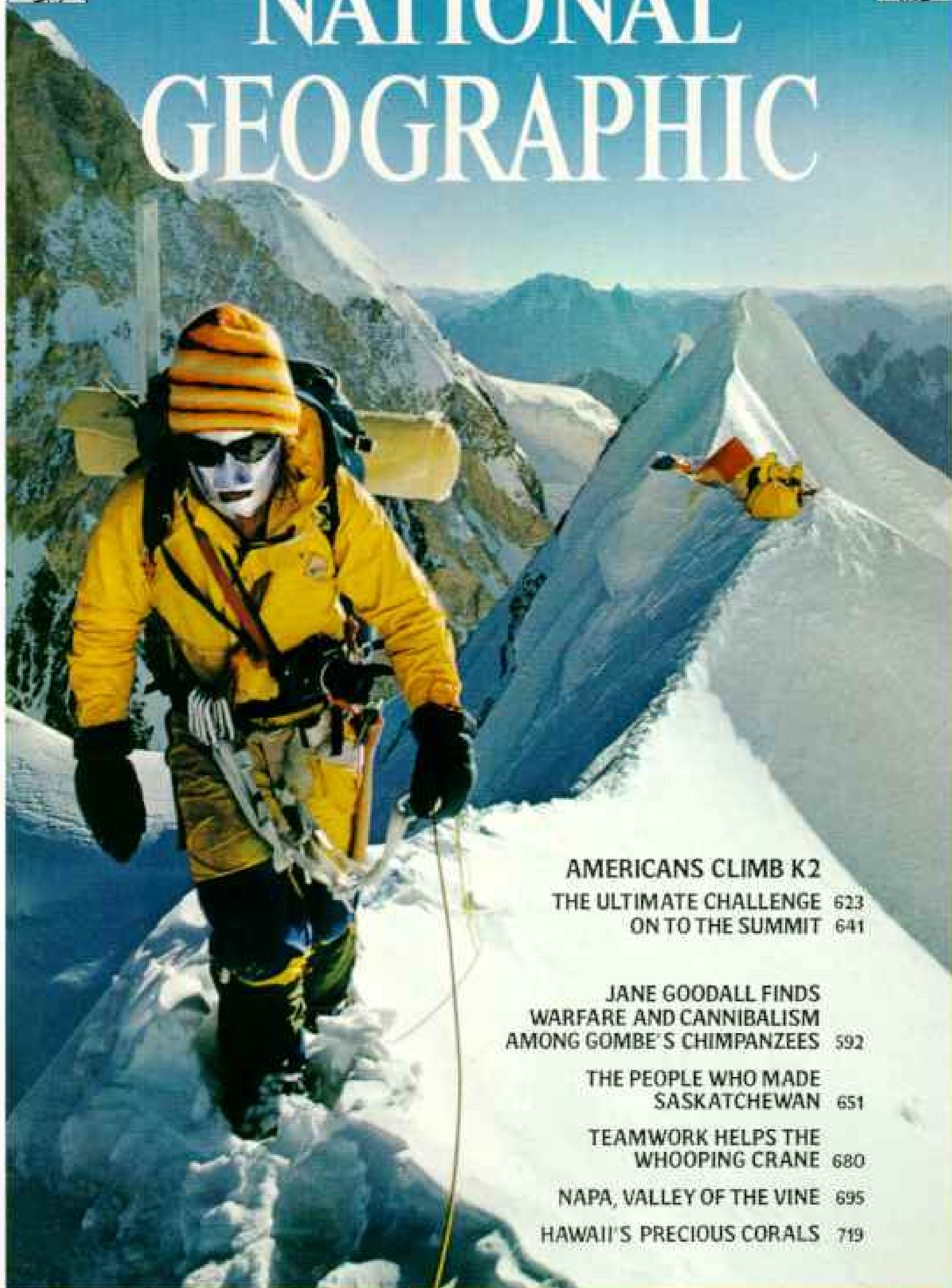


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NATIONAL GEOGRAPHIC

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May 1979

IT SEEMS LIKE YESTERDAY that a lithe young Englishwoman named Jane captured the world's imagination by going into the forests of East Africa and making friends with a group of wild chimpanzees. In magazine articles and a book published by the National Geographic Society, Dr. Jane Goodall described the life and times of her friends, and in the course of her observations recorded behavior that upset armchair naturalists—such as the first evidence of toolmaking by a primate believed to be incapable of the required reasoning.

Had Dr. Goodall's work stopped a decade ago, her contribution to the knowledge of primate behavior would have been lasting and substantial. Now it is even more so. Reflecting a dogged determination, the observations have continued, with the help of a staff trained by Dr. Goodall, and the history of chimpanzee families we first met at Gombe Stream Game Reserve 16 years ago has been played out through new generations.

The results, reported in this issue, are even more startling. And, alas, they center on contention, with warfare and killers on the loose. It is saddening to find that those inventive and social chimps of first discovery have apparently matured in a way that brings them even closer to the world of men, with its wars and territorial and clan struggles.

This new report from Gombe also points up the hard price at which greater knowledge comes. Those institutions like the National Geographic that support such research believe in expanding horizons of learning—and the unknown places where they might lead. Fostering pure research often demands a long-term commitment, but it pales in comparison to the dedication required by those in the field. It was difficult enough to begin at Gombe, but more difficult to continue. The observations were interrupted at one point by a guerrilla raid that resulted in the kidnapping of four of Dr. Goodall's student assistants. The irony is that a similar story of chimpanzee aggression was emerging from the reports of the observers in the field.

So there we have it—are men acting like beasts or beasts like men? The question hangs over all history, and the answer is not yet agreed upon.

Lilith Brown

Life and Death at Gombe 592

Primate specialist Jane Goodall, continuing her 20-year study of chimpanzees, makes incredible discoveries: Rival groups wage war, and some individuals kill and eat infants of their own kind.

Americans Climb K2

The world's second highest mountain, in Asia's remote Karakoram, proves to be "the ultimate challenge," reports James W. Whittaker, leader of the first successful U. S. expedition. 623

James Wickwire describes the final push to the summit and a harrowing bivouac on descent that tested human endurance. All photographs by members of the expedition. 641

The People Who Made Saskatchewan 651

Free land and a free life lured the venturesome of many tongues and faiths to Canada's plains. Ethel A. Starbird tells of the thriving province and zesty ethnic mix that resulted. Photographs by Craig Aurness.

Teaming Up to Help the Whooper 680

U. S. and Canadian biologists raise the stately whooping crane's chances of survival by putting its eggs into sandhill crane nests for hatching. By Roderick C. Drewien, with Ernie Kuyt.

Napa, Valley of the Vine 695

Vintages that compare favorably with Europe's finest support a major California industry, but urban sprawl nibbles away at the vineyards. Moira Johnston and photographer Charles O'Rear report.

Precious Corals, Hawaii's Deep-sea Jewels 719

Marine ecologist Richard W. Grigg describes his nine-year study aimed at ensuring the survival of these spectacular and valuable undersea gemstones. Photographs by David Doubilet.

COVER: *Like a tightrope walker, Rick Ridgeway inches his way up a jagged ridge on K2 (page 640). Mask helps thwart cold and solar radiation. Photograph by John Roskelley.*



Shadow of doom hangs over a mother chimpanzee as she cradles

Life and Death at Gombe

By JANE GOODALL



JANE GOODALL

her infant, later killed and eaten by group members here cying the two.

*Violence never seen before erupts among
Africa's chimpanzees in the continuing chronicle
of their behavior by a pioneer observer*

WAR AND KIDNAPPING, killing and cannibalism: How inappropriate—how jarring—those words seemed as I stood in a tree's shade looking out across the glinting waters of Lake Tanganyika.

Behind me, where the westering sun had turned the tall grass into a sea of gold, a large group of chimpanzees was feeding. The scene was utterly peaceful, as peaceful as it was on a day 17 years earlier when I had first set foot in what is today Tanzania's Gombe Stream National Park (map, page 600).

Yet now I had new knowledge—now I knew that there, among those dark mountains across the lake in Zaire, moved terrorist forces, armed men who had raided Gombe in the night and left haunting fear behind. And I knew that some of our chimpanzees, so gentle for the most part, could on occasion become savage killers, ruthless cannibals, and that they had their own form of primitive warfare.

Yes, I recalled all this. Even so, in the quiet of the tropic evening I could relax, back again in Gombe—back home. Many old chimp friends were there, familiar members of the community that has been the subject of scientific study, under my direction, since 1960 (pages 602-603).

Melissa and her 7-year-old daughter, Gremlin, were enjoying their last meal of the day, the yellow blossoms of the *msiloti* tree. Nearby sat my old friend Fifi. I had first known her as an infant: Now she was mother of two. Fifi's older son, Freud, was playing a wild game with his friend Prof, a 6-year-old like himself. As they sparred and grappled, I heard outbursts of chuckling chimpanzee laughter from Prof as the bigger, stronger Freud dug tickling fingers into his playmate's neck or groin.

Passion and Pom, Prof's mother and adolescent older sister, occupied the same tree. Five of the community's six adult males were in the group. Figan, top-ranking male, fed in another tree with Humphrey.

There was a sudden swishing of branches

behind me. Hooked around at a bristling figure, head and chest just topping the grass, eyes glaring. He swaggered there a moment, working himself up. Wham! With a sudden lunge he slammed my back with both hands and charged off, slapping and stamping the ground. Satisfied with his display of male superiority, he climbed a tree near Melissa and fed.

This was Goblin, Melissa's 12-year-old son, now on the brink of social maturity. In adolescent male chimpanzee style, he had bullied and blustered at the adult females until they had begun to defer to him.

When the chimps moved on into the forest, I followed close behind and watched as they made their tree nests for the night. There were 21 individuals all told, including the infants. Such a group is not stable: Soon, perhaps next day, the chimpanzees would be scattering in the small temporary groups of three to six that are most common in their society.

Why do my helpers and I continue to observe the chimpanzees at Gombe after nearly two decades? Partly because chimpanzees are fascinating creatures with advanced brains and complex behavior. Their life expectancy is probably between 40 and 50 years in the wild. The females give birth only once in five or six years (unless a baby dies, and then the mother usually conceives again within a few months). Also, there is such individual variation among them that a very long-term study is necessary if we are to understand their behavior.

Beyond all this, chimpanzees are more like humans than are any other living creatures. There is the hope that knowledge of their ways and habits may help us in understanding our own.

Physiological similarities, both biochemical and anatomical, between humans and chimpanzees are remarkable. The structure of the chimpanzee brain is amazingly close to our own. The chimpanzee life cycle is not very different from ours—five years of infancy, then

(Continued on page 598)

Clash of primates ends in a rout as a male baboon retreats from an aggressive female chimp named Pom. Though young of both species often play together, adult chimps sometimes kill and eat infant baboons. The author early discovered chimpanzees to be meat eaters, never dreaming they might devour members of their own species.

JANE GOODALL







Ranking male in his Gombe group, Figan (left) lolls in midday heat. Each sex has its own hierarchy, but the alpha male stands dominant over all. A lightweight at 88 pounds, the canny Figan ascended to alpha status by enlisting the support of his brother Faben in confrontations with then ranking Humphrey. With Faben nearby for the final power grab, Figan hurled himself (below) on his heavier opponent, and they tumbled from the tree nest. Humphrey retreated, conceding defeat. Top rank confers few privileges; one is partial immunity to attack.



JANE GODDALL (LEFT); DRAWING BY DAVID BYGOTT

a period of childhood, followed by adolescence from about 9 to 14 years. Old age sets in at about 35 years. As among humans, affectionate and supportive bonds between mothers and their children, and between siblings, may persist throughout life.

Chimpanzees use more objects as tools and for more purposes than any creatures except ourselves. They may show cooperation when hunting for food, and when a kill is made (usually a monkey, young bush-buck, or young bushpig), adults may share the prize with one another and with offspring. Friendly social gestures include holding hands, patting one another, embracing, and kissing. Those who have worked closely with chimpanzees agree that their emotions—pleasure, sadness, curiosity, alarm, rage—seem very similar to our own, though this is difficult to prove.

And so we carry on, aided by the National Geographic Society, which strongly supported our work in earlier years.* We recently celebrated another anniversary of my first landing on the shores of Gombe, with my mother, Vanne, back in 1960. On the pebbly beach of the lake all the staff of the research center, together with their families, gathered round a big fire. We spooned out huge helpings of rice and stewed goat from the great cooking pots. My husband, Derek, my son, Grub, and I sat on the beach and, like the others, ate with our fingers.

After the feast, as I listened to rhythmic native songs, I recalled that day when I first arrived in this place, strange in the beginning, often inhospitable. I conjured up my first three chimpanzee friends, David Greybeard, William, and Goliath—all three dead now, but vivid in memory. I thought back to 1964, when my first assistant had arrived to help record chimpanzee behavior. Many of the chimps had become accustomed to the presence of humans and, in order to make observation easier, we had started a banana feeding station.

Ten years later, at the 1974 anniversary, what a different Gombe it had become. About twenty students mingled with the Tanzanian field assistants around the fire. Mostly they were from the U. S., but some came from Europe and from the University of Dar es Salaam in Tanzania.

In my mind I contrasted the happy 1974

celebration with the one in 1975. I wish I could forget parts of the year that intervened. It was in 1975 that four of the students were kidnapped by a rebel group from Zaïre. They came across the lake, about 40 armed men in a little boat, at night. They took the hostages and chugged away into the darkness. Two agonizing months passed before the last of the four was finally released.

In 1975, therefore, it was a small and somewhat bewildered group of people that gathered around the fire. There were no students; it was no longer safe for non-Tanzanians to work at Gombe. The Tanzanian field assistants felt lost without the students to guide them: They had not yet realized how much they themselves were capable of contributing.

Yet that 1975 anniversary, somber though it was, marked the start of a new era for Gombe. During the awful time when the students were held hostage, the Tanzanian field assistants had struggled on, maintaining the daily records. Then, when the young people were safely back with their families, Derek and I had set to work to start a new research program at the old station. Gradually, as the seasons passed, the Tanzanian staff developed a new self-confidence and with it a new enthusiasm and reliability. Today Gombe is as flourishing a research center as ever it has been.

Concern for Humans Prompts Study

Recent years have brought an increased public awareness of the horrors of human aggressive behavior and a growing fear of what a terrible fate this aggression may bring to the world. This concern in human society has led to an upsurge of interest in the aggressive behavior of nonhuman animals.

Threatening gestures and calls are more frequent in animals (including man) than are actual physical fights. This is certainly true in chimpanzee society.

Of course, fights do break out. The most common causes are competition for status, defense of family members, and frustration that leads an individual who has been

*Dr. Goodall's research has also been supported by the William T. Grant Foundation, the L. S. B. Leakey Foundation, and private donors. The Jane Goodall Institute for Wildlife Research, Education and Conservation has been established in Tiburon, California.

thwarted by one stronger to turn and vent his aggression on a smaller or weaker bystander. Sometimes, not often, fights may break out between individuals competing for food, or between males competing for the same female. Males may attack females seemingly in order to drum into their victims, again and again, that theirs is a male-dominated society.

While fights between members of the same community may look ferocious, we have seldom observed them to last more than a minute. Only rarely do these conflicts result in serious wounds. Disturbingly, though, in the past few years we have found that fights between individuals of neighboring communities may be characterized by extreme brutality and may occasionally lead to deaths.

A chimpanzee community has a home range within which its members roam in nomadic fashion. At Gombe the home range of our main study community has fluctuated between five and eight square miles. The adult males, usually in groups of three or more, quite regularly patrol the boundaries, keeping close together, silent, and alert. Sometimes they climb a tall tree and stare out over the "hostile" territory of an adjacent community. As they travel, they may sniff the ground or pick up and smell leaves and twigs. They seem to be searching for clues to locate strangers.

If the patrol meets up with a group from another community, both sides, after exchanging threats, are likely to withdraw discreetly back into home ground. But if a single individual is encountered, or a mother and child, then the patrolling males usually chase and, if they can, attack the stranger. Ten very severe attacks on mothers or old females of neighboring communities have been recorded since 1970; twice the infants of the victims were killed; one other infant died from wounds. Curiously, young childless females may actually leave their natal community and, temporarily or permanently, join another.

For reasons yet undetermined, in 1970 our main study community began to divide. Seven males and three females with offspring established themselves in the southern (Kahama) part of the home range. During the next two years these individuals

returned to the north less and less frequently. By 1972 they had become a completely separate community.

For a time the situation seemed fairly peaceful. If groups of the northern (Kasakela) and southern communities met near their common boundary, the males would display, calling loudly, drumming on the trees, dragging branches as they charged back and forth. *(Continued on page 606)*



CURT BURSE

Simian social graces, deeply ingrained, come into play as Figan crosses paths with a chimp mother. Grunting submissively, she will approach and crouch before him. Other greetings run a humanlike range of handshaking, back-patting, and embracing. Mutual grooming for dirt and insects engages friends for hours.

Chimpanzee territorial conflict

Kasakela chimpanzees

Lake Tanganyika

Kahama chimpanzees



+800 m
2,625 ft

0 KILOMETER

0 STATUTE MILE

MAP BY JANE WILFE
CONCEPT BY BOB W. JENSEN
NATIONAL GEOGRAPHIC ART DIVISION

Daily dispatches from Gombe via two-way radio (lower left) keep Jane Goodall, at her home in Dar es Salaam, in touch with the drama of chimpanzee life. Her husband, Derek Bryceson, member of Tanzania's National Assembly and director of its National Parks Service, assists in translating the Swahili reports. Meticulous records kept on the Gombe chimps have revealed a complex range of behavior, including charging displays, sometimes triggered by a sudden downpour. Similarly excited by a waterfall, a male (right) assumes the upright stance and bristling hair characteristic of some displays. When angry, aroused, or frustrated, chimps also display by stamping, throwing things, and screaming.

Sovereign and safe in their tiny realm, chimpanzees freely roam the Gombe Stream National Park (left, and inset below), a swath of forested valleys and treeless ridges. Established in 1943, Gombe was the first sanctuary in Africa earmarked for these apes. Aided by the National Geographic Society, a research center directed by Dr. Goodall focuses on fifty individuals, about half of the park's chimpanzees.

Events in this troubled part of the world have posed hazards for Dr. Goodall and her staff. In 1975 a rebel group from Zaire crossed the border and kidnapped four of her students for ransom. Two months passed before the last one was released.



JANE WILFE (ABOVE) AND CURT BUSSE





ORIGINAL MOTHERS

1948

1950

1952

1954

1956

1958

1960

1962



FLO High ranking and a good mother until old age interfered with her ability to cope with son Fint. Died in 1972.



FABEN Flo's oldest-known offspring. Contracted polio in 1966 and lost use of arm. Helped brother Figan win top-rank position.



FIGAN Took over as alpha male in 1973. Intelligence and a high level of motivation helped achieve his elevation in rank.



FIFI An affectionate, good mother, much as her mother, Flo, had been. Relaxed in the presence of adult males.



MELISSA Has become very high ranking, is quite social, and travels with males. Mother of twins.

MELISSA born



OLLY Nervous temperament, possibly result of a goiter. Disappeared and presumed dead in 1968.



EVERED At first persecuted by Figan and Faben, he almost left community. Today, a clear number two to Figan.



GILKA Suffered in polio epidemic of 1966, then contracted fungus infection that left her with swollen nose and brow.



PASSION She is known to have eaten at least three babies.

PASSION born

Unstudied infants shown without eyes.

ILLUSTRATED BY DAVID BYRD
COMPILED BY BOB WILSON
NATIONAL GEOGRAPHIC ART DIVISION

My Life Among Wild Chimpanzees



New Discoveries Among Africa's Chimpanzees

By Jane Goodall

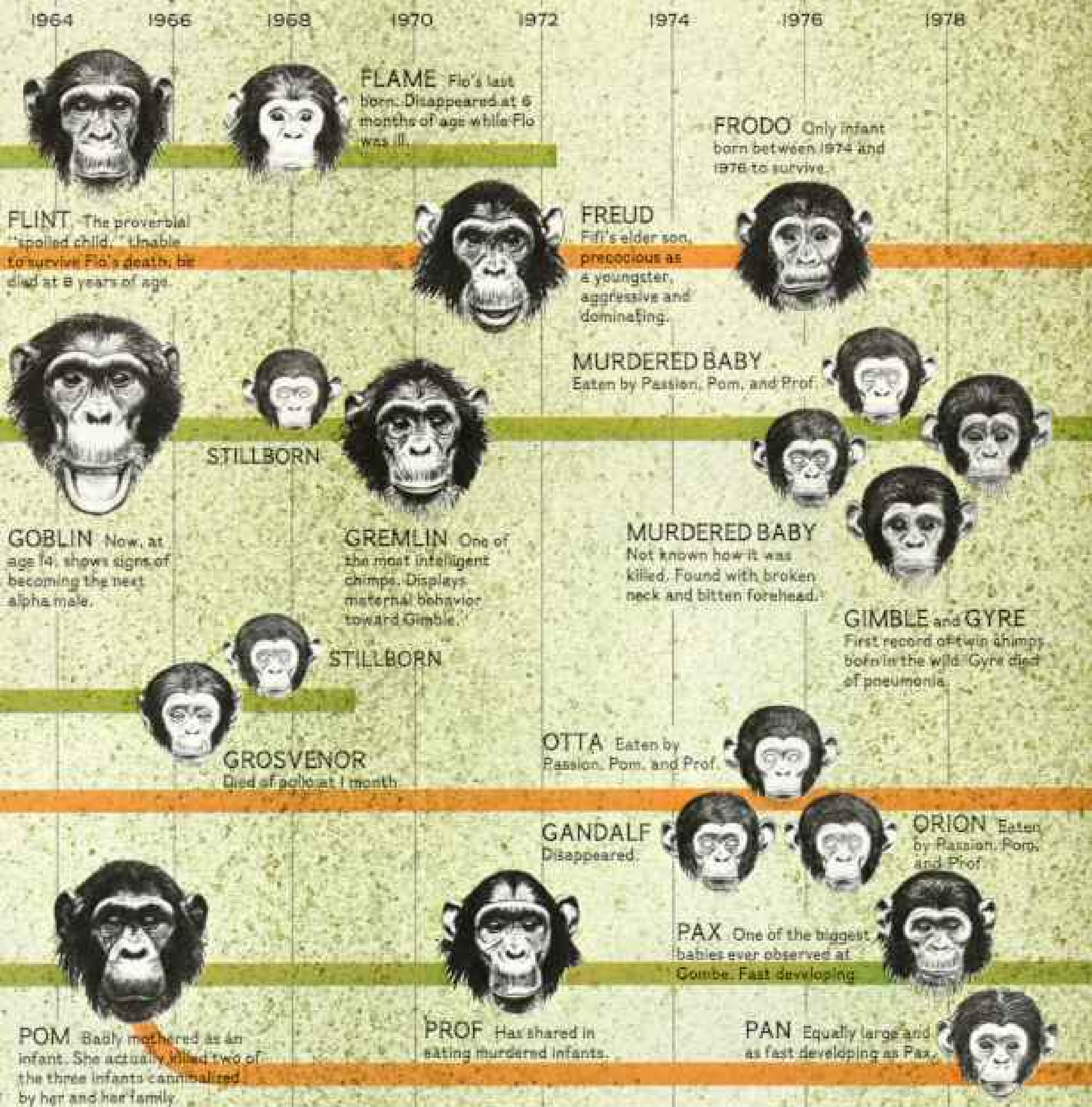
For the first time, a chimpanzee has been seen to use a stick to dig for termites. This discovery has led to a new understanding of chimpanzee behavior and intelligence.



The Wild Chimpanzees



Unfolding tale: The Geographic has published two articles and a book by the author.



Genealogy of four families

Character portraits of a colorful cast dramatize nearly twenty years of research that have made Jane Goodall a leading authority on man's closest primate relatives. The genealogy (above) charts four maternal lines at Gombe, where she began her work in 1960 at the urging of her mentor, anthropologist Louis S. B. Leakey. Frustration weighted her early efforts: Wary chimps fled at the sight of her; malaria and an oppressive climate sapped her strength; lack of funds forced her to work virtually alone. But remarkable revelations followed—discoveries of chimpanzee toolmaking and meat eating, fluctuating hierarchies, and, now, observations of violence.

Spanning three generations, ragged-eared Flo (below, from left), grandson Freud, daughter Fifi, and youngest son, Flint, form a quartet laced together by the strong family ties common to chimps. After reaching sexual maturity at the age of 9 or 10, females begin a life of promiscuity, often mating indiscriminately with several males from their group.

Females usually give birth once every five or six years, well after the last born has been weaned. But should a baby die, the mother might conceive again within a few

months. After birth the practically helpless infant clings to its mother's long hair, accompanying her everywhere. Youngsters usually become more independent from the age of 3 and no longer sleep in their mothers' nests. Born when Flo was in her 40's, Flint (right, facing camera) was an exception, forcing himself into his mother's nest even after the birth of his sister, Flame, four years later. Flo tried to stop him, but like a human child he threw tantrums. Too old to cope, she finally gave in—an action that had grave consequences. . . .





FAT MCGINNES



BARON HOGG VAN LAWICK (LEFT); ANNE FUNKE

Weary with age, Flo (above) died. Flint, then 8 years old, seemed to lose the will to live, and was unresponsive to his sister Fifi's attentions (below). Three weeks after Flo's death, Flint returned to the spot where she had breathed her last. And he, too, lay down and died.



WITTE THORNBOM

(Continued from page 599) These displays served to persuade members of the neighboring groups to turn back into their respective home ranges.

Then, early in 1974, a gang of five chimpanzees from the Kasakela community caught a single male of the Kahama group. They hit, kicked, and bit him for twenty minutes and left him bleeding from innumerable wounds. Field assistants later searched for days for the victim, but he was never seen again.

A month later another prime Kahama male was caught by three from Kasakela and severely beaten up. A few weeks later he was found, terribly emaciated and with a deep unhealed gash in his thigh. That was the last time *he* was ever seen.

Violence Claims Author's Favorite

It distressed me deeply that the third victim in this outbreak of murderous violence was my old friend Goliath, who had been one of those to move south. At the time of the attack he was very old, his head almost bald, his body shrunken with age. The five males who set upon him beat him so severely that afterward he could not even sit up (pages 610-11). The following day all the students and field assistants searched for Goliath to see if he might be helped. But he, too, was never found.

The next to be killed was an old female, Madam Bee. The four males who caught her continued their attack until she was inert. Somehow she managed to crawl into thick undergrowth, where she hid so effectively that the field assistants didn't find her for three days. Her whereabouts was given away by her 10-year-old daughter, Honey Bee, who was keeping her mother company.

Hilali and Eslom of the Gombe staff took bananas and offered water, trying to give the old female some comfort. Honey Bee stayed with her mother until the end, grooming her and shooing the flies away from the many festering wounds. But Madam Bee died five days after the attack.

Nearly two years passed with no further violence observed between the two communities. Then, early in 1977, the aggressors claimed Charlie as another victim. After the fight his body was found, scored by wounds, lying in a stream. By then it was almost



An extraordinary stride for a chimpanzee, Faben's walk is actually an adaptation to an attack of polio that left his right arm



CURT BUSSE

atrophied, precluding quadrupedal locomotion. Chimpanzees walk upright for a few yards when their arms are full of fruit or when peering over long grass, but Faben can maintain this stride for about thirty yards at a stretch.

certain that only one of the southern males, Sniff, still survived. (Two males had died earlier, apparently of natural causes.) At the end of the year he, too, was finally caught. Five northern males pounded on him and left him with a broken leg and bleeding from countless wounds. He, too, managed to hide, but could not have survived.

It seems that we have been observing a phenomenon rarely recorded in field studies—the gradual extermination of one group

of animals by another, stronger, group.

Why these brutal attacks? The northern males were not defending their own territory, since all the attacks except one were deep within the southern community home range. On the other hand, the aggressor males, before the community split, had access to the area that the southern community took over. If they were merely trying to reclaim territory they had lost, then they have certainly succeeded. Not only Kasakela



adult males, but also females and youngsters, now travel, feed, and sleep freely throughout the southern area.

Chimpanzees are creatures of extremes: aggressive one moment, peaceful the next. Two days after the attack on Sniff, I watched Frodo, 1½ years old, totter out to greet Jomeo, perhaps most vicious of all in the intercommunity fights. Frodo looked up at the huge male, and Jomeo gathered the infant into his lap and began to groom him.



A month later I watched as young Freud started a play session with his powerful uncle, Figan. Soon Figan was pacing round and round a bush, Freud grabbing at his legs. Once each time around, Figan, laughing, turned a complete somersault. Then little Frodo joined in. Their mother, Fifi, relaxed as always, lay sprawled on the ground and watched.

In the wild the young female chimpanzee learns about babies by watching mothers and, when allowed, by carrying infants, playing with them, and grooming them. We have never known a totally inefficient mother at Gombe.

Occasionally, however, we see what happens when a mother does fail her child. It happened with Flo and Flint. In 1964, when her daughter, Fifi, was about 6 years old, Flo gave birth to Flint. Flo was an excellent mother, affectionate, tolerant, and playful—and also a high-ranking and aggressive female (pages 604-605).

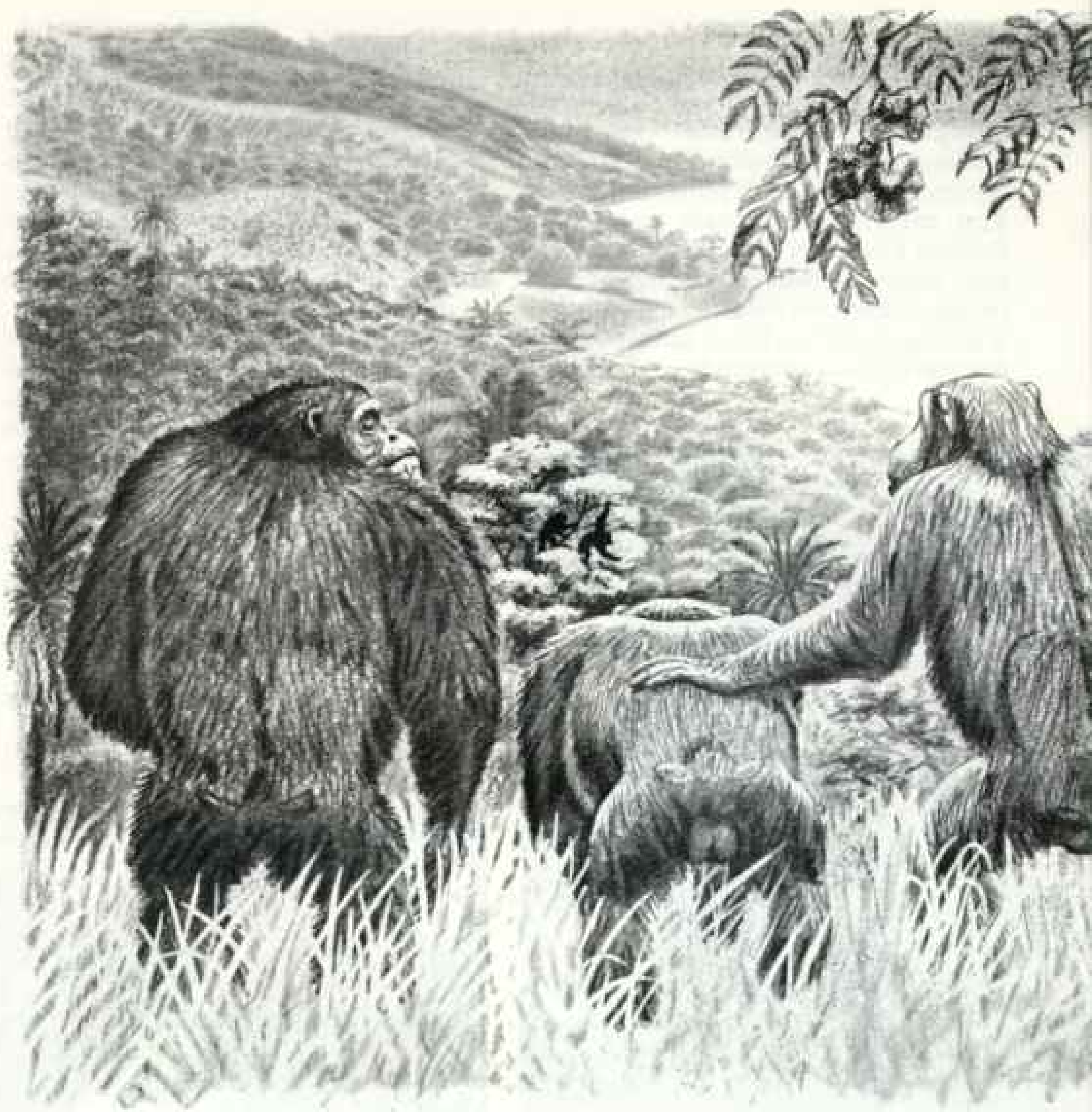
When Flint (Continued on page 614)

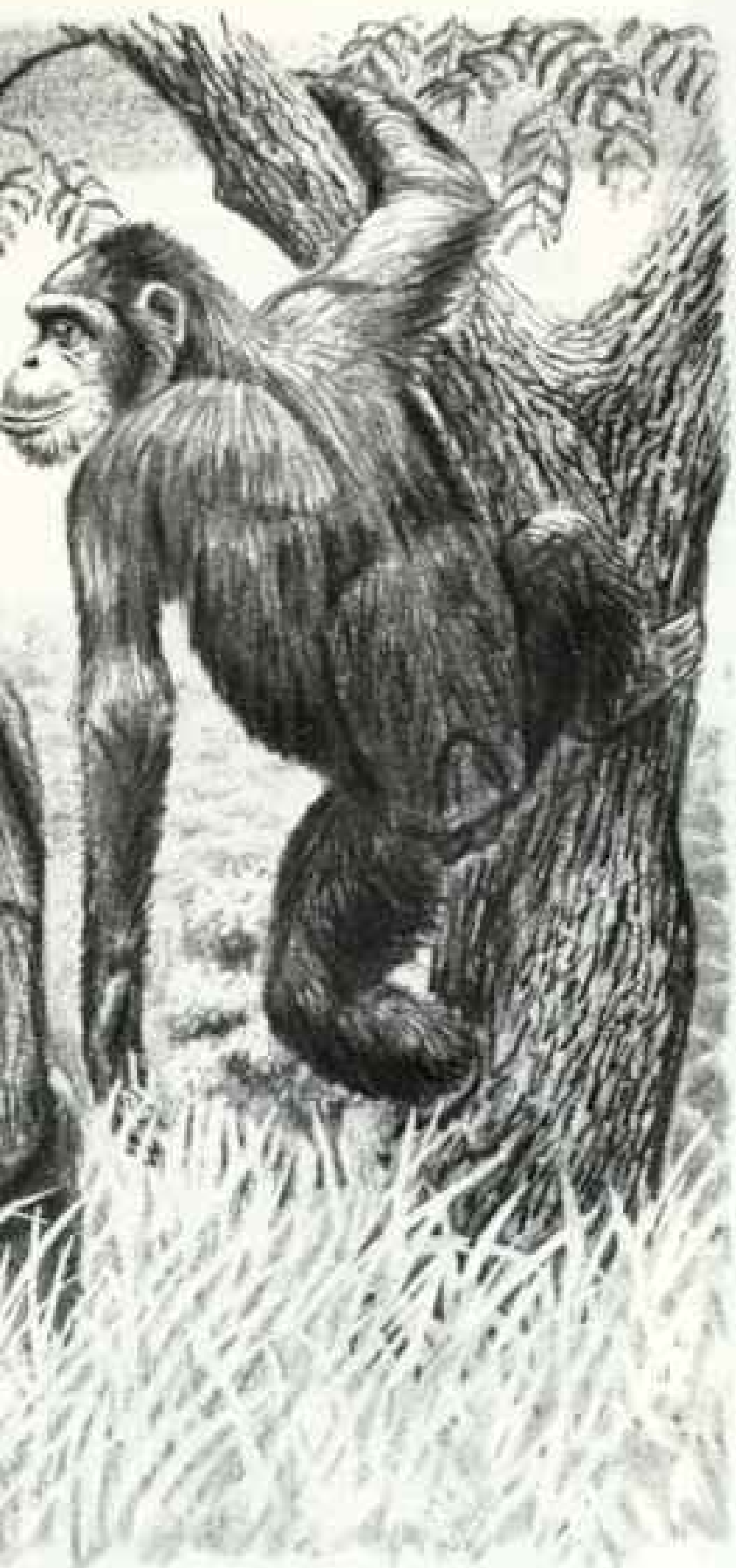


JANE GOODALL (LEFT); BEREN BRUNSON

Bouncing baby chimp, 3-month-old Frodo nestles in the arms of his doting mother, Fifi (left). Mother's love alone sees youngsters through their vulnerable infancy; their fathers play little or no part in parenthood.

