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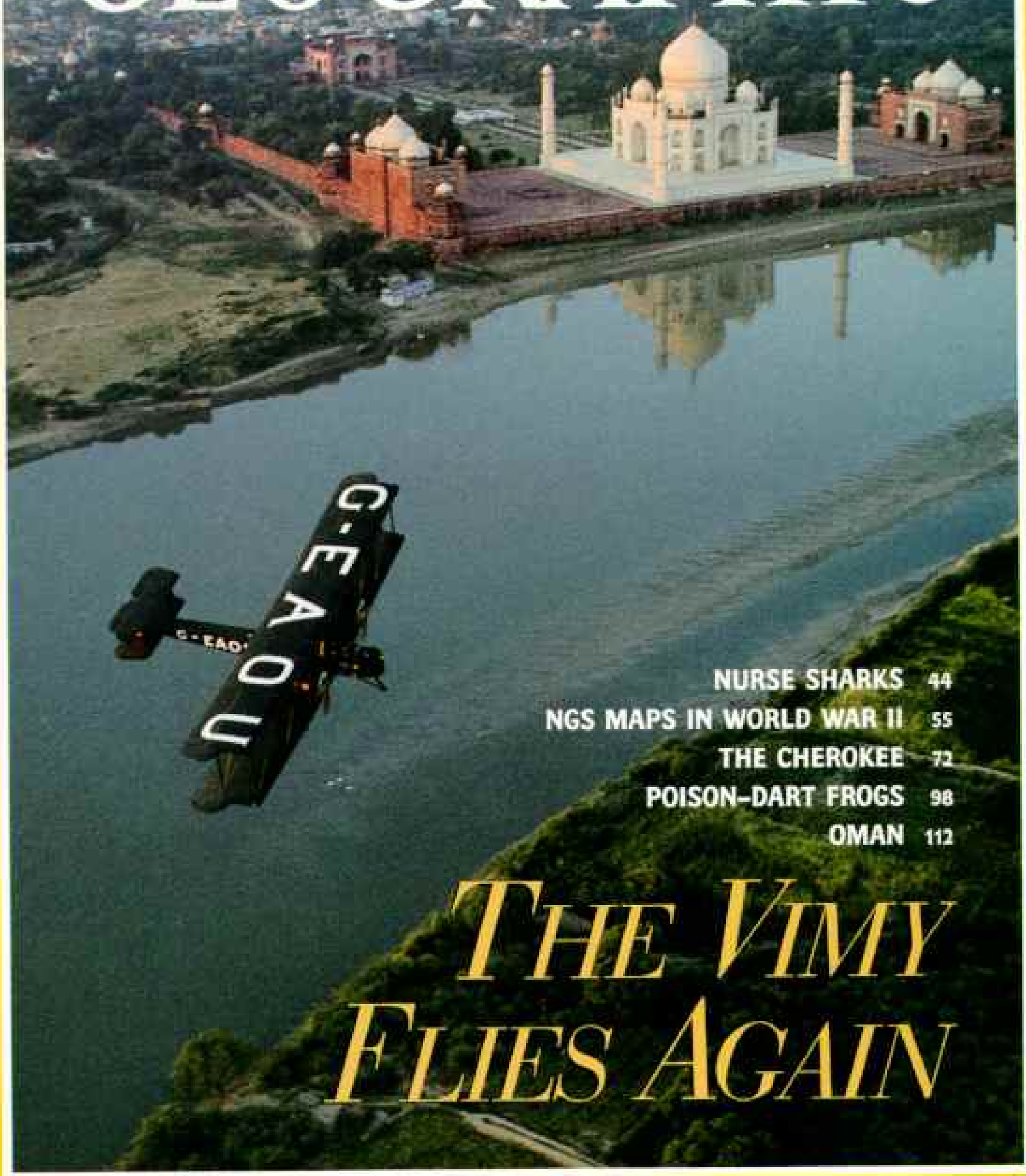

THE VIMY FLIES AGAIN

SEE "THE GREAT INDIAN RAILWAY" WEDNESDAY, MAY 17, ON PBS

NATIONAL GEOGRAPHIC

MAY 1995

COVER: Awed by India's Taj Mahal, the crew of the Vimy biplane flies in loitering circles and exceeds the fuel budget—forcing a search for gas to continue their historic journey. Photograph by James L. Stanfield.

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The Vimy

Reliving the first aerial voyage

In the antique light of a desert dawn, the author's Vickers Vimy biplane circles the Pyramids of Giza in Egypt. In 1919 another Vimy buzzed above the sands here, attempting the longest, riskiest flight in history.

FLIES AGAIN

from England to Australia

By PETER McMILLAN

Photographs by JAMES L. STANFIELD

Winging over four continents—at

75 MILES AN HOUR

Wind in its wires, the Vimy threads its way through rugged border passes between Myanmar and Thailand.

JAMES L. STANFIELD AND JOSEPH S. STANCAMPIANO, NGS STAFF

ALL OF SUMATRA appeared to be on fire. From one end of the Indonesian island to the other, farmers were burning the jungle and rice fields for planting. So much smoke filled the air we could hardly see the ground 2,000 feet below as we desperately searched for a place to land. Our twin-engine biplane, a replica of the open cockpit, World War I-era Vickers Vimy bomber, was going down.

"Mayday, Mayday, Mayday. Vimy 1, Vimy 1, Vimy 1. We've had an engine failure," Lang Kidby, my Australian copilot, called into the radio. "We're making an emergency landing."

The 11-foot propeller on our starboard engine windmilled to a stop. Without power from both engines, there wasn't much I could do to slow the descent of the big, awkward aircraft, which was coming down like a huge kite without a string.

"See any place to land?" I yelled.

"There's a small airfield 25 miles away," Lang said, scanning a map.

"We'll never make it."

"What about that road on the left?" he said, pointing to a dirt lane cutting

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PETER MCMILLAN, 35, is author of *The Greatest Flight*, an account of the 1919 and 1994 Vimy projects to be published this fall by Turner Publishing, Inc. After 27 years on the staff of NATIONAL GEOGRAPHIC, photographer JIM STANFIELD retired in 1994, though he has no plans to ease up on a schedule that has produced 52 articles for the magazine.

