending quite enough on highways."

But others see needs outpacing expenditures by 50%. Traffic has doubled since '65. Two severe winters in a row have heaved, cracked and washed out our roads. Expenditures grow. But needs and inflation grow even faster. Today's road dollar buys only half what it did 10 years ago. No wonder others say, "We must spend more now or suffer later."

Roads are indispensable. They carry most of our goods and services. Our jobs depend on them. Our recreation, security. Money we "save" by letting roads deteriorate we lose on wasted fuel, vehicle damage, accident costs. Bad roads cost 60% more to drive on than good roads. And construction costs will surely increase in future years. The time to save is now, with a solid program aimed at enhancing America's valuable road asset.

Caterpillar machines are used to build and maintain roads. Our engines power trucks. We believe attention to roads is essential to America's well-being.

There are no simple solutions. Only intelligent choices.

CATERPILLAR

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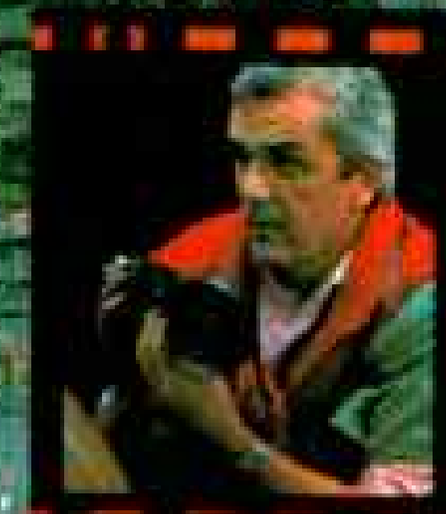
"Roads are in terrible shape."

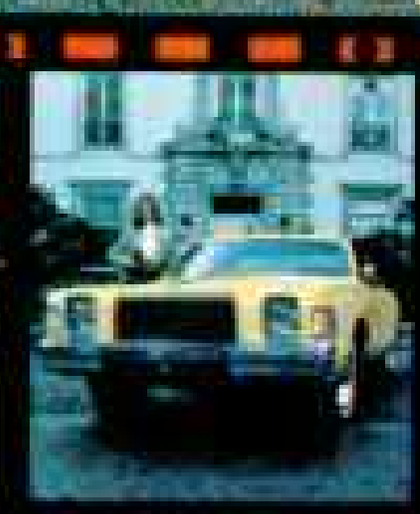
1978 Chrysler Cordoba

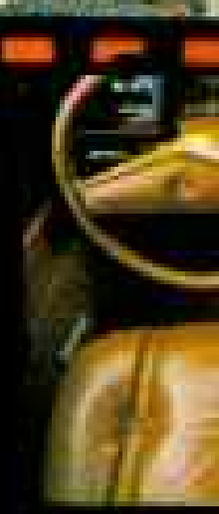
"The picture of style and taste."

Anthony Edgeworth, contributing photographer, Esquire Magazine

We asked New York fashion photographer, Anthony Edgeworth to show you a new Cordoba the way he sees it. *"To me . . . Cordoba is classic. Look at the proportions . . . the unbroken reflective surfaces . . . an absence of chrome. It has a strong look. I like that. I like the interior too. It's uncluttered. The car looks like it would fit a very special way of life. Cordoba? It's the picture of taste."*







That's the way one of the nation's leading photographers sees Cordoba. Now put yourself in the picture when you buy or lease a new Cordoba at your Chrysler-Plymouth dealer.

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