Frodo's older brother, Freud (above), tugs playfully at the author's hair—a kind of contact she discourages, since it could be dangerous if carried to adulthood. Grown chimps may weigh 150 pounds and have three times the strength of the average man.





Warmongering apes mobilize on the southern border of their range in the Kasakela region of Gombe Park (left). The object of their hostility is a small number of chimpanzees who broke away from the Kasakela group to establish a separate territory in the park's Kahama region. The warfare began in 1974, and an early victim was Goliath. Once broad-shouldered and splendid in size—but by then wasted with age—he was pummeled and bitten for 20 minutes by five males (left, below) and abandoned to die.

Madam Bee was next. After a merciless beating by four males, she languished near death for five days, while her daughter Honey Bee kept vigil at her side, occasionally brushing flies from her mother's festering wounds (below). At the end Honey Bee put her ear near her mother's chest, as if listening. But there was no heartbeat.

By 1977 all adult males of the Kahama community had been killed or had disappeared, the first known extermination of one chimp community by another. The author speculates that the brutality may have been motivated by the Kasakela chimps' desire to reclaim territory for their nomadic wanderings. Whatever the reason, the events point up dramatically an aspect of chimpanzee behavior that she finds disturbingly similar to the darker side of human nature.



DRAWINGS BY DAVID BYBOTT



A strange, mad look glazes the eyes of Passion (left), who as a new mother was callous and indifferent to her daughter, Pom (lower left). Passion's unusual behavior took a grotesque turn when she killed an infant chimp in 1975 and shared the grisly feast with her offspring (below).

Passion and her children, Pom and Prof, "behaved as if the



DEREK BRYCESON (TOP); JAKE GOODALL (ABOVE); TSOLO DO FISOO



baby were normal prey," Dr. Goodall relates. "They were quite calm. There was begging and sharing of the meat. They fed until they couldn't eat any more, then abandoned the remains." The author was further horrified when Pom, apparently taught and helped by her mother, later killed two babies. Passion and Pom may also be responsible for the

disappearance of other infants.

In 1978, when Pom had a baby of her own, she hid from her mother for two weeks. "I think she was afraid her mother would eat her baby," says the author. Some anthropologists believe that Passion and Pom's behavior is aberrant. Refusing to speculate, the author says, "It will take many more years of study to determine the cause."



(Continued from page 509) was about 4, Flo suddenly began to show her years. (We estimated that she was in her early 40's.) Flint, living amid a large supportive family, had become like a spoiled human child. When Flo, in an effort to wean him, tried to prevent him from suckling or riding on her back, he would throw violent tantrums. He would even hit and bite his mother, behavior rare in youngsters. Flo, often seeming to lack the energy to cope with Flint's aggression, would give in.

In 1968 Flo gave birth to a female infant. Her problems with Flint increased. Youngsters normally become quite independent after the birth of a sibling, but Flint persisted in riding on Flo's back, despite the new baby clinging below, and he insisted on pushing into the family nest at night.

When the baby was 6 months old, Flo became very ill. Worried because she had not been seen for a few days, we searched and found her lying on the ground, unable even to climb a tree. The baby had disappeared. Flo recovered, and it seemed she was then prepared to accept Flint's infantile behavior. In some ways he seemed to fill the place of her lost baby.

Four years later Flo died. Flint, 8, was still sleeping with her at night. He had only stopped riding on her when she was unable to support his weight. Flint immediately became lethargic and depressed. He scarcely ate, and seldom interacted with another chimpanzee. In this state he fell sick.

Fifi showed concern for her younger brother, grooming him and waiting for him to follow her. But she had her own infant to look after, and Flint failed to respond. It seemed that he had no will to survive without his mother. Three weeks after Flo's death, Flint himself died.

Mother Maintains Constant Vigil

Fifi's effort was an example of why she has always been a special chimp for me. Now she is an excellent mother, affectionate, tolerant, and playful as Flo had been. Sometimes as her two sons, Frodo and Freud, romp with a potentially dangerous baboon, it seems that she is overly permissive. Yet she is watching constantly; if danger threatens, she retrieves Frodo swiftly.

Today Frodo watches everything Freud

does and often tries to imitate him. Owing to constant association with a 7-year-old brother and his mother's permissive yet protective nature, Frodo at 2½, is the most precocious infant I've ever known at Gombe. In about twenty years one of these two brothers probably will become the alpha, or top-ranking, male of the community. The support of a brother may be very significant in attaining this seemingly highly desired position.

Goliath was the first alpha male that I knew. He lost his dominance in 1964 to Mike. A small male, Mike embellished his charging displays by banging empty kerosene cans and so intimidated the other males with the racket that in just a few months he bluffed his way to the top. We never saw him actually fight any of the other males, not even Goliath.

Mike reigned for six years, then was



Disfigured by disease, Gilka today (right) bears little resemblance to the silky, long-haired youngster that peered from the

overthrown by Humphrey. Exceptionally aggressive, Humphrey showed none of Mike's ingenuity—nor did he need to. He simply charged at Mike one day and attacked him. It was an easy victory, for by then Mike was beginning to age.

Humphrey's reign, however, was short-lived. After two years the coveted top position was claimed by Figan (pages 596-7). Figan, like Mike, has small stature but plenty of intelligence. Instead of trying to tackle the heavier Humphrey on his own, Figan made use of his supportive relationship with his brother Faben.

When Figan challenged Humphrey, Faben almost always joined him, and the two brothers displayed in unison. Figan avoided confrontation with Humphrey when Faben was not around.

Humphrey became more intimidated each day, and eventually Figan grew bold

enough to attack. It happened late one evening. Figan, displaying back and forth in a tree, worked himself up to a frenzy, then hurtled down on Humphrey, who was already in his leafy nest. Together they crashed to the ground. Humphrey escaped and ran off, screaming. Figan, at the age of about 21, took over top status and still maintains it today, seven years later.

Quite clearly, many of the male chimpanzees expend a lot of energy and run risks of serious injury in pursuit of high status. To what end? In some primate societies the advantages of alpha status are reasonably clear-cut. The top-ranking male baboon, for instance, will sire a high percentage of the infants in his troop. True, the alpha male chimpanzee can often inhibit other males from mating with a particular female in his group. But if his attention is distracted, the other males will take immediate advantage.



BARON (MUSE VAN LAWICK (LEFT) AND JANE GOODALL)

pages of the author's 1965 article (left, at left). A fungus infection that spread across her face left her nose and brow permanently swollen and her breathing and sight impaired. Potassium iodine-laced bananas cured the infection.

Double duty for Melissa but a singular event for Gombe marked the arrival of Gyre and Gimble, first birth of twin chimpanzees ever observed in the wild (facing page). A handsome male, Satan (below), here with hair erect and braced for a charging display, was the probable father. Because Melissa was unable to provide sufficient milk for the twins, both suffered from malnutrition. Weak and highly susceptible to infection, Gyre died at 10 months, probably of pneumonia.



BOTH BY JANE GOODALL

Moreover, almost any adult male chimp can persuade a female to accompany him, away from the other males, on a consortship. If he is successful, she will not be available to the alpha male at the time she is likely to conceive.

The top-ranking chimpanzee can claim right of access to choice foods most of the time. Yet when there is a shortage of food, in the dry season, the chimpanzees break up into small foraging groups: In each such group one individual will rank highest and take the best food site—the alpha male will have no special advantage except in his own mini-group. Perhaps to acquire a position exempt from attack by fellow chimps (who

almost always show him deference) is reward enough.

Often, after supper, our assistants come to tell us what they have seen during the day. We sit companionably on the soft sand outside the house, with the lake waves lapping or sometimes slamming onto the shingle, and listen to the recounting in soft Swahili of the activities of the chimpanzees. We discuss the possible meanings of some of the stranger events, or the results of a particular program of analysis.

Killing, Cannibalism: Crimes of Passion

When we are back home in Dar es Salaam, the news from Gombe comes to us daily by radio.

One morning—it was in August 1975—we heard that Gilka had given birth to an infant. I was delighted, for her first baby had mysteriously disappeared when just under a month old. Three weeks later the news about Gilka was tragic and horrifying. As we listened to the distorted voice, speaking to us from 700 miles away, we couldn't believe what we were hearing: "Passion has killed and eaten Gilka's baby."

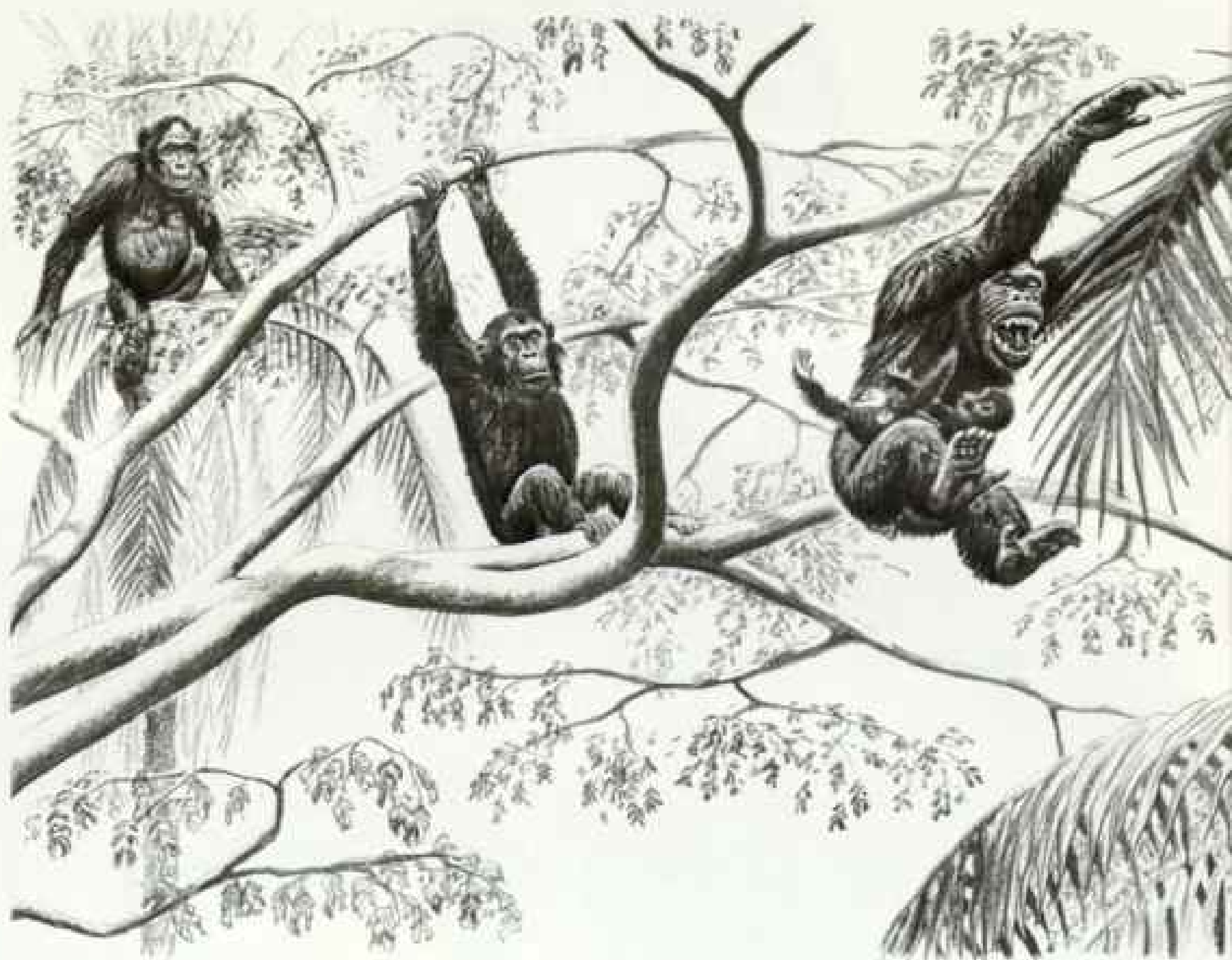
We got the full story on arrival at Gombe. Gilka had been sitting with her infant when suddenly Passion, another mother, had appeared and charged her. Gilka had fled, screaming, but Passion, chasing and attacking her, had seized and killed the baby. Passion had then begun to eat the flesh, sharing her gruesome meal with her own two offspring—adolescent daughter, Pom, and infant son, Prof (pages 612-13).

The following year Gilka gave birth for a third time. To our utter dismay, this baby met the same fate. The circumstances were more dreadful, for it seemed that Pom had learned from her mother: This time it was the daughter who seized and killed the infant. Again the family shared the flesh.

A month later Melissa's tiny new baby was killed, again by Pom, after a fierce fight between the two mothers.

I began to feel desperate. We knew for certain that three babies had been killed. Still others had vanished—like Gilka's first-born. We began to suspect that Passion and Pom were responsible for all these deaths. It came to me suddenly that in three years—1974 to 1976—only a single infant in the





Leap born of desperation foils an attack by Pom and saves Melissa's twins from almost certain death (above). Pom's pregnant mother, Passion, left, does not join in this time. Reaching Satan, Melissa and her twins found safety; his mere presence

thwarted further, perhaps murderous, attack. Pom's aggression seemed boundless. At the salt lick at Gombe camp she flails a palm frond and tries to intimidate Melissa (below), as Gremlin hoots in support of her threatened mother.

DEBRA BRUCESON (BELOW), DRAWING BY DAVID BYCOTT





Kasakela community had lived more than one month, Fifi's son Frodo.

What was the reaction of other chimpanzees in the community to Passion's behavior? We don't know how many, other than the victims, were aware of what was happening. No other chimps were nearby during the three killings that were seen. We did find, however, that the adult males, when they were around, would defend a mother and new baby.

How long had Passion been killing babies? How much longer would she and her family persist in this horrible behavior?

One day in July 1977 I followed Passion and her family as they left camp. Pom and Prof, who had moved ahead, presently climbed into a low palm tree. Passion sat below, looking up. Suddenly I realized that there was a third chimpanzee in the tree: a young female, Little Bee. Pom was very close to her, staring intently at something in her lap—a tiny newborn baby.

Cautiously Pom reached a hand toward the infant, then glanced down at Passion. I could see what was going to happen. So apparently could Little Bee, who had already lost one, probably two, infants. Uttering squeaks of fear, she began to edge away toward a tall tree close by.

I looked again at the baby, almost hidden in its mother's embrace, and picked up a big stick. Feeling totally inadequate, I reached up and tapped Pom's arm with my stick. She pushed it away in an irritated manner, scarcely giving me a glance. At that instant Little Bee leaped into the next tree, Pom and Prof close behind. Passion was already racing up the trunk. Helplessly I shouted and threw things, but the second tree was tall, and already screaming and fighting had erupted high above.

I do believe, though, that the commotion I made added to the general confusion and helped Little Bee escape. Passion and Pom searched for a full hour before moving on, but they did not find her.

We decided to have Passion and her family followed every day for several weeks. Melissa was again in advanced pregnancy. Perhaps our field assistants could help if Passion made another murderous attack after Melissa's baby arrived.

Two months later Passion was still being followed. Melissa simply got bigger and bigger. Then, in October, we received another astounding message: Melissa had finally given birth—to twins!

Double Trouble for Melissa

Two weeks later Derek and I got our first glimpse of the new arrivals (page 617). Melissa cradled them close, shielding them with her arms and legs. By evening, after Melissa had made her nest for the night, I had realized the immensity of her task. Most new infants can cling to the mother's chest and belly without help for long periods of time. The twins gripped well enough, but they kept clinging to each other. One would pull the other loose from Melissa's hair and, uttering loud cries of distress, both would start to fall. Melissa had to give them almost continuous support.

I spent several days with Melissa. Despite her burden, she managed to keep up with one or another of the adult males, who

would protect her. Most frequently she traveled with Satan, who probably is the father of the twins, for he and Melissa had been away from the group together at the likely time of conception.

Once, as I watched, Pom and Passion joined Melissa's group. Stealthily Pom approached Melissa, high in a palm tree. Melissa uttered loud, urgent screams. Fortunately Satan was nearby. Melissa made a terrific leap to the next tree—it looked most dangerous for the twins—and sat close to Satan, her hand on his back for reassurance. Pom followed halfway, then stopped, foiled (preceding pages).

That time Passion did not join Pom. Perhaps she knew that Satan would have interceded. She was probably hesitant, too, because she herself was pregnant and had become lethargic. It was this that probably saved the twins. Sometimes the two families met when no adult male was nearby, but Pom, not yet fully grown, could not tackle Melissa on her own.

When I visited Gombe early last year, the twins, Gyre and Gimble as we named them, were 4 months old, inevitably tiny and backward, but alert and healthy. Passion had borne her infant too. Hoping his birth would bring to an end his mother's horrible behavior, we called him Pax. He was the largest infant I'd ever seen—at 1½ months already bigger than either twin. Some of the field assistants attributed his size to the bones and blood of murdered infants!

The day before we left, I followed Melissa as she traveled with her family across a lush valley. When her mother stopped to rest, daughter Gremlin groomed her and, cautiously, touched one of the twins. If only Gremlin would become fascinated with the babies, and if Melissa would tolerate this, Gremlin could be very helpful in raising Gyre and Gimble.

All at once Melissa got up and ran through a tangle of vines. Wriggling after her, I was just in time to see her greeting Passion. Both

mothers, voicing small tense screams, rose upright to embrace. Pom stood watching but did not approach. The two families then went their separate ways.

I felt reassured; the worst seemed to be over. Passion was occupied with her own infant. Pom herself would conceive during 1978—a son, Pan. It now seemed that Melissa had little to fear from that family. Still, she would have a hard time in the dry season, for then, when food is often scarce, the twins would be bigger and need more nourishment. But we would try to help.

Study Will Chart Chimps' Progress

This year and next, which will close the second decade of research at Gombe, we shall be following the progress of Fifi and her two sons, of Passion and her family, and of Melissa and her sons, Goblin and Gimble. Sadly, Gyre died last August, apparently of pneumonia. But in all three families we shall have a record of the development of the relationship between brothers from the very beginning—something we've not documented before. We shall watch Freud and Gremlin as they enter adolescence. Probably a new alpha male will rise to power.

The late Dr. Louis S. B. Leakey predicted, when I set off to Gombe in 1960, that I was starting a study that would take ten years; I was young, and that seemed a lifetime. Now I realize that the first ten years were just a beginning. Certainly our picture of chimpanzee behavior would be very different if the work had ended in 1970. We had no notion then that chimpanzees might, deliberately and systematically, kill one another.

It is sobering that our new awareness of chimpanzee violence compels us to acknowledge that these ape cousins of ours are even *more* similar to humans than we thought before.

What new and startling developments, I wonder, will the third decade of our study disclose? □

Suspended for an instant in the twilight world of the jungle, an adult male maneuvers through trees. A more profound twilight shadows the future of chimpanzees as civilization diminishes their habitat. But man has much to learn from these great apes. "There is a great deal in chimpanzee relationships to remind us of our own behavior," says the author. "More, perhaps, than many of us would care to admit." ORON PALMER







Americans Climb K2

Second to Mount Everest in height, but not in treachery, “the Savage Mountain” had been scaled but twice. Four decades had seen five U.S. expeditions fail. In 1978 Jim Whittaker returned to lead a team determined to reach the top.

PHOTOGRAPHS BY
MEMBERS OF THE EXPEDITION

Portaging supplies ever higher, Rick Ridgeway leaves Camp III on K2's Northeast Ridge. Icy wall poses no imminent threat to the tents beyond. JOHN HUSSELL

AMERICANS CLIMB K2

The Ultimate Challenge

By JAMES W. WHITTAKER

AN HOUR BEFORE MIDNIGHT the snow began to fall—beautiful, silent, heartbreaking. Huddled in the relative warmth of the tent, I knew our last hope was fading.

We were two in the tent, my wife, Dianne, and I, perched on a ridge 22,300 feet high on the world's second tallest mountain, the peak known as K2 in Pakistan's Karakoram Range. On the slopes far above us four teammates lay camped beneath the summit, poised for the final assault. A snowstorm now would cost them the victory and possibly even their lives.

Weather, more than the mountain, had been our problem from the start. During the two months since we had established Base Camp at the foot of K2, violent summer storms had swept the mountain, immobilizing us about half the time and setting us far behind schedule.

Now, on September 5, 1978, we faced a last-chance situation. Food, fuel, and—above all—human endurance had reached dangerously low levels. Only clear weather could open the way to the summit.

As the snow continued to fall, Dianne and I dozed inside the tent, occasionally waking to peer grimly out at the weather. Sometime in the early morning she opened the tent flap for a routine check, then turned to me.

"Jim," she said quietly. "There are stars."

In a third of a century of climbing mountains, including that mightiest of all, Everest, I recall few moments so vividly.

Dianne's discovery of a change in the weather meant not only the revival of hope but also an agonizing choice: whether to risk everything on a slender chance, or to wait for better odds that might never come.

The decision belonged not to me as expedition leader but to our teammates high up near the summit. If they chose to risk it, they would start long before daylight. Even with the summit in plain view of our camp, we would not know until midmorning.

Sunrise took an eternity. At length the first rays touched the peak above us, and the mountain began to emerge in a great wash of light. After a time Dianne trained her camera with a telephoto lens on the summit. Slowly she panned along the southeastern ridge, then stopped.

"They're going for it," she said. "I can see two climbers."

The final choice had been made.

For years I had longed to climb K2, as a sequel to our conquest of Mount Everest on the 1963 American expedition led by Norman Dyhrenfurth.* Although Everest is the higher mountain by 778 feet, K2 at 28,250 feet is to me a more difficult and dangerous challenge.

Chief among the difficulties are the violent storms that can load the slopes of K2



JAMES WICKWIRE

Bridge technique is the lesson as Jim Whittaker shows the head porter how they will rig a rope span to cross a swollen river. In 1963 the author became the first American to stand atop Everest. Now he leads his second attempt on K2.

with snow during the summer climbing period. Furthermore, the slopes of K2 are generally steeper than those of Mount Everest, with a higher risk of avalanches. Finally, despite the snow, K2 is a high-altitude desert, with very little moisture in the surrounding atmosphere. The extreme dryness, the high altitude, and the need for rapid breathing threaten climbers with severe dehydration, a condition that can lead to exhaustion and death.

Both the Karakoram and Himalayas are formidable opponents. On an average, one climber out of twenty is lost there through accident, illness, or exposure. K2 has taken its own grim share: seven climbers killed, five of them on United States expeditions. Small wonder that only two teams before ours, an Italian one in 1954 and a large Japanese group in 1977, had managed to scale K2. Since the valiant U. S. effort of 1953, which was battered by a 12-day storm, it has been called "the Savage Mountain."

I had had a taste of that savagery in 1975, when I organized my first K2 expedition. Bad weather and difficulty with porters had finally forced us to abandon the attempt, although we reached 22,000 feet. By the spring of 1978 we were ready to try again.

Like a military invasion, a high-altitude climb takes planning, experience, knowledge of the terrain, and adequate supply lines—plus that indispensable and elusive ingredient, luck. With all but the last item assured, our team of 14 climbers flew from the United States to Pakistan in mid-June.

During the following three weeks, with the help of 350 local porters, we moved nine tons of equipment and supplies in 55-pound loads more than a hundred miles from the end of the road at Baha to the base of K2 (map, following pages). Finally, on July 5, we established Base Camp on the Godwin-Austen Glacier at an altitude of 16,300 feet.

"*Inshallah* [As Allah wills], this time we make it to the top," declared Jim Wickwire, an old friend and Seattle attorney who took part in the 1975 attempt.

*As a member of the 1963 expedition, sponsored primarily by the National Geographic Society, the author was the first to plant the U. S. and National Geographic flags atop earth's highest mountain (October 1963 *GEOGRAPHIC*). He also wrote about the first ascent of the Yukon's Mount Kennedy in the July 1965 issue. The first ascent of Everest was reported by Sir John Hunt and Sir Edmund Hillary in the July 1954 issue.



LOUIS REICHARDT

On K2 once more, Jim Wickwire eases across an ice slope. Veteran of the failed 1975 attempt, he and Lou Reichardt will make the first assault. From the final camp they will push up in predawn darkness on a sortie toward the summit.

All agreed, though only four of us had firsthand experience on K2. Besides Jim and me, the 1975 team had included my wife, Dianne Roberts, a professional photographer, and Rob Schaller, a Seattle surgeon.

The newcomers were all experienced climbers from a variety of professions: Craig Anderson, a zoologist; Terry Bech, a musician and anthropologist; Terry's wife, Cherie, a nurse; Diana Jagersky, an art student; Skip Edmonds and Chris Chandler, both physicians; Lou Reichardt, a neurobiologist; Rick Ridgeway, a filmmaker and writer; John Roskelley, a photographer-lecturer; and Bill Sumner, a physicist.

Tragedies during the previous 19 months had removed three expert members from the original list—Dusan Jagersky, Diana's husband, and Alan Givler, killed climbing in Alaska, and Leif Patterson, who died in an avalanche in British Columbia.

After we set up Base Camp, the weather began to assert itself, alternately treating us to sparkling days in the 60's and to wild snowstorms. At lower levels such storms

were largely a hindrance; higher up their cost was to become appalling.

From my previous experience and my knowledge of past attempts on K2, I laid out a route up the mountain. From our Base Camp we would thread our way up Godwin-Austen Glacier to the base of K2's Northeast Ridge. There we would establish Camp I, at 18,500 feet.

From Camp I the route ran up the Northeast Ridge, traversing slopes as steep as 65 degrees, many of them glazed with solid ice or carpeted in waist-high snow that threatened to avalanche under the first climber.

Camps II, III, and IV would take us by stages to about 22,800 feet, slightly higher than we had reached on a different side of K2 in 1975. From there, Inshallah, we would attempt the last 5,450 feet to the summit.

In addition to climbing, we would haul most of our own supplies, for I had dismissed all the porters below Camp I except four natives of Hunza, in Kashmir, who had done some high-altitude portage.

After one particularly grueling stretch, carrying the 55-pound loads, Rick Ridgeway surveyed the Hunzukuts. "I can see doing this for the sheer fun of it," he said dryly, "but there have to be better ways to make a living."

BY JULY 13 we established Camp II at 20,200 feet and began supplying it while advance teams opened the route higher up. Despite the tougher going at increased altitudes we made excellent progress, reaching the site of Camp III at 22,300 feet within five days. And there, as Lou Reichardt puts it, the weather did a number on us.

The number turned out to be eight—eight precious days in which we hardly advanced a foot. Relentless storms lashed the mountain, the driving snow at times blinding us even to our own outstretched hands.

During periods of relative calm we were able to move from Camp III to lower sites, but any advance upward was out of the question. Beyond Camp III our route lay along the spine of an exposed, razor-thin ridge several hundred yards in length, with a sheer drop on either side, one into Pakistan, the other into China. To be caught on the ridge

(Continued on page 631)

At long last, success on K2

IN THE REMOTE Karakoram Range on the frontier of Pakistan and China, some 20 peaks rise above 25,000 feet. K2 looks down upon all the rest. The last road ends more than a hundred miles short of the mountain. Like others before them, the 1978 American expedition had to trek in along the Braldu River gorge and to the head of Baltoro Glacier, where K2's immensity could be seen for the first time.

These detailed route maps are based on the cartography of Dee Molenaar, himself a climber on one of five American attempts. All were turned back. Only Italians in 1954 and Japanese in 1977 had reached the summit.

Assessing chances for success, Whittaker picks the Northeast Ridge. Before the Americans achieve their goal, they will have followed the longest route to the top of K2.



63 days up

Enduring storm after storm, climbers set up camps. On September 6 from Abruzzi Camp, Reichardt and Wickwire reach the summit, followed a day later by Ridgeway and Roskelley.



PAINTING BY JAIME QUINTERO
NATIONAL GEOGRAPHIC ART DIVISION
FROM A COPYRIGHTED DRAWING BY DEE MOLENAAR

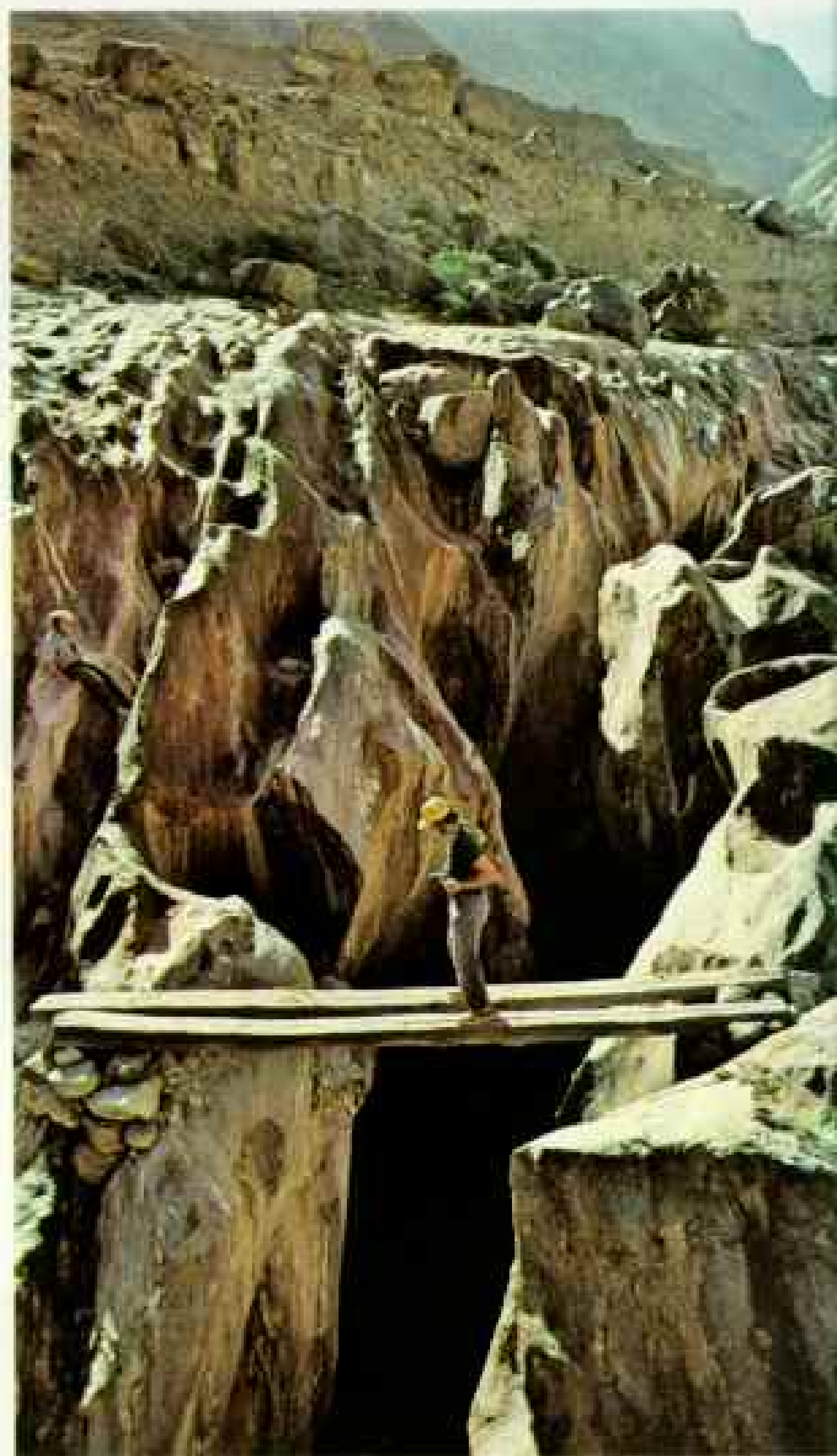
13 days in

Despite searing heat, icy rivers, and roller-coaster landscape, the trek to Base Camp goes smoothly.



PAINTING BY JAIME QUINTERO
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BASED IN PART ON A COPYRIGHTED MAP BY DEE MOLENAAR





JOHN ROUSSELLEY (LOWER LEFT), WILLIAM B. SUMNER (UPPER LEFT);
ROBERT T. SCHALLER, JR. (ABOVE)

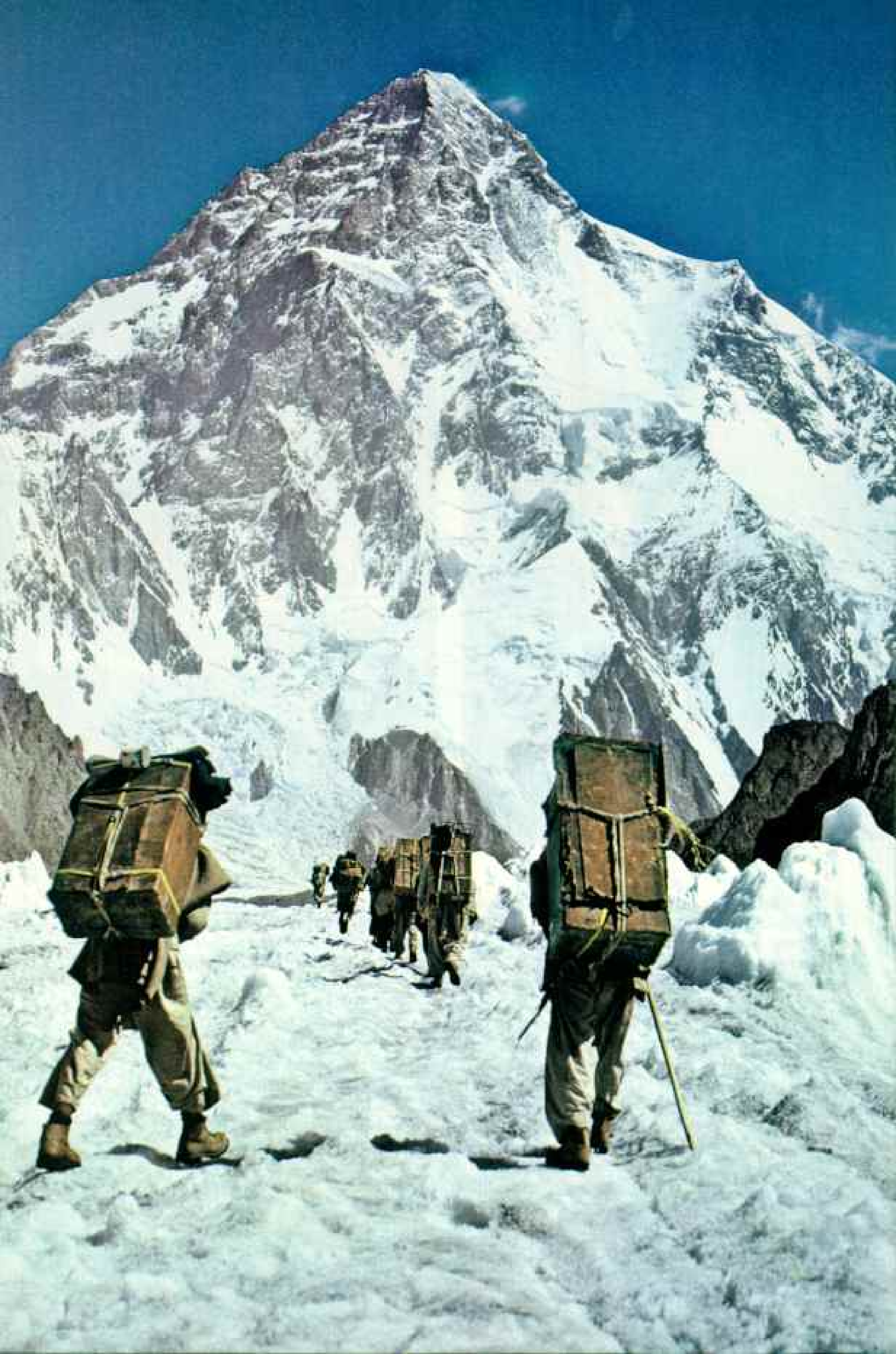
Bank job comes on payday as Wickwire, Whittaker, and Ridgeway (left) count the porters' wages for distribution. Quarrels and porters' strikes delayed the 1975 expedition. On Whittaker's recommendation, procedures were standardized, and the 1978 supply trek passed without incident. Just off the Baltoro Glacier, porters congregate (above) as the wind kicks up, threatening a storm.

Daytime temperatures on the march reached as high as 126°F, blistering the 14 climbers and 350 porters. The walk put a fine edge on the conditioning of the climbers but hardly prepared them for the 30° below zero F and worse

they would face on the mountain.

Averaging nearly ten miles a day, the expedition made good progress through rough country. Curiosity brought Craig Anderson onto a footbridge over a chasm (above right)—looking like a miniature skier improbably stranded in wildly eroded terrain.