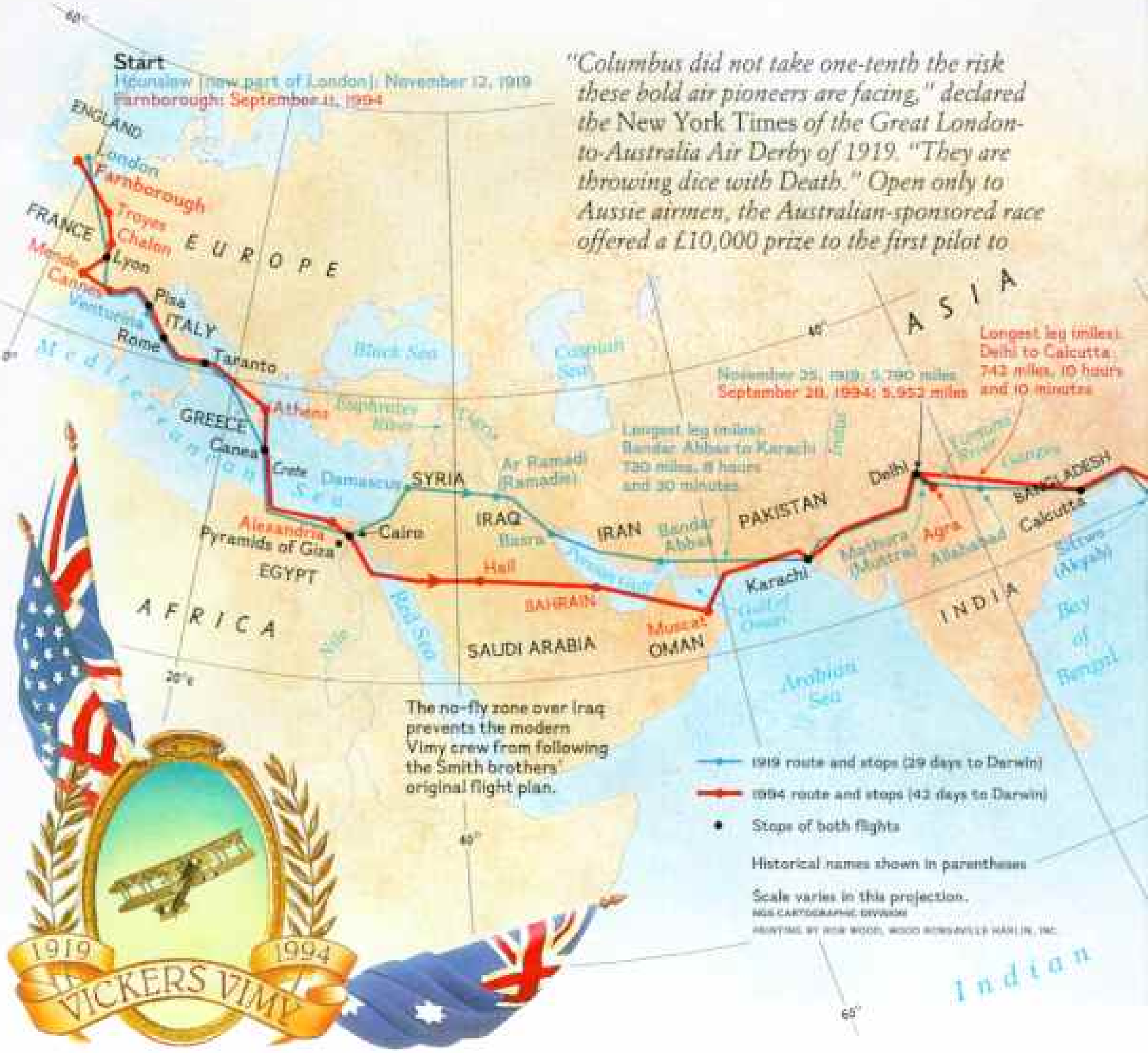
Engines exposed for scrutiny, American Peter McMillan, at right, and Australian copilot Lang Kidby test their ship over England before setting out for the land down under. Their Vimy, a replica of a 1919 British bomber, would prove a handful to fly. "It's like weight lifting," author McMillan says of the leaden controls.

through a paddy. As I fought to bring the Vimy's nose around for our one and only chance to land, I noticed ten-foot-deep ditches on either side of the road, which looked dangerously narrow. Worse, a blue dump truck filled with dirt was blocking our path—too close to land in front of, too far away to glide over. Directly ahead on the road, four boys on bicycles looked up in horror as we bore down on them. They dived headlong into the ditches.

Jim Stanfield, the NATIONAL GEOGRAPHIC photographer, popped up with a camera from his seat in the plane's nose, blocking my view. "Jim, not now!" I yelled. "We're about to crash!" He disappeared.

"We can't use the road," I shouted seconds before touching down. With less than 50 feet to go, I revved the port engine, spun the aircraft to the right, barely clearing a grass hut, and pancaked us down into the recently burned rice field. Our landing gear slammed hard onto the dirt, our big tires bashing into a two-foot-high earthen wall. We vaulted into the air, and I yanked back on the control wheel to keep us from flipping over onto our back. *(Continued on page 14)*

"Columbus did not take one-tenth the risk these bold air pioneers are facing," declared the New York Times *of the Great London-to-Australia Air Derby of 1919. "They are throwing dice with Death." Open only to Aussie airmen, the Australian-sponsored race offered a £10,000 prize to the first pilot to*



The no-fly zone over Iraq prevents the modern Vimy crew from following the Smith brothers' original flight plan.

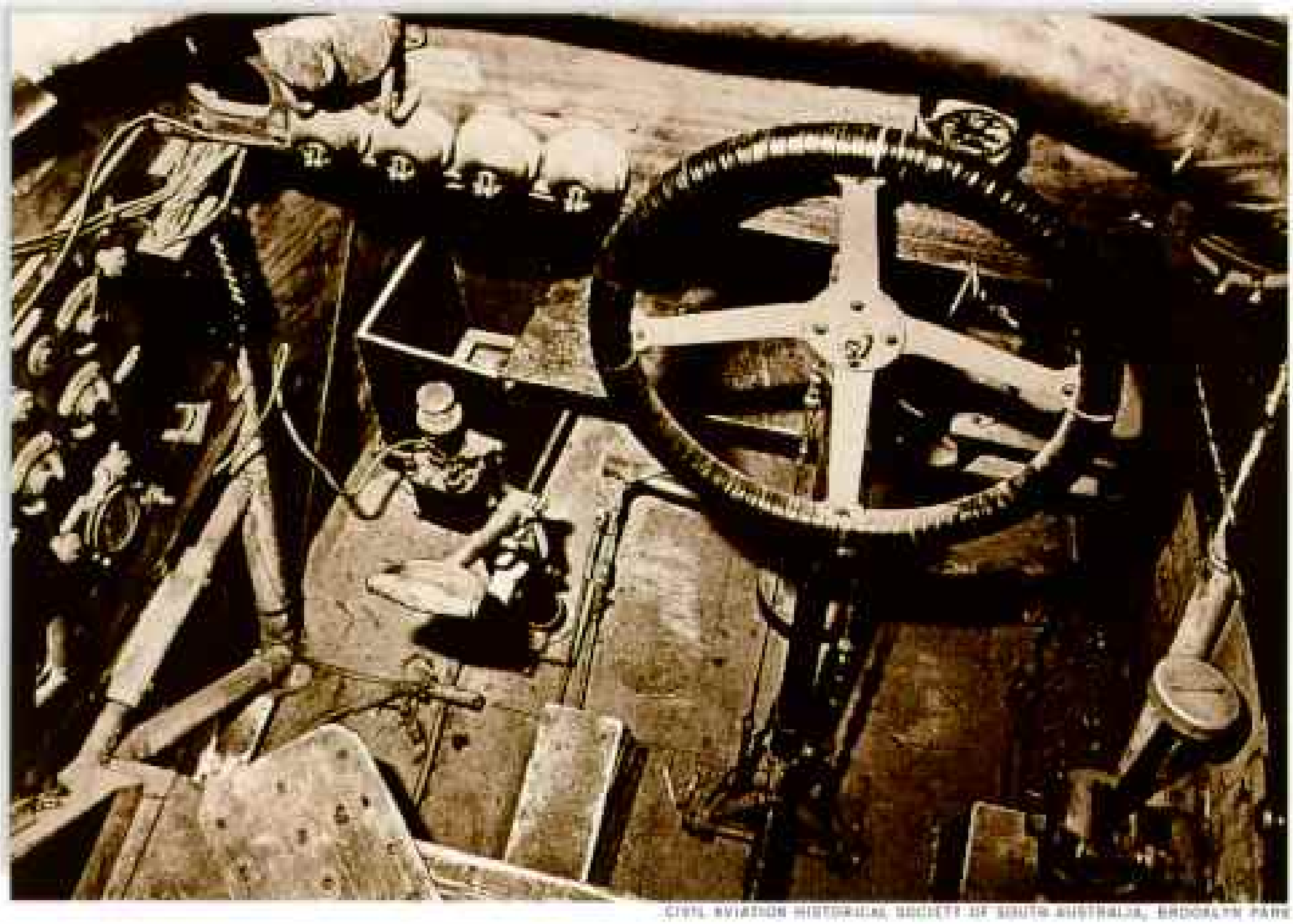
Airborne odysseys past and present

BOTH FROM SIR ROSS SMITH

link the heart of the British Empire with its far-flung commonwealth. The catch: The 11,000-mile journey had to be completed in 30 days or less. Six planes competed; victory was finally clinched by brothers Ross and Keith Smith in a twin-engine Vickers Vimy, repaired en route with chewing gum and pieces of fruit crates. "It was an amazing feat of endurance," marvels McMillan, whose expedition reenacted the Vimy's epic journey last year. Besides the usual dangers of storms and mechanical failure, the American-Australian team dodged a more modern obstacle: red tape.

One of Australia's most decorated World War I pilots, Ross Smith (far left) recruited his brother Keith (left) and two ace mechanics to ensure a first-place finish in the 1919 race. Of the 16 contestants, four died in crashes, two were arrested as spies in Yugoslavia, and two others —after a forced landing in Iraq—had to fend off local tribesmen with hand grenades. Only half joking, Smith's crew read their Vimy's G-EAOU registration letters (right) as "God 'Elp All Of Us."

SIR ROSS SMITH



CIVIL AVIATION HISTORICAL SOCIETY OF SOUTH AUSTRALIA, BROOKLYN PARK

Seat-of-the-pants simple, the 1919 Vimy cockpit (above) featured a compass for navigation; a rope tied to the steering wheel passed for an autopilot. The new Vimy (right) was equipped with radios, racing-car engines, and a computerized fuel-injection system, but its airframe was painstakingly recreated from original plans. "We had to build a 75-year-old airplane factory from scratch," says John LaNoue, the plane's chief builder. In a California hangar (facing page), craftsmen spent thousands of hours rigging the Vimy's 114 flying wires and lacing together the cotton fabric skin with some 10,000 stitches. "Seeing it fly for the first time," recalls LaNoue, "had to be one of the most emotional moments in my life."

"Hit the brakes, hit the brakes, we've got to stop this thing!" Lang shouted.

We bounced more than a hundred yards through the paddy, shearing the tops off three more walls, wings sweeping through a swath of waist-high grass, before rolling to a stop within spitting distance of a field full of tree stumps and a smoldering fire.

"You OK?" hollered Dan Nelson, our engineer, scrambling out of the Vimy's rear cockpit. "What happened?"

"The engine just quit," I said, dazed. As I pulled off my helmet and goggles, I was astonished to see a crowd gathered around us. "Where did all these people come from?" I asked. Hundreds of men, women, and children were pressed up against the Vimy. Many were rice workers, wearing conical hats and carrying sharp scythes.

"Why have you come here?" one man called out, a cigarette dangling from his lips.