Even before the Americans reached the base of K2, the mountain sent an ominous message out with a team of British climbers. They had been climbing well with no apparent problems, when a sudden avalanche swept one of their party to his death. Again K2 had lived up to its reputation as the Savage Mountain.



(Continued from page 626) without fixed ropes in a sudden storm was to risk a fatal plunge thousands of feet into one country or the other.

Prolonged delays at high altitude can spell the end of any climb. Every day spent marooned in camp exacts a physical toll from each climber and also requires another day's supplies from below—not just from the next camp down, but in relays all the way from Base Camp. The added burden of resupply robs a team of vital energy that can never be regained at high altitudes.

Fortunately we were all in good condition, and I sent the Hunza porters back to Base Camp while the rest of us shuttled between there and higher camps to cache supplies as the weather permitted.

The bulk of the portage was food—cartons of freeze-dried beef, chicken, beans, and assorted vegetables and fruit. They were lightweight and did the job, though the vote was unanimous in regard to taste. As Dianne says of mountaineering fare: "Food is the one thing everyone can rally around to hate."

The most cumbersome items were 14-pound oxygen tanks that we had stored at the base of the mountain in 1975 for a subsequent attempt. Although we might be able to scale K2 without oxygen, the tanks were good insurance against the rarefied atmosphere near the summit. As it turned out, one of the tanks may have helped Jim Wickwire through a nearly fatal night.

ON THE MORNING of July 30 the weather was clear, and within four days we had crossed the ridge, secured fixed ropes along it, and set up Camp IV at 22,800 feet (pages 638-9). We had only 5,450 feet left to go, yet in terms of total effort we were barely halfway up the mountain.

Throughout the previous four weeks I had studied each team member carefully, analyzing his or her climbing technique, endurance, and instinctive will to reach the summit. By the time we established Camp IV, I had selected our summit assault team: John Roskelley, Rick Ridgeway, Jim Wickwire, and Lou Reichardt.

The week following establishment of Camp IV was literally a blur of driving snow, of winds gusting to near-hurricane

force, and of endless reopening of routes obliterated by drifts. On August 5 the storm reached such intensity that we had to evacuate the mountain in order to conserve supplies at the higher camps. Our spirits fell step by step with the retreat.

Once more the weather cleared and we struggled back up the mountain. On the welcome afternoon of August 19 we established Camp V at 25,200 feet. A major victory, yet weeks behind schedule.

Camp V gave us our first climbing record. In reaching that altitude, Dianne and Cherie



BOTH BY DIANNE ROBERTS

The immense goal finally revealed, porters under 55-pound loads (facing page) trudge on toward Base Camp above Concordia, a confluence of glaciers. In a level section beyond Camp I, an unroped climber (above) vaults a crevasse.



Step by slow step, climbers shuttle loads above Camp II. After a heavy snowfall this slope at 21,000 feet became dangerous. Climbers from higher camps descended to break trail and pinpoint hazards. The summit pyramid rises another 7,000 feet. The final assault will hug the left skyline.

Bech stood higher than any woman on an American expedition. The record was to be superseded several weeks later when the American Women's Himalayan Expedition conquered the peak known as Annapurna I, at 26,504 feet.*

From Camp V we had two possible routes to the summit, one pioneered by an unsuccessful Polish team in 1976 by way of the northeast side, the other taken by the victorious Italian expedition in 1954 and by



ELIANE ROBERTS

the Japanese in 1977, known as the Abruzzi route.

Following my announcement of the assault team, we tentatively chose to continue up the Polish route, convinced that our team could finish the route the Poles had all but completed.

Our climbers would have only one chance. Food, fuel, and our physical reserves were draining rapidly at high altitude in the face of marginal weather. On

August 29 Jim Wickwire and Lou Reichardt broke trail through deep snow to the site of the former Polish camp and supplied it for the final summit assault. While waiting out a storm, the climbers discussed routes, at last deciding to divide into two teams and try different approaches.

By September 2 *(Continued on page 637)*

*Arlene Blum, Irene Miller, and Vera Komarkova told of this history-making Himalayan climb in the March 1979 NATIONAL GEOGRAPHIC.



CRIG ANDERSON (TOP); DIARR JAGERSKY (MIDDLE); DIANNE ROBERTS (BOTTOM AND RIGHT)

K2 rations draw nothing but a pained look from Wickwire (top), facing yet another packaged meal. The pressure cooker helped reconstitute freeze-dried food at higher altitudes. Lower down, the big raves went to fresh goat meat.

Oops: Rob Schaller reaches for his errant kit (middle). Snow has melted around the tent, leaving it perched on a shaded platform.

On the trek in, the weather had been clear; on the mountain, it almost never was. After three days of snow and wind, Reichardt shovels a tent clear at Camp III (bottom). This scene was played again and again: snow—then dig out, sort out, and start to climb—followed by snow.

Inching across an almost vertical slope in windy, snowy, and below-zero weather at 22,500 feet, Craig Anderson (right) grins when told, "Your mother will love this one."







we were all in position: the two summit teams poised at Camp V, with Terry and Cherie Bech in support; Dianne and I as further backup at Camp III, where we had a clear view of the summit through Dianne's powerful telephoto lens. The lens was part of a generous loan of photographic equipment to the expedition by Nikon Inc.

That evening I radioed Base Camp via walkie-talkie and spoke with our friend Subedar Major Mohammad Saleem Khan, Pakistani liaison officer.

"It's now or never, Saleem," I said. "We haven't enough supplies for a second attempt. We must meet the porters at Base Camp on September 10. Win or lose, that's our deadline." Within hours we were in the grip of another storm.

For an agonizing day we rode it out, our hopes diminishing by the hour. On the 4th the weather cleared and the assault teams at Camp V wasted no time. John and Rick advanced to the Polish Camp. Meanwhile, Jim and Lou attempted to reach the Abruzzi route but were finally turned back by hip-deep snow.

The next morning Lou and Jim decided they would try again for the Abruzzi route. With Terry Bech to help carry supplies, they forced their way through the snow to a point 2,450 feet below the summit. There, in full view of Dianne's telephoto lens, they pitched camp for the night. It was the memorable night that began with snow and ended with stars.

IN THE ARTICLE accompanying this one, Jim Wickwire describes the final victory over K2 and the terrifying ordeal that followed (pages 641-9). Through Dianne's telephoto lens she and I witnessed the triumph, but we could only imagine the terror.

At midmorning on September 6 the lens picked out two microscopic figures on the Abruzzi route, silhouetted against an incredibly cloudless sky. Hour by hour the figures advanced toward the summit, now and

then lost in the shadow of the mountain.

At 5:20 p.m. there was a sudden flash of color at the peak—the unmistakable red of Lou Reichardt's parka. He and Jim had emerged into full sunlight with nothing above them: For the first time Americans stood atop K2!

Almost instantly Lou began his descent. As we learned later, his oxygen system had never functioned, and he preferred not to risk a prolonged stay on the summit. Jim, who was using oxygen, remained longer to take photographs and to deposit a micro-filmed list of some 4,000 names on the peak. The list represented those who had supported our expedition and whom we chose to honor in a special way.

Through the long lens Dianne and I had seen one figure, in shadow once more, begin the descent. With growing concern we waited for the second climber to follow.

Finally around sunset we saw the second figure start down, and worried that in the gathering darkness he could never make the Abruzzi Camp. At ten o'clock that night John Roskelley confirmed our fears.

During the day John and Rick had abandoned the Polish route and followed Jim and Lou's traverse to the Abruzzi Camp, where they planned next morning to continue to the summit.

"Lou's back, but Jim's still up there," John announced grimly to me over the walkie-talkie. "He has no tent or sleeping bag, only a bivouac sack. As far as Lou knows, Jim's had nothing to eat and only a sip of water since morning."

After a triumphant day it was dreadful news. With nothing but an unlined nylon sack for protection, Jim faced a night of almost complete exposure near the summit, with temperatures as low as minus 40°F and winds gusting to 50 miles an hour. Also, Jim was suffering from dehydration and could well be unconscious or out of his mind. To the rest of us John and Rick's planned ascent the following day seemed more a rescue mission than a summit attempt.

Along a great Chinese wall, climbers make a ferry run from Camp III to Camp IV. On the rocky side of the ridge is Pakistan. The route stays close to the ridgeline to minimize the danger of falling snow and ice. In good weather the traverse took two hours. In bad, as many as seven.





We were wrong. As Jim describes that night in the following pages, there were moments of extreme danger but never a loss of hope. At midmorning on September 7 our telephoto lens picked Jim out on the Abruzzi route, slowly descending as John and Rick climbed to meet him. We saw the figures pass one another with only a brief pause, then Jim continued down alone.

BY THAT NIGHT K2 had been scaled a second time without oxygen, and we began our retreat from the mountain. The cost to Jim Wickwire proved greater than we had realized, and without Rob Schaller's constant medical care on the trek out, Jim might not have survived the combination of pleurisy, pneumonia, and blood clots resulting from his night below the summit.

That Jim did survive and that all of us returned safely is a victory perhaps greater than that of reaching the summit. In a dozen attempts on K2 the mountain has claimed seven lives, heavy odds by any standard.

In addition to the first American conquest of K2, we had achieved several other successes on the Savage Mountain: Including porters, ours was the smallest expedition to scale the mountain, and the first to include women climbers. Three of our four summit team members reached the top without using oxygen. We had also established a new route near the summit, between Camp V and the Abruzzi Camp.

Each ascent of a high and dangerous mountain, whether the first or a sequel attempt, adds new knowledge and therefore a greater margin of safety for those to come. Certainly we climbed K2 on the shoulders of previous expeditions. We owed our success to those who had tried and failed, and to those who had tried and won. Perhaps others will some day say that of us. Inshallah. * * *

Barnacles on a leviathan, the tents of Camp IV cling to a humpback ridge at 22,800 feet. From here on up, steps take longer, breaths come shorter, and supplies run thinner. Climbers follow the dictum "carry high, sleep low" to conserve food, fuel, and their own energies.

WILLIAM D. BURNER



On to the Summit

By JAMES WICKWIRE

I AM SLIPPING and cannot stop myself. Stretched on my side in the darkness and the cold, I doze off, then come awake to find myself a few feet closer to the sheer drop-off below me. The drop-off is 10,000 feet, a thought that strikes me as oddly funny.

I dig the heels of my climbing boots into the snow crust, and the sliding stops. But only for the moment. Somehow I must make myself get out of the nylon bag I have pulled around me and climb back to safety. In a minute I will do it. Any minute now. . . .

Something snaps me awake again. The drop-off is considerably closer, perhaps only thirty feet away. Time for action. No more delays; get out of the bag, crawl back up the slope, and find the makeshift platform dug into the slope below the summit. Now.

Slowly I crawl upward, pushing the bag, which contains my pack and my nearly empty oxygen tank. Their weight drags at me, as does the wind. I estimate the gusts at 40 or 50 miles an hour. The temperature has fallen to around minus 40°F (-40°C), maybe even lower. Quite a chill factor—say, minus 115°F? Cold, anyway. No argument there.

Finally I reach the platform I had scraped out of the slope hours before. It is narrow, and I have a sudden inspiration. Battling the wind, I manage to lay my bag flat, jabbing my ice ax through one corner of it into the snow beneath. I pin the other corner with

my ice hammer. No more slippage. Again I crawl into the bag, which still contains my oxygen tank and pack. And wait. Wait for the sun to bring warmth and light enough for me to start back down the mountain.

In retrospect, that night under the summit of K2 was both an ordeal and a minor victory. No one to my knowledge had ever bivouacked—that is, camped without tent or sleeping bag—alone as high as 27,800 feet. It was undeniably risky, but the alternative was worse: a perilous descent in the dark.

The risks of bivouacking were increased to some extent by a series of small mishaps that had occurred during the final assault. But on mountains the unforeseen is a basic fact of life.

Lou Reichardt and I decided the night of September 5 to go for the summit. By 4:30 the next morning we were under way from the Abruzzi Camp with Lou in the lead, toward our goal 2,450 feet above us.

Lou started off smoothly, but I had trouble developing my normal climbing rhythm. At 26,500 feet I decided to use oxygen. When I turned the valve, I discovered that the tank was only a little more than half full; someone had brought up a used cylinder. Small mishap number one.

With added oxygen I was able to spell Lou in the lead, and we continued roped together through deep snow toward a sheer ice cliff rising some 200 feet abruptly above the

Alien in an alien land, Rick Ridgeway picks his way toward Camp V along a knife-edged ridge. The metallic mask insulates the face and reflects intense solar radiation in the thin air. The expedition has now gone well above the maximum altitude of the 1975 attempt. Yet to come: the untried and dangerous traverse to the Abruzzi Camp and, if time and weather permit, the final climb to the summit.



slope. Rounding the cliff, we encountered even deeper drifts, and I began to question whether we would ever reach the summit.

At around 27,200 feet I turned to look at Lou. He had stopped 75 feet below me and had unroped to remove his pack. Then he struggled up beside me.

"My oxygen system's no good," he said. "I'm going to risk going on without it; I'll leave the pack. Keep talking to me. If I act strange or sound funny, send me back down." Small mishap number two.

Higher up, we separated to look for firmer snow. Lou traversed left toward some rocks on the skyline; the summit was still out of sight. I plowed on through deep drifts until Lou yelled, "I've got better snow over here."

To reach him, I had to climb unroped across a steep slope of windslab snow, a dangerous formation produced by heavy winds, with a tendency to sudden avalanche. It was not a pleasant ten minutes.

Hours had passed, and still no summit. Finally, at about four in the afternoon, we crested a rise and there it was—a converging of ridges, beyond which lay only the cloudless sky. Only 500 feet more, and it was ours.

Lou had performed magnificently without oxygen, but the last stretch seemed to tire him. I took the lead up the final, 45-degree slope, concentrating with each labored step on the family and friends whose love and support had carried me this far. *(Continued on page 646)*



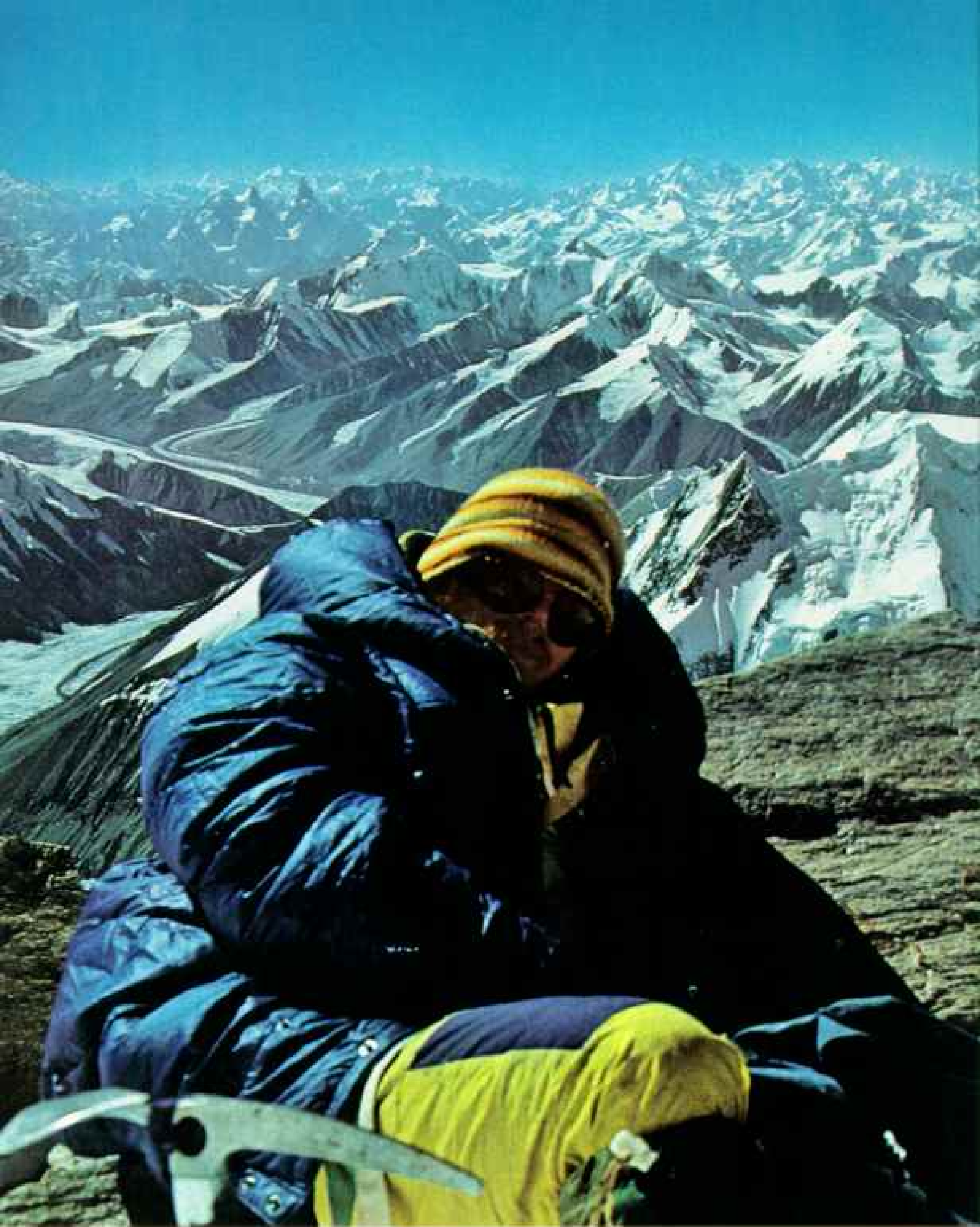
ROBERT T. SCHALLER, JR. (ABOVE); JAMES WICKWIRE

The mountain swallows the sun as two specks—barely visible in silhouette—approach the final flank of the summit.

Jim Wickwire and Lou Reichardt had begun their 2,450-foot assault in the blackness of 4:30 a.m. Now they work their way up the remaining 300 feet and arrive side by side, first Americans atop K2.

Reichardt displays the United States and Pakistani flags (right), then goes down. Wickwire lingers, and is forced to make the highest solo bivouac in mountaineering history, just below the summit.





A forever sight of the Karakorams' jumbled pinnacles is a dream realized by heavily bundled Rick Ridgeway and John Roskelley, who made this photograph. Following the first team to the summit by a day, they were also granted deliverance from storms. The expedition had achieved a major goal of American mountaineering and further



JOHN ROSELLEY

stretched the limits of human capacity at high altitudes. No climbers breathed bottled oxygen to establish their camps, nor did three of the four to reach the summit. Now the mountain had to be unclimbed, a race against even worse September weather and physical and mental collapse from oxygen starvation.

Stepping onto the nearly flat summit ridge, I stopped and turned to Lou. "We've done this together," I said as he caught up, "and that's the way we'll finish it."

At 5:20 p.m. we set foot on the highest point. I remember hugging Lou and thinking that after so many years of heartbreak and defeat, Americans had finally made it. Not Lou Reichardt and Jim Wickwire, nor Jim Whittaker and our other teammates. Simply Americans.

The view was magnificent. To the west the sun appeared low and as if balanced on the lesser peaks of the Karakoram. To the north we could see over dun-colored mountains deep into China's Sinkiang region. Below and to the south lay the massive Godwin-Austen Glacier, named for the Britisher who explored its approaches in 1861. A few years earlier the mountain was first surveyed and named K2: the second peak designated in the Karakoram Range.

As Lou and I had agreed, he stayed only long enough for us to take a few photographs. Then he started down to retrieve his pack and make for camp.

I remained on the summit a while longer, depositing the microfilmed list of our supporters beneath the snow and trying to change the film in the camera. It was a ludicrous exercise, my bared fingers turning numb within seconds from the low temperature and a stiff breeze. Then the lens coated up with ice, and I simply couldn't clear it. With a final look around I started down. Too late.

One glance in the direction of the camp

2,450 feet below convinced me that I couldn't make it. Sunset was approaching, and I had failed to bring a flashlight. Small mishap number three.

ON THE SLOPE 450 feet below the summit I scraped out a bivouac platform. It was dark and I had virtually run out of oxygen, but I had a small propane stove for warmth. I lit it and crowded close for the welcome heat. Then the fuel cartridge ran out, and I reached for the spare. It wouldn't fit, thanks to a faulty gasket on the stove. Small mishap number four.

I was concerned, but not overly worried. I had bivouacked at high altitude before, though almost always with teammates who could lend a hand in an emergency. One thing that troubled me was the prospect of dehydration. I had had only one small sip of water from Lou's bottle. I had lost mine leaving camp that morning. I had no pot in which to melt snow (you can't melt enough in your mouth). Lack of water and food could result in progressive weakness and impaired judgment, neither of which I could afford.

But I could afford even less to dwell on my difficulties. I had a night to get through and I would do it; it was that simple. Huddled in the thin bivouac bag, I moved my arms and legs constantly to maintain circulation. Eventually, I told myself over and over again, this night will end. Then I began dozing and sliding down the mountain.

After the close call with the drop-off and my return to the platform, I dozed again, but now the ice ax and hammer anchored me.



JOHN RODRIGUEZ (ABOVE); DIANNE ROBERTS (FACING PAGE)

Utterly drained by their summit assault, and by scant food, water, sleep, warmth, and oxygen, Reichardt and Wickwire (left) slump on their packs in Camp III.

The retreat from Abruzzi Camp to Camp I took four days and one storm, with Wickwire in pain from what he thought was a cracked rib.

Diana Jagersky hugs Ridgeway in joy and relief (right), as Rob Schaller follows him into Camp I. A physician, Schaller quickly diagnosed Wickwire's chest pain as, at a minimum, pleurisy and pneumonia.



Sounding cymbals of success by beating empty kerosene cans, porters greet the expedition at Base Camp. Wickwire in a blue parka at the far right is steadied on his feet. Despite frostbitten toes and a damaged lung, he will have to walk out 40 miles to meet an evacuation helicopter.

The expedition attained two objectives. First, the successful ascent. Second, and more important to leader Whittaker: They all came down alive.

And at last the morning came, a first faint gathering of light, then full sun on the peak above me. My ordeal nearly over, I slid out of the bag and got unsteadily to my feet. At that moment, I believe, I approached the point of greatest danger.

I became confused and disoriented, aware that I had to get down the mountain, yet unable to make the necessary moves. Part of my mind said, "Look, there's ice down there between you and the camp; get your crampons on." Another part said, "It doesn't matter, let's just sit here."



After what seemed a long time, I did get one crampon on, but the strap was dangerously loose. The sight struck me as funny, and I began to giggle incoherently, although conscious that I was in serious trouble.

For the second time in less than a day my family in far-off Seattle came to my help. Abruptly my thoughts turned to my wife, Mary Lou, and our five children, and everything suddenly seemed to focus. I tightened the one crampon, strapped on the other, and set off down our trail toward the camp.

As Jim Whittaker has recounted, I met



Rick Ridgeway and John Roskelley on their ascent to search for me and perhaps to reach the summit. In Rick's words I seemed "like an apparition emerging from a cloud of snow," though apparently a welcome apparition.

Once assured that I could make it down alone, the two continued their ascent, and in passing, John patted me affectionately on the head. It struck me as the first human contact I had had in 14 hours, a much appreciated gesture.

Lou greeted me with obvious relief at the camp and offered me water. Although I was severely dehydrated, it seemed vital to me that we clear away the snow that had drifted overnight onto Rick and John's tent as well as our own. Once inside the tent, I had my first taste of water in nearly an entire day, and I sensed somehow that I had made it.

THE FIFTH and final mishap was hardly a small one. That night when Rick and John returned, exhausted after their own great victory achieved without oxygen, their stove blew up inside their tent. Rick's sleeping bag, with Rick inside it, instantly caught fire. He managed to free himself and throw the bag out into the snow; the tent was a charred ruin. The four of us spent the night in our remaining two-man tent, an episode that would have been comic but for our weakened condition.

The weather had been kind to us during the climb and the crucial first part of the descent, but a storm harassed us at Camp III. At Camp I Rob Schaller diagnosed the severe pains in my chest as a combination of blood clots in my lungs, pneumonia, and pleurisy. In addition my toes were frostbitten, two of them seriously. But for Rob's prompt and skillful treatment with antibiotics and intravenous fluids, K2 might have claimed its eighth victim.

During the week's trek out to the end of Baltoro Glacier, I suffered far more than I had during the night below the summit. Beyond the glacier two Pakistan Army helicopters rendezvoused with us, and I was evacuated along with John and Lou, plus Rob as attending physician. Our other ten teammates were judged fit to walk the remaining fifty miles to the road at Baha.

I don't begrudge them the experience. □

WESTERN CANADA

THE NEW ELDORADO

HOMES FOR
EVERYBODY
EASY
TO REACH
NOTHING
TO FEAR
PROTECTED BY
THE GOVERNMENT



WHEAT
LAND
RICH
VIRGIN SOIL
LAND FOR
MIXED FARMING
LAND FOR
CATTLE RAISING



WHEATFIELD AND CROP IN WESTERN CANADA

A WHEAT FARM
- IN THE -
CANADIAN WEST



THE OLD AND THE NEW WEST

**FREE
160 ACRES
WESTERN
CANADA
FARM
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WESTWARD THE STAR OF EMPIRE TAKES ITS WAY

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THE PEOPLE WHO MADE SASKATCHEWAN

By ETHEL A. STARBIRD

NATIONAL GEOGRAPHIC SENIOR STAFF

Photographs by CRAIG AURNES

STURDY AS A SILO and shaped somewhat the same, Daniel Kazakoff, at 93, remembers Saskatchewan before there was one. In his young days this vast domain—more than a quarter of a million square miles of promising plain and rocky hinterland—was merely an empty, undefined slice of “western Canada,” which had no boundaries either.

Less than a hundred years ago settlement took root here, and Dan was one of its first transplants. The family Kazakoff arrived in the Yorkton area in 1899 with fellow members of the Doukhobor sect. All were fleeing Tsarist Russia to avoid military service, which their pacifist faith condemns.

“Here is offer freedom and free land,” Dan said, his speech still strongly influenced by his native Russia. “We hear Queen Victoria tell Canada ‘leave Doukhobors alone.’ So we come, more than seven thousand.”

A “harsh land of high sky” then, Saskatchewan has had some taming since, largely in its southern half. In this endless sweep of prairie country, where most of the province’s 947,000 people live, grain growing dominates the economy.

The northern half remains a forbidding expanse of rock and water, but the promise of riches from mineral-bearing ores begins to intrude on its emptiness. (See **Close-Up:**

Canada—Saskatchewan, Manitoba, and Northwest Territories, a supplement to this issue.)

To pioneer such a place required strong and courageous settlers. Canada found them in many lands, setting the pattern for today’s multicultural population.

Eastern Canadians, Americans, British and other Europeans—they came like the Kazakoffs, most of them lured by the country’s turn-of-the-century campaign to people its prairies with hardy sons of the soil.

The program evolved after John A. Macdonald, later Canada’s first prime minister, expressed concern in 1865 over U. S. ambitions above the 49th parallel. “I would be quite willing . . . to leave that whole country a wilderness for the next half-century, but I fear that if Englishmen do not go there, Yankees will.” He obviously favored Anglo-Saxons as homesteaders.

Clifford Sifton took a broader view. As minister of the interior from 1896 to 1905, he believed national interests could well be served by the “peasant in a sheepskin coat . . . with a stout wife and half a dozen children.” The oppressed and land-starved of eastern Europe tended to agree.

Responding to his encouragement, settlement companies and transportation agents, earning a few dollars for any healthy recruit

A promise of land brought takers in droves. From the Missouri River to the Volga, agents and advertisements spread the news that Canada had decided to populate her west. As the century turned, immigrants crossed oceans, rode trains, and walked the prairies to claim the quarter section, 160 acres, offered every male over 18 years of age. They came, too, for the right to live their own lives in their own way, a freedom still celebrated in Saskatchewan.



WE'RE SAILING WEST. WE'RE SAILING WEST.
TO PRAIRIE LANDS SUNKISSED AND BLEST-
THE CROFTER'S TRAIL TO HAPPINESS.

CANADIAN PACIFIC RAILWAY



M O N A R C H

MONARCHIST LEAGUE
REGINA BRANCH

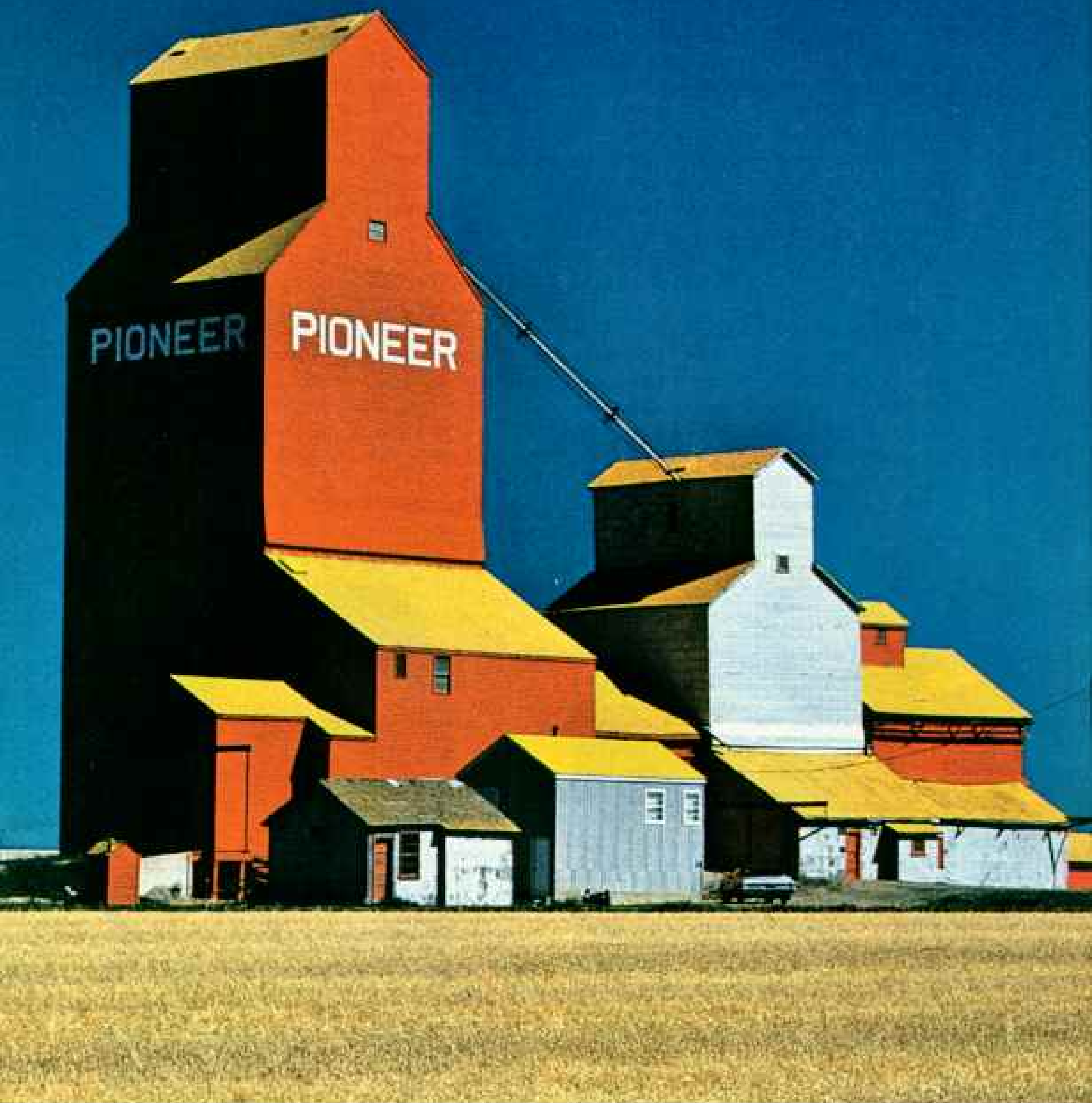
BEST SETTLERS IN THE WORLD," was Clifford Sifton's judgment of Scotland's sturdy tenant farmers (left). As Canada's minister of the interior he mounted an immigration campaign in 1897 to recruit families who knew land and how to work it. A rising demand for Canadian wheat and the land hunger of crowded city people and peasants helped loose a flood of newcomers that by 1910 had deposited nearly half a million inhabitants in Saskatchewan.

Incoming groups were directed from Canada's sea gates to tracts assigned by the government in the west with less chaos than in the unruly land rushes south of the border. Despite their far-flung origins, new arrivals almost universally accepted allegiance to the British crown. A deep reservoir of respect for the royal family was revealed last August by groups like the

Monarchist League (below left), during Queen Elizabeth II's whistle-stop tour of Saskatchewan and Alberta. The league's membership, like Saskatchewan's populace, reflects a largely non-British background with no single ethnic majority.

On meeting the queen, Chief George Whitefish (below) of the Big River Cree Indian band gave her the original copy of a treaty signed a century before by Cree Chief See See Wa Hum and representatives of Queen Victoria. His medallion dates from the signing of the treaty, one of several that endowed Saskatchewan's natives with special status and reserves. Chief Whitefish fears eventual loss of Indian lands and culture through the federal government's reinterpretation of treaty rights. So he entrusted the papers to the sovereign, whom Indians have long considered their protector.





of any age, combed two continents, using the hard sell for all it was worth.

"The last best west."

"Richest land on earth."

"Free homes for millions."

"The crop never fails."

Even the Salvation Army got into the act, urging mass migration to the colonies of an oversupply of English widows.

Between 1885 and 1910, some 450,000 newcomers descended on Saskatchewan. Not all promises came true. Nor did every

immigrant stay. Almost half the Doukhobors left after losing their right to claim free lands for refusing, on religious grounds, to swear allegiance to Great Britain.

Enough of every ethnic group remained, however, to endow this province with a population of many origins—foreign as well as native Indian and métis, those of mixed blood (map, page 657). The Doukhobors etched in one of its earliest lines.

"We live some in tents, some in sod houses," said Dan Kazakoff, "while we



build villages like in old country. Doukhobors got no moneys, so men walk to Winnipeg—250 miles—for work on railroad. No ox, no horses then. Women plant and pull, sometimes 16 on one plow [pages 658-9].

“Winter, men bring back moneys for sugar, flour, salt. No one own nothing; everything belong colony. Ten years so, then peoples want for selves. Buy land, leave villages. Me too. No more villages now, but plenty Doukhobors.”

Of about ten thousand still around,

Treasuries for Saskatchewan gold, grain elevators dominate the Canadian wheat belt. The trans-Canadian railroad first linked the region to world markets in 1882. Branch lines soon threaded the prairie, carrying farmers to some of the world's richest cropland. Towns grew, and elevators appeared. Few communities today lack these wheat-filled monuments to productivity in the province that provides more than 60 percent of Canada's yield.

some—like Jim Popoff and his wife, Polly—descend from the “independent” Doukhobors around Blaine Lake who accepted British authority and private ownership without a fuss. A fair trade, Jim says. “Those days government give any man 18 years or older quarter section—160 acres—for only ten dollars if he live on it part-time and break thirty acres in three years.”

Like most farm families of this province, the Popoffs now live in town, returning often to the old homestead where their cheerful chunk of a son named Sam follows in his father’s furrows.

Nothing has yet erased three tiers of habitation at the Popoff place: a sagging frame house where Sam was born; Jim and Polly’s first home of mud and wattle; long-collapsed dugouts where Jim’s parents and 160 other determined Doukhobors sheltered during their first six years in Saskatchewan.

“Is Doukhobor tradition to till the land,” Jim said reflectively. “For us, best occupation: always at home with family. Now we cultivate 2,000 acres. No man need that much. But farming run big these days, and I want to be, like you say, like Joneses.”

Flax in bloom blued Popoff property along the North Saskatchewan River; in the distance Sam made summer smoke turning the rich dry loam of fields in fallow.

“We cherish our Canada. Russian ask many time, Doukhobors come back. I say ‘OK, you treat us same as here.’ No way! We go, they put uniform on our children.”

Mennonite Culture Remains

Threat of assimilation also triggered an extended migration of Mennonites from Russia, and they congregated, for the most part, around Rosthern and Swift Current. Their faith and farms still flourish, though time blurs the once sharp imprint of their inherited culture—their original German language, dress and customs, separate schools. Of 20,000 practicing Mennonites in the province today, the majority—in common with almost all ethnic groups—live and look like everyone else.