I looked at him for a long moment, at a loss for words. How could I explain the outlandish idea that had driven Lang, a levelheaded former Australian Army pilot, and me, a San Francisco investment broker, to quit our jobs, invest every penny we owned, and even risk our lives to celebrate a historic but largely forgotten aviation achievement?

"We had a problem, had to land," I said. But there was so much more I could have told him.

SEVENTY-FIVE YEARS BEFORE, a brash young Australian pilot named Ross Smith, his navigator brother, Keith, and mechanics Jim Bennett and Wally Shiers flew a Vickers Vimy over this same spot on their way to becoming the first aviators in history to fly 11,000 miles from England to Australia—an astounding feat in 1919.* Barely 16 years had passed since the Wright brothers had lifted off from Kitty Hawk, North Carolina, skimming just above the ground for only 120 feet.

Ross Smith and his crew were in an epic race. Australia's flamboyant prime minister, W. M. "Billy" Hughes, had offered a prize of £10,000, the equivalent of nearly half a million dollars today, to the first Australians to make the England-to-Australia journey in 30 days or less. His aim was to draw the world's attention to his up-and-coming commonwealth, whose soldiers had recently made a name for themselves on the battlefields of World War I. But the race had a greater impact on the history of aviation, demonstrating the feasibility of long-distance air travel. At least one major airline, Qantas, traces its origins directly to the 1919 race.

But who remembers the race today?

To remind the world of those courageous heroes and their daring achievement—that was the idea that took hold of Lang and me. For the 75th anniversary of the flight, we would build a brand-new Vimy and fly it from England to Australia.

*Sir Ross Smith told the story of the 1919 flight in the March 1921 NATIONAL GEOGRAPHIC in a 110-page article titled "From London to Australia by Aëroplane: A Personal Narrative of the First Aërial Voyage Half Around the World."

Taken under the U. S. Air Force's ample wing, the disassembled Vimy hitches a ride from Travis Air Force Base, California, to England, where the private expedition would formally begin. Once in the Vimy, crew members carried little more than the clothes they wore, freeing up the biplane's payload for more fuel.

Ross Smith had gotten his Vimy directly from the manufacturer, Vickers Ltd, of Brooklands, near Weybridge, Surrey. Measuring 43½ feet long, with a 68-foot wingspan—more than twice the size of biplane fighters of the day—the twin-engine biplane was a state-of-the-art heavy bomber. But it entered production too late for the war.

We wanted our new Vimy to duplicate the original as closely as possible, from the hand-sewn cotton fabric on her wings to her steel bracing wires, made in the same factory as the originals. But our engineers, John LaNoue and Wayne Daley, could not avoid a few changes. In place of Rolls-Royce Eagle VIII engines, which haven't been made for 70 years, we installed two 454-cubic-inch Chevrolet V8 engines like those found in dragsters. To help us deal with air-traffic controllers, who didn't exist 75 years ago, we added radios and navigational equipment. It took us two years, 20,000 man-hours, and more than a million dollars to finish the job.

We could have done many other things to improve the Vimy's handling. With her 114 external bracing wires, 20 massive struts, *(Continued on page 20)*

Playing hopscotch with clouds, the Vimy probes a wall of rain in southern France, searching for blue sky. Even light winds tossed the fabric craft like a feather.

Slashed by rain, frantic crew members pit their muscles against gale-force winds in Pisa, Italy. A nearby hangar saved the Vimy from sure destruction.

and eight-foot-long mahogany-and-ash nose skid, she creates a huge amount of drag when she flies, making her feel heavy and sluggish. But we didn't want a better Vimy. We wanted an authentic time machine to take us back 75 years to join Ross and Keith Smith on their great adventure.

WE BEGAN OUR FLIGHT to Australia in a frantic blur on September 11 at the Farnborough International Air Show south of London. As a Qantas 747 painted with Aboriginal designs did a low-level flyby over our starboard wing, I pushed the throttles forward and accelerated down the runway.

"One small step for a 747, and one giant leap for a Vickers Vimy," the tower radioed. "Have a safe journey now."

Photographer Jim Stanfield was riding in the gunner's seat in the nose. Dan Nelson, who had helped build the plane and knew her better than anyone on the trip, had the mechanic's seat behind the wings. Two chase planes were right behind us with expedition personnel, a National Geographic television crew and photo technician, a BBC radio reporter, and gear.

"Turn left, turn left!" Lang shouted as we rose above the runway, worried that we might fly into the turbulent vortices of air spinning off the jumbo jet's wingtips. Although I had flown many types of antique aircraft over the years, I was still getting used to the Vimy's stubborn ways—like an old horse, she wouldn't do anything in a hurry. Lang, who'd had a bad bout with fish-and-chips the day before, was not eager for a bumpy flight. We could not guess that in the coming weeks we'd face torrential downpours, blazing dust storms, and an outbreak of plague. Our route would follow that of the original flight southeast across France, Italy, and Greece to Egypt. Then we'd go east across Saudi Arabia, Bahrain, Qatar, the United Arab Emirates, Oman, and Pakistan to India, before turning south through Bangladesh, Myanmar (formerly Burma), Thailand, Malaysia, and Singapore to Indonesia and, finally, eastward again to Australia. Shell had agreed to make gasoline available at designated stops, just as they had for the 1919 flight.

A dense fog had cloaked the snow-covered field at Hounslow, England, on the wintry morning of November 12, 1919, when Ross Smith and his crew prepared to leave. The weather had been declared Class V, or "totally unfit for flying." To 26-year-old Ross Smith, however, the fearless aviator who'd flown for Lawrence of Arabia during the 1918 campaign against the Turks in the Middle East, a little bad weather was nothing to stand in his way.

Taking off with nothing but the clothes they were wearing and a toothbrush apiece, Ross and his crew headed toward France. There they ran into a miserable mix of sleet and snow, which *clotted up our goggles and the wind screen and covered our faces with a mushy, semi-frozen mask,* as Ross reported in the March 1921 NATIONAL GEOGRAPHIC. When Keith unpacked a few sandwiches, he discovered they were frozen solid. *This sort of flying is a rotten game,* Ross grumbled to his diary. *The cold is hell, and I am a silly ass for having ever embarked on the flight.*

We also ran into stormy weather over France, getting thoroughly soaked in the Vimy's open cockpits. Fighting a strong head wind, we could make only 43 knots, or 50 miles an hour. Then the big plane's nose began to dip and rise like a sailboat in high seas, and *bam, bam, bam,* our wings were slapped down by the wind, first on the left then on the right. The wheel was practically snatched out of Lang's hands. The sky darkened to an evil brown, lightning flashed all around, and the rain slashed down.

We were already behind schedule by Day 3, when we arrived in Pisa, Italy—late. When we tried to depart the next morning, we ran into severe head winds again along the coast. Our ground speed at one point was down to 20 miles an hour. As we flew above a road, we noticed a small red car pass us, then stop at a curbside fruit

Reporters scramble for sound bites at Hail, Saudi Arabia, after McMillan's team arrives from Egypt. Airborne day after day, the crew inevitably grew exhausted, ragged. "I couldn't hear very well," McMillan says of the ringing that echoed in his ears after numbing, hours-long flights. "My knees were pretty wobbly."

stand, where the driver hopped out to make a purchase. I saw him return to his car, get in, and drive off again, and we still hadn't caught up with him.

"We'll never get anywhere at this rate," Lang said, so we returned to Pisa's Galileo Airport. There Dan Nelson and Mark Rebholz, the project's logistics manager, tied the biplane down with a dozen ropes. Lang and I went to consult with Gen. Domenico Mazza of the Italian Air Force, commander of the military side of the airport. When we returned, the wind was blasting across the tarmac. The Vimy, which lifts off at about 45 miles an hour, was straining to leave the ground by herself.

"Find some sandbags to hold her down," shouted Dan, who was hanging onto the outer strut on the starboard wing.

"And put the covers on the cockpits," Mark yelled. "It's getting ready to pour."

As the gusts rose to 50 miles an hour, I grabbed onto a strut on the port wing, while Mark and Maj. Mick Reynolds, pilot of the Nomad, our camera plane—on loan from the Australian Army—held fast to the starboard wing. Then a black wall of water swept over us, the winds howled, light posts swayed, and a few small trees were sucked out of the ground.

"I don't know how much longer we can hold on," shouted Lang, clinging to the Vimy's tail with Joe Stancampiano, the Geographic's photo technician. "If the gusts get any stronger, something's going to break loose."

After 20 minutes, however, the winds eased up. We had to make a decision. General Mazza had offered to let us put the Vimy in a hangar a mile away on the other side of the field. But that meant untying her and taking the chance

Greeting the pilots with an ebullient war chant, businessman Mohamed Ebrahim Khalifa Al Kadeer (left) joined some 15,000 countrymen in welcoming the Vimy to Bahrain. The Bahrainis' loud reception (above) would have rung true to Ross Smith, who fought in the Middle East with Lawrence of Arabia.

of getting caught in the open by a second, rapidly approaching squall line.

"We'll be lucky if we get ten minutes," I said, looking at the boiling black clouds in the distance.

"Let's make a dash for it," said Lang. He hopped into the cockpit and taxied the Vimy across the tarmac, while Dan and I rode on her lower wings. As we pushed the plane backward into the hangar, another wall of water hit. Within 15 minutes the winds were roaring at 75 miles an hour, snapping in two a nearby construction crane and tearing part of the roof from the cathedral next to the Leaning Tower. The Vimy would never have stood a chance.

The sky brightened before we left Italy, but we ran into a new challenge in Greece: We had to lose weight. Since the next two legs of the journey were over water, we didn't want to carry any unnecessary gear. We began unloading at the Athens airport, shedding more than 600 pounds. Among other things, we decided to ship all our warm clothes back home, leaving me with my thin flight suit, a pair of pants, a pair of shorts, three shirts, and not enough underwear. We did not know that from this point forward we'd get hot and sweaty each morning preparing the plane for takeoff, then freeze for hours once we hit altitude.

Lang took the wheel for the 200-mile crossing of the Mediterranean to Crete, which gave me a spectacular view of the Greek archipelago, with its azure waters, sculptured bays, and cliffs speckled with white stucco houses and blue roofs.

During the same flight in 1919, the Vimy's two mechanics had engaged in a wrestling match with four tire inner tubes, which they had inflated to serve as life

Luminous from the air, the Taj Mahal gleams at sunrise on the banks of India's Yamuna River—the welcome halfway point in the Vimy's journey.

preservers. When the plane ascended, the tubes expanded, nearly crowding them out of the rear cockpit. As Wally Shiers told an interviewer years afterward: *I said to Benny, "They're expanding, Benny! Blimey, what are we going to do?" He said, "Oh, we can't put up with this, Wal, next thing they'll lift us out of the cockpit." And sure enough, one of them did bulge out that much that we had to get the jackknife and puncture it.*

As we made our descent into Cairo the next day, I was struck by the sour, dusty smell of animals, mixed with automobile exhaust. Flying as low as we did, we could not help noticing all the smells along our route. The French countryside had seemed almost floral compared with the smog of Athens, which reminded me of burning asphalt. Pungent woodsmoke would later fill the air as we pushed into Asia.

We'd been looking forward to seeing the Pyramids from the cockpit of the Vimy. But a misunderstanding almost got the plane shot down over Giza. It happened on Day 9, when Mark Rebholz, whose regular job is to fly 737s for United Airlines, took the Vimy up with Mick Reynolds for a dawn tour of the ancient monuments. After our stressful week in Europe, Lang and I were taking a day off. The Geographic photo teams were following the Vimy in the chase planes. Awakened by the familiar note of the Vimy's big V8s, an almost musical humming, I looked out my hotel window to see her orbiting the Pyramids. When Mark landed later that morning, however, he was met at the airport by Paul Strickland from the Australian Embassy.

"You really stirred up a hornet's nest around the Pyramids," Paul said. "Egyptian soldiers are on their way out here right now."

"What do you mean?" Mark asked.

"Apparently gunners in the Air Defense Command had antiaircraft weapons trained and ready to fire on all three of your planes."