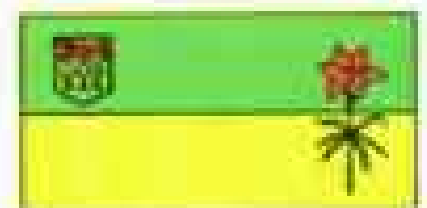
Though many immigrant families have diversified, farming remains the leading occupation. With over 45 million acres in production and more being added, the province accounts for as

(Continued on page 660)



A POLYGLOT PATCHWORK of settlements was growing up when Saskatchewan came of age as a full-fledged province in 1905. Settlers concentrated in the territory’s southern half. To the north lay the Land of Little Sticks, a rock-strewn country of lakes and scrawny pines. Since the early 1950’s technological pioneers have mined large uranium deposits in the hinterlands. But the farthest-reaching northbound road still ends a hundred miles below the border.





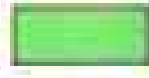





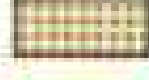



AREA: 251,700 square miles. **POPULATION:** (1978 estimate) 947,000; British, German, Ukrainian, Scandinavian, French, North American Indian. **LANGUAGE:** English and French are official languages; others are used in local schools. **ECONOMY:** Agriculture leads—wheat, barley, rapeseed, flax, oats, livestock; potash, 40 percent of world market; food processing and products; petroleum (2nd in nation); uranium. **MAJOR CITIES:** Regina (pop. 154,600), capital; Saskatoon (pop. 138,800). **CLIMATE:** Cold winters and hot summers, winters severe in north.



Key to settlements

Data from Atlas of Saskatchewan

Round color spots show settlements of undetermined area. Dates indicate time of settlement.

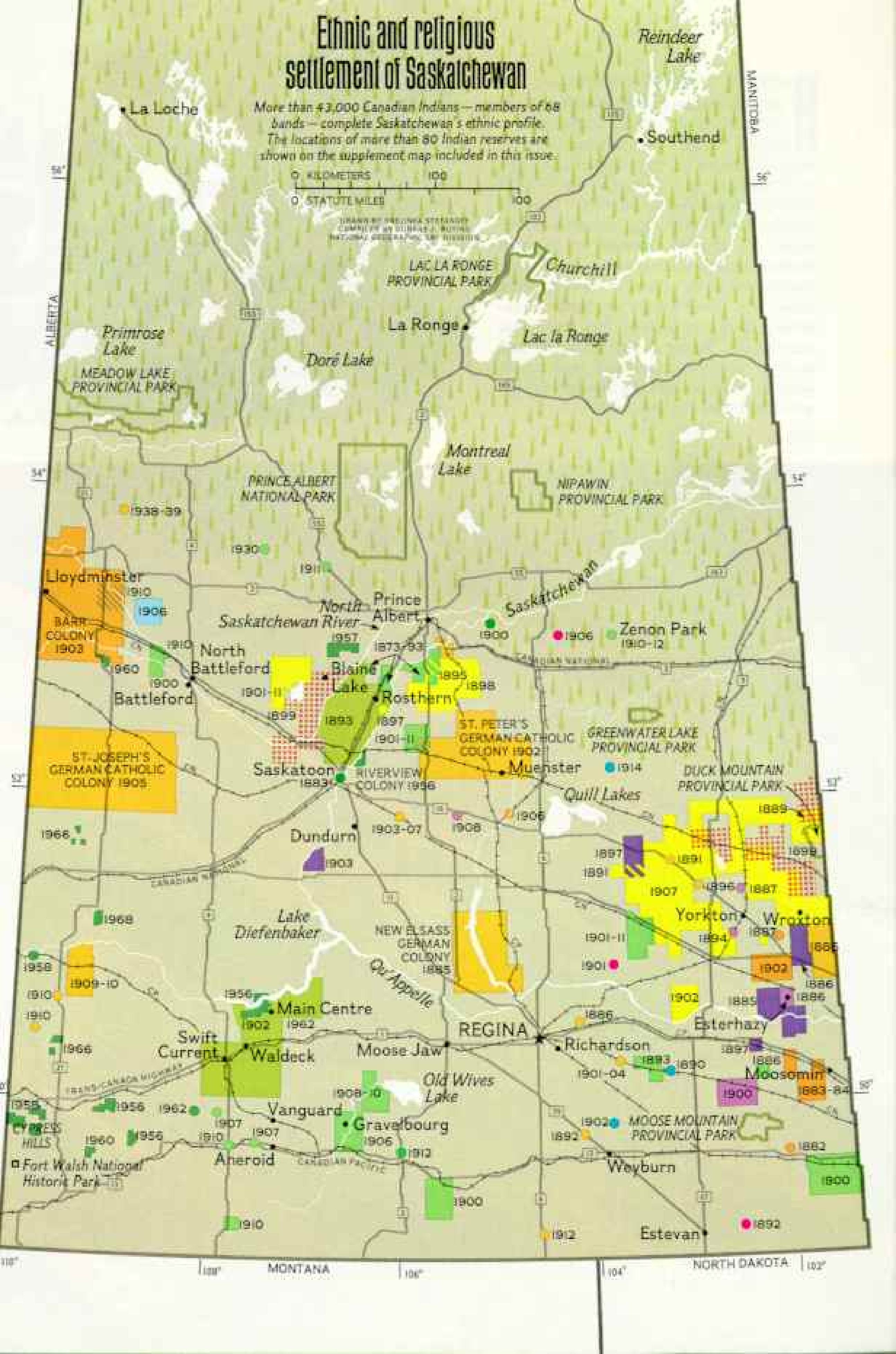
	BRITISH		HUTTERITE
	DUTCH		MENNONITE
	FRENCH		U.S. NEGRO
	GERMAN		UKRAINIAN
	HUNGARIAN		SCANDINAVIAN
	DOUKHOBOR		POLISH
	TEMPERANCE		JEWISH

Ethnic and religious settlement of Saskatchewan

More than 43,000 Canadian Indians — members of 68 bands — complete Saskatchewan's ethnic profile. The locations of more than 60 Indian reserves are shown on the supplement map included in this issue.

0 KILOMETERS 100
0 STATUTE MILES

DRAWN BY PRUDENCE STEVENS
COMPILED BY GILBERT J. BURTIN
NATIONAL GEOGRAPHIC MAP SERVICE



HARD NECESSITY yoked Doukhobor women to plows for spring planting in the sect's first years in Saskatchewan (right). Some 7,500 adherents of the pacifist faith escaped persecution in Tsarist Russia and arrived in Canada in 1899 with farming skills and little else. The only jobs lay far from their early communal villages. So women farmed while men worked away from home for cash to buy staples and draft animals. With growing prosperity, Doukhobors gradually abandoned their communes for individual homesteads. Better strains of wheat and modern combines (below) now allow farms to grow beyond the dreams of those who first broke the tough sod.

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SASRATCHOWAN ARCHIVES, UNIVERSITY OF REGINA



much as 45 percent of Canada's cultivated land, 25 percent of its agricultural income.

The top crop, wheat, did more than shape Saskatchewan's fortunes; it also set the pattern of community development.

After the railroads steamed through, towering grain elevators erupted at intervals of every ten miles or so beside the tracks. Those who came to serve this end of the grain chain settled in their shadow. Rising like king-size milk cartons above the horizon, the bins act as welcome beacons of civilization in the wide and often featureless sweep of southern Saskatchewan.

Another Moses in the Wilderness

Barr Colony pioneers didn't wait for the train; they founded Lloydminster when the "end of steel" still lay 170 miles away.

"What a show that was! This preacher fellow, Isaac Moses Barr—a fast man with a buck if it wasn't his—brought over a bunch of Englishmen in 1903. Most of them out of banks and shops; didn't know a stook from a saskatoon berry. Did their chores in spats and bowlers."

Only 10 years old at the time, Sid Early was better prepared for frontier life than most; his father had homesteaded for a while in Moosomin.

"A lot come thinking they'd find jobs. Only work in a hundred miles was getting this bald-headed prairie to grow something besides brush. Nearest supplies were in Saskatoon; a lively ox and cart could make it out and back in 17 days."

Finding Sid is easy; his high-roof, gabled home adds a pleasing dash of pink to its often dun-colored setting. "Father built the place in 1916; not many this big being lived in nowadays."

See-through houses—decaying and windowless—litter the landscape; isolation and expensive upkeep emptied them of inhabitants long ago.

"My mother had her heart set on red brick, but they shipped white instead. So she painted the face of every last one herself.

"Queen's coming through next week to meet all us old Barr colonists. Might as well go; don't see how it could hurt me any."

Sid has passed his property on to son Allen, who prefers ranching to farming. Rodeo-riding Early grandsons think land's only worth working if there's oil under it. And that's about everywhere around here.

The Lloydminster field, operative since the 1940's and one of the first of Saskatchewan's extensive underground resources to be exploited, produces about 25,000 barrels of heavy black crude a day; most of it used for asphalt. Some 1,500 pumps bob amid the wheat, pecking, like hungry chickens, at reserves estimated at 16 billion barrels, a bonanza that should last 20 years at present rates of recovery.

Sid re-lit his pipe and added another charred match to a heap beside his chair. "Ol' Barr, he meant this to be an all-English community. Saturday night, there's so many drillers and riggers from all over in Lloydminster, you can't even tell what country you're in."

Although there is no ethnic majority in the province, residents of British ancestry hold a substantial lead over any other group.

"Oil's been a good thing, though. Most of us didn't get mineral rights with our land, but companies pay up to \$1,500 for every pump they put in and around \$300 annual rent to keep it there. Got 11 wells on one half section bringing in a tidy little income without lifting a finger."

Oil flows freely around Estevan as well, and this area, near the North Dakota border, supplies much of the lignite coal to fuel the government's electric power monopoly. In recent years Saskatchewan's socialist regime has "nationalized" a number of once private enterprises. This includes nearly half the province's potash industry, now nibbling away at supplies sufficient, some experts say, to fertilize all earth's arable lands for the next 3,000 years.

First to solve the problems of reaching deep potash (Continued on page 664)

Spires of the East crown St. Elias Ukrainian Greek Orthodox Church in Wroxton, one of many towns largely populated by Ukrainians. Slanting bars on the crosses recall when the crucified Christ raised His right foot in agony, as well as the X-shaped cross on which the church's patron saint, Andrew, was crucified.





HOMETOWN LOVE led to the altar for John and Kristy Charles (left) in the northern community of La Ronge, a commercial center for 18 nearby Indian reserves.

Ukrainian folk dancer Lesia Fedeyko (right) gets a hug from John Rozdilsky, who aspires to be a lawyer, at a friend's wedding. Rozdilsky's parents reached Saskatchewan after World War II in the third and most recent wave of immigration from the Ukraine; the first came around the turn of the century, the second in the years following the Bolshevik Revolution and the First World War. Ukrainians today occupy a solid position in Saskatchewan's middle and professional classes.

Conjugal prospects were less bright in the province's early days, when one of the settlers' most pressing concerns was a dire shortage of women. These bachelors evidently hoped that advertising might aid their cause (below).



LOCAL HISTORY DEPARTMENT, SASKATOON PUBLIC LIBRARY

deposits below tricky subterranean waters, independently owned International Minerals and Chemical Corporation (Canada) Ltd. has been tapping rich reserves near Esterhazy since 1962.

Seventy-six years earlier, Paul Esterhazy—a Hungarian “count” of questionable credentials—convinced a large contingent of U. S.-based countrymen to relocate in the area. Today their descendants help operate one of the world’s largest potash mines, whose cavernous depths reach 3,500 feet.

The Gonczy men—father and son—and in-law Ernie Dlouhy have all worked at the mine. But like their forebears they also grow grain, sharing in the labor and investment. I sat beside big Bill Gonczy, a wise and witty patriarch, as he aimed his combine down a row of wheat while his petite daughter kept pace beside him in a similar rig.

“Esterhazy, he put together a complete settlement before starting out,” said Gonczy, his tongue firmly in his cheek. “Farmers, a lawyer, doctor, judge, harness maker, and two shoemakers. Seems the doc got into an argument on the way and killed one of the party. Judge and lawyer tried him on the spot. Now, how the hell you going to hang the only doctor? They didn’t; strung up the extra shoemaker instead.

“All around here was first called Kaposvár, like in Hungary. In 1901 they build beautiful church on high point over there. Used only for weddings and funerals now. I tell friend, I get buried in graveyard alongside. ‘Not me,’ she say. ‘I don’t know nobody there.’

“Being farmer, you pray a lot. Good year, we got grain no one wants and bills everyone wants paid. Bad year, just as many bills and no grain. Last year I’m lucky. No surplus to store; hail wiped out all my crop.

“Neighbor of mine saw this storm coming. Drove his car out of the garage for a free wash job. Might just as well have kept it inside and beat it all over with a ball peen hammer.”

Unruly Weather Rules Plains

A century of progress has gentled much of Saskatchewan’s lower half, but not its weather; it remains as ornery as a bronco under blackfly attack. Temperatures may soar in summer to 110°F, plummet in winter to

50° below. Winds, powerful and persistent, stir things up in any season. Drought and downpour do as they please. Two weeks of steady rain had reduced grid roads around Muenster to the gooeyness of sauerbraten gravy. Great for the duck populations exploding in every pond but, in my opinion, no day to slog cross-country. But Barbara Bunz thought otherwise.

Not much bigger than a scythe handle and considerably straighter, this bouncy 93-year-old hurried me through thickets of lodged rapeseed to show me a decaying house of hand-hewn timbers (page 669). Here, she and six adult relatives—all members of St. Peter’s German Catholic Colony from the States—homesteaded in 1904. Today some 180,000 Germans give the province its largest minority after the British.

“Men cut and square logs; I pick skin off and dig cellar. Keep fire going seven day and *Nacht*, cooking limestone for chimney brick. Make the plaster, ve drive oxen in big circle, mixing mud mit grass.

“Mosquitoes so bad, oxen try to drown themselves in slough. One day I plow mit reins ‘round vaist, they go crazy and almost drown me too.”

Midges by the billions join in Saskatchewan’s annual insect blitz, their dense swarms hanging like haze in shady wood-side stretches.

“Next year, *Mein Mann*, Chon, and I build own place. Ve roof mit Canadian shingles—sod. Rain outside two days, drip inside four. Our babies start 1906. Chon spend two year in bed with broke back from haying. Spring, I plow three acre and seed by hand. Ve live on potatoes and cabbage I grow; rabbit and prairie chicken I fat up mit grain and shoot from vindow.”

An effervescent raconteuse, Barbara acts out her anecdotes as she tells them.

“Later, ve get horses and nice sleigh for vinter.” She slapped imaginary reins and shivered a little. “Cover it mit caboose and put stove inside. One *Nacht*, snow so deep, shaft dig in and whole t’ing flip up. Whoosh! Everywhere fire and sparks. I cry ‘*Mein Gott, Mein Gott*, ve burn to deat.’ Chon no worry; he say ‘Not so bad. Already ve know how hell is.’”

Barbara and John made the inevitable move to town in 1948. Their final and finest

farmhouse came along too; it now forms part of son Edwin's home.

Edwin owns 640 acres, including the original Bunz place: "About enough to support one family. Rain's already washed away 10 percent of my grain; we'll need at least two dry weeks in a row to save the rest. I've never lost everything, but sometimes my harvest doesn't cover costs. That's why I have an electrical business too."

Bunzes before him struggled to stay even and saw little cash in the process. "First money we get was ven my Chon trap and skin one t'ousand muskrat; he sell for \$90."

Recrossing the soggy landscape to where our paths would part, I urged Barbara to take care of herself.

"*Das Unkraut vergeht nicht!*" she reassured me. "Veeds don't go away!"

Depression Brought Exodus

Southwest of Regina, Saskatchewan's capital and largest city, the sun was shining. Banks of clouds contoured the horizon with mirage mountains, the only kind the prairies produce. On a clear day you can see forever; on an overcast one, about half that far.

Despite the unpredictability of weather and the ability of residents to grin and bear it, no one was prepared for the devastation and duration of the "Dirty Thirties." Plowed under by the Great Depression and ten consecutive years of futile, scorched-earth farming, rural families by the hundreds fled elsewhere.

Among the hardest hit: those around Gravelbourg, a bloc settlement of French founded in 1906 by a persuasive Roman Catholic priest. In his time Father Gravel managed to talk thousands into trying his new world.

Some kept on going. Others like Blanche Piché had the grit to outwit those gritty years. "The dust began May 24, 1929. It came like a wall across the prairie. When it hit the house, all we could see inside were the red rings around lids on the coal stove. When it stopped, grasshoppers and armyworms ruined anything left in the fields."

Flashing his ready smile, husband Oscar took up the tale: "You seed, sprouts would show, then a three-day wind would blow everything into Oklahoma. Dust got so thick, gophers were digging up, not down."

"Unlike most farmers," said Blanche,

"Oscar and I had a good well, but unless we got our day's supply before sunup—not that we could see it—the neighbors would dip us dry.

"Streams of people leaving looked like refugees from a battlefront, carrying everything they could on their old trucks and hay wagons. We had a car but no place to go. No money for gas, either, so we made it into a Bennett buggy." (The Depression-era prime minister, R. B. Bennett, got the blame for that one.) "Took the engine out, welded shafts on, hitched up a horse, and drove with reins through the windshield.

"Put the kids in boarding school. Each one cost us two cows and a pig for tuition."

At 78, Oscar still farms every day, helping his son, Gerald. "One man with six horses used to handle a half section. With machinery, now almost ten times that much. Summer fallowing good job for old man like me—air-conditioned cab, power steering, radio, CB—some's even got tape decks."

Gerald lost one hand in a farm accident some years back, but, at 41, he works 3,400 acres on which he owes nothing.

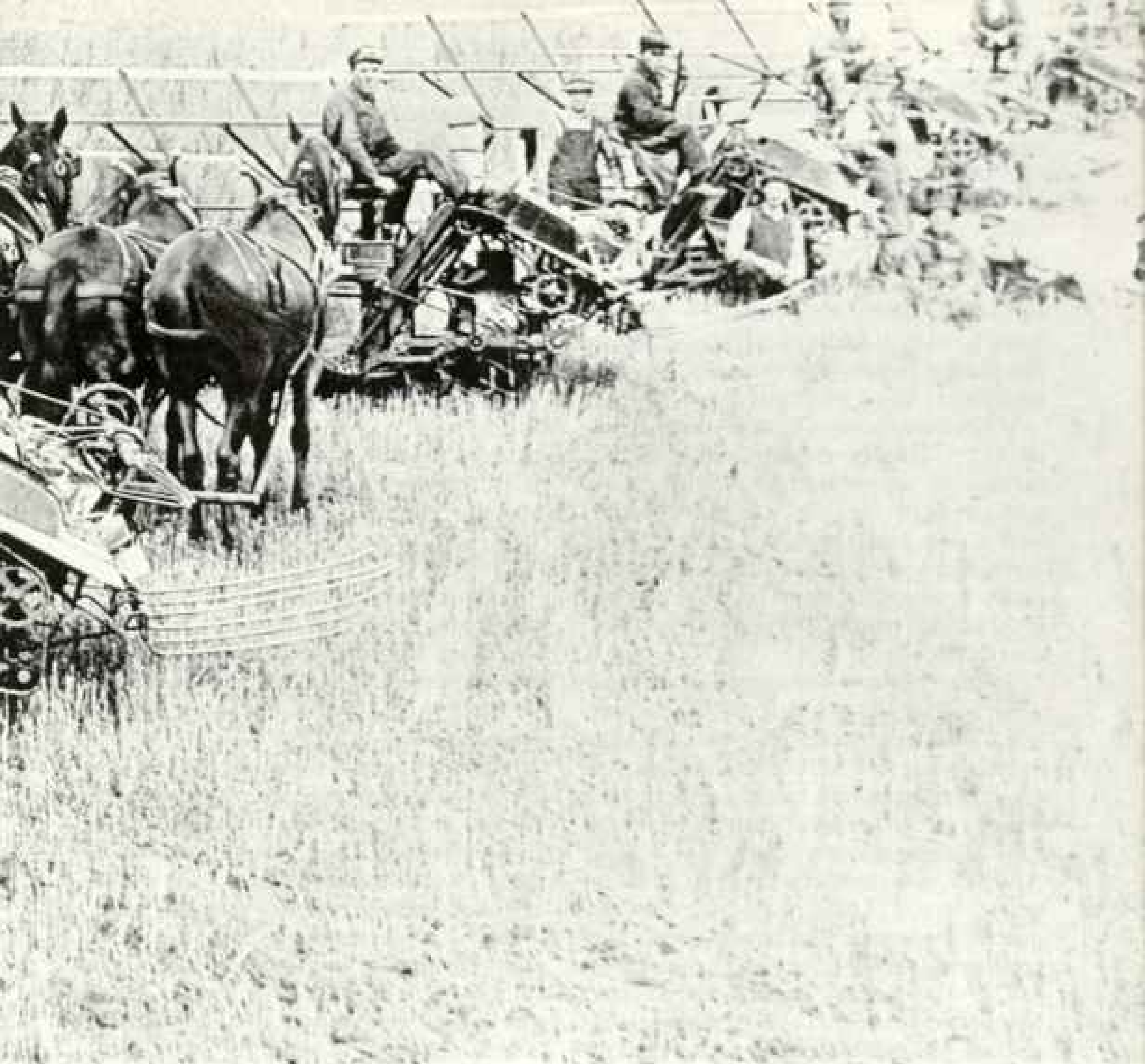
"After the drought, the government put in reservoirs, but not many of us bother with irrigation or fertilizer. Most people think that summer fallow's enough: Turned-under stubble puts nitrate in the soil and prevents water loss."

Gerald's teenage sons already know the ways of wheat and weather. "They can't go it alone," he said, "paying \$60,000 for a quarter section and as much again for start-up machinery. You hear a lot about farms growing bigger and fewer. Around here, kids who've left are returning. Their fathers subdivide and loan equipment to get them going. So now we may have three farms where one was before. My boys will probably do it that way too."

Expansion room for a growing family of boys brought Oscar's father from Quebec in 1909. Blanche's parents moved up in 1913 from North Dakota, where, forty years earlier—according to family legend—her grandparents had made houseroom for a while for a notorious métis of French and Indian stock named Louis Riel.

The Dominion's indifference to métis rights drove Riel, in 1869, to establish his own government over part of Manitoba's





LOCAL HISTORY DEPARTMENT, SASKATOON PUBLIC LIBRARY (ABOVE); GLENBOW-ALBERTA INSTITUTE, THOMAS V. SIMPSON

FOUR-HORSE POWER pulls wheat binders (above) around 1905 near Dundurn, where newcomers from Minnesota provided man power. Men often arrived first to make a start before being joined by families like this one from central Europe (right).

The French-Canadian Daoust family homesteaded in 1911, but lost their quarter section when Depression years hit the province hard. Son Richard, accompanied here by his daughters (left), saved enough to buy 160 acres in 1952, and now farms 1,280. "If I tried to start the same way today," he reflects, "I don't think I'd make it. The interest rates on land just eat you right up."



Red River Valley, long occupied by his people. After a series of unwise moves turned public sentiment and the Canadian militia against him, he drifted across the border, where he eventually became a U. S. citizen.

In 1884, when traditional métis lands along the Saskatchewan River were being surveyed with new settlers in mind, Riel returned to plead the natives' case. Ignored again by federal authorities, he hustled up a rebellion of Indians and métis that ended in their defeat and his execution.

Many Saskatchewan métis—an estimated 85,000—descend from Indian women and French voyageurs who paddled, poled, and portaged their 25-foot canoes across half a continent, swapping eastern goods for western furs. Preferring Indian ways, early generations lived largely off the great buffalo herds now long vanished from the plains.

Today, métis in the south—along with their Indian kin—find rough going in a white man's world. Faring better are those in the Land of Little Sticks—Saskatchewan's immense and lonely northern half, where undernourished forests resemble stubble on an old man's chin.

White men continue to invade its far reaches in search of riches, boring more frequently these days into possible sources of precious minerals, principally uranium.

The "Yellowcake Road," the region's only year-round route overland, dead-ends at Gulf Mineral Company's uranium pits near Collins Bay—a spine-twisting 24 hours by truck above Saskatoon. Indian and métis mine workers from Stony Rapids, Uranium City, and Fond du Lac commute the only way possible—by plane. In exchange for seven straight days of 11-hour shifts, they—like fellow employees from the south—are airlifted out for equal time at home.

Once at cruising altitude, I joined Gulf's charter pilot for a vantage view of endless emptiness. "Lotta room left down there if you're set on being the first to set foot in a place. Helps if you can walk on water."

Lakes, ponds, and rivers—a running Rorschach test of blue-black blots—drown almost a quarter of the north country; only for a few deep-winter weeks can tough drivers with tough vehicles make it over frozen muskeg and Lake Athabasca ice to Uranium

City. Much of this make-do outpost descends from houses hauled in during freeze-up from abandoned mine sites.

A feisty French woman named Anita Frame runs a car rental service there, bringing in replacements over the winter road.

"Some don't make it, though. Coupla big trailer trucks fell through a while back. My son dove down in fifty below weather to hook on salvage lines. Had 'em both up and running again in a week.

"I was the last to cross a year ago; the bridges over cracks were already busting up. Sure, it was scary. But when you live 600 miles from anywhere, you're taking chances from the time you get here."

Chipewyan Rely on the Land

A short floatplane flight from Uranium, Chipewyan Indians of Fond du Lac village benefit from mine jobs and local construction projects. But their basic livelihood still derives from the woods and water that fed their ancestors.

Julianne Djure and Rose Gatrou are friends, possibly relatives. Now in their nineties, both move slowly and as little as possible within their limited world—a single-room clapboard home that kindly neighbors come in regularly to clean.

Seated on facing beds beyond a small wood-burning stove, they smoke their pipes and entertain each other with tales of the way things were. Rose, now blind, is the talkative one.

"We live only here and in the bush when we stalk the caribou. Everyone go where they winter, around Athabasca and farther north. Two or three families share hunting grounds. Everybody work, even the children. From hides we make clothes and shelter; from the meat our meals. Fishing we do mostly to feed the dogs.

"Our children grow up trapping bear; they learn young how to get along. What does your white man's school teach them? They don't even know why they're there."

A much younger Eli Adam sees no reason to stray from the old ways. He, his wife, most of their 21 children, three skiff loads of gear, and a chorus of nondescript dogs were just back from a foraging month in the forest. A frozen caribou haunch from last winter's kill thawed in the sink while Mrs.

Adam snacked on a rabbit one of the kids had snared. Protein deficiency poses no problem here.

"We not get much this trip; only two black bear. But we live OK on smaller game. Everything that move in woods good to eat. Lynx best of all: best white meat, best price for furs. November we all go again, to my cabin across lake till spring. We fish, trap, wait for the caribou."

Home only a few weeks, Mrs. Adam already yearned for bush life. She finds her village of 450 people and a dozen motor vehicles "too noisy; it is best to be where is more peace and quiet."

In Eli's opinion, the near-constant chatter of prospectors' planes handicaps his hunting. But flyovers increase, a sure sign of mounting interest in Saskatchewan's undeveloped northland.

Chipewyan—combined with the Cree,

Assiniboin, Dakota, and Salteaux farther south—give the province the highest percentage of Indians in Canada. Yet they're outnumbered two to one by a minority of outside origin: the Ukrainians.

Sifting into Saskatchewan around the turn of the century and embellishing the landscape with their distinctive onion-domed churches, these adaptable peasants in sheepskin coats came in three waves. The first peaked around 1900; the second came after 1918. World War II triggered another rush of refugees, among them Anna Maria and Theodore Baran.

Like many recent migrants who gravitated to urban centers, they chose Saskatoon, a river-split city of considerable charm whose founders—a temperance colony out of eastern Canada—never managed to dry up the local liking for booze. Twin cathedrals of commerce—lofty flour mills



Planted on fertile soil, the Bunz family stands four generations deep beside their first home. Great-grandmother Barbara Bunz, seated, moved from a tent into the house in time for Christmas of 1904, when it was 50° below zero F.



EARLY BIRDS ROOST at the door of the land office in Battleford (facing page) to ensure first pick of new tracts opened for settlement in the early 1900's. While many immigrants relied on agents hired by the Canadian Government, others came in response to advertisements and traveling exhibits (below).

Alongside them at the land office were successful homesteaders who could file to buy an additional quarter section after meeting the first claim's requirements—part-time tenancy and thirty acres of ground broken within the first three years.

Not everyone found it a promised land. About half the Doukhobors left in disgruntlement at policies they felt infringed on their religion. A group of greenhorns from England's cities found themselves ill used by their leader, Moses Barr. But most stayed, despite the loneliness and hardship of their new lives.

Mechanization enabled farmers to live in towns and still work their land. Many today commute from homes and jobs in cities like Regina (above), the province's largest and the seat of its socialist government. Along with "nationalizing" many businesses, including almost half the operations at the huge potash deposits, the government has established a "land bank" of acreage for rental to those who can't afford, or choose not, to buy farms.



PUBLIC ARCHIVES OF CANADA



SASKATCHEWAN ARCHIVES, UNIVERSITY OF REGINA



UNIFORM PRIDE holds a graduating class of women eyes-front at the Royal Canadian Mounted Police Training Academy (right) in Regina. Often the only law officers for vast areas, Mounties meet the whole gamut of Canadians. When métis—citizens of mixed Indian and white heritage denied the status of “treaty Indians”—blockaded a national park before a meeting of all provincial premiers there, RCMP officers negotiated at the roadblocks (below). The park was opened, and Saskatchewan’s premier, Allan E. Blakeney, met with métis leaders to discuss their problems.

Protesting in a way still honored by Doukhobor extremists today, sect members disrobed (bottom) near Yorkton in 1903 when police stopped their marching demonstration for the right to own lands communally.



SASKATCHEWAN ARCHIVES, UNIVERSITY OF REGINA





—flank Saskatchewan's second largest city.

The Barans arrived in 1949 after three anxious, homeless years in a displaced-persons camp. Theodore can't remember ever making a wiser move. "We come to live without fear and for our children make future, absolutely. You want to work and learn, here is good. I start with nothing, paint houses and chop wood for neighbors. Then I get first job for church picture." Today his masterful icons illuminate churches from coast to coast, but the Barans' modest life-style remains unchanged.

Anna Maria explained why. "We never want for selves—no special house, nothing special for dress. Everything for children. First thing we buy, encyclopedia. Next,

piano. Then, most important, education. All five graduate from university."

This kind of drive has propelled many of Saskatchewan's 86,000 Ukrainians into positions of political and professional prominence. "For us, ethnic ties most important. Always we have our language and dance; keep alive our customs like Easter-egg art and celebrating by old calendar."

When public prejudice disrupted the cultural expression of other ethnic groups, the Ukrainians simply went underground, continuing as always behind closed doors of their numerous clubs and churches. They are, the Barans are certain, the most highly organized society in Saskatchewan.

A mecca for the metropolitan-minded,





high-rising Regina floats like a fantasy above the pancake plains (pages 670-71). Today's lofty silhouette hardly suggests its humble beginnings as a place called Pile O' Bones, a name particularly appropriate after buffalo thundered into oblivion.

U. S. buyers sought their bones for fertilizer and for bleaching sugar. Hard-pressed farmers picked up a handy six dollars a ton hauling them into town, where mini-mountains of remains rose beside the railroad tracks.

The city counts, among its attractions, the recruit training center for the Royal Canadian Mounted Police (pages 672-3). As the celebrated North West Mounted Police Force, the RCMP had, as an early assignment, bringing order to Saskatchewan's Cypress Hills. Headquartered at Fort Walsh for four years, the stout-hearted Mounties rode out after badmen from below the border, then profiting on sales to naive Indians of forbidden firewater—cheap liquor laced with cayenne pepper.

Shady Days in Moose Jaw

Other lawmen eventually began policing the province, but they apparently didn't mess with Moose Jaw when it roared into the twenties as Saskatchewan's city of sin.

Under protection from a corrupt police chief, brothels and bootleggers ruled River Street; Chicago gangsters rode in on the Soo Line to relax undisturbed when things got too hot at home. When two alien zealots from Indiana showed up in 1927, the town was obviously ripe for redemption.

Claiming the Ku Klux Klan had come to save Saskatchewan from just about everyone not Anglo-Saxon Protestant, the pair soon signed up some 12,000 disciples province-wide, more than 2,000 of them in Moose Jaw. Before they skipped town with most of the membership dues, they had

Drowning in a sea of sand, trees and bushes surrender to marching dunes south of Lake Athabasca, where deep sandstone deposits are overlaid with sand and gravel. Older rock covers the rest of Saskatchewan's north, an area of thin soil and stunted vegetation. Where the two formations meet, a wealth of uranium is found.



Peace and plenty of it marks the tempo of life at the Waldeck Hutterite Colony (above). Its founders arrived from Alberta in 1962 to farm and follow their faith.

One practice is segregation of sexes on

occasions like meals in the dining hall (below), where children eat after adults. Tots at kindergarten (below right) mingle freely, as do older children who attend public school at the colony until formal education





ends with the eighth grade. But boys and girls sit apart at morning and afternoon sessions of German school to learn hymns, the Bible, and German.

"To an outsider it looks like a rigid life,

but we think we have enough freedom," says Elder Michael P. Entz. Despite some friction, he says, "We like our neighbors. It's not only us Hutterites who'll go to Heaven, you know!"



attracted the largest audience the province had ever seen—7,000 for a gala cross burning up near the fair grounds. Things are quiet now along River Street, and an annual multicultural carnival outdraws that cross burning by far. But uneasiness over some latecomers dies hard in the hustings.

Hutterites Face Criticism

West of Moose Jaw the wheat belt begins to buckle a bit, rising in low knolls as smooth and round as the rumps of once plentiful buffalo. This is cattle country, more suitable for grazing than for grain. Closer to the Cypress Hills, where the land levels out again, Saskatchewan's most recent immigrant group—highly disciplined Hutterites of German-Russian origin—have set up a chain of some 35 colonies.

A peaceful agrarian people rigidly regulated by their faith, they strive for self-sufficiency through communal effort, refusing any change that would disturb their established life-style.

When a Hutterite colony outgrows its productive capacity, it simply starts a new colony of some six to eight thousand acres. In Vanguard sharp opposition has risen to a satellite of the Waldeck community, now nearing completion in defiance of local laws. I listened to the muttering:

"They kill every town they get near, buying up the land and putting nothing back into the economy."

"When did you ever see one at a hockey game or the movies?"

"If they take over, they never sell. So what chance do my kids have of staying here?"

"They'll pay anything for property they want; already they've pushed prices up around here from \$40,000 to \$60,000 a quarter section."

"We have to send them a teacher of their own; they won't go to school with other kids."

"And they're breaking their agreement to keep colonies 35 miles apart."

When Alberta required such a spacing in

the 1950's, many Hutterites spun off to Saskatchewan, where no province-wide restrictions exist. So, affected rural municipalities are beginning to make their own. Knowing the close-knit Hutterites depend on huddled housing, citizens around Vanguard voted to limit occupancy of farmlands to two single dwellings a quarter section.

Elder Michael P. Entz, a highly articulate spokesman for a people whose formal education stops with the eighth grade, disagrees with the opposition on all counts.

"We may not attend village functions, but our kids don't tear up the place either. For forty students, we have one teacher. It would cost more than that single salary to send them all to public school. For which we pay taxes like everyone else.

"If we're to blame for all the ghost towns, how come there're so many with no Hutterites around? Sure we're for self-sufficiency. But we spent almost half a million dollars outside this year. Fourteen people lived here before; I'll bet they didn't spend 2 percent of that. And our money stays in Canada—we don't drop it in Hawaii or Florida.

"The 35-mile thing was only an informal agreement, and it expired five years ago."

If the case reaches the courts, the Hutterites may find themselves, for the first time, committed to a fight in Saskatchewan.

The wind had risen by the time I reached nearby Aneroid, blowing me into that prairie-town fixture—a Chinese-run diner. The counterman fielded a flying napkin.

"Quite a breeze," I commented.

"No one pays much attention here until they see whitecaps in their bathwater."

Behind me sun-reddened men and women in well-worn denims talked of buying larger planes, trips to Hawaii, newly acquired microwave ovens.

"Would you believe, only 15 minutes from freezer to table."

"Guess that about does away with the need for you women."

For Saskatchewan, it had been a good year. □

Spring's fresh-turned earth smooths a ride for a young member of the Riverview Hutterite Colony. Saskatchewan's latest immigrant group, Hutterites may count as neighbors men and women who pioneered the untamed prairie. Theirs is a young province, still vibrant with the energy of its beginnings.