"You're joking. We had permission to make that flight. We were talking to the control tower at Cairo airport the whole time."

"Maybe so, but nobody told the officer commanding the restricted military area beside the Pyramids. He was furious. He even asked his superiors for permission to shoot. You had better leave right away."

Taking Paul's advice, Mark and the rest of the crew retreated to the hotel, where, with more help from the Australian Embassy, we eventually defused the situation. Feelings were still tender about our brazen flyby for the next two days, however, during which fog and red tape kept us on the ground.

IT WAS WEDNESDAY MORNING, Day 11, before we took off on a nine-and-a-half-hour flight to Hail, an oasis in northern Saudi Arabia. The Vimy's broad wings could get little lift in the hot desert air, which was a problem since Egyptian air-traffic control had demanded that we fly at 11,000 feet to keep clear of sensitive military areas. The radar operator in Cairo kept checking up on us.

"Vimy 1, why aren't you higher?" he asked.

"Cairo Radar, we're still climbing," we replied. But the truth was that we had no chance of getting much higher. In fact, as we headed toward the Red Sea, we couldn't get the plane above 2,200 feet, forcing us to squeeze through a pass in the rugged coastal mountains. Mercifully, we also lost radio and radar contact with Cairo, so we didn't have to deal with the persistent air-traffic controller.

Much to my embarrassment, I lost our regional map at this point. I was plotting navigation points on the Vimy's global positioning system when it blew out of the cockpit. (We later recovered part of it from a strut on the Vimy's tail assembly.) For a few uncomfortable hours, we had to rely on my best estimates of our position, which made things rather tense, since we were still flying through restricted zones and hazardous terrain. To make matters worse, Lang and I couldn't hear each other over the

"Mystery juice"—questionable gas from a local station—slakes the Vimy's thirst in an emergency refueling in Agra, India. A bystander plugs the leaking drum with his hand. "People always helped us get to the next stop," says bearded Vimy engineer Dan Nelson. Shell supplied all scheduled fill-ups, as they did for the 1919 flight.

deafening roar of the engines and the whine of the propellers, a problem throughout the flight. To remind him of our dwindling fuel reserves, I had to write him a note. About a hundred miles from Hail we ran into a thunderstorm mixed with blowing sand that caused Lang some calisthenics with the control wheel. By the time we landed at dusk, we were all thoroughly exhausted.

The next morning, after many cups of hot, sweet Saudi tea, we shoved off for Bahrain. Today was my turn at the controls. Lang and I alternated days in the pilot's seat, during which time we had to keep both hands on the wheel and both feet on the rudders for as long as ten hours at a stretch. Because of the cramped cockpit, my back would ache and my feet fall asleep.

The sky over the desert was clear, which was a change for us, giving me a good view of bright green circles of irrigated alfalfa fields in eastern Saudi Arabia as well as the occasional Bedouin encampment. Once or twice we circled wild camels to get a better look or scattered a herd of black goats, which darted from our noisy Chevy engines like a school of fish, abruptly changing direction all at once.

"Better not go any lower," Lang warned. "We don't need a bullet through the floor from some angry Bedouin."

We often went all day without any food. Chris Weber, the National Geographic television producer on the project, had given us a bag of mixed nuts to snack on. But when I reached down to pick out some cashews, Lang slapped my hand. They were his favorites too.

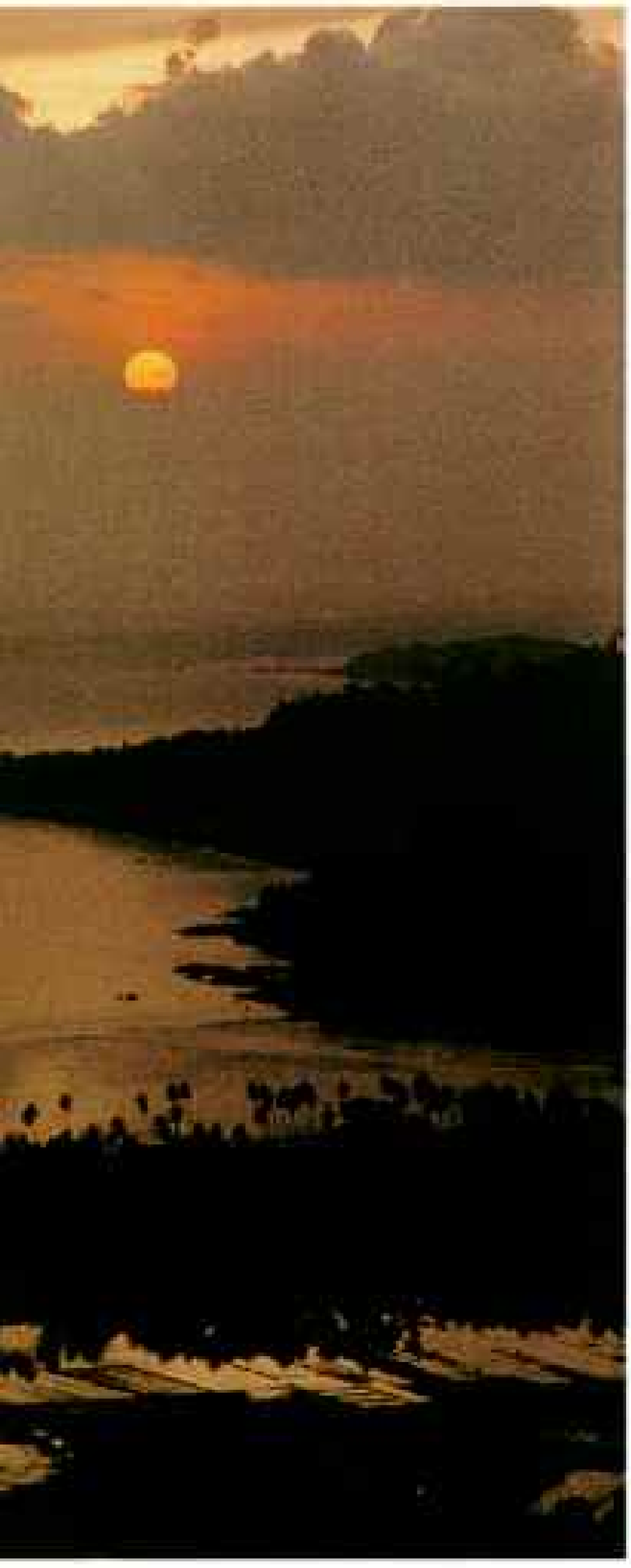
Dusk fell as we arrived at the Bahrain airport, where we were met by a trumpet

Sunset raises a reddening flag over the Malaysian coastline, tinting smoke from burning jungles. Severe air pollution was not a hazard the Smith brothers had to contend with. Neither was bureaucracy. McMillan's team often spent as much time in airport offices as they did in the cockpit.

fanfare and our friends Tessa Barroll, the project manager, Jenny Moseley, from National Geographic, and Morag Barton, director of Brooklands Museum, who had all flown down from London to meet us. From there it was only a 30-minute hop to the makeshift runway in the desert where a big welcome party had been planned for the next day by the Civil Aviation Affairs Department and Gulf Air.

On the Vimy's first low pass over the sprawling Bedouin tents the following morning, I saw horsemen racing along beneath us, with white robes and ammunition belts across their chests, and a crowd of perhaps 15,000 surrounding an open area where we were supposed to land. Lang put us down smoothly despite a howling crosswind, and we taxied across the sand, accompanied by the horsemen. As soon as the propellers stopped, the crowd surged forward.

The scene was colorful but bewildering to me. A band wearing red-and-white uniforms with gold braid was playing marching music on bagpipes on one side of the aircraft while traditional dancers in white robes and headdresses were



chanting and swaying on the other to the accompaniment of tambourines and drums. All around us beautiful Arabian horses were galloping.

Yousuf A. Shirawi, the minister of development, led us into a huge air-conditioned tent with Persian carpets, majestic sofas, and floral arrangements to meet other dignitaries and enjoy some cardamom coffee. Then we heard a helicopter landing, and we all went outside to greet Crown Prince Shaikh Hamad bin Isa Al Khalifa, who took a brief tour of our plane. As we chatted with the prince, he summoned a rider from those around us with a wave of his hand. The horseman, bowing in the saddle, brought a dappled gray Arabian to the prince.

"Isn't this stallion beautiful," the prince said, smiling. "He is my favorite."

When it came time to leave, I became worried. The area of compacted sand on which we had landed was short—less than half the length of a small-town runway—and we'd be taking off directly over the crowd.

"I'm not too sure about this, Lang," I said. "If you don't think we're going to make it, you need to tell me to chop the throttles. I don't want to turn this into an ugly incident."

With as much confidence as I could muster, I rolled the Vimy slowly forward, dragging the brakes a bit to get the tail up, and accelerated down the gentle hill. The plane started moving faster and faster, and the people got closer and closer. To see over the nose from the deep cockpit, I loosened my seat belt and stood up. Then we lifted off the desert floor, clearing the crowd, tents, banners, and flagpoles by less than 75 feet.

"Now that wasn't so difficult, was it, mate?" Lang said. I was never so relieved.

Lumbering east across the Gulf of Oman three days later, we skirted the southern coast of Iran and crossed into Pakistan, passing some of the most bizarre landforms we had seen. Between tiny fishing villages, thousand-foot plateaus thrust sharply out of the sea, attached to the mainland by skinny necks of land. As we neared the sprawling port city of Karachi, we spotted ten or more containerships that had been deliberately run aground on the beach to be hacked apart for scrap. One had only a crust left around the stern, like a cake being devoured by ants at a picnic.

That night we were invited to a 1919-costume party at the home of Mr. Eric Calloway, the British deputy high commissioner. Stepping from our taxis at the gate to his property, we heard the clip-clop of a horse-drawn carriage coming down the half-mile-long driveway to meet us. The path was illuminated by hundreds of tiny oil lamps. Carpets covered the lawn behind the pink sandstone main house, where Lang and his wife, Bev, along with Mark, Dan, and Ian Snell, the pilot of our support plane, the Islander, mingled with flappers in fringed skirts and headbands and men in white dinner jackets. The only jarring note came from the Pakistani band, which was playing Beatles tunes, cocktail-lounge style.

But in my daydreams about the past there was no escape from the present. A man from the Karachi office of Shell, clutching a portable telephone, waved me over.

"They want to know when you'll be arriving in Delhi," he said, referring to his Shell colleagues in India. Good question.

We had learned that afternoon that the flight plan approved months before by Pakistani authorities was no longer possible. Because of tensions along the eastern border with India, where the Pakistani Army was conducting maneuvers, air-traffic control was now requiring us to cruise at 21,000 feet to avoid trigger-happy soldiers. That was more than five times higher than the Vimy could fly with a full load. The authorities were studying a new route that would take us south through the Indian city of Ahmadabad. But they had to coordinate with their Indian counterparts.

"Why can't we just get on with it?" said Lang, exasperated. "They didn't have to put up with this in 1919."

When Ross Smith and his team made the journey, their route had traced the outlines of the British Empire from Egypt to India to Australia. Our trip, by contrast, took us to 16 independent nations, each with its own immigration control and security demands. We spent as much time in airport offices as we did in the air.

When we arrived at Karachi International Airport the next day, we discovered that the problem had taken a new twist. There was word of a massive exodus from the Indian city of Surat, where pneumonic plague had been reported. Health officials were concerned that the highly contagious disease would spread across the Indian state of Gujarat, where Ahmadabad is located, or even go beyond. Flights in and out of Bombay, 150 miles south of Surat, had already been canceled.

Following nine hours of discussions, and five or six more flight plans, we eventually obtained approval to take a route to Delhi that avoided both the military and the plague. Shortly after sunrise the next day we were gone.