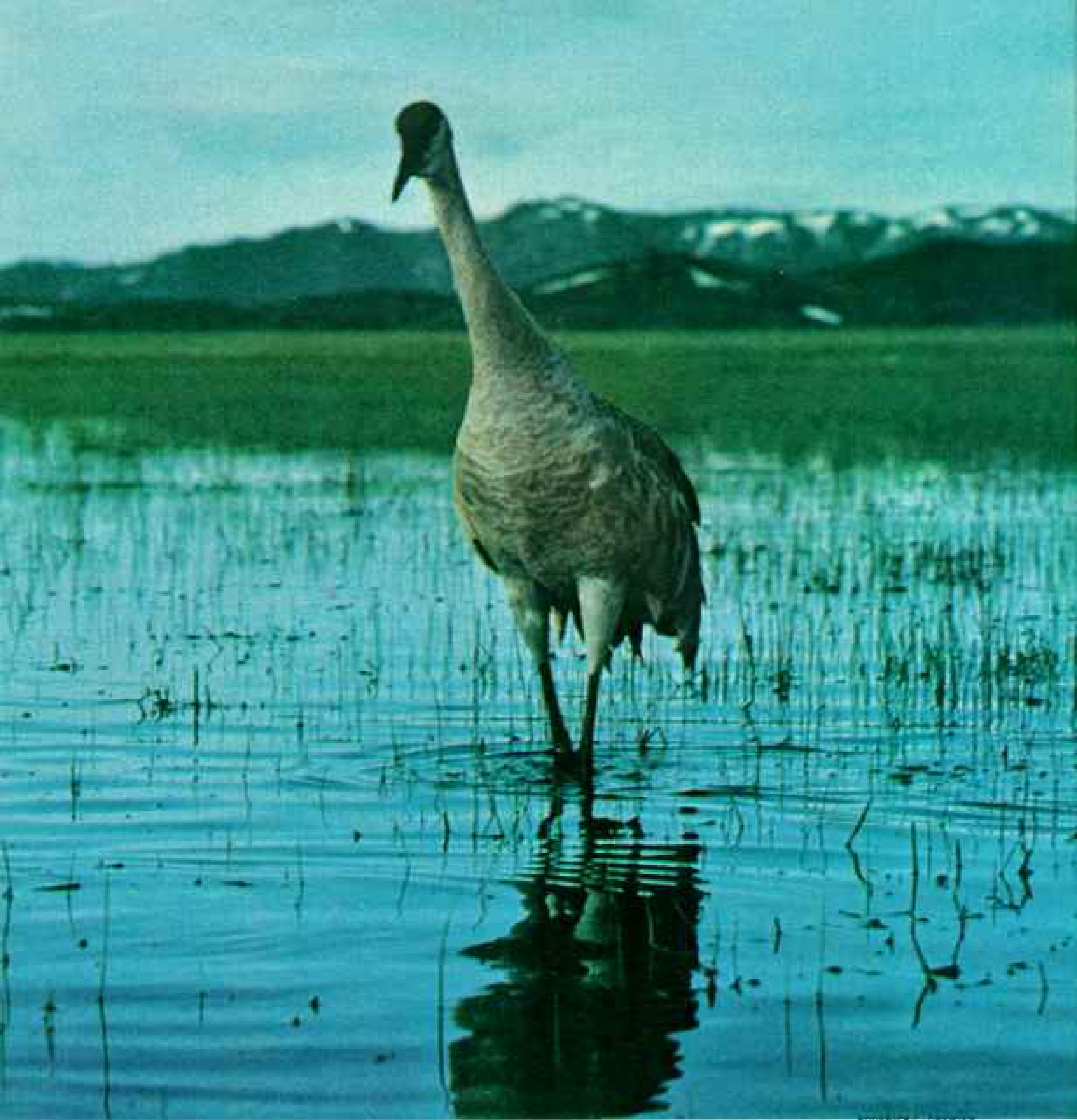


In Idaho, a greater sandhill crane plays father to a rare baby whooping crane in a

Teamwork Helps the Whooping Crane

BY RODERICK C. DREWIEN
COOPERATIVE WILDLIFE RESEARCH UNIT, UNIVERSITY OF IDAHO

WITH ERNIE KUYT
CANADIAN WILDLIFE SERVICE



test to see if sandhills will hatch whooper eggs from Canada and raise the chicks.

THE TWO SANDHILL CRANES were stately silhouettes in the dawn light, slowly strolling the shallow marsh at Grays Lake National Wildlife Refuge in southeastern Idaho. Studying the cranes through a spotting scope, I saw no newly hatched chick. Had something upset the sandhills at their nesting?

I stood up to walk across the broad meadow bordering the marsh. Instantly the sandhills trumpeted their alarm, calling

continually as they stalked to safety on a nearby island.

Moments later a chick swam from the area where the adult cranes had been foraging. The tiny bird was special—not the sandhill species at all, but an endangered whooping crane. And it was thoroughly confused: Instead of skittering to cover, it made for the center of the open marsh.

Suddenly the female sandhill was charging back through the water. Blasting an

alarm call, she overtook the errant chick and herded it into a stand of thick rushes.

Each spring since 1975 my colleagues (from the U. S. Fish and Wildlife Service and the Canadian Wildlife Service) and I have fooled the sandhills at Grays Lake into hatching and rearing whooper chicks from eggs collected at Wood Buffalo National Park in Canada (map, page 685). In time this annual deception may restore whoopers to part of their original range and help bring them back from the edge of extinction.

Things have not always been bad for *Grus americana*. Though never abundant, whooping cranes ranged from New Jersey wetlands to Rocky Mountain marshes when Europeans first colonized North America.

As human settlement expanded westward, transforming their habitat, whoopers dwindled, declining most rapidly between 1870 and 1920.

By 1941 only 21 whooping cranes were known to exist in the wild; 15 wintered on the Texas Gulf Coast, and 6 others formed a nonmigratory flock in southwestern Louisiana. By the end of the decade the Louisiana birds had vanished, and only the establishment in 1937 of the Aransas National Wildlife Refuge had saved the Texas flock from a similar fate.* Winter population counts at the refuge near Austwell, Texas, illuminated the birds' precarious status and spurred

*Aransas is part of the National Wildlife Refuge System described in the March 1979 GEOGRAPHIC.



ELWOOD BIZEAU/RODERICK C. BREWSTER (RIGHT)

With precious booty gingerly suspended in a warm wool sock, Canadian biologist Ernie Kuyt carries a whooping crane egg from one of the 15 to 17 whooper nests thought to exist in the wild—all in Canada's Wood Buffalo National Park (right). Purpose of tapping this sole wild breeding ground of the endangered species: a U. S.-Canadian effort to establish a second breeding flock of wild whoopers among close-kin sandhill cranes.



efforts to preserve their remaining habitat.

In 1954 the whooping cranes' long-sought nesting grounds were discovered along the northern margin of Wood Buffalo National Park. The discovery would enable scientists to try rearing a captive flock from eggs collected there.

Taking this idea a step further, Fred G. Bard, of the Saskatchewan Museum of Natural History, proposed in 1956 that the eggs be hatched by wild sandhill cranes. They would rear the whoopers as their own and thus keep them in the wild.

Like the whooping crane, the greater sandhill also declined drastically in numbers during the first half of the century. By the early 1940's only about 250 pairs remained

in the Rocky Mountains, principally in the area around Grays Lake.

Concern for the future of the sandhill brought me in 1969 to Grays Lake, site of the continent's largest nesting concentration of sandhills. As a biologist with the Idaho Cooperative Wildlife Research Unit at the University of Idaho, I netted and banded more than 700 cranes and tracked many of them from summer to winter areas and back. Later in the six-year study I was able to show that the greater sandhill crane had made a dramatic comeback: Today more than 10,000 summer in the Rockies alone.

Favoring Fred Bard's foster-parent experiment were traits common to greater sandhills and whoopers. Adults seem to



mate for life, and breeding pairs return each spring to traditional nesting territories. Their eggs, similar in size and appearance, are usually laid in clutches of two; incubation periods of about thirty days produce look-alike chicks that remain with their parents for nine to ten months after hatching.

By cautious experiment in 1970 I learned that the sandhills at Grays Lake would not abandon their nests if I switched or removed an egg. Meanwhile, Canadian Wildlife Service biologist Ernie Kuyt was finding whooping cranes equally tolerant.

Under Ernie's direction, air searches at Wood Buffalo recorded the spring arrival of the whoopers, the location of breeding pairs, their approximate laying and hatching dates, and the size of their clutches. In 1967 these observations enabled Ernie to begin collecting whooper eggs for breeding.

Studies by Dr. Ray Erickson and his staff

of the U. S. Fish and Wildlife Service had suggested earlier that whooping cranes would not desert the nest if one of their eggs was removed; indeed, successful rearing of twin young is a rarity. Acting on this, Ernie picked up six eggs at Wood Buffalo for transfer by jet to Ray, who is an assistant director at the Patuxent Wildlife Research Center in Laurel, Maryland. The center's captive flock of 22 whoopers now includes 15 hatched from Canadian eggs.

Egg Removal Aids Chick Survival

As Ray had predicted, collecting the eggs did not imperil the Wood Buffalo flock. In fact, the number of wild chicks reaching maturity was higher during years when eggs were removed. The operation was repeated, and in 1975 Ernie prepared for the sixth egg transfer in nine nesting seasons, this time to Grays Lake.



That year in early May the 22,000-acre Grays Lake marsh was still frozen beneath two feet of snow. The month before, sandhills had begun arriving from their wintering grounds in New Mexico's Rio Grande Valley, some 800 miles away. Now, after reestablishing territorial boundaries, expelling trespassers, and squabbling with neighbors, about 250 breeding pairs awaited the melting of snow to begin nesting.

On May 9 Ernie telephoned from Fort Smith in the Northwest Territories. That day's aerial survey at Wood Buffalo had already revealed 11 whooper nests. The earliest laid eggs would hatch about June 1; they should be collected at latest by May 26.

I told Ernie of the bleak weather at Grays Lake—it might delay the start of the nesting season there by as much as three weeks. Reluctantly he agreed to postpone the egg pickup until May 28. After a night in an

Jet-setting eggs will be flown 1,200 miles in a special insulated suitcase (below) from Canada to Grays Lake National Wildlife Refuge in Idaho, a prime sandhill crane nesting ground. Ernie Kuyt removes a whooper egg from a sock (left) and exchanges it for an egg in a sandhill nest. Nest-to-nest time: 32 hours.

Removal of a single egg from a whooper's normal clutch of two actually bolstered the original flock by increasing the number of wild chicks reaching maturity; only one baby from each nest usually survives.

Whooping cranes now total 83 in the wild, 26 in captivity—desperate numbers, but reassuringly up from a low of 21 in 1941. Removal of excess eggs at Wood Buffalo has made possible the building of a captive flock at Patuxent Wildlife Research Center in Maryland and, now, a second wild flock in the U. S. Rockies.



BOX BY ROBERT C. BREWSTER



incubator at Fort Smith, the eggs would be packed in insulated suitcases and flown south by Ernie, Ray Erickson, and Elwood Bizeau, like me a biologist with the Idaho Cooperative Wildlife Research Unit.

I began searching for cranes I had banded in previous years, looking for those with the best records of hatching and raising young. I chose 14 nesting sandhill pairs as foster parents, and by May 28 had taken an egg from each pair's clutch.

Removing the eggs in advance made it easier when, the next day, Ernie and I exchanged the remaining egg in each nest for a whooping crane egg. Incubating sandhills protested loudly and fled their nests as we skimmed the marsh in an airboat, gathering and depositing eggs. We distributed 14 in all, dropping off the last egg just 32 hours after it had been collected at Wood Buffalo.

By June 3 the first whooping crane chick had hatched, and eight more followed within the week. Three eggs were infertile, and predators—possibly coyotes—destroyed the other two.

At one nest I could find neither foster parents nor adopted whooper. Likely they were hiding nearby, with the chick concealed apart from the adults. I decided to try locating the chick with a sandhill call.

"Purr, purrrr, purrrr-r," I called. A high-pitched "peep, pee-ep" from a patch of bulrushes betrayed the chick. Moments later a cinnamon-colored ball of fluff came bobbing across a pond toward me. At once the foster parents jumped from the rushes, blaring an alarm call. The confused chick hesitated, then swam back into hiding.

Five of the nine chicks hatched in 1975 lived to migrate south that fall with their foster parents. Encouraged, we transferred 75 more eggs to Grays Lake between 1976 and 1978, including 31 Ray Erickson sent from the captive flock at Patuxent.

Drought Gives Edge to Coyotes

A drought in those years was especially severe at Grays Lake; by midsummer of 1977 most of the marsh was dry. One after another, whooper chicks vanished as lack of water reduced their natural foods and enabled coyotes to forage deep into the marsh. Only 11 of 45 young hatched between 1976 and 1978 lived to migrate.



DEYMOND CALL

With all the menace it can muster, a 2-month-old whooper—too young to fly at an intruder's approach—raises its wings in a threat display (right) as it charges Rod Drewien (above), hissing and pecking.

After being gently subdued by net in a technique the biologist first perfected on sandhills, the gawky chick (below) submits to banding—vital to tracking movements but never done in the past for fear of injuring the birds.



BALPH STORR; BODERICK C. DREWEN (RIGHT)



Whooper chicks that survived trailed their foster parents everywhere, foraging and roosting with them. Often the older birds presented the chicks with tidbits—insects. More than once I saw a sandhill stand over a youngster to shelter it in a rainstorm.

When mature, the sandhills' exotic charges would be North America's tallest birds, and by August some of the chicks already stood four feet tall. That was large enough, I decided, to accommodate an identifying leg band.

First Tagging Effort a Success

Wild whooping cranes had never been banded before 1975, and I asked Elwood Bizeau and Desmond Call, a refuge employee, to pioneer the operation with me. Our first target fled as we approached and eluded us for nearly an hour until Desmond spotted it in the dense cover beside a pond. As I moved in, the chick spread its wings and charged, hissing and pecking. I netted the counter-attacking crane just before it reached me.

The whooper soon calmed down, but lost no chance to peck us while we fastened a band to one leg, then slipped a color-coded plastic marker around the other. Weighed, measured, and released, the chick quickly disappeared again in the man-high rushes.

About 2,000 cranes migrate annually from Grays Lake, and when the first flock spiraled skyward in late September, five whoopers had been banded. One morning in early October, I watched a bugling flock attract a whooper chick and its foster parents.

Seemingly tethered to the attentive pair of sandhills, the young whooping crane traced their every turn as they circled upward in the bright autumn sky. The chick's white body and black-tipped wings contrasted with the mouse-gray sandhills. The flock established formation and swung southeast toward Wyoming.

Flocks head first for Monte Vista National Wildlife Refuge in Colorado's San Luis Valley. There they may rest for a day or a

month or more before following the Rio Grande south to their winter home in and around Bosque del Apache National Wildlife Refuge in New Mexico.

I alerted the manager of the Monte Vista Refuge, Charles R. "Pete" Bryant, that the first whooper was on its way. Pete called back the following afternoon.

"We have a whooping crane on the south end of the refuge. He's wearing your plastic leg marker." Incredibly, the bird and its foster parents had covered the 500 miles from Grays Lake to Monte Vista in only 30 hours; along the way they topped the Continental Divide, flying above 14,000 feet.

The trio rested at Monte Vista for two weeks, then resumed their odyssey on October 24. The next day they were foraging in a cornfield at Bosque del Apache, where refuge employees soon nicknamed the grain-loving whooper "Corny."

Three more juvenile whoopers arrived to winter in New Mexico. Encounters between the young whoopers and sandhills other than their foster parents became more frequent—and more hostile—particularly as the two species competed for food.

Contentious cranes often sought to bluff each other, spreading their wings in threat displays. Sometimes one bird pursued another, nipping and pecking; occasionally a face-to-face pecking duel developed.

Radios Warn Goose Hunters

Thanks to the precautions taken, the 16-day snow goose hunting season at Bosque del Apache didn't worry us much more than these bloodless battles. Hunters, selected in a drawing, must pass a bird-identification course. Also, they are issued portable radios tuned to a refuge station, which warns of approaching whoopers. Between 1975 and 1978, whoopers entered the hunting area many times without mishap. In the past four years, several whoopers have wintered in New Mexico, then started northward again in early spring. Six summered at or near

Already taller than its foster parents, a 7-month-old whooper, at right—having delighted scientists by joining the sandhills' fall migration from Idaho—forages at Bosque del Apache National Wildlife Refuge in New Mexico. After shedding brownish juvenile plumage for adult white with black trim, the full-grown whooper, tallest bird in North America, will stand nearly five feet tall—half a foot above its greater sandhill kin.

RODGERICK C. BREWSTER



Bugling an alarm, a 2-year-old whooper at the sandhills' New Mexico wintering ground (below) sounds the trumpetlike cry that gives whooping cranes their name. Flexing its black-tipped wings (right), the whooper skirmishes with a sandhill over feeding territory. The sandhills' 800-mile fall migration is short compared to the whoopers' normal 2,500-mile flights (map, page 685).

BOTH BY RODRICK C. DREWEN



Grays Lake. Three died after striking barbed-wire fences or power lines.

Most of the returning whoopers remained in the company of their foster parents only as far as the San Luis Valley in Colorado, then continued northward on their own. So far only one mixed family has returned intact to Grays Lake.

As nonbreeding subadults, the whoopers still settle nightly in community roosts with sandhills and continue to migrate back and

forth between Grays Lake and New Mexico in company with sandhill flocks. But the whoopers no longer maintain permanent social bonds with individual sandhill cranes.

I have seen evidence that whooping cranes may be able to recognize each other even after a long separation. The most interesting such interaction, between a subadult and a chick, took place during the second half of 1977.

Summering at Grays Lake, in late July,



the subadult discovered two sandhills rearing a whooper chick hatched two months before. The older bird soon showed strong interest in the chick and continually trespassed on sandhills' territory to be near it.

At first the male sandhill always chased the subadult away. From prior observation I knew that this whooper could dominate almost any sandhill it met, yet it would withdraw, then approach the chick once again. This persistent retreat and advance ended in

August when the sandhills at last allowed the subadult to join them and the chick.

The subadult danced and vocalized before the chick several times in the next weeks, but prompted no response. Nonetheless, it continued shadowing the chick until the foster family migrated in October.

In December these whoopers met again, on the New Mexico wintering grounds. Now the subadult played the older brother, protecting the chick from aggressive

sandhill cranes. Finally, in mid-February, the subadult migrated north, leaving the still unresponsive chick behind.

This and other associations prove that it is possible for the nine surviving Rocky Mountain whooping cranes to find one another even when mixed among 10,000 to 15,000 sandhills wintering in and around Bosque del Apache. Such contacts are vital if the whoopers are to pair and nest.

Heartening, too, is the whooper's ability to adapt to the diet and activities of sandhill cranes. Introduced whoopers have shown that they can survive on agricultural grains at the wintering grounds in New Mexico. This may indicate a brighter future than expected for them.

Though snowmelt partially restored pre-drought water levels at Grays Lake marsh in 1978, the high mortality of flightless young—a major problem—continued.

How long the Grays Lake experiment continues depends on the cranes. The goal, assuming the birds mate and nest, is to establish a Rocky Mountain population of at least twenty breeding pairs.

Several questions concerning the project remain unanswered. Reared by sandhills, will the whoopers try to mate with them? Or will differing plumage, behavior, and habitat preferences prevent the two species from crossbreeding? If the whooping cranes pair with each other, will they be able to nest and rear young in their new habitat?

Whooping cranes are not believed to reach sexual maturity until 5 or 6 years of age. Hence answers to these questions may come just as U. S. and Canadian officials meet next year to review the experiment and decide its future. By then, one of North America's most majestic marsh birds may be reclaiming a homeland in the Rockies. □

Hunters, beware! Bright white whooper in a squadron of gray sandhills presents a tempting target and could be mistaken for a snow goose. As a result, during goose-hunting season, refuge personnel hand out transistor radios to warn hunters when whoopers take to the air. But even with every possible assist from man, the ability of sandhill-raised whoopers to find their own kind, to mate, and to establish flocks will remain unknown until the 1980's.

TOM D. MARBLESON







CLOTHES GET DIRTY even in paradise, so I happened to be wrestling my laundry bag into the Yountville Washeteria when I heard a familiar voice yelling from across the road. "Hey, Moira, come on up with us. We've got an extra space."

With flashes of flame and a roaring of hot air, a balloon was being brought alive in the parking lot of Vintage 1870—a restored winery that now houses shops and restaurants. As the balloon sprang into a breathtaking inverted teardrop—rainbow striped and 60 feet high—it looked eager to be up, up, and away over Napa Valley, the famous wine-growing region of California—the state that supplies more than 70 percent of the wines sold in the United States.

Steve Frattini, a young native Napan, and his partner, Ron Clifford, have found a means of survival in this expensive valley by taking people aloft for \$100 each. The three balloons rising each morning above ground-hugging mists have become a happy sight. Their gentle pace. Their joie de vivre! They've become symbols of an attitude that sets Napa Valley apart from the bustling San Francisco Bay area to the south. My wash could wait. How could I resist?

We lifted into a clear harvest sky to find the wind that would carry us over one of the world's most compelling valleys. "Until I got balloon fever, I never knew how beautiful this valley really was," Steve said.

By eight o'clock we could feel a Mediterranean sun on our arms. Below us a century-old frame winery gave off the warmth of traditions as deeply rooted as the vines; the old Eshcol cellars were alive again as the Trefethen Vineyards winery—one of the more than forty new wineries born since 1970 in Napa Valley's coming-of-age.

Three years ago the wine world was stunned when two tiny, neophyte Napa Valley wineries—Stag's Leap Wine Cellars and Chateau Montelena—triumphed over some of the greatest wines of France's Bordeaux and Burgundy regions in a celebrated U. S. Bicentennial tasting in Paris.

Just to the west of Yountville we floated over a sign of Napa's new esteem—Domaine Chandon's recently opened winery, restaurant, and vineyards. In *le grand tribut* to the valley's potential, (Continued on page 700)

Napa, California's Valley of the Vine

By MOIRA JOHNSTON

Photographs by
CHARLES O'REAR

Sailing away over waves of grapes, a hot-air balloon makes a vivid splash against the earthy green vineyards of California's Napa Valley. *Adventures Aloft of Yountville* provides a morning's airborne tour over one of the nation's foremost wine-producing regions. The view from above is heady: a 35-mile-long vale with superlative vineyards sweeping into graceful blue mountains. But problems cloud the horizon of this valley whose rural charms lie within easy driving distance of San Francisco. Development has threatened to eat up the vineyards that feed the wineries, just as Napa is beginning to produce vintages that compare favorably with the best that Europe has to offer.



Dark, luscious clusters of Cabernet Sauvignon—Napa's great red hope—bow before the sun in the Chateau Chevalier vineyard (above). Experts gloat when extolling the Cabernet, perhaps the valley's noblest European transplant.

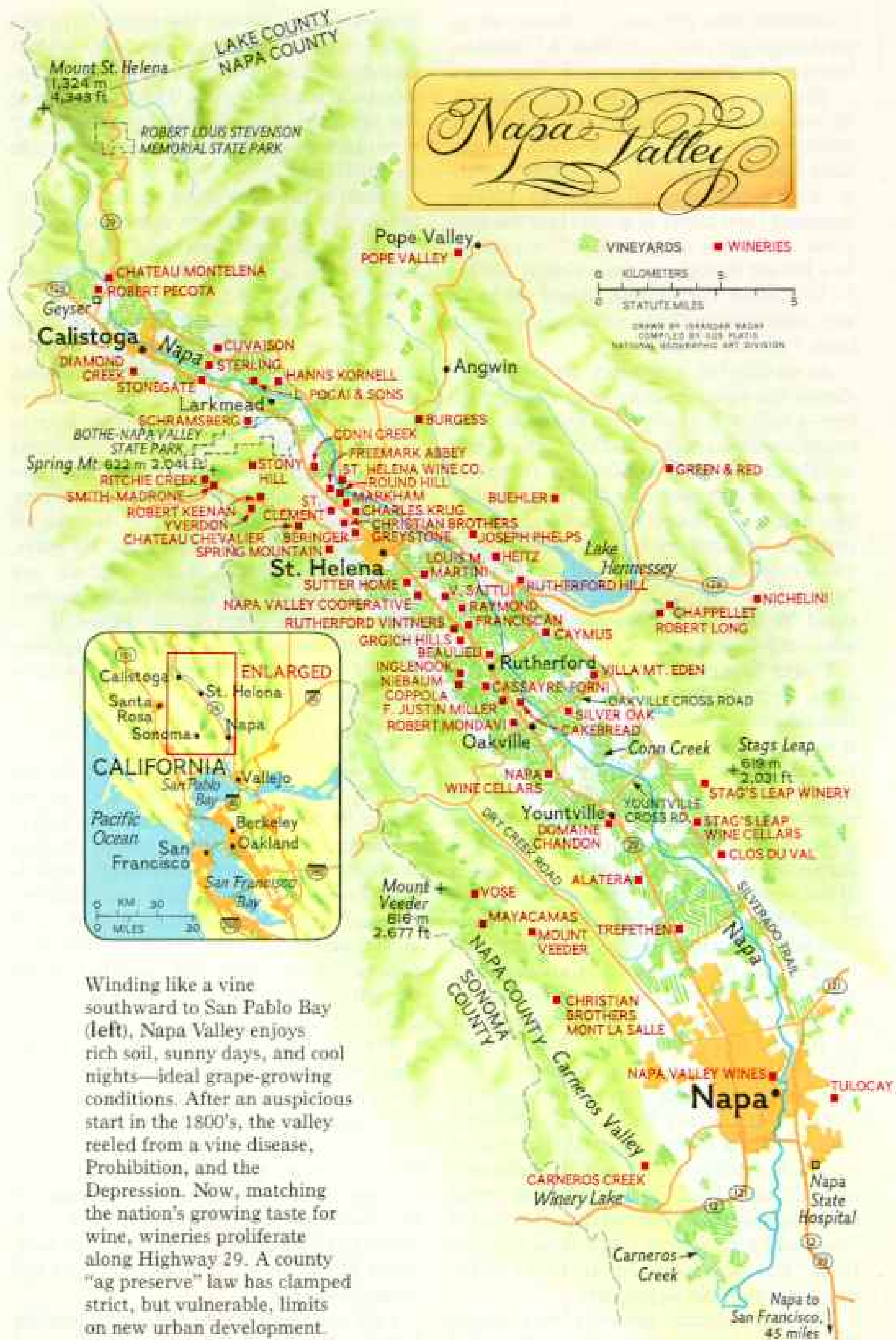
To Russian-born André Tchelistcheff (right), the Cabernet has demonstrated an elegant adaptability that promises ever greater triumphs in California soil. Here Tchelistcheff presses his experienced 77-year-old nose to the task of sniffing out the differences between two Rieslings. The bouquet of a superior Riesling, says he, evokes a melding of fresh fruit, dried apples, and a pungent hint of kerosene. Tchelistcheff was doing research at France's National Institute of Agronomy vineyard in Paris when French-born Georges de Latour lured him to Napa Valley in 1938 and made him wine master at Latour's prestigious Beaulieu Vineyard in Rutherford. With him, Tchelistcheff brought a Slavic moodiness ("I never taste wine when I'm depressed; I wait") and a Latin anthropomorphism (A great wine is, naturally, "a ravishing woman"). Most important, he brought a Gallic preciseness to his art. During his 35 years at Beaulieu and through the research company he founded, Tchelistcheff has influenced a generation of Napa wine makers.



Shades of Europe's aristocracy live on as Latour's daughter, the Marquise de Pins (right), receives a fruit-and-champagne drink from Robert Boutonnet on her veranda. Although the winery itself was sold to Heublein, Inc. in 1969, the Marquise maintains her home in Rutherford.







Winding like a vine southward to San Pablo Bay (left), Napa Valley enjoys rich soil, sunny days, and cool nights—ideal grape-growing conditions. After an auspicious start in the 1800's, the valley reeled from a vine disease, Prohibition, and the Depression. Now, matching the nation's growing taste for wine, wineries proliferate along Highway 29. A county "ag preserve" law has clamped strict, but vulnerable, limits on new urban development.

(Continued from page 695) France's largest champagne producer, Moët & Chandon, has come to Napa to make sparkling wines.

Then we were drifting low, over harvest. Between the rows of vines, tractors pulling yellow gondolas full of grapes left herringbone patterns in the soil. We dipped to within waving distance of Mexican pickers dumping their boxes of grapes into the gondolas. "¡Buenos días, amigos!" we yelled. In a hot-air balloon we were clearly not the U. S. Border Patrol, and illegal aliens, if any, need not run. They waved and laughed back, "¡Buenos días!"

As we lifted to 3,000 feet, we could scan almost the entire 35-mile length of the valley—a lush strip from one to five miles wide (map, preceding page). To the north, Mount St. Helena loomed, a pale blue truncated cone of volcanic rock that guards the valley like a fortress. Below the mountain, vineyards flowed like green lava, enclosing the quiet towns of Calistoga and St. Helena, "up-valley's" agrarian hub. In mid-valley stood Yountville, where, emotionally, the wine country begins.

Tawny hills reached down the valley like arms, protecting its flanks—the watershed that shapes the valley and provides its soils. It is these soils—along with the climate and the individualists who have been drawn here since frontiersman George Yount planted the first grapes in 1838—that have given Napa Valley its special destiny. For they make it uniquely suited to the growing of the finest wine grapes and to the making of world-rank wines. Somewhere in these soils and microclimates may be the acre that will produce the world's best Cabernet Sauvignon, the grape of the great red Bordeaux. Perhaps the best Chardonnay, the grape of Burgundy's white wine. Napa's own Mouton-Rothschild or Montrachet!

But will the valley survive to realize its destiny? One of my balloon mates voiced doubts. "It's a unique cultural resource, of national, even *international* importance," said Michael Gage, the sandy-haired young California assemblyman who was taking his 7-year-old son, Damon, on a final summer fling. "But these vineyards are only here today because of the ag preserve."

The agricultural preserve was established in 1968 by the Napa County Board of

Supervisors to protect the prime farmland on the valley floor from the urban sprawl that devours 65,000 acres of California's agricultural land each year. The board limited the subdivision of preserve land to twenty acres or more and established tax protection for the farmer.

"But the preserve could be wiped out tomorrow by a three-to-two vote of the board. Look, you can see it from here!" Mike pointed out the boundaries of the ag preserve as if it were the Maginot Line.

North of the boundary, vineyards rolled in an almost unbroken swath. Abutting the line on the south were the tract houses and mobile-home parks of Napa, the city where half the county's 93,000 people live, largely a bedroom community for the industries south of the city, in Napa County and adjacent areas. South of the boundary is where 80 percent of the jobs are: in the Mare Island Naval Shipyard, the Napa State Hospital, Kaiser Steel, Basalt Rock. Beyond, we could barely see the Golden Gate Bridge, just an hour's drive south. Below us, a relentless line of traffic moved up Highway 29; the valley has become a major tourist attraction.

From Oakland to the Emerald City

We were coming down, heading for the roof of a house. I closed my eyes as we skimmed the roof and thudded with bull's-eye accuracy onto the pavement of Paulson Way, a curving street of ranch-style subdivision homes. Mothers and tiny children crowded around our rainbow bubble as if we'd flown in from Oz. A toddler with diapers riding perilously low squatted beside the balloon, entranced, as the chase crew deflated it and folded it up.

For the child's mother, Kathy Dean, Napa has been "just like a fairy tale" since she and her husband, Ron, a fireman with the Oakland Fire Department, moved here the year before. And now, this! "In Napa, blood pressure goes down and happiness goes up," Kathy beamed. Ron commutes to the firehouse in Oakland—an hour each way—but it's worth it. "Someday," she said, "we'd like to have a little piece of land up-valley, some horses. . . ."

I felt that elemental tug on a commanding hilltop a few miles east of Paulson Way as I

plunged my bare feet and legs into a wooden vat of cool, slippery red grapes. As hundreds of home wine makers do in the valley, John Kongsgaard, student wine maker and fifth-generation Napan, was making his wine. Sharing the vat with John's friends, I pumped my feet to the music of Duke Ellington and toasted the new vintage with last year's Cabernet. Euphoria!

This warmth reaches out everywhere in Napa Valley. At a 4-H club barbecue in St. Helena, my children and I shared hay bales with valley families, and, again, felt the belonging that let my 11- and 6-year-old get up and join a thumping, clapping, elbow-flapping crowd of all ages in a square dance. "Wow, Mom, this could never happen in San Francisco!" said my astonished son.

Running out of gas on Yountville Cross Road, I went to a small farmhouse to use the phone, and was given gas by an old Italian ranch caretaker who said, when I tried to pay him, "We don't leave folks stranded on the road in Napa Valley."

"It's the old barn-raising spirit," says publisher Starr Baldwin, sitting, jowly and wise at 79, behind his desk at the *St. Helena Star*. "We work things out together."

This countywide sense of cohesiveness has a strong southern anchor in the city of Napa. Dozens of decorative old Victorian houses flanking the shopping section are being revamped, a sign of commitment to a vital downtown. More powerful curbs to urban sprawl lie underground.

"We've been able to maintain our downtown as the commercial core of the entire county," explains affable Mayor Ralph Bolin in his downtown office, "and to stop big shopping centers in the county because we control the water, and we won't sell water to anybody outside the city unless they follow our rigid policies."

At the north end of the valley, in the old spa town of Calistoga, I leaped from the politics of growth to the valley's primeval past. Soaring in a glider over a spouting geyser, then wallowing in a tub of heavy, hot, sulfur-fumed mud (pages 710-11), I was reminded of the geologic violence of the valley's birth. Calistoga's geysers, hot mineral springs—my mud bath—were the final gasps of volcanic activity that had spewed lava and cast blankets of ash over

sedimentary rock, which, eons earlier, had been heaved up into the coastal range.

"Some of the lava formed the black obsidian the Wappo Indians used for arrowheads," geologist Peter van de Kamp explained. "And some formed pyroclastic rocks, the gray stone the Italians and Chinese built into wineries and bridges." Among the valley's greatest charms are massive stone wineries like Christian Brothers' Greystone cellars, called the largest in the world when built in 1889, and the stone bridges that still arch over the Napa River.

The earlier cattle-raising men of the ranchos left no stone bridges. Mexican land



Looking both ways as they cross the streets of Calistoga, two among the town's sizable Russian-American community use a tricycle built for two. Basil Liubomudrov watches where they're going as his wife, Alexandra, sees where they've been.



Grapes turn to gold for large growers such as the owners of this rambling manor on the valley's west slope. With a spectacular view of the valley, they need no



more than the graceful tiers of vines for a lawn. Though the wine industry employs relatively few—only 2,600—it is Napa County's biggest source of income.



Palates grow keener in the vineyards of Robert Mondavi Winery when picnickers savor fine wines during Mondavi's annual jazz festival. Pearl Bailey, Teddy Wilson, Dave Brubeck, and other jazz artists drew a capacity crowd to the ninth edition last summer. All proceeds went to the Napa Valley Symphony and to the Queen of the Valley Hospital.

grants, sweeping gifts of acreage made in the 1830's and '40's, had divided the entire Napa Valley into nine ranchos. Some of the names—Caymus, Napa, Tulucay—still cling to the valley. Traces of the ranchos, like traces of the vanished Wappo and the Chinese who had been the laboring class, are few. One of the two surviving rancho adobes is now the Old Adobe Hut restaurant—decked out with TV aerials and asphalt shingles! But as I rode in the hills, I could conjure up the lavish fiestas that had brought guests galloping in from as far away as Monterey. For sport, bears and bulls had fought to the death. And at table, Mission wine had been served.

"California hospitality began in the missions," Brother Timothy, Christian Brothers' cellar master, told me as we talked at Mont La Salle, the headquarters of the valley's largest winery. The Christian Brothers is a teaching order that uses its after-tax wine profits to fund its western schools.

"Christ's first miracle was elevating water into wine," he said as he poured some Chardonnay, just as Franciscan padres once poured Mission wine to travelers visiting the missions that still dot the California coast. Of European origin, the Mission grape was carried by cuttings from mission to mission to be planted in vineyards, reaching as far north as Sonoma, just across the hills from Napa Valley, when a mission was founded there in 1823.

The Mission grape has been replaced by far better European varieties, but the old tie between church and wine persists. At some wineries priests bless the first crush and sprinkle the grapes with holy water.

The teetotaling Seventh-day Adventists are one religious group with little regard for such tradition. Founders of a college here and a strong force in the valley community, they offer a treatment center in the hills east of St. Helena for alcohol, smoking, and weight problems.

But the tradition of serving wine to travelers is still strong in Napa Valley. I rode an aerial tramway up to the Sterling Vineyards winery, perched on a promontory above the valley, took a self-guided tour, and sampled wines, free, in their tasting room—as you can do at many wineries here. The valley has become a place of pilgrimage, a source of

education for a nation with a growing taste for wine.

The yearly adult per capita consumption of table wines in the U. S. has doubled in the past ten years to 1.7 gallons, and is predicted to grow at an even brisker rate in the kinds of wines produced by Napa Valley—the dry table wines made from the premium grape varieties. Napa County has leaped from fewer than 30 bonded wineries in 1971 to 70 in 1978, with applications for many more pending. Although the grape and wine industry employs only 2,600 people, it surpasses all other Napa industries in dollar value. It passed the cattle industry a few years ago, and it has forced prune and walnut orchards to yield to new plantings that have brought total grape acres to 24,500.

For me, this dynamic growth is centered in the small, family-run wineries. At Chateau Chevalier, an old gem of stonework and stained glass, I found former stockbroker Greg Bissonette and his wife, Kathy, picking the vineyard they have reclaimed from dense forest. Tasting their Cabernet, I found the same robust character that has brought the urban Bissonettes and their six children to challenge Spring Mountain.

At Schramsberg Vineyards, Jack Davies took me through his champagne cellars, hewn deep into stone (page 715), as proudly as Jacob Schram had toured Robert Louis Stevenson through the same caves in 1880, the year the writer spent two months camping in an abandoned bunkhouse on the side of Mount St. Helena.

Summer Nurtures the Arts

As Joe Heitz (following page), one of Napa's most respected wine makers told me: "Once you've been bitten by the wine bug, there isn't much cure." But there are alternatives. In the valley's creative environment the arts ferment quietly all year—the Napa Valley Symphony, musicales and jazz concerts in private homes, painting, and crafts. And in the summer they swell to include the tourists as the valley becomes a stage. There is Shakespeare at Vintage 1870; there are August Moon Concerts at Charles Krug Winery. At Robert Mondavi Winery I listened as the jazz flute of Herbie Mann reached out over a lawn transformed into an elegant campground and spread

with feasts of cheese, pâtés, turkeys, and wine and champagne in ice buckets.

"But the real Napa Valley," said artist Veronica di Rosa, "is the balance between pain and pleasure, the yoga principle of 'playing with your edge.'" She wanted me to see beyond the summer parties to the work and risk that give the good life its meaning. Her setting at Winery Lake is one of the valley's most enchanting—peacocks, bell-towered chateau, and modern sculpture scattered through the vineyard.

But her husband, Rene, has chosen to play the critical edge of the valley—the southwestern Carneros region where the soil is thin and the weather cool, with perils of frost and of rains coming before the grapes are ripe. And he has planted heavily in Pinot Noir, the most difficult grape. As Rene stalked the vineyard, he kicked at a grape stake: "Look at this vine—18 years old! Not even one bowl of grapes!" But if a great Pinot Noir ever comes from Napa, it may be from Carneros grapes. "And," Rene said with a smile, "I like eking it out."

Pain and pleasure are still finding their balance in the home of vineyard worker Raul Gadino and his wife, Maria. They live in housing provided free by the ranch that Raul works for, where the voices of the Mexican picking crew next door come through the thin walls.

"Raul will make it. He works hard," Rafael Rodriguez told me. He is the ranch general manager and has worked the valley since 1944 (following page). "I see myself in Raul. When I came here the foreman said, 'I want a man who will work hard, be steady, and wants to drive a tractor.' Driving a tractor! It was my dream! At that time the back-breaking work was done by Mexicans. No one could touch a vine but an Italian." Then he laughed. "I finally *taught* budding, pruning, and tractor maintenance to other young Mexicans!"

Rafael is the only bracero ever to have been elected to the St. Helena School Board. His ranch-style house is a sign of the growing stability of the Mexican work force, 55 percent of whom now live in the valley.

For four years Rafael left the land to work for the California Grower Foundation, created in 1972 by valley growers and wineries to stave off

(Continued on page 710)



Wine was thicker than blood to the Mondavi brothers, who feuded bitterly over control of the family business. Charles Krug Winery. The fight ended when Peter (above left), bought his brother's interest in Krug. Robert (above, at right), who left to form a winery under his own name, shows a stainless-steel crusher to French wine maker Comte Alexander de Lur Saluces, whose interest reflects a growing respect for American innovation.

Joe Heitz (left), another respected valley vintner, gets by with a 30-year-old truck to dump grapes at Heitz Wine Cellars.

Rafael Rodriguez, cheek-to-cheek with his wife, Tila (left), was a bracero (a Mexican admitted for seasonal farm labor in the U. S.), "and I'm proud of it." He worked his way up to general manager for Niebaum-Coppola Estate. Relaxing after harvest, wine-industry leader Louis Martini square dances near St. Helena (right).









Everyone wants a place in the Napa Valley sun—homeseekers and wine makers alike. For wealthy San Franciscans like Pat Montandon (with parasol) and her husband, Alfred Wilsey, a 25-acre estate provides room to socialize in grand style; their Gay Nineties bash was stirred by a 60-piece marching band. Others settle for parcels in a St. Helena subdivision (right), where street signs are the grapes of wrath to those who bemoan the paving of agricultural land. In some areas the ag preserve law restricts development to lots of 20 acres. Another alternative is restoration. In the city of Napa (left), state conservation workers bring a new tree to adorn a renovated Queen Anne-style house.



(Continued from page 705) Cesar Chavez's United Farm Workers (UFW) by offering an attractive package of worker benefits. The valley wanted to solve its own problems. With Chavez's union already established at Christian Brothers, it was a time of tension as grower Ren Harris went from door to door to galvanize support.

Seventy-eight growers and wineries are now under contract to the foundation; workers earn an average of four dollars an hour during harvest, and have medical and retirement plans and paid vacations. Shaking his head over young activists who continue to work for the spread of the UFW,

Rafael says, "They complain *before* they work. If we are willing to work, the rights are there for us!"

"We *don't* work the way we used to," says Ambrosio Velazquez, defending the union he helped negotiate at Christian Brothers in 1967. Sharing his company lunch of tacos cooked over a little fire built between the rows, he says, "And we do a better job because we aren't so nervous. We have job protection. If a worker can't do a job, they move him, but they seldom fire him."

Louis Martini knows that holding on to the good life can be as perilous as achieving it. Louis (page 707), the gentle giant who is



respected for his industry leadership and for keeping his wine prices reasonable, is president of one of the few large family-owned wineries in Napa Valley that have resisted selling out to a major corporation. He has taken two of the four Martini children into the business with him, the third generation. Gathering for a turkey dinner at their gracious old stone home, fortified with the bounty from their huge backyard garden, the Martinis seem impregnable. But they are trapped in an economic vise.

"When dad died, 50 percent of the estate went for taxes," Louis says. "When mother dies, it will be worse."



"All our capital is tied up in assets—vineyard and winery," his son Mike adds. "To pay estate taxes, you either have to pull a loan against your assets—or sell them."

Louis uncorks an old Cabernet made before most of the other valley wineries were born. "The time may come when we have to sell. But even if you have to go into debt to keep your identity, I think it's worth it."

Perseverance Built the Valley

As with Martini, it will take another lava flow to uproot Virgil Galleron or Sattimo Dal Porto from the land they have farmed through most of the booms and busts of this century. Spare-boned Sattimo, 79, came from Tuscany in 1902 to a Napa Valley ravaged by phylloxera, the root louse that destroyed the vineyards of France and California during the last half of the 19th century. Sattimo struggled through that time when Napa, its vines reduced to a mere 3,000 producing acres, led the research on the phylloxera-resistant native rootstocks that saved the industry.

Virgil's dad arrived in 1919, the year Prohibition began to take its devastating toll. "During Prohibition, some of the farmers used to stay alive by loading the back of a truck with bootleg wine," Virgil recalls. "They piled the kids on top as camouflage and drove to Nevada to sell it."

In 1947 Virgil and Sattimo saw grape prices fall to \$27 a ton, "if you could find a home for them," says Virgil. "But Mr. Gallo has brought stability to this valley."

For a quarter of a century both men have had their grapes under long-term contract to Gallo, the world's largest producer of wine. More than 20 percent of the valley's yearly crop goes to the Napa Valley Cooperative Winery, which makes and ships the wine in bulk to the E. & J. Gallo Winery in Modesto.

"Napa Valley grapes go into all our

It may soil the skin but it cleanses the soul, according to operators of the mud baths at Calistoga, a name coined from California and another health resort, Saratoga. Here the author, foreground, relaxes before rinsing off to resume the day with renewed vigor.

varietal wines as well as our Hearty Burgundy, our Chablis Blanc, and our Burgundy," Julio Gallo told me. He is an inconspicuous gray eminence who flies in by helicopter to meet with the growers and visit the vineyards. His visits are swift and unannounced. Few people in the valley have ever seen him. But many valley vintners appreciatively ride the coattails of the wine market he and his brother Ernest have opened.

"He is always on our neck for higher quality grapes," Virgil said. "He educated us. But mainly," he concluded with great feeling, "Gallo gave our grapes a home."

"It isn't enough just to have a home. We must share in the profits of the wine business," President Andy Beckstoffer told the Napa Valley Grape Growers Association.

"We are the *first* agricultural area with a real chance to survive in an urban environment. An economically healthy grape market is our only real 'agricultural preserve.' "

The effort to keep Napa's vineyards from the hands of developers who have leveled the orchards of other California valleys has turned the valley into a vast town hall. "There *must* be restrictions to preserve this land," insists Julio Gallo, "or we'll be losing an irreplaceable source of grapes." Assemblyman Mike Gage joins the debate, explaining the paradox: "The ag preserve's limitations on the land have created aesthetic values—beauty, a way of life—and people want to live here. Increased competition bids the price up."

Virgil Galleron shakes his head at the



A grand old man of wine, Francis "Paco" Gould chats with his wife, Romilda, in their St. Helena home. Gould was a pioneer in the marketing of Napa wine at Charles Krug Winery. Though 95 and hard of hearing, Gould still writes Krug's folksy newsletter, "Bottles and Bins." To what does he attribute his longevity? "Wine, of course."

\$10,000 it now costs to develop an acre of grapes. Undeveloped grape land that cost his father \$85 an acre in 1919 now costs \$5,000. "You have to be a millionaire to plant a hundred acres!" Sattimo says. Concern is heard over a cup of coffee in Coveys coffee shop in St. Helena: "My wife's in real estate," a man tells his friends, "and this week an Arab marched into the office and slapped down \$350,000 cash."

As Napa risks becoming a valley of the rich, Napa Mayor Ralph Bolin, a Presbyterian minister, worries, "I don't want to pave the valley, but how do we provide for all segments of the society?"

Others say, close the doors. The county voted overwhelmingly last June for strict growth controls through the year 2000. But the growth juggernaut continues to press up from the south. I saw bulldozers across the fence that marks the Napa county line, pushing dirt into the first of 4,000 homesites just approved for Vallejo.

Growth has already crept over the county line at American Canyon, a blue-collar development that has the political levers to become a city: its own sewer and water systems. Bumper stickers proclaim "American Canyon City. Self Government."

"It could become a city of 40,000 people," says county administrator Albert Habberger as we tour the ag preserve he helped create. "If there is a shift in the balance of the County Board of Supervisors, the agricultural preserve could be gone in 30 days."

Reputation Protects Valley

"I'm not too worried about the supervisors," says Warren Winiarski, preoccupied with the final blending of his 1976 Cabernet as we chat in his living room overlooking the rocky crown of Stags Leap. The former academician whose Stag's Leap Wine Cellars' Cabernet surpassed Mouton-Rothschild's in the competition in Paris believes, "The Paris tasting has given us a weapon. The valley is now a national treasure. If it is threatened again by development, wouldn't the world help protect it?"

Ultimately, the valley's best defense is a fine harvest. By mid-August, in vineyards and winery labs, samplings of grapes were being crushed and checked for sugar levels, a critical factor in determining when to pick.

High on Mount Veeder, Keith Bowers, University of California viticulturist in the valley, had magnifying glass to eye, examining spores of damaging powdery mildew—continuing the university's nearly one hundred years of service to the valley. Growers glanced at the sky as rain spattered the dust—just a sprinkle. On September 9 it rained hard, and again on the 10th. Drying winds followed, but too late. *Botrytis* mold had already begun to take hold, a glory in varieties like Riesling, where it produces a rich, honeyed wine, but ruinous in others.

Minutes Crucial in Picking

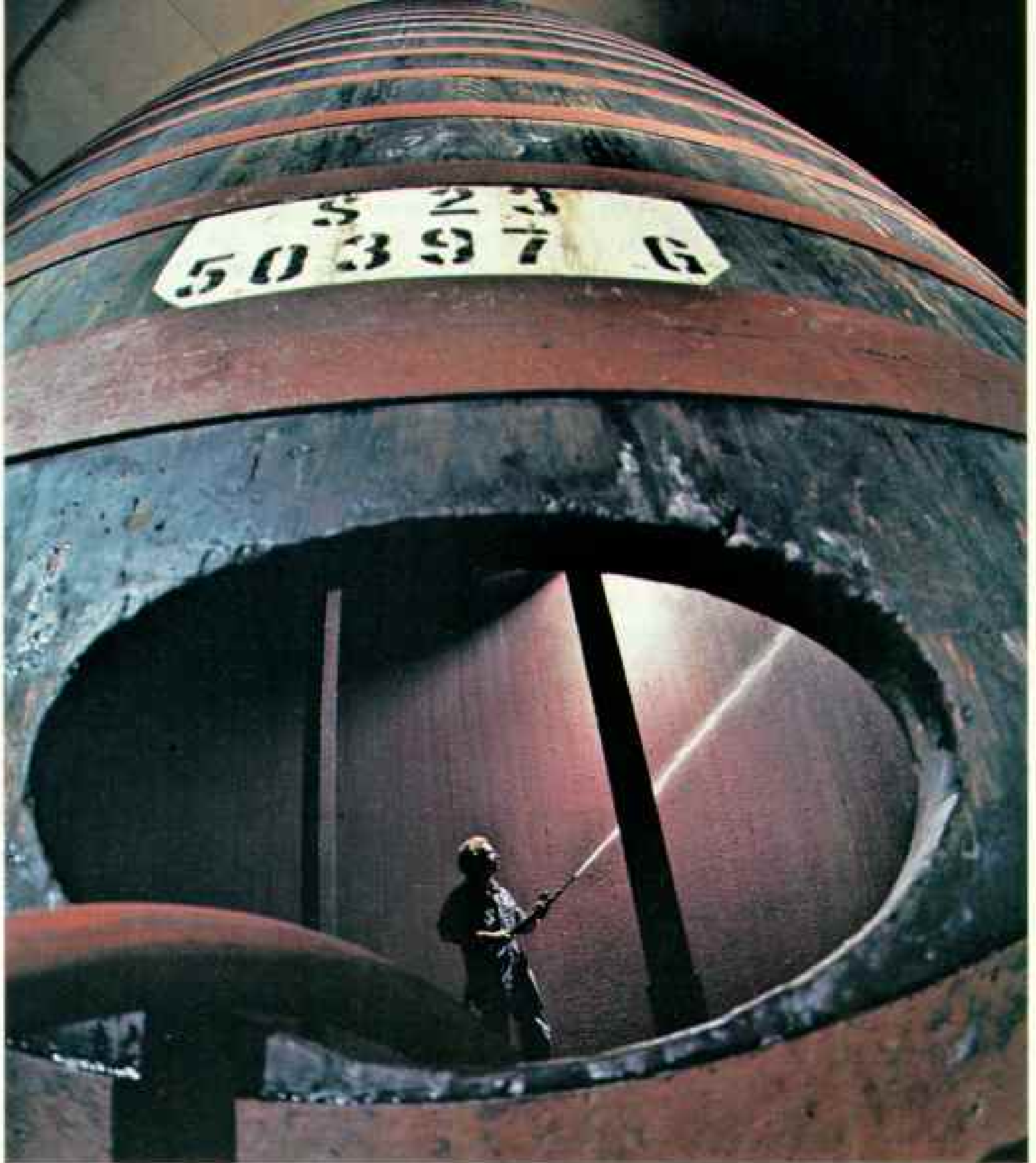
I raced the sunrise to Jerry Draper's fine vineyard at the crest of Spring Mountain and found crews picking clusters of Chenin Blanc before a form of *Botrytis* known as bunch rot could overtake them. The days got hot. Late-maturing varieties were sugaring up too soon, crying to be picked. The valley geared up for a swift, early harvest. The normal progression of varieties collapsed, as Chardonnay and Cabernet were picked at the same time—a rare event.

From his command post in his pickup truck, in contact with six other pickup trucks by shortwave radio, contract vineyard manager Laurie Wood directed the picking of 22 vineyards like a military campaign. At night mechanical harvesters moved down the rows like eerie nocturnal monsters, headlight eyes blazing.

The crop was huge, thanks in part to heavy spring rains. At the wineries, gondolas lined up in convoys, waiting to dump their loads. But fermenting tanks were getting full. Exhausted "cellar rats," the young men who do the physical winery work, played "musical tanks," whipping juice-filled plastic hoses from tank to tank.

At Villa Mt. Eden, wine maker Nils Venge looked up and saw two green and white cars with red lights, followed by two vans, cruising Oakville Cross Road. A raid by the U. S. Border Patrol, at peak of picking! The convoy passed by, but in a sweep of the valley the vans were filled with illegal aliens, the men taken back to Mexico. Of 14 men at one ranch, only two were left after the raid.

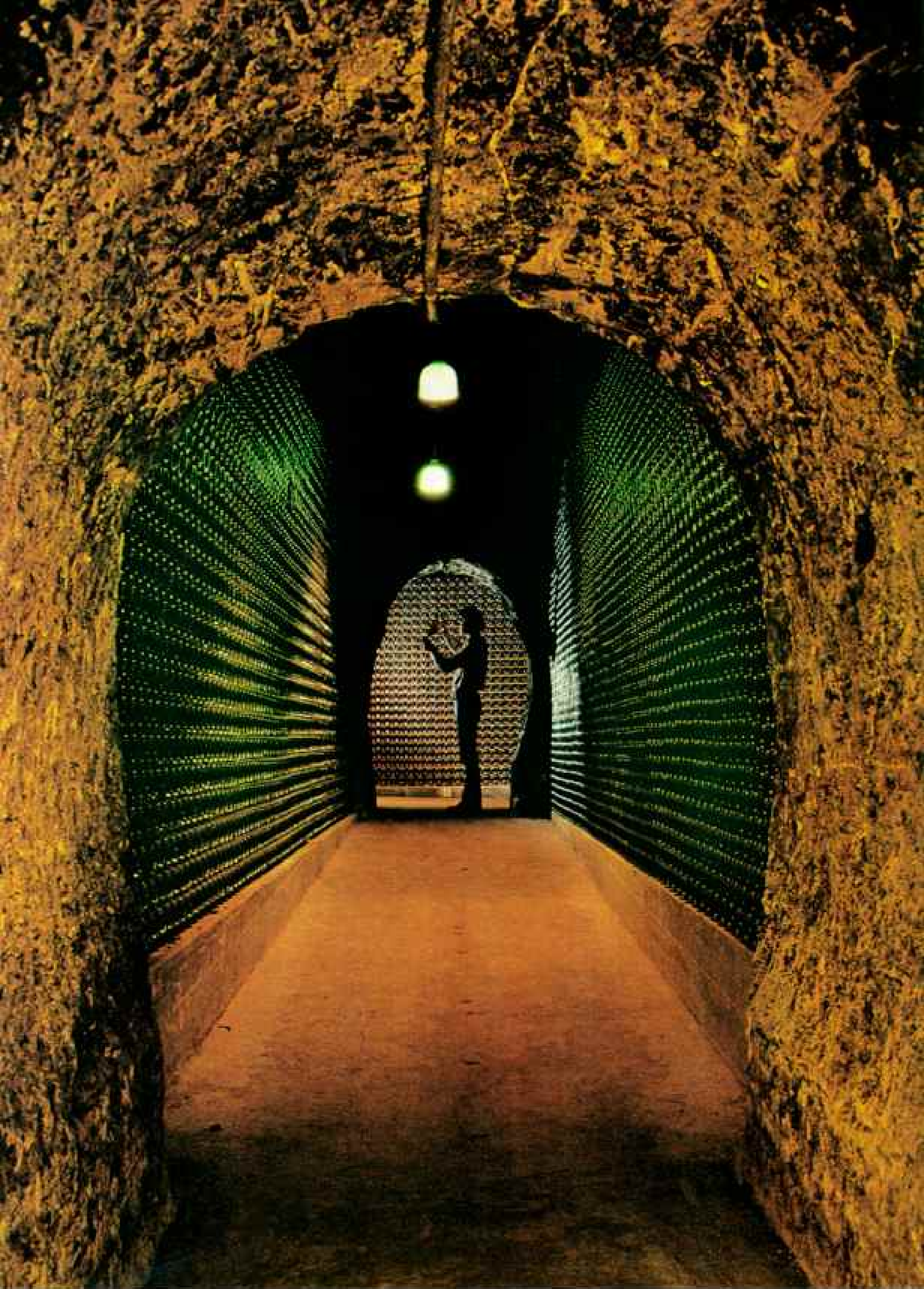
And then the commotion ceased; harvest subsided. Goats were roasted as workers



A silver jet of water plays against the walls of a 50,000-gallon holding tank at the Louis M. Martini Winery (above), cleansing it for a new batch.

Changing tempos, Jack Davies gets away from the slower but more painstaking rhythms of running Schramsberg Vineyards by practicing for his Dixieland band (right). In a nearby cave where the temperature always hovers around 58 degrees (far right), a cellar foreman checks the fermentation in one of thousands of bottles of champagne, Schramsberg's only product. Demand has always exceeded the winery's modest production.







Autumnal leaves bring beauty to the vineyard, as does Katie Barnette, who picks for a high-school fund raiser. Picking for a living is thirsty work for Abelino Calderon (below). A bright-eyed harvesting machine gathers champagne grapes in the cool of night (facing page). Napa vintners know that a few degrees or a few hours can spell the difference between a wine that's good—and one that's great.



celebrated the end of the crush, and I was whirled to a mariachi band by men who would soon be home in Mexico with their families. By the end of October the valley was looking back on perhaps the largest crush in its history. Despite some mildew and mold, 1978 would be a good year. Possibly even a great year.

As if in celebration, the valley turned a flaming quilt of color.

Napa Quality Known Worldwide

Bob Mondavi was getting on a plane for London, carrying the Cabernets he would introduce at Harrods, the famed department store, to some of Europe's most experienced and critical drinkers of that wine. He seemed to be lifting a page from history, for as long ago as 1889, Napa wines had gone triumphantly abroad, winning 18 of the 42 awards at the Paris Exposition.

And the early wine makers had opened their doors to the world, as Mondavi does now. At a recent feast at his winery at Oakville, an honored guest was André Tchelistcheff (page 696), the Russian wine maker brought from Paris in 1938 by Beaulieu Vineyard's Georges de Latour.

For the three decades that preceded the '70's, Tchelistcheff's Cabernets carried the flag of quality for Napa Valley. His influence on the new wave of California wine makers runs like an underground stream. Mondavi toasted him: "Now Napa Valley wines belong in the company of the finest wines in the world."

A man of dynamic energy and a promoter *extraordinaire*, Mondavi never stops innovating, trying to prove that a large winery can lavish the same loving care on wines as a tiny one. His experiment in "bottle pricing," in which the price of grapes is based on the retail price of the wine, may prove the secret weapon in the survival of Napa's grapes, letting the growers share in the wine boom.

Even a swim after some hard sets of tennis last summer inspired experimentation. Bob Mondavi lifted his glass of white wine and speculated, "I wonder if this could float." It looked impossible. But he eased the stemmed glass into the water and—eureka—it floated, and prompted by a gentle push, carried Napa Valley wine across the water. □





ON MY FIRST DIVE to the beds of black coral off Lahaina, a thick mist obscured the verdant mountains and valleys of the Hawaiian island of Maui. The land lay only five miles distant, but already we seemed to be in mid-ocean. The cobalt blue water was featureless, empty; it looked absolutely bottomless.

I gulped. "Is *this* where we're diving?"

Harold Hall, a husky young Lahaina diver, was too busy rigging up to give me an answer. I followed his example, pulling on my wet suit, then weight belt, fins, Aqua-Lung, and flotation vest. He splashed over the side, gripping a 15-pound hammer. Then I, too, was sinking, falling, following the long silver trail of bubbles from his exhaust. Down . . . down . . . a hundred feet down and still no bottom in sight.

Deeper; still deeper. At last a vast gray vista emerged from the gloom. My air now tasted metallic and felt heavy in my lungs; nitrogen was dulling my brain when the bottom finally came into focus.

I recall a forest of black branches reaching up from the underside of a cliff face at 200 feet. Great, lacy branches, six to eight feet long, swayed gracefully in the current. Somewhere above I could hear the groaning song of a humpback whale. I drifted along, amazed, transfixed, and totally isolated from the rest of the world. I had found the subject for my master's thesis in marine ecology, and a direction for my life.

The year was 1961, only four years after these now famous black coral beds had been discovered by divers Jack Ackerman and Larry Windley, two of the first to use scuba gear in Hawaii. "The fish had never seen divers," Jack recalls. "They would swim right up to us and bite our bubbles. And the coral—it was a bonanza. It was beautiful."

They had indeed found a bonanza. Among the hundreds of coral species that inhabit earth's warmer waters, only a few deep varieties are highly prized for making jewelry because of their beauty, hardness, and luster. Like many gems, precious coral is almost imperishable.

Hawaii's black coral species (*Antipathes dichotoma* and *Antipathes grandis*) are among these. Together with pink and gold varieties, they produce some ten million dollars annually in retail sales and employ

PRECIOUS CORALS

Hawaii's Deep-sea Jewels

By RICHARD W. GRIGG

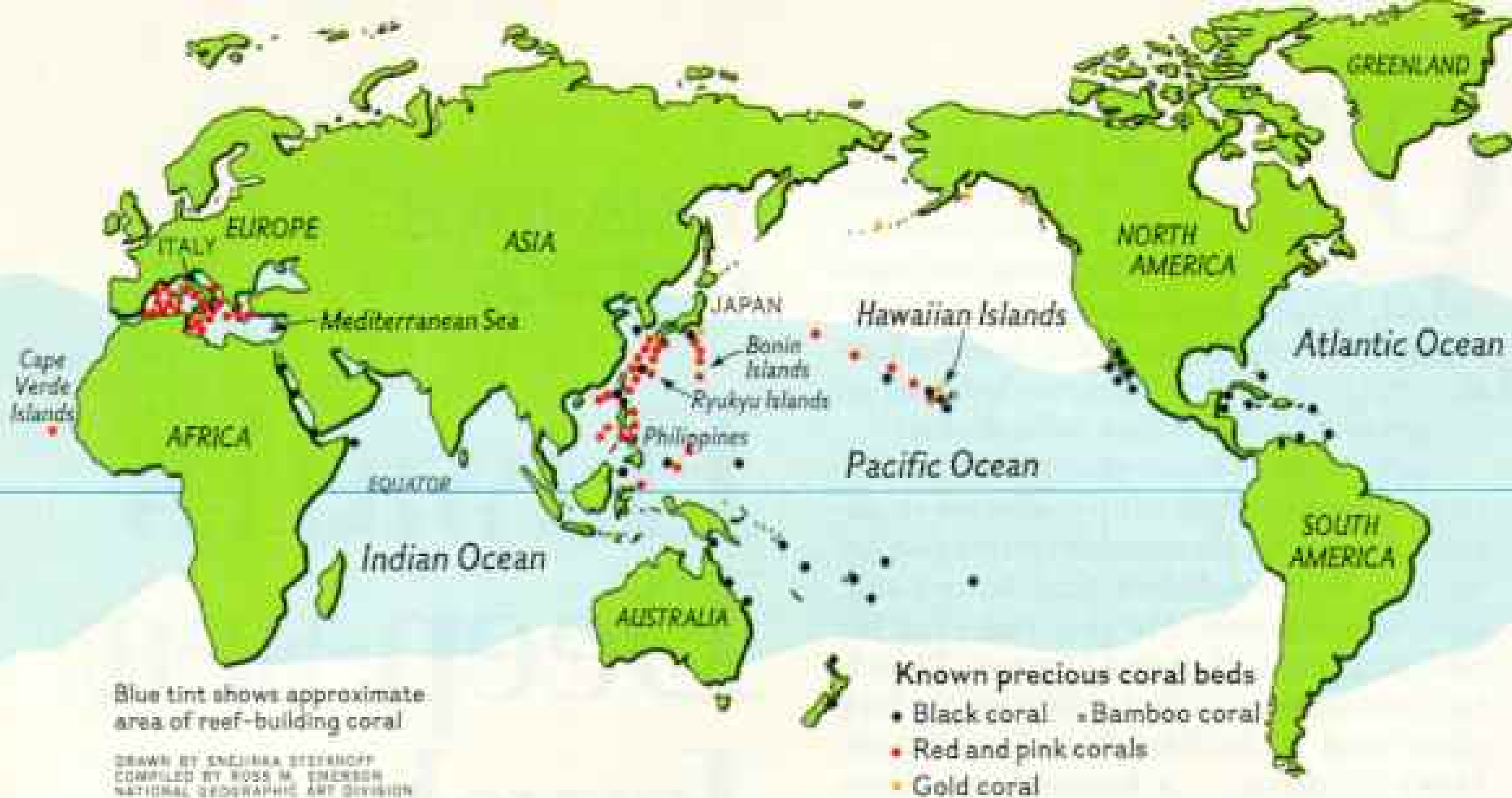
HAWAII INSTITUTE OF MARINE BIOLOGY,
UNIVERSITY OF HAWAII

Photographs by

DAVID DOUBILET

Rarest of bouquets plucked from the sea's dim reaches, vivid boughs of coral fill the collecting basket of *Star II*, a deep-sea submersible. Waiting to surface, pilot Bohdan Bartko gazes through a porthole at pink, gold, bamboo, and other corals—some chosen for laboratory specimens, others for fine jewelry, a multimillion-dollar industry in Hawaii.

As everlasting and elusive as diamonds, only a few coral species, growing as deep as 2,000 feet, are prized by the jewelry trade. Often devastated by dredging, they may have a brighter future in Hawaiian waters. There the author, a University of Hawaii marine ecologist, has made a nine-year study of precious corals to emphasize selective harvesting and help develop a management plan to ensure survival of these gems of the sea.



about 800 people in Hawaii alone. Worldwide, the precious coral industry is worth an estimated 500 million dollars a year.

Any resource this valuable—and exhaustible—merits careful study and management. Two years after that awesome dive off Lahaina in 1961, I completed my master's thesis and headed for the Scripps Institution of Oceanography in La Jolla, California, where I continued my research on the population ecology of corals for a doctoral degree. By the time I returned to Hawaii in 1970, the Maui black coral divers and the industry had become well established. Other varieties, which grow too deep for scuba divers—pink, gold, and bamboo corals—are now being harvested by submersible (pages 718 and 726-7).

Aided by the Sea Grant Program at the University of Hawaii, I have spent nine years (including countless hours underwater, mapping beds and collecting data) studying the precious corals of Hawaiian waters. I am now confident that present regulations—coupled with the enactment of proposed new ones—will prevent depletion of these species in Hawaii. Unfortunately, precious coral harvesting is not well managed in many other areas of the world.

While they often resemble lovely undersea flowers, precious corals are scientifically classified as animals. These polyps reproduce to form extensive colonies, building upward upon their own skeletons.

The coral species that make up the world's vast shallow-water reefs are porous, and too soft for jewelry manufacture. Precious corals, however, are approximately as hard as ivory and pearl, and generally grow in dim, eerie depths.

Cave Yields Ancient Coral Beads

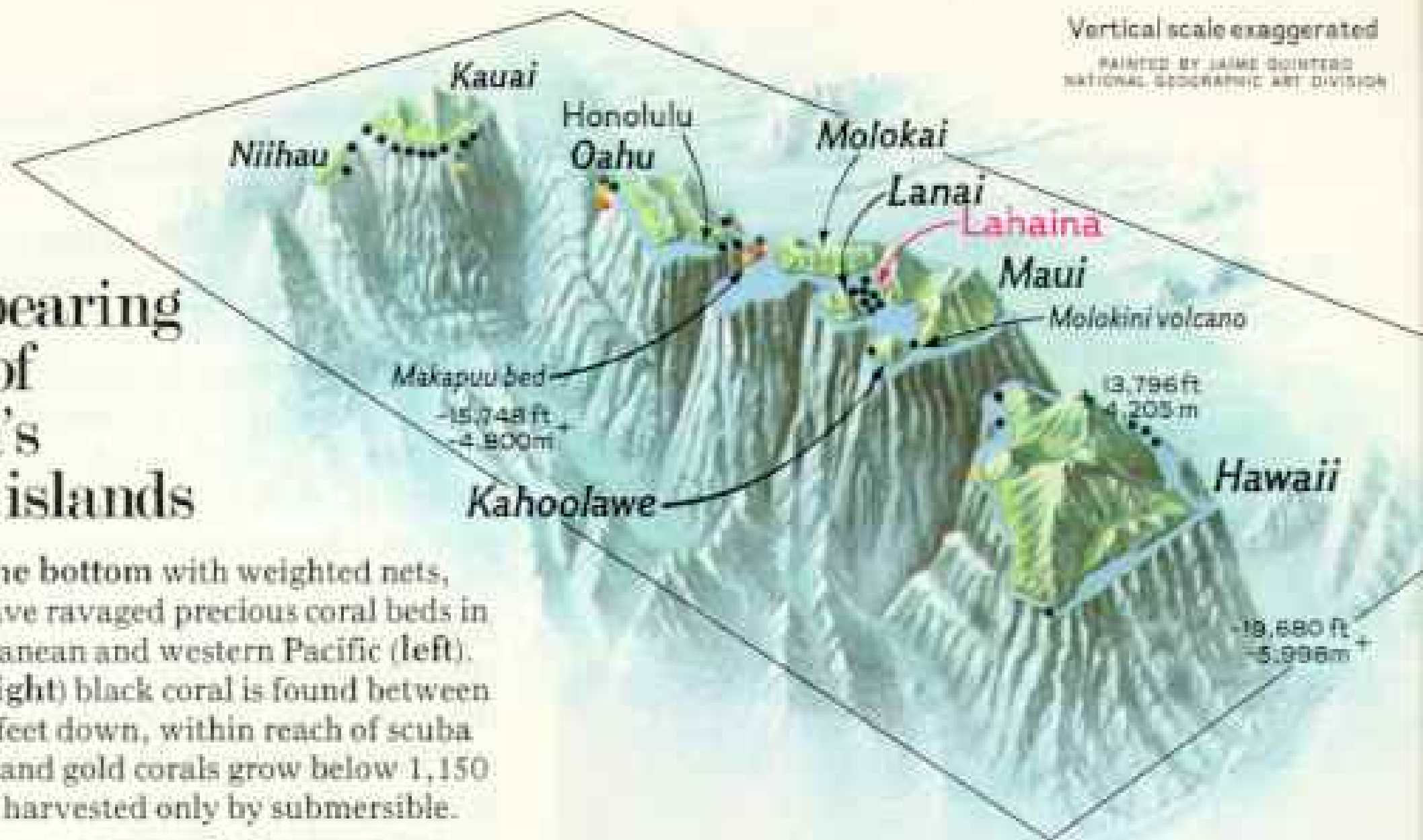
Man's earliest known use of precious coral dates back about 25,000 years. In Wildscheuer Cave, north of Wiesbaden, Germany, in 1908, archeologists unearthed the remains of Paleolithic man together with tiny, irregular beads of coral. These first jewels of the sea probably broke off in storms and washed up on Mediterranean beaches. In contrast to the Pacific beds, where pink and red corals are found only below 300 feet, in the Mediterranean a red variety of the same genus (*Corallium*) occurs at depths ranging from 30 to 900 feet.

A Sumerian vase dating back some 5,000 years is decorated with depictions of coral. Even before the Minoan civilization (circa 3000-1450 B.C.), Neolithic man collected coral by diving in Mediterranean caves.

Perhaps because of its branching shape and vital color, red coral became a symbol of immortality to the ancient Greeks. They believed it to be a panacea and protector against all sorts of ills, including gout, poisons, and enchantments. It even was regarded as powerful enough to neutralize the dreaded evil eye. Red and pink corals are

Coral-bearing slopes of Hawaii's largest islands

Sweeping the bottom with weighted nets, fishermen have ravaged precious coral beds in the Mediterranean and western Pacific (left). In Hawaii (right) black coral is found between 100 and 350 feet down, within reach of scuba divers. Pink and gold corals grow below 1,150 feet, and are harvested only by submersible.



still said to bring good luck to their owners.

I discovered what precious coral means to the people of the Mediterranean on a recent visit to Italy. Below a sign outside Torre del Greco, at the foot of Mount Vesuvius, were the words *La Città del Corallo*—"The City of Coral." Here 80 percent of the people depend upon coral in some way: fishing, carving, sales. I found an institute for coral jewelers and artists—the Royal School of Incision on Coral and Similar Decorative Arts. I asked a boy sweeping a factory floor what he intended to be when he grew up.