THE BORDERLANDS were greener than I had expected, with long parallel ridges of farmland like a bunched-up carpet in need of straightening. A steam train inched along a narrow-gauge railroad, telling us that we had reached India, as did the sandstone palace of a former maharaja. Turning north toward Jaipur, we faced a new hazard: kite hawks. The sky was thick with them. We managed to dodge those flying in ones and twos, but when we overtook a large flock, we could do nothing but close our eyes and wait for the sickening thump—a potentially disastrous prospect for Lang and me, since our heads were only twelve inches from the tips of the props. The thump never came, though a few birds passed between our wings.

Ross Smith hadn't been quite as lucky. As he took off from eastern India, a kite hawk had flown straight into the port propeller. *There was a crash as if a stone had hit the blade, and then a scatter of feathers. . . . It was a breathless, not to say a terrifying, moment, for we fully expected to hear the crash of broken propeller blades. . . . I have known so tiny an object as a cigarette end thrown carelessly into a propeller to cause the whirling blades to fly to pieces!*

The news in Delhi, meanwhile, was not good. As soon as we landed, we were told that the plague had spread to at least 20 towns and cities, killing more than 50 people. Delhi residents, however, did not appear to be overly concerned. Many felt that the media had overblown the crisis.

To be ready for a dawn flight over the Taj Mahal, we had to make a short flight the next day to Agra, 120 miles to the southeast. Lang generously offered to remain in Delhi for a dinner with government ministers so that I would be free to make the flight. Because of a press conference at the hotel, however, I was delayed until almost dusk. By the time I got through security, the Vimy, with Mick Reynolds at the helm, was taxiing out to the runway in a race against the setting sun. The plane had no instruments for night flying. I sprinted past the prop blast, hopped up onto the back of the wing, and slid into the seat, minding the turning propellers.

"Through small holes in the smoke, you could see the rows of flames burning below," says Kidby, at left, of the blazing forests of Sumatra, Indonesia. Set by farmers, the huge fires choked off visibility for hours, forcing the pilots to skim only a few hundred feet above the canopy.

As we got closer to Agra, a city of some 900,000, we radioed ahead to the airport to confirm that all the runway lights would be turned on, since we were now flying in total darkness. To see the engine gauges—six feet away from me on the sides of the engines—I had to ask Dan to shine his flashlight from his seat in the rear cockpit. The control tower said everything would be ready. But as Mick made our final approach, all we saw were dozens of smudge pots lined up in the darkness. We later learned that these were all they ever used, except that, for our benefit, they had lighted them all. Mick made a smooth landing, despite a tense moment or two when flames from the pots licked at the bottom of our cloth-covered wings.

Firing up the Vimy's engines at first light, we took off over the Yamuna River, a tributary of the Ganges, and followed it to the Taj Mahal, the tomb of Mumtaz Mahal, wife of the 17th-century Mogul emperor Shah Jahan. As we circled the elegant structure, flying in close formation with our two support planes, I hardly dared to take my eyes off the other aircraft for more than a second. But when I did, I saw an iridescent pearl in the first rays of sunlight, recalling Ross Smith's description of a *matchless white jewel reclining in a setting of Nature's emeralds.*

Back on the ground we had to face the fact that we hadn't planned to refuel in Agra and we had stayed above the Taj Mahal longer than expected. Indian Air Force officials had said they could provide drums of gasoline at Agra, but none had shown up. Shell offered to send fuel from Delhi, but that would take at least a day. So Squadron Leader Kamal Deep, our military liaison, went off to look for gas.

He returned a few hours later in a Russian-built truck with a single empty drum in

Out of the frying pan into disaster: The starboard engine died just as the Vimy cleared the worst of Sumatra's pall of smoke. Wounded, the Vimy was going down.

SIR ROSS SMITH

Hundreds of amazed villagers materialized minutes after the stricken Vimy skidded across a parched Sumatran field. "Everyone wanted to sit on the plane, so I just moved away and they followed," says Dan Nelson, crouching. In 1919 the Smiths drew ogling crowds at every Indonesian landing, including Sumbawa (below).

the back, along with a small man in rags. I climbed aboard, and together we bounced down a crowded, dusty road, scattering bicycles and animals, until we reached a worn-out-looking filling station. I saw only scooters filling up. What kind of fuel was it?

"Normal gas," said the cashier evasively.

"Eighty octane," said another man.

"Sixty-five," corrected yet another.

With a sense of foreboding, we pumped the mystery fuel into our beat-up drum, which began to leak like a sieve. The little fellow wrapped his arms around the drum, plugging the largest holes, as we lumbered back to the Vimy. There Mick and Dan attempted to siphon the noxious liquid out of the drum with a garden hose, sucking and spitting gas onto the dirt, where I noticed it didn't evaporate. Not a good sign. If it didn't evaporate, it wouldn't burn too well.

Back in the air, I couldn't help wondering what the scooter juice was doing to our engines. I wanted to kick myself for letting my impatience get the better of my good sense. As we got closer to Delhi, however, I began to worry that we wouldn't have enough of the gas. After draining three of our four fuel tanks, I shifted to our last-chance tank. The final 15 miles were tense. About a mile from the airport, at 2,000 feet, I saw the starboard fuel-pressure gauge plummet. I knew we could probably glide to the end of the runway, but I managed to restore partial power by tipping the nose down to slosh the fuel around. We landed and sputtered to a stop.

OUR TEN-HOUR FLIGHT to Calcutta the next day was less harrowing. Flying over endless green paddies, we passed just north of Allahabad, where the original Vimy team had been delayed by a territorial bull. Ross Smith described the incident: *I frightened him for the moment by a roar from the engines. Evidently he took the roar for a challenge, and stood in front of the Vimy, pawing the ground and bellowing defiantly. At this point a boy scout rushed out from the crowd to move the monster, and, much to the amusement of ourselves and the crowd, the bull changed his intention and turned on the hero. Our brave toreador retreated to the fence, pursued by the bull.*

A different kind of monster was waiting for us in Calcutta when we arrived on Day 21. The plague had caught up with us again. More and more nations around the world, including most of India's neighbors, were refusing to let flights from India land on their soil. At least half of India's international airliners had been grounded.

Mick Reynolds and Ian Snell felt strongly that we should leave as soon as possible


NATIONAL
GEOGRAPHIC
SOCIETY
WELDON OWEN

Bone-weary after