"I did not know my father," he replied. "He died before I was born. But he was a coral carver, and I will be a coral carver."

Giovanni Tescione, the foremost authority on the history of precious coral, might have been expressing the spirit of Torre del Greco when he said, "As the tiny coral polyps build slowly on the shoulders of the old to form the beautiful coralline tree, so the fishers of the coral have built their lives on an ancient tradition of the sea."

Precious corals have been sought since antiquity. During the Middle Ages trade routes multiplied, greatly increasing the demand for jewels. In the 12th century Arabs were using the *ingegno*, a dredge made of a heavy wooden cross with attached nets. This "mop" was dragged across the bottom, smashing and entangling coral fragments. In the 19th century rich beds found between Sicily and Tunis were rapidly plundered by

more than 2,000 boats using the *ingegno*.

In the early 1960's the equivalent of a gold strike occurred in the Pacific. Huge beds were discovered in the Bonin Islands near Japan and in other rich banks near Okinawa in the Ryukyu Islands. A coral rush ensued, and overexploitation using the coral "mopping" technique led to rapid depletion.

In the past this pattern has characterized the coral fishery. My job in Hawaii has been to find a better way. Specifically, I have developed a plan for the management of precious corals in the entire Hawaiian archipelago. My work has included some two hundred dredge hauls from our University of Hawaii research vessels and more than thirty dives to 1,200 feet aboard a two-man submersible named *Star II*, used for both commercial collecting and research.

Destination—a Shadowy World

Twelve hundred feet. Below us stretches a vast undersea landscape of ghostlike and shadowy images; we have touched down just beyond the outer limits of the Hawaiian Islands' shelf. A cone of light from our submarine penetrates the darkness, searching. There ahead, bathed in a yellow glow, stands a magnificent colony of gold coral. We have landed in a forest of precious coral known as the Makapuu bed.

Huddled inside our five-foot steel sphere, Bohdan Bartko, pilot of *Star II*, and I peer down through a two-inch-thick Plexiglas

In a coral garden off Maui the author measures black coral on a cliff face (below) and atop the *Bluegill* (facing page), a World War II submarine sunk by the U. S. Navy in 1970 for scuba training. Dr. Grigg estimates that the species grow an average of $2\frac{1}{2}$ inches a year. A proposed state law would prohibit harvesting black coral "trees" less than four feet tall and with stems less than $\frac{3}{4}$ inch in diameter. "If the law is passed and enforced, our black coral will be protected," he says.



ANTIPATHES BICHOYOMA

port. The pressure on our hull is 549 pounds per square inch—nearly forty times the surface pressure.

I can see the trunk of the gold coral just four feet ahead. Boh adjusts our course against a one-knot current. We inch forward, then slightly to one side. The belly of *Star II* skids lightly against the bottom.

In the dim light inside the submarine I watch as Boh's stubby fingers delicately play on a keyboard of push-button controls. The jaws of the coral cutter open. Another thrust from the port motor and the cutter closes around the trunk of the coral. Boh hits the button to cut. Hydraulic pumps whir and the blade closes. Momentarily the cutter labors and then—*snap*—the coral tree falls into our collection basket.

As Boh continues his harvest, I count the coral colonies and record other data: temperature, current, bottom characteristics, sediment distribution. Occasionally I take photographs through my view port.

The current picks up; it flows now at $1\frac{1}{2}$ knots. Boh is absorbed in his task of selecting and cutting coral. He mutters under his breath, struggling to maneuver *Star II* along the bottom. From time to time he stops to radio our depth and heading to the research ship *Holokai* on the surface.

Relentless Current Ends Trip

"That's it," he says after two and a half hours. "I can't fight it any longer." The current has quickened to a relentless $2\frac{1}{2}$ knots. I peer down for a last look at the bottom as he prepares for our ascent.

Patches of pink and bamboo coral gleam in our passing light. Like willowy serpents, the bamboo corals coil from the seafloor, their spiral tips oscillating in the current. Interspersed randomly are delicate gorgonian sea fans of many species and colors.

It is chilly at this depth. I wipe the condensation from my window and stare into the void. In our reflected light a "snowfall" of tiny particles of organic detritus reminds us that we are slowly rising. Some 45 minutes later we are bobbing in the choppy Molokai Channel. *Holokai* picks us up and we pop the hatch; the fresh air smells sweet.

Boh has collected a hundred pounds of pink and gold coral—a good dive. Valued at about \$50 a pound in its raw state, it will





BOTH GENUS *GERARDIA* BORDAN BARTHO (ABOVE)



The sea works its alchemy 1,250 feet deep, where a gold coral tree nearly four feet tall glitters on the bottom (left). Tiny architects with a Midas touch, gold coral polyps encrust a branch (lower left). A thorough washing (right) removes the animals to reveal the skeletal base they secrete—hard, lustrous, and perfect for the jeweler's creative eye.

Most corals, too porous for jewelry, build reefs near the surface, where their polyps seek life-giving sunlight. They host symbiotic algae that live within the polyps and produce photosynthetic nutrients that supplement their diet. In contrast, precious corals grow tree-like on deep, clean-swept surfaces; they shun sunlight in the larval stage. Their polyps lack symbiotic algae and feed solely on drifting larvae and detritus snared by tentacles.

Some species light up their murky domains with a bioluminescent glow. Marine biologist Katherine Muzik was inside the *Star II* submersible when, with its lights out, it bumped into a coil of bamboo coral. "A band of light went streaking up and down the whole colony—lighting it up like a Christmas tree," she says.

become roughly \$50,000 worth of jewelry after craftsmen have cured, cut, carved, ground, and buffed it (pages 731-2).

I have collected something else of value—scientific data on how to manage this harvest and ensure the coral beds' survival.

Among other findings, we discovered that in Hawaiian waters valuable species of black coral occur only between 100 and 350 feet. The more exotic pink, gold, and bamboo varieties start at 1,150 feet and go down to about 1,600 feet. In contrast to reef-building corals, which host symbiotic algae that require light to grow, precious corals contain no algae in their tissues and are "negatively phototaxic"—they swim

away from light during their larval stage.

It took several years to estimate precious coral growth rates: $2\frac{1}{2}$ inches a year for black species, about a third of an inch annually for pink corals. Both varieties have similar life spans, about 70 years, although occasionally very large (and presumably very old) colonies are found. In black coral, at least, annual rings exist in the skeleton and, as in trees, can be counted to gauge the age of colonies.

Light-producing Species Discovered

One of our most exciting discoveries was that certain species of gold and bamboo coral can somehow produce their own light



in a lightless sea. Marine biologist Katherine Muzik was the first to report bamboo coral glowing.

On a recent dive in *Star II* she had asked Boh to turn off the sub's lights while they slowly drifted across the bottom. To their amazement, when the collecting basket bumped the bamboo coral, flashes of light traveled in waves up and down the unbranched, whiplike colony. She named the new species of *Lepidisis* "olapa," after the Hawaiian word for "flash."

While our research continues, the data we have collected has been used to produce recommendations on annual quotas and minimum size. In 1977 Hawaii passed laws

including weight and size restrictions for specific coral beds. With the United States' extension of jurisdiction to 200 miles, the Department of Commerce is now evaluating more comprehensive management plans.

In any two-year period, state law permits divers to harvest 4,400 pounds of pink coral (*Corallium secundum*) from the Makapuu bed. *Star II*, operated by Maui Divers of Hawaii, Ltd., is the only submersible working the area. Under the law, only pink coral colonies ten inches or larger may be taken. For the commercial black corals, I recommend a minimum height of four feet, and three-fourths of an inch in stem diameter.

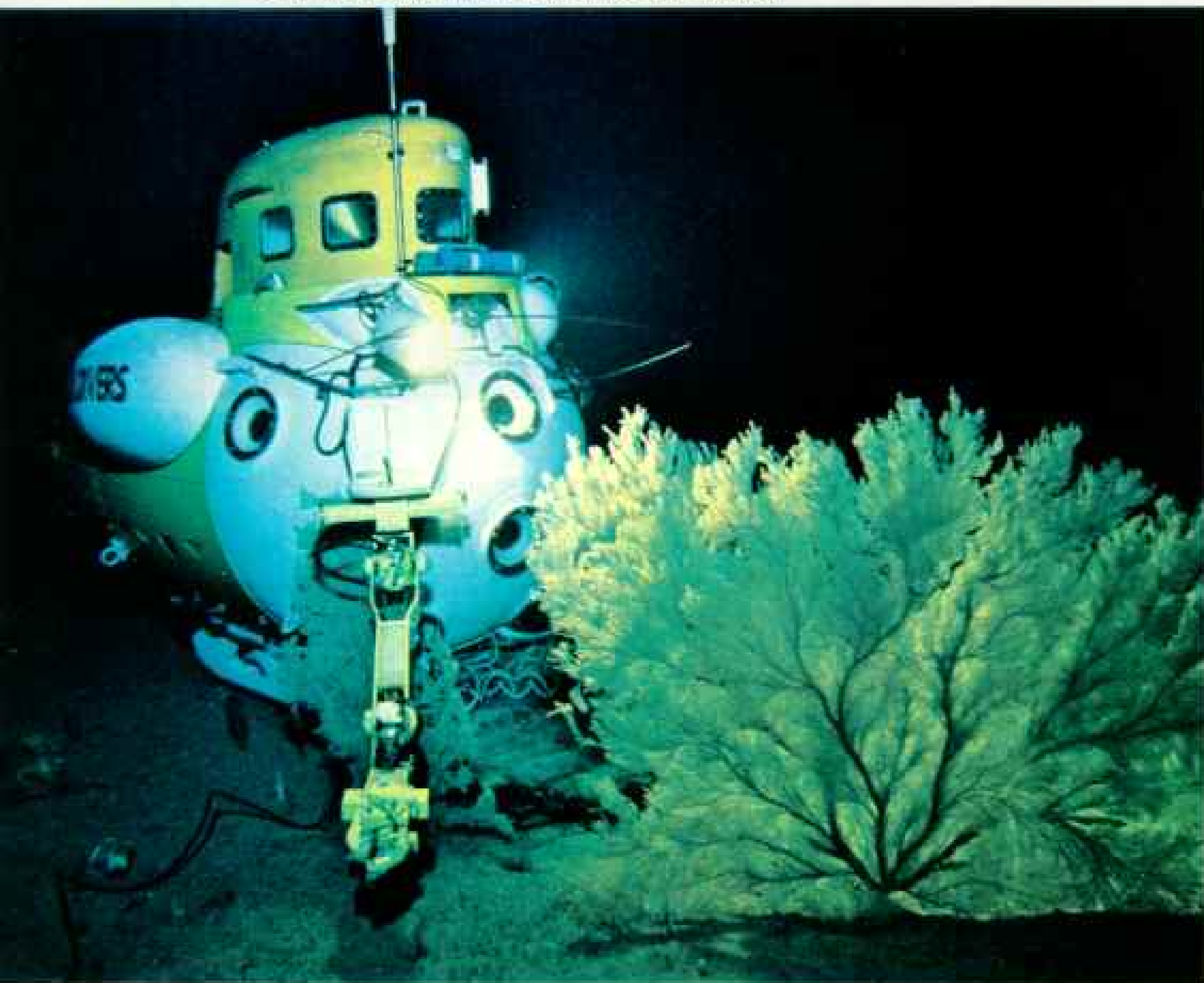
In Lahaina (Continued on page 730)



BONDAN BARTKO AND ALVIN M. CHANDLER, NATIONAL GEOGRAPHIC STAFF (ABOVE)

Double-edged tool, the *Star II* submersible serves both University of Hawaii scientists and Maui Divers of Hawaii, Ltd., which uses it to gather precious coral. The craft rides piggyback on a special vehicle (left) that is first towed by a mother ship and then sunk to 60 feet, where the sub can be launched and recovered in calm water. After targeting a colony, pilot Bartko uses a cutting blade and mechanical arm to slice and maneuver the coral into a wire basket. He makes a spectacular remote-control photograph of a newly discovered species of *Calyptrophora* (below), with a deep-sea camera mounted outside the submersible.

In an eerie void *Star II* glides down the outer rim of Molokini, a sunken volcano (right), on an exploratory dive.







HAWKISH: *HYDROPHITES TYPUS*, 3.8 CM (1.5 IN.)



ENGLISH: *GENUS ANTONARIIUS*, 1.4 CM (1.1 IN.)



Nearing the outer limit of scuba range, Lance Cherry harvests a black coral tree 180 feet down in a buffeting current (above, left). He works in the Lahaina beds, a rich lode discovered in 1957 between the islands of Maui and Lanai. "They call this spot 'Most Radical' because of the steep drop-off," says photographer David Doubilet, "and it's really hairy diving." Only a handful of men risk such dangers—accidents have killed at least 15 of them in the past two decades.

Reward for two months of collecting, a bonanza of black coral fills the storage room of the Maui Divers factory (above). Masked against dust and the pungent odor, a worker grades and breaks up the cured coral. Designers will then mark patterns on stems and branches for craftsmen to cut, grind, polish, and mount.

Jewel-like visitors sometimes adorn the delicate boughs in their natural state, where a hawkfish (far left) and an anglerfish (left) seek food and shelter.



Spellbinding beauty of a perfect pink specimen (above) reflects a love affair that spans nearly 25 millennia. Coral has been found mingled with human remains from Paleolithic times and depicted on a Sumerian vase made 5,000 years ago. The ancient Greeks revered red coral as a source of immortality and wore it as a talisman to thwart poisons and enchantments. The magic attraction lingers today in a pendant and strands of pink coral modeled by Hawaiian-born Judi Andersen, 1978's Miss U.S.A. (facing page).

The beauty of precious coral stands unquestioned, but to some a philosophical dilemma remains: Even though man would seldom see these living jewels of the world's oceans, are personal adornment and profit proper reasons to harvest them?

(Continued from page 725) the black coral divers know that it is in their interest to comply with these regulations. Only then can they expect to sustain their livelihood over the long term. If, in this profession, one can look forward to the future at all.

Only eight men, all in their 20's and 30's, dive on the black coral beds off Lahaina. They are tough, even surly, unless you know them; they form a loose cooperative with no fixed rules. Their lives are on the edge every day they dive, and they dive five days a week. Their time as black coral divers is limited, and each man knows it; yet each feels a certain sense of immortality. Many have died or have been disabled in the quest. Larry Windley was paralyzed from the waist down by the bends, and later died. Harold Hall, my old partner, also was crippled by too rapid an ascent.

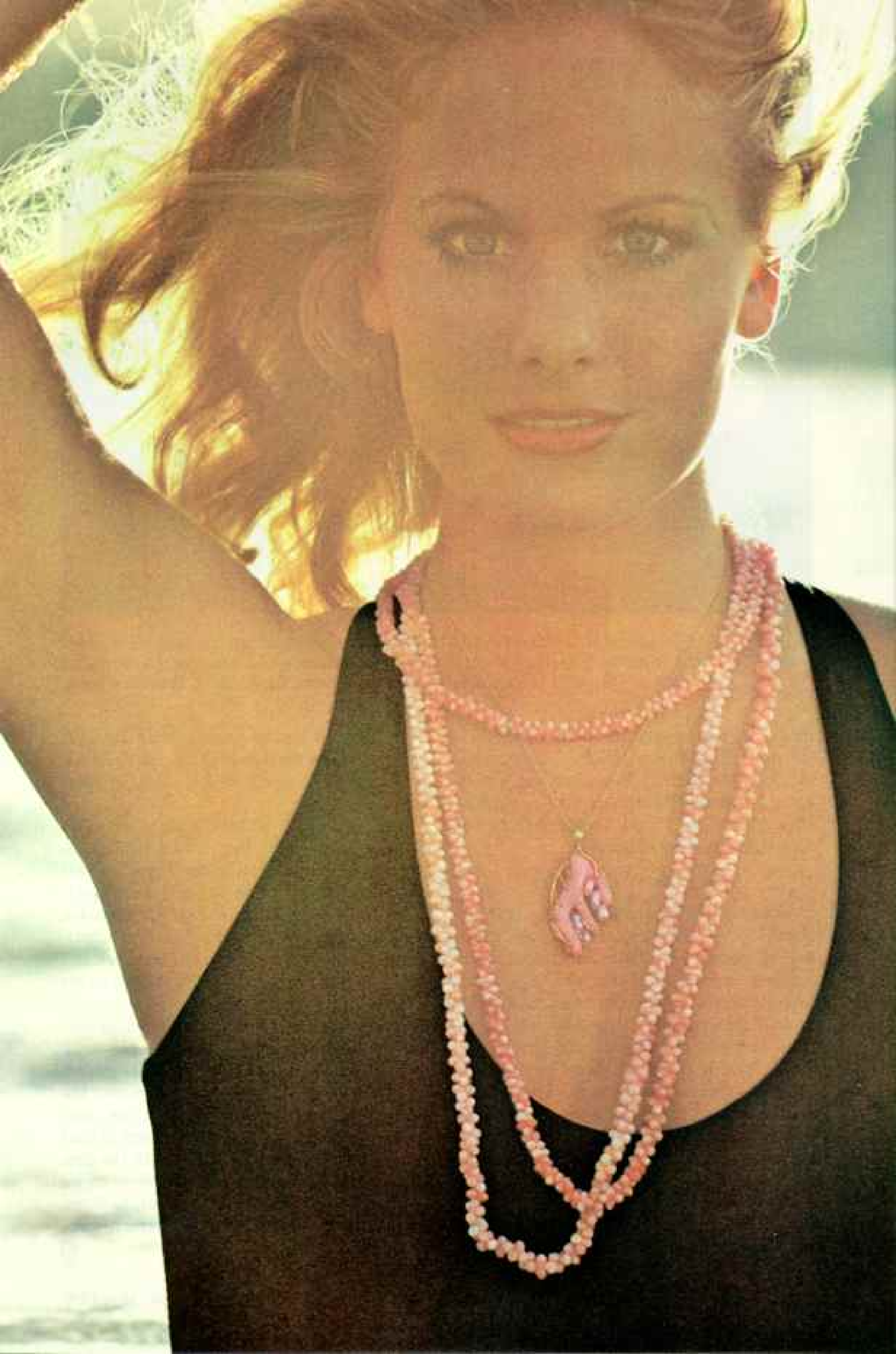
One Diver's Tale of Terror

To hear how Mike King got the bends is to understand why black coral diving is so dangerous. Mike had chopped loose a large tree at a depth of 220 feet. He was tying it to a lift bag when four sharks appeared. Mike slowly blew air into the bag until he felt it lift off the bottom, carrying him and the tree. The sharks were circling slowly as they commonly do; they appeared only curious.

Then, as Mike rose toward the surface, a fifth shark joined the group. Mike hunched in between the branches of the tree for protection, still rising with the float bag. As he approached the surface, he knew he needed at least 30 minutes of decompression at 10 feet before he could get into the boat. But at that moment the fifth shark started swimming erratically, darting in toward his legs.

To hear Mike tell it: "It was too much action and I just couldn't handle it. It was the bends or that shark; I went up."

Forgoing a required decompression is to violate an invisible but unforgiving barrier. Five minutes after Mike climbed into the boat, he felt his right leg going limp. His friends moved the boat, and he went back down to decompress at 30 feet for an hour. After that Mike felt better, but by the time he reached shore, he could only drag the leg. He was flown to the Navy recompression chamber at Pearl Harbor. By then his right leg was paralyzed, and an electric pain had





Treasures of earth and sea marry in a pink coral pendant and its diamond-studded gold frame. It overlays a branch of the same species, which grows only a third of an inch a year and is protected by a quota to conserve these hidden Hawaiian gems.

lodged in the base of his skull. Bubbles of nitrogen had filled Mike's bloodstream, blocking the normal flow. Four years later, after extensive treatment and rehabilitation, Mike King has difficulty walking and no longer dives for black coral.

Other Divers Fare Worse

Mike King's case is a sad one, but there are other stories still more tragic. Jose Angel, one of the greatest Hawaiian watermen of all time, mysteriously disappeared while he was diving for Lahaina black coral. Danson Nakaima passed out on the bottom at 180 feet. The next day his partners found what was left of him; about thirty large sharks were still cruising in the area. The air hose on his regulator had been severed by a single bite. At least 15 scuba divers have died since the beds off Lahaina were discovered two decades ago.

Black coral diving may sound crazy, and for most people it undoubtedly is. But a certain breed thrives on such adventure,

and there is a special pride among them. A close bond ties these men to the sea. To them it is a place of peril, of isolation, of total independence.

To me there is all this, plus an array of scientific mysteries that await further research. Looking to the future, there are vast reaches of the Pacific yet to be explored. There is the challenge to apply submarine technology and the knowledge of precious-coral ecology to conserving the resource and modifying antiquated methods of harvest that cause depletion. And finally, the economic potential is tantalizing: Finding precious coral is like discovering treasure.

The age-old search for wealth may drive the industry, but for Boh Bartko and the Maui black coral divers, and for me, perhaps the greatest appeal is to return to that special place of absolute beauty in the dim depths where precious coral grows, to be there and to drift with the current, to listen to the moans of a far-off whale, and to gaze at all that is nature's wonder. □

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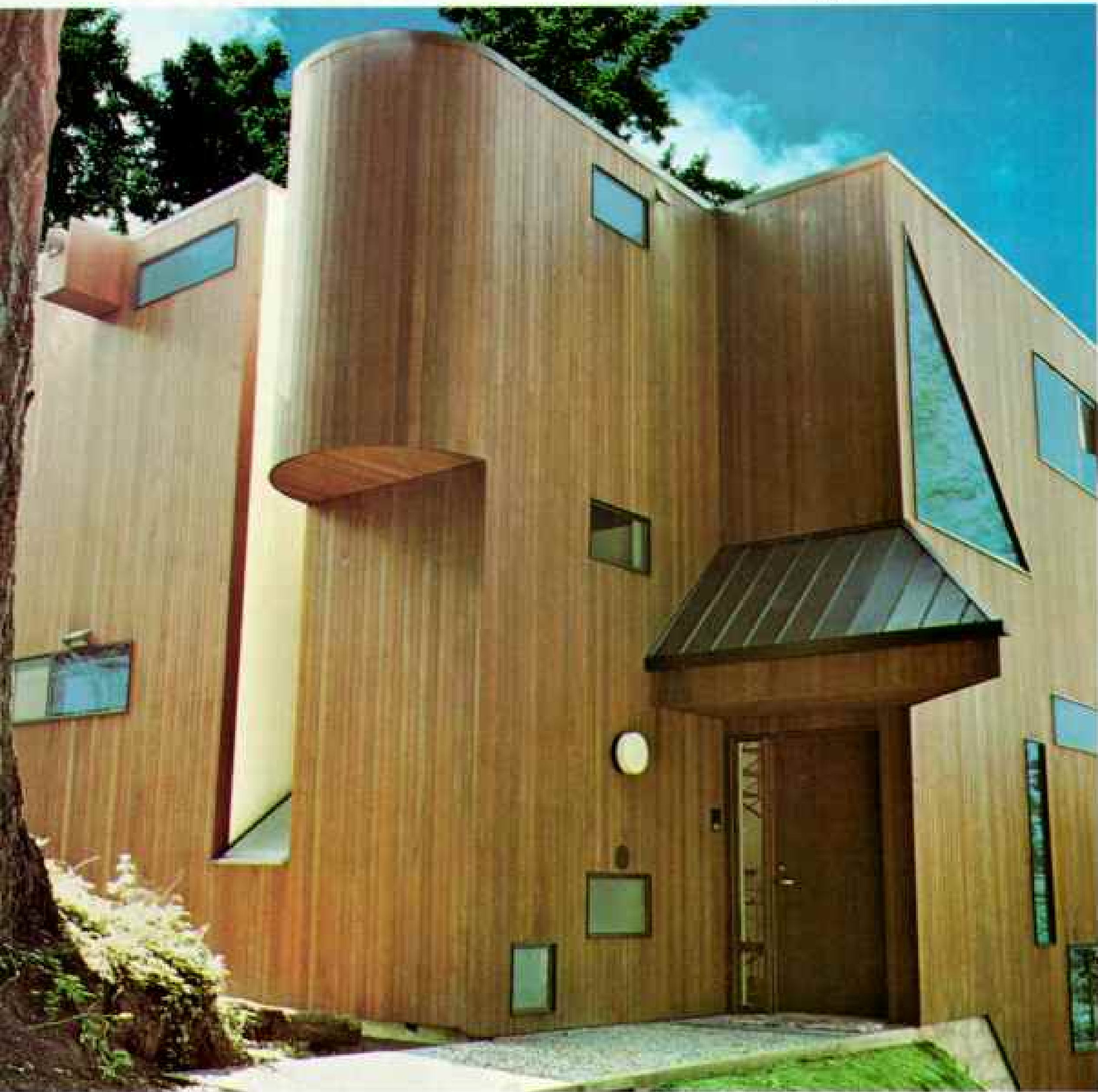
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Massacre at Martin's Hundred

"THE FATAL DAY" for the Virginia colonists at a settlement known as Martin's Hundred came on March 22, 1622. About fifty-eight were slain, some with their own tools and weapons, by Indians (right). Martin's Hundred had survived only in historical documents until resurrected by Colonial Williamsburg archaeologists, supported by the National Geographic Society.

A chilling echo of the 1622 massacre, a fractured skull (below) was found on the site of Wolstenholme Towne, the settlement's central community, where excavation revealed traces of the earliest town plan yet unearthed in British America. Next month archaeologist Ivor Noël Hume describes these exciting discoveries. Share such adventures by nominating a friend for membership.



PAINTING BY RICHARD SCHLECHT



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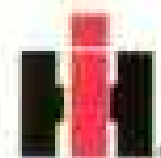
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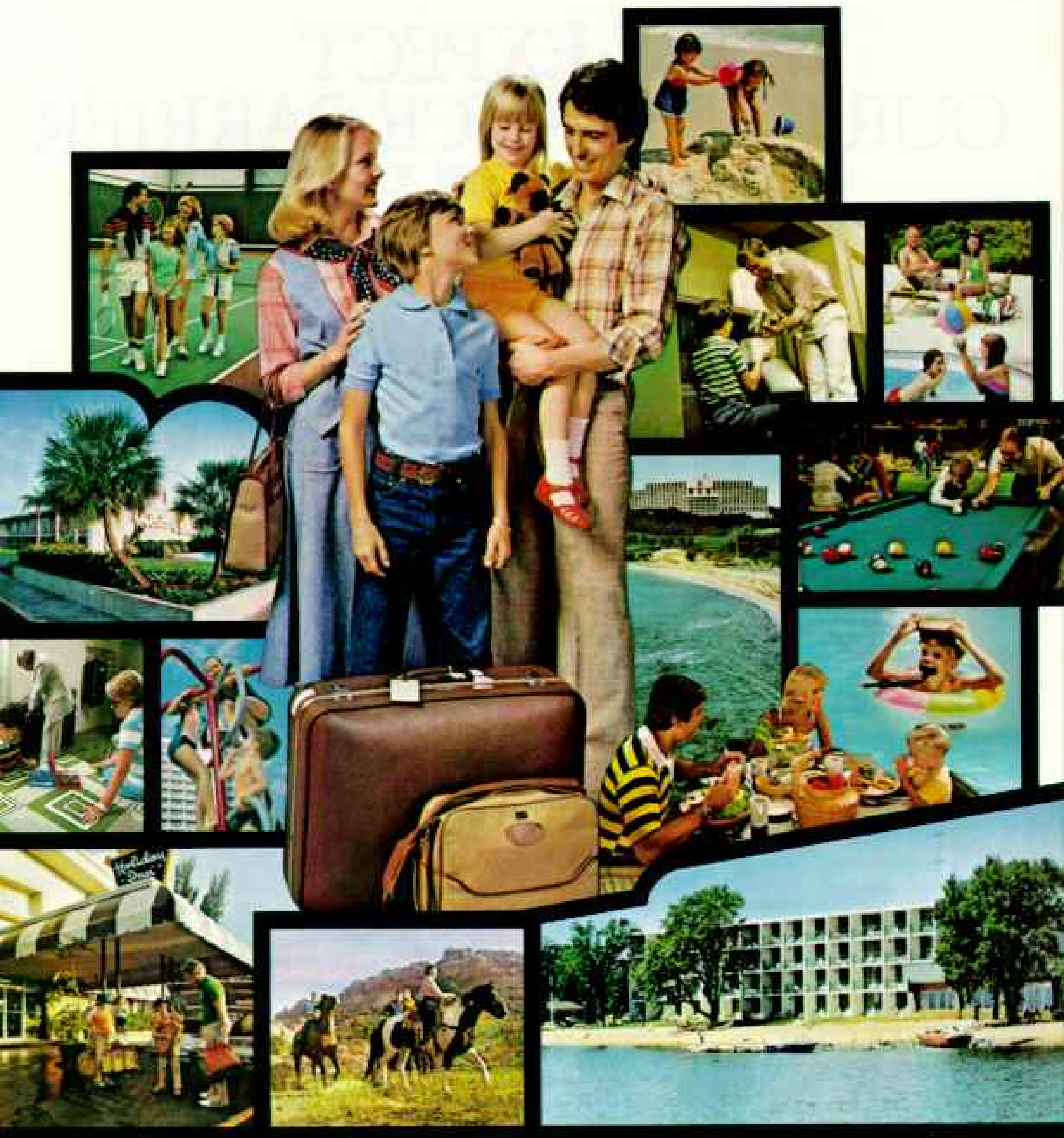
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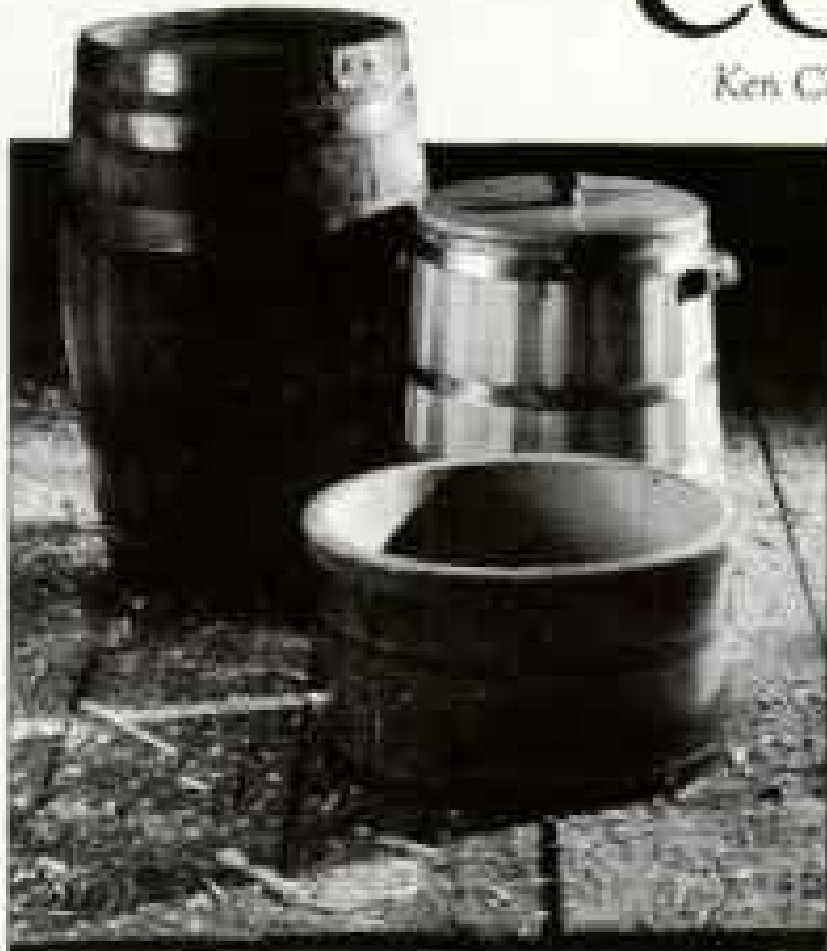
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Menasha's Risk Manager says, "Our association with Employers of Wausau has



Foreground, Ken Chicoine. At desk, Employers Insurance sales representative, Lynn Heimerl

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been steady and constant. While we've 'gone to the market' many times to test the value of our insurance carrier, we've always stayed with Employers. We've assigned four lines of business insurance to them and their work in loss control stands out like a big beacon. In the past five years our mutual efforts have been especially productive."

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Left to right: Don Rydel, Safety Consultant, Employers Insurance and Allen Stinnett, Vice President, Land and Timber, Menasha Corporation, on policyholder's land near North Bend, Oregon.

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In almost any light, the Kodak Ektramax camera can take pictures without flash! With its fast f/1.9 lens and 400-speed film the Ektramax camera can take pictures in light as low as candlelight. And when you want it, the Ektramax camera has a built-in electronic flash that stops the fastest action cold.

In daylight, low light or any kind of light, Ektramax is the camera for you. Ektramax... the ultimate "Can-Do" camera from Kodak.

© Eastman Kodak Company, 1979





Dawn to dusk on a tankful. That's the new diesel-powered Cadillac.

An estimated cruising range of **540** miles based on EPA estimated mpg (city) mileage figure... and 756 miles based on estimated highway mpg... dawn to dusk on an average day. That's the available diesel-powered Fleetwood Brougham and DeVilles. These range figures are obtained by multiplying the car's 27 gallon standard fuel tank capacity rating by the EPA estimated miles per gallon rating (city) of **20** mpg... and the highway

estimate of 28 mpg. Remember. Compare the estimated mpg to the estimated mpg of other cars. You may get different mileage and range depending on your speed, trip length and weather. Your actual city mileage and range will be less in heavy city traffic. Your actual highway mileage and range will probably be less than the highway estimate. Cadillacs are equipped with GM-built engines produced by various GM Divisions. See your Cadillac dealer for details.



Cadillac

Now—the no-rent, no-upkeep branch office from the Bell System.



You can do business in a distant city for only \$16* a month.

Thanks to the new miracle of Remote Call Forwarding—RCF—you can open a "branch office" in a distant city where there is potential business for your firm. Without investing in office space, equipment or additional help.

Your cost? Only \$16* a month, plus the low direct dial rate for each incoming call.

How RCF works.

The Bell System will assign your firm a local telephone number in the city where you want to develop new roots. And to establish your identity in this city, your company will be listed in both the white and yellow-page directories. *At no additional cost.*

Your customer in the remote city simply dials your local number, and the call is automatically forwarded *directly to you... with no waiting and without operator assistance.*

All you pay for your new "branch office" is the low monthly service charge of \$16* plus the low direct dial rate for each incoming call. Since your RCF number is connected to your regular business phone, *no telephone is needed in the distant city.*

RCF—fast, convenient, inexpensive.

RCF establishes your identity in another city. Your customers and field representatives can call you locally and directly.

Though you're physically located in a distant city, to your customers you're only a local phone call away.

Now you can grow with your market.

RCF offers you the opportunity to explore new markets—practically without investment.

You may want to start with RCF in a single market. Later, you may want to open additional markets. No problem. You simply add RCF as needed.

As you'll find out from a Bell Account Executive, there are countless applications for RCF.

Find out from the Bell System how we can help your business grow.

Your business has special needs. This is why you should talk to a Bell Account Executive. We can tailor service to *your* specific needs.

There's no obligation, of course. Call our toll-free number right now—while you're thinking about RCF.

*\$16 is the typical monthly rate for your first RCF number, with slight rate variances in some locations. In addition, a minimal service connection charge usually applies. Each call forwarded is charged at low direct dial rates and is applied to your RCF bill. Your Bell Account Executive will advise you on the availability of RCF in the market area you choose.

800-821-2121

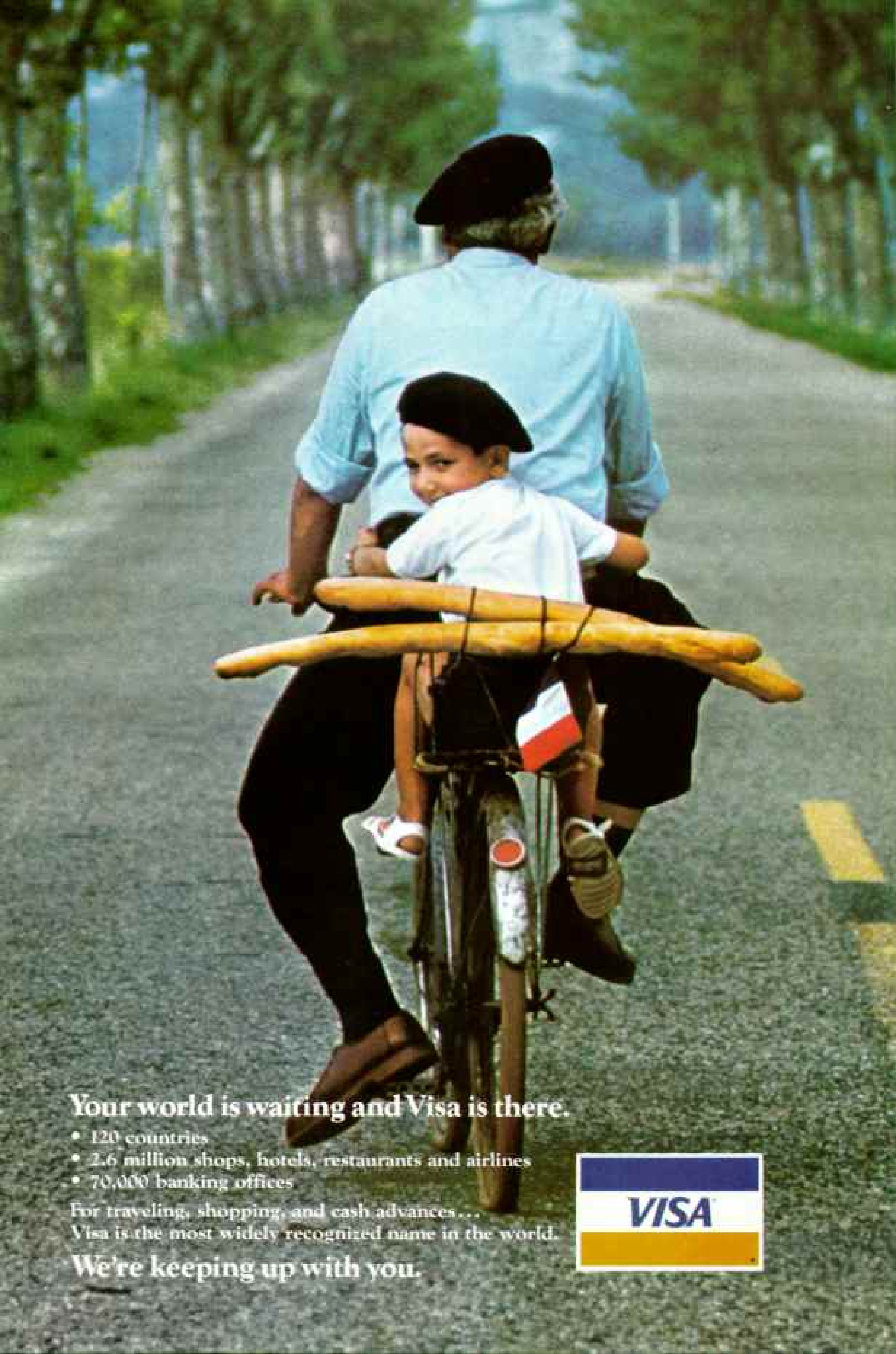
Anywhere in the contiguous United States
(In Missouri call 800-892-2121)

Or, if you prefer, just complete and mail the coupon below.

Bell System Sales Center	107-146
811 Main Street	
P.O. Box 1418	
Kansas City, Missouri 64141	
YES! I'm interested. Tell me more about Remote Call Forwarding and how it will benefit my firm. I understand there is no obligation on my part.	
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Title _____	
Company _____	
Address _____	
City _____ State _____ Zip _____	
Area Code _____ Business Phone No. _____	



Bell System



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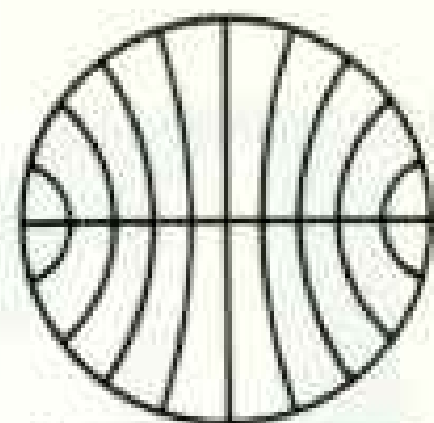
- 120 countries
- 2.6 million shops, hotels, restaurants and airlines
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Visa is the most widely recognized name in the world.

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So, for First Class passengers on our 747SPs, we are proud to introduce new ideas you won't find on any other airline.

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Whether you fly First Class on our 747SP with the Sleeperette™ seat or on our traditional 747, you'll experience the same high standard of service that our First Class passengers have always enjoyed.

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PAN AM

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3½"

4"



5"

If you took a roll of 35mm film to Fotomat for developing, you'd get back a 3½ x 5 print.

And you'd really like it.



6"

If you took that roll to Fotomat for our new Series 35 developing, you'd get back a big 4 x 6 print.

And you'd really, *really* like it.

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Custom Series 35. Not just bigger. Better.

Our special Series 35 color print is not only 37% bigger than our terrific regular-size print. It's better, too.

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Here's what you get:

Our most experienced photo-finishers, in a separate section of our own Fotomat processing labs, use all their skills to produce a perfect nega-

tive. Then painstakingly print every detail and nuance.

The result is a 35mm print with brilliant color and clarity. Optimum contrast and density. And a borderless studio or glossy finish that's definitely the finishing touch.

No matter what kind of photographer you are, Series 35 gives you just what you need.

If you're an expert, Series 35 will make it more obvious.



If you're not an expert, Series 35 will do something equally valuable.

Make it less obvious.

FOTOMAT 



The smooth, quiet road to the top.

The New Chevrolet.

1979 Caprice Sedan in Silver Classic Custom Two-Tone.

You've heard of the rocky road to success.

Well, that old cliché sure doesn't fit The New Chevrolet.

The ride to the top was swift and sure.

It was also smooth and quiet.

A winner on the charts.

Within weeks of its introduction, in the autumn of 1976, our new generation full-size car became

the best-selling car in America.

And it's been solidly on top ever since.

"Must be some car," you say.

"You're so right," we say.

A winner on the road.

Owners are giving The New Chevrolet particularly high marks in ease of handling, and riding comfort.

Take a ride in one and see.

Feel how Full Coil suspension helps flatten out the bumps. And how 16 strategically located rubber body mounts help muffle road noise and vibration. Let your body bask in the comfort and quiet of The New Chevrolet.

Then talk to your Chevrolet dealer about buying or leasing a 1979 Caprice or Impala for your very own.

America has driven it to the top.

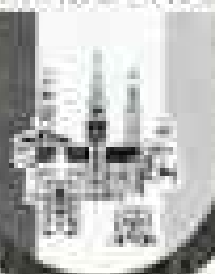
 Chevrolet

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Belgium
Where
Europe
Begins



Announcing a remarkable series of
twelve collector's plates by the Orient's outstanding artist in the classic Rimpa style
... her first works of art in porcelain

Birds and Flowers of the Orient

BY NAOKA NOBATA



*Each plate bears an original work of art
created by Naoka Nobata exclusively for this limited edition.*

Exclusive Signature Edition.

Available by subscription only.
Advance deadline: May 31, 1979.

THE ARTIST. Naoka Nobata is one of the most brilliant and imaginative of today's painters in the traditional Oriental style. She is celebrated throughout her native land both for her exceptional talent and the sensitivity of her technique. Indeed, Mme. Nobata is today's foremost exponent of the classic "Rimpa" tradition of Oriental art—which marvelously intertwines the real and the imaginary.

The works of Naoka Nobata have been shown at important art exhibitions throughout Japan, including the first Sogakai Exhibition, and she has been honored with a one-woman show at the distinguished Shirota Gallery. In addition, her paintings have been exhibited in the Tokyo Central Art Gallery and the Miyuki Gallery, and her work has been acquired by many prominent collectors including the leading art critic Tetsuji Takechi for his own private collection.

And now, at the pinnacle of her career, Naoka Nobata has created her very first works of art in porcelain: *Birds and Flowers of the Orient*. A series of twelve collector's plates portraying exquisite flowers of Oriental lore and legend—and the exotic birds associated with them.

Each of the plates is a distinctive work of art in itself. Together, they form a breathtaking collection that will enhance the beauty of any home. Rich in the symbolism of the Orient... imbued with its meaning... touched with its mystery... this is a collection that will provide endless hours of joy and inspiration.

BIRDS AND FLOWERS OF THE ORIENT PLATES. Each plate represents a different month of the Oriental year, and combines the flower and bird symbolizing that month. Deep green pine branches and the stately white crane for January... the Japanese iris and the Mandarin duck for May... the languid water lily and the exotic egret for August... the brilliantly colored chrysanthemum and the tree sparrow for October... the yellow narcissus and the graceful wren for December... Twelve flowers and birds of the Orient brought together in works of extraordinary beauty.

These collector plates will be exceptionally large—10-1/4 inches in diameter—to provide full scope for the artist's imaginative portrayals. And, as a finishing touch for Naoka Nobata's lovely designs, each plate will be hand-decorated with a border of pure 24 karat gold.

Moreover, each plate will be produced in the finest Japanese porcelain—highly prized for its translucence and strength. And the delicate, sensitive quality of the artist's work will be meticulously captured in every detail, every nuance, every line.

A wide variety of colors will be used in the creation of these designs. Brilliant reds and oranges contrasting with pale yellows, soft greens and cool aquas. Rich browns and ambers mingled with bright blues, subtle violets and magentas. All the lovely shades one might see in an Oriental garden. And to add to the unique-

ness of the plates, elements of the design will form a charming floral border on the reverse.

LIMITED SIGNATURE EDITION. The first edition of the *Birds and Flowers of the Orient* plates will be a special limited Signature Edition. This edition will be distinctive because it is the *only* edition in which the artist's "hanko" (personal signature mark) will be impressed by hand on the reverse of each plate.

The plates in this desirable Signature Edition will be crafted in Japan exclusively for individual subscribers, and the limit of one collection per person will be strictly enforced. Thus, the total number of sets to be issued in this edition will be forever limited to the exact number of original subscriptions entered during a rather brief offering period, plus one set for the artist and one for the archives of Rockdale Porcelain, which is issuing the collection.

Because the plates comprising the Signature Edition will not be available for sale through dealers or stores, subscribers will be the *only* people who will be able to acquire them. Any collector who wishes to obtain the plates in this edition later on can only hope to do so by purchasing them from an original subscriber.

ADVANCE DEADLINE FOR SUBSCRIPTIONS: May 31, 1979. The collection of twelve plates will be sent to subscribers at the rate of one every other month, and the issue price for each porcelain plate is just \$55. Included will be fascinating reference information and twelve individual wall brackets for display of all the plates.

To enter your subscription for the Signature Edition of *Birds and Flowers of the Orient*, you must mail the application at right by May 31, 1979. A final announcement will be made in November, and then the subscription rolls for the Signature Edition will be closed forever.

It is not necessary to send any payment at this time. However, your Advance Subscription Application must be mailed to Rockdale Porcelain, Wallingford, Pennsylvania, by May 31st.



Reverse of plate bears hand-impressed "hanko," or signature mark, if the artist



ADVANCE SUBSCRIPTION APPLICATION

Birds and Flowers of the Orient

BY NAOKA NOBATA

Must be postmarked by May 31, 1979
Limit: One collection per person.

Rockdale Porcelain
Wallingford, Pennsylvania 19086

Please enter my subscription for the Signature Edition of the *Birds and Flowers of the Orient* porcelain plate collection, bearing original works of art by Naoka Nobata. I need send no payment now. The twelve plates are to be sent to me at the rate of one plate every other month. I will be billed for each plate in two monthly installments of \$27.50,* each, with the first payment due in advance of shipment.

*Plus my state sales tax

Signature _____

ALL APPLICATIONS ARE SUBJECT TO ACCEPTANCE

Mr. _____
Mrs. _____
Miss _____

PLEASE PRINT CLEARLY

Address _____

City _____

State, Zip _____



Top: The Bush Warbler and the Apricot
 Middle: The Water Lily and the Egret
 Bottom: The Quail and the Seem Grasses

Match Point

The bold stroke of a soft tip pen – the finesse of a ball point. Each Cross writing instrument is masterfully executed to complement your style. In select and precious metals. From \$7.50.*



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YOU WON'T FIND MANY GRAVELYS IN THE GRAVEYARD.

In an era that finds most Americans expecting their machines to meet with untimely deaths, Gravelys are a pleasant surprise.

Every year we get letters about Gravelys 10, 15, even 25 years old still on the job.

That may surprise you. But it doesn't surprise us.

Because we've never tried to just scrimp and produce our tractors to sell for less.

We always try to make them work better and last longer.

Which is why you'll find something on Gravelys you won't find on other lawn and garden tractors: an all-gear drive direct from the engine through the transmission to the attachments.

So there are no belts to break, slip or wear out.

We also precision-cut the gears, which operate in an

A Gravely won't wear you out. It's got instant forward and reverse, eight speeds for almost any job.

Our tractor can work for you 12 months a year with over 20 attachments, from mowing to cultivating to snow removal.



oil bath for less friction and an extended life.

For greater durability, we use cast iron for the transmission housing as well as the pivoting front axle.

For improved efficiency, we bolt the engine directly to the transmission in the rear.

In short, we build our tractor to be out mowing grass long after most machines its age are out pushing up daisies.

For your nearest dealer, check your Yellow Pages.

For the full story, write to Gravely, 0539 Gravely Lane, Clemmons, N.C. 27012.

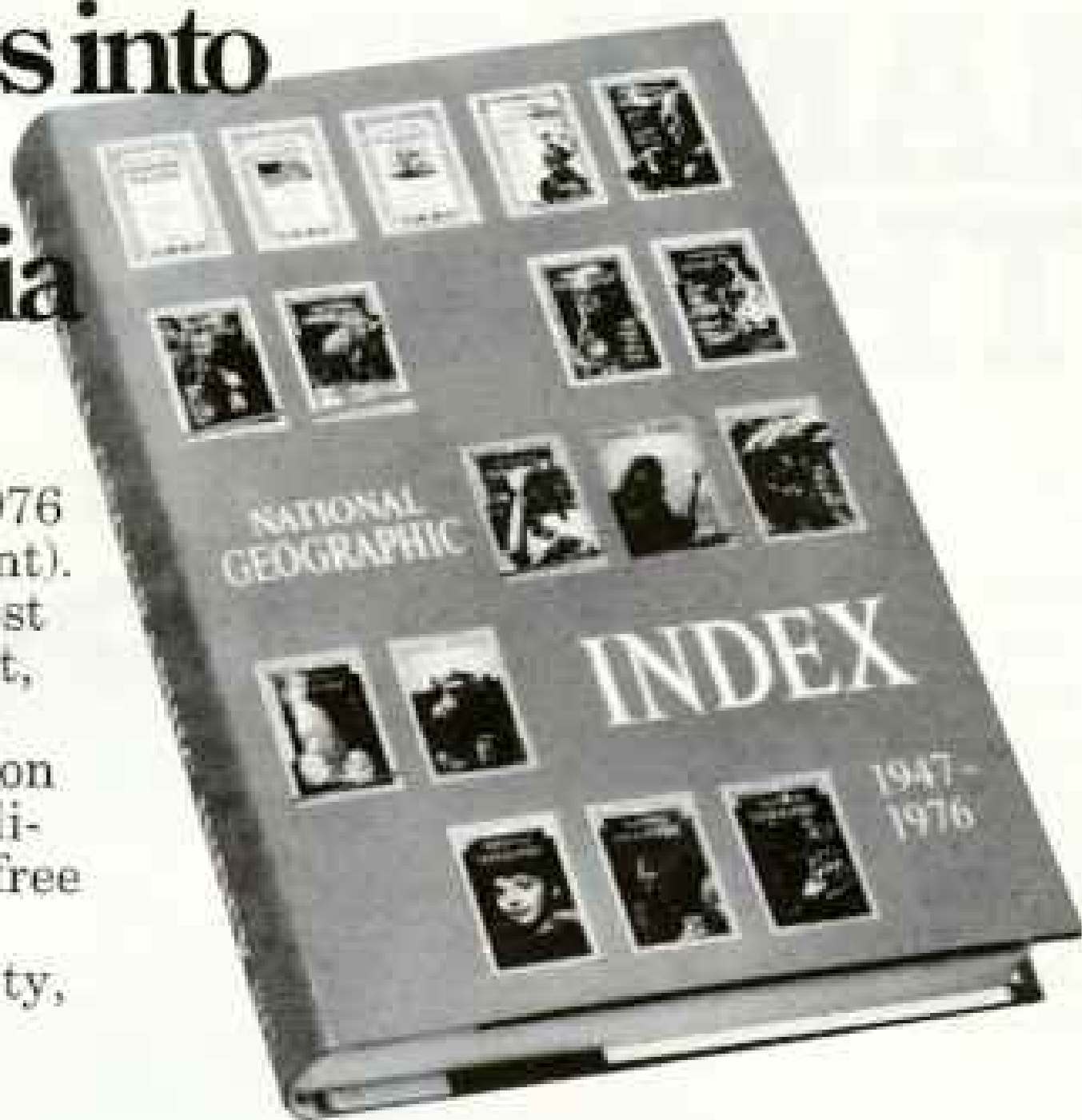
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Walkout Windows.

Think of Andersen® Gliding Doors as big windows you can walk through.

These slim, trim gliding doors slide aside easily to make your patio part of your dining area. Your pool part of your bedroom. Your deck part of your living room.

And just as smoothly, they close up tight and secure. Bringing the luxury of a beautiful view indoors. Creating a wide-open feeling of spaciousness.

Like snug-fitting Andersen Windows, they also help lock out foul weather.

In fact, Andersen Gliding Doors are two times more weathertight than recognized air-infiltration standards. To help seal out drafts, dust and rain, help save on heating and cooling bills.

They're made of wood, too. One of nature's best and most attractive insulators.

Insulating safety glass and a thermal barrier in the sill reduce heat loss, check condensation and frost.

For the added beauty of low upkeep, choose Perma-Shield® Gliding Doors. Their long life rigid vinyl sheath doesn't rust, pit or corrode. Doesn't chip, crack or peel.

Want to know more? Walk through an Andersen Gliding Door at your lumber dealer's showroom. He's in the Yellow Pages under "Windows, Wood." Or send this coupon for more details.



Please send me your free booklet, "How to get good windows when you buy, build or remodel."

Mail to:

Andersen Corporation, Bayport, Minn. 55003

I plan to build. I plan to remodel a _____

Name _____

Address _____

City _____

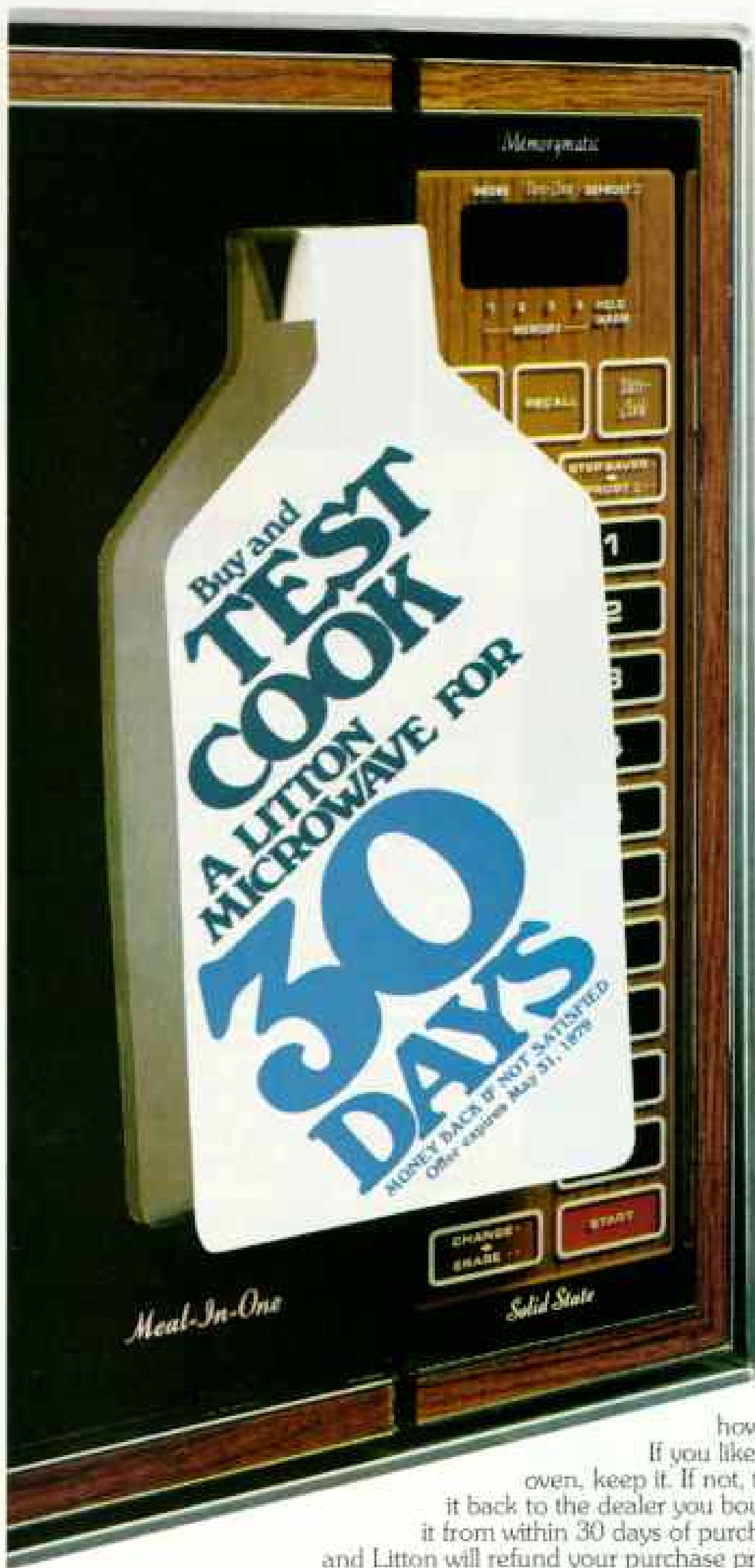
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The beautiful way to save fuel.

Andersen Windowalls





It's Litton's unusual microwave oven home-trial offer: You like your microwave, or Litton buys it back!

Can you think of a nicer way to find out how much you'll like microwave cooking?

Neither can Litton.

Now until May 31st, buy and take home any of this year's full-line of countertop microwave ovens at its regular price. And try it in your own kitchen for 30 days.

It comes with a Litton cookbook that shows you

how easy microwave cooking really is.

If you like the oven, keep it. If not, take it back to the dealer you bought it from within 30 days of purchase and Litton will refund your purchase price.*

Now what could be nicer than that?

See your participating Litton dealer for full details.

LITTON
Microwave Cooking

*All returns must be accompanied by dated proof of purchase.



Litton... changing the way America Cooks.®

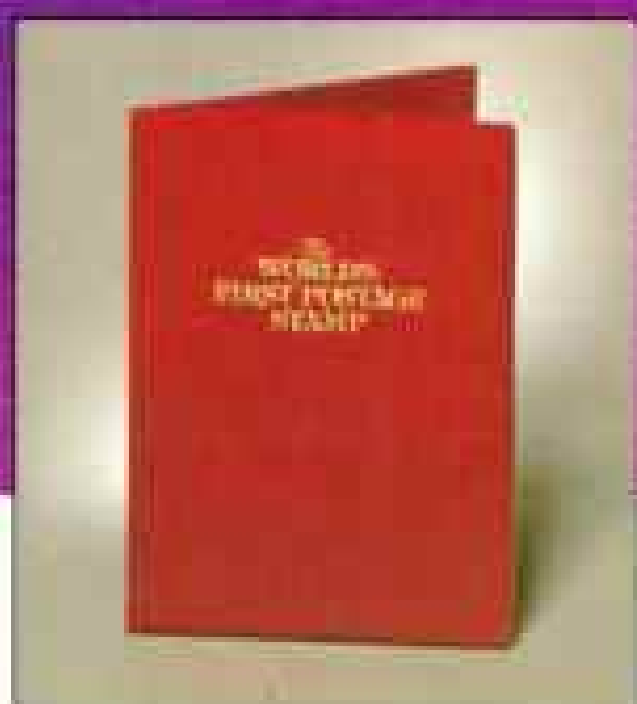
Every knowledgeable collector dreams of owning it.
Today, you can join the fortunate few who own

The WORLD'S FIRST POSTAGE STAMP



"Penny Black" illustrated actual size. Postmarked, it is typical of the actual used stamp you will receive, although each stamp will vary.

©1979 Fleetwood



One hundred thirty-nine years ago — today, exactly — Great Britain issued *The World's First Postage Stamp*, the famous "Penny Black." Historically, it is the world's most important postage stamp, and the *one* stamp which every collector dreams of someday owning.

The brain-child of Sir Rowland Hill — whose centenary collectors are celebrating world-wide this year — it is simply engraved in black with a portrait of the young Queen Victoria and cost One Penny when issued in 1840.

In the past decade, stamps like the "Penny Black" have been called "Paper Gold." But the pleasant surprise is that a *genuine* used "Penny Black" is still modestly priced and within your reach. But this may not be so much longer. For its catalog value has risen from \$11 in 1965 to \$150 and more today. Your opportunity to acquire *The World's First Postage Stamp* should be viewed in this light.

Achieving what many knowledgeable dealers thought was impossible, Fleetwood has been able to obtain just under 5000 of the "Penny Black" in the past year. This very small number is now available to Americans. Collectors and non-collectors alike will be proud to own the "Penny Black." *Not* for investment. But as a *genuine* and very significant heirloom to share with close friends and to hand down to their children.

Because of the small number available, you should order promptly. Your very own "Penny Black" will arrive at your home by Registered Mail in its own handsome album, with a certificate of authenticity and authoritative historical information. Send your order and payment or charge authorization today to Fleetwood, One Unicovert Center, Cheyenne, Wyoming 82008. Of course, your check will be returned if it is received too late. *Limit: One per Collector. Price: \$150. (guaranteed only until May 31, 1979).*

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The WORLD'S FIRST POSTAGE STAMP

*Price guaranteed only
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Limit: One per Collector*

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Please accept my order for **ONE** of *The World's First Postage Stamp* in used condition with album, certificate of authenticity, and historical information. I will allow four weeks for shipment by Registered Mail.

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 Charge my order to my credit card account:
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Established 1928, Fleetwood is America's foremost purveyor of philatelic collectibles. A Division of Unicovert Corporation, it is not affiliated with any governmental agency.

PENTAX SYSTEM 10. THE FIRST 110 SLR AS PRECISE AS A FINE WATCH AND ALMOST AS SMALL.

It might make you feel good to know that if you sometimes think you are hard to satisfy, we believe we are almost impossible to satisfy. Ever.

This attitude was the reason we spent years and millions of dollars seeking a way to drastically improve the 110 camera, to make it the perfect traveling companion.

The new Pentax System 10 is the first 110 SLR (single lens reflex) with interchangeable lenses, a power winder, a dedicated auto flash and a host of accessory filters, close-up lenses, lens shades and carrying case.

We've overcome the limitation of the fuzzy 110 picture.

In fact, System 10 produces pictures which can be enlarged with incredible clarity to 8 x 10", 11 x 14", or even larger. An astounding claim, but true.

The image is razor sharp, crystal clear and free of perceptible grain.

What also makes System 10 unique and so astonishing is its incredible lack of size and weight, coupled with the most sophisticated SLR technology.

It measures 2-1/5 x 3-9/10 x 1-4/5" and weighs less than 6 oz.

System 10 is designed to be the ideal complement to your

35mm SLR. The whole system can fit in a small area of your current camera case (or handbag). And it's the perfect camera for the times you just don't want to carry a 35mm SLR around, like when you're traveling, hiking, or strolling on the beach.

Now with the Pentax System 10, you'll never again have to say "I wish I had my camera with me."

Pentax System 10. Available in limited quantities only at select fine photographic stores.

For more information, write: Pentax System 10, P.O. Box 2585, Littleton, CO 80161.





You owe it to yourself to drive this car.
Introducing the all-new 1979 Mercury Marquis.
 Take the Ten Minute Test Drive and discover a new
 Marquis standard of driving comfort.

You owe it to yourself to spend ten minutes comparing the 1979 Marquis to last year's Marquis and comparing its EPA Interior Volume Index ratings to any full-size car.

Minute 1: Check the luggage capacity.

No American car has more. With the new mini spare, there's even more room than last year.

Minute 2: Settle into a more spacious interior.

More shoulder room and hip room than the biggest '79 Buick or Olds; there's nearly half a foot more hip room in front. The '79 Marquis is even roomier than last year.

Minute 3: Take corners flatter.

Marquis has a new rear suspension. A four-bar link design with axle centered coil springs, front mounted shock absorbers and larger bushings at all suspension points.

Minute 5: Take bumps and dips with more stability.

Lincoln-Mercury took years creating a tradition of Marquis riding comfort. Ten minutes on the road and

you'll discover how far we've come in 1979.

Minute 7: Handle with new maneuverability.

A reduced steering ratio makes steering more responsive, maneuvering in tight places easier.

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More glass, a lower hood and new seating give you a commanding view of the road.

Minute 10: Read more visible instruments. Operate more accessible controls.

Dials are positioned to be read easily. Horn, wipers, high beam switches are on the steering column virtually at your fingertips.

Listen to Buick and Olds owners who drove Mercury Marquis and bought it. Dial toll-free.



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A new Marquis standard of driving comfort.

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LINCOLN-MERCURY DIVISION



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Cracker Barrel natural cheddar cheese from Kraft. Nurtured with the kind of care and encouragement that naturally makes it the best. Another reason America spells cheese KRAFT.

Our Pride. Your Joy.



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COMPUTER COLOR FOR A 25% SHARPER, CRISPER, CLEARER PICTURE. Ordinary color TV pictures have 260 lines of resolution. Magnavox Computer Color 330 delivers 330 lines of resolution. For a 25% sharper, crisper, clearer color picture than ever before possible.

COMPUTER TOUCH-TUNING FOR EASE AND EXACTNESS. A highly sophisticated microprocessor lets you touch-tune directly to any UHF/VHF channel. Easily. Exactly. An optional touch-tune remote control even allows you to scan channels up or down.

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 PARKER

A superb gift. A highly personal accessory.
The Parker Classic Imperial ball pen in 22K gold electroplate. \$20.

How to buy a typewriter.

Clip and save

Choosing a portable typewriter isn't hard if you know what to look for. This brief guide will help you make the best choice.

Test the feel. Check the slope and height of the keyboard, the size and shape of the keys. Make sure the controls are uncrowded and easy to reach. Test the Smith-Corona® electric typewriter against other brands. We welcome the comparison.

Try the touch. A responsive touch makes for better, easier typing. Look for a touch that is prompt, easy and dependable.

Listen to the sound. If it sounds tinny, beware. This may indicate that the construction is too light.

Note the look of the type. Lines and letters should be straight. The impression should be crisp, clean and even. Print quality should be even over the page.

Look at the carrying case. Does it have double walls for air-cushioned protection? Sturdy latches and hinges? The Smith-Corona case does.

Compare prices. A typewriter that sells for less than others might be less type-

writer. If price difference is minor, choose the one that tests best.

Ask who makes it. Smith-Corona makes all its own typewriters, not true of most brands. So choose a company that will be around in the future to give your typewriter necessary service and maintenance.

A note about ribbon systems. Smith-Corona offers a unique cartridge ribbon and cartridge correction system. It lets you change ribbons in seconds and correct typing errors neatly and easily. Compare correction systems for results.

Try the Smith-Corona carbon film ribbon. We offer a re-usable nylon ribbon for ordinary typing jobs...the only kind most makers offer. We also offer carbon film ribbon in 5 colors. It's the kind of ribbon expensive office typewriters use, perfect for jobs requiring a crisp, professional look such as term papers or a resume.

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Do you like the comforts of life? We thought so. That's why Skylark was designed to handle irregular road surfaces with an aplomb you might expect from larger, heavier machines.

Do you like nice, quiet, roomy, luxurious places? The Skylark Limited's Body by Fisher gives you room for 5, and a feeling of luxury like the Electra.



Does the thought of good economy make you happy? Then so will Skylark. It offers an EPA estimated mileage of 24 miles per gallon, estimated 35 for highway.

Remember. Compare this estimate to the "estimated MPG" of other cars. You may get different mileage depending on your speed, trip length and weather. Your actual highway mileage will probably be less than the estimated highway fuel economy. Estimates lower in California. The Skylark is equipped with GM-built engines produced by various divisions. Your dealer has details.

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It just might be the perfect car for you.



Do you hate holding the luggage on your lap? Rejoice. The 1980 Skylark Sedan gives you even more usable trunk space than last year's model.

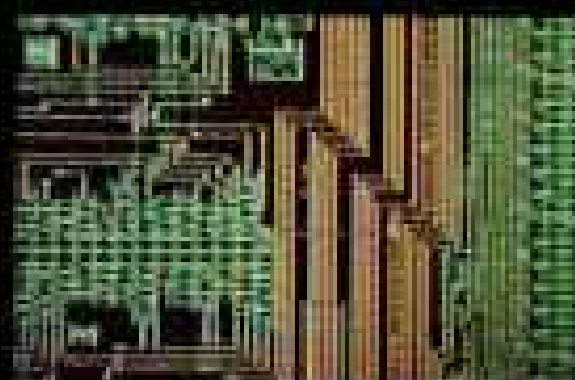
Do you like the idea of owning a Buick? Then you'll love this one. Like the Riviera, it has front-wheel drive. The interior of the Skylark Limited offers luxury like the Electra, as well as good looks like the Regal, and the common sense Skylarks have always had. With all of that going for you, it just might be... well, perfect.

Do you think a car this nice costs a bundle? Then you've got another think coming. In fact, Skylark's price could make the notion of buying or leasing one positively irresistible.



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2 Aperture Priority automation: Select the shutter

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3 Programmed automation: On the A-1, this unique exposure mode picks both aperture and speed in ideal combinations depending on the light. You don't have to set anything.

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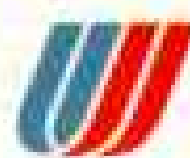
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The educational institutions listed in the Directory will be pleased to send additional literature to any National Geographic families expressing an interest in receiving further information. By mentioning The Geographic, your inquiries will be assured the best possible attention.

Treasures from the tomb reveal Chan Chan's past

Carbon-impregnated black ceramic vessel bears witness to an ancient kingdom as rich as a pharaoh's. Chan Chan, pre-Columbian capital of Chimor on the coastal desert of northern Peru, has yielded treasures for 500 years. Conquering Incas looted it in the 15th century. Conquistadores mined it for gold artifacts. Pedro Pizarro found a doorway slabbed with silver. *Huaqueros*—grave robbers—have been tunneling into the ruins ever since. A maze of mud-brick walls enclosed nine spacious compounds. These served successive monarchs as palaces in life,

as shrines in death. Huge adobe platforms honey-combed with chambers entombed kings, hoards of treasure, and human skeletons "stacked like cordwood"—bones of young women. They were apparently sacrificed to tend royal needs in the afterlife. Threatened by squatters, Chan Chan might have remained an enigma had not archeologists sponsored by the Society completely mapped and extensively excavated the city, puzzling out its past. Digging for facts rewards readers every month in the pages of NATIONAL GEOGRAPHIC.





"We must substitute more coal for oil."

The 1973 embargo and recent Mideast events have renewed interest in oil substitutes. But we also hear there's plenty of oil to be discovered. What's the story?

America leads the world in oil consumption. 45% of that oil is imported. This gap between use and production leaves us vulnerable to embargo pressures, price escalation, shortages. The \$153 billion outflow since 1973 for imported oil certainly adds to inflation and dollar problems. Meanwhile we have coal in abundance. "Use more coal," proponents say, "ease the petroleum situation."

Others talk of coal's problems: land disturbance, pollution. And point out we've had local oil shortages before. But they say, "No need to stampede. North Slope oil is coming in. The East Coast's Baltimore Canyon looks interesting. New discoveries in nearby Mexico are big. Even China may offer possible low cost supplies. Deep sea areas, polar regions are as yet largely unexplored. We're finding new oil all the time."

Where do we stand? Day to day oil supplies fluctuate. But it's a finite, nonrenewable resource. It will run low. Become increasingly expensive. We must act now on the energy options available. We have ample coal reserves. Four times what's been mined in 100 years. Excellent for electric power generation in place of oil and natural gas. Good potential for conversion to clean burning petroleum substitutes.

True, coal has problems. Air pollution and disturbance in mining. But mined lands are being restored. Sometimes made better. And, although difficult, technology is reducing pollution problems.

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22 29

EPA estimated mpg.

Hwy. est.

Every Cutlass Cruiser also has a functional split tailgate to make fast work of loading and unloading, along with a whole roster of other standard and optional features.

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If wagons are your sport, meet one that's in a league all by itself. The Olds diesel Cutlass Cruiser.

Oldsmobile
Cutlass Cruiser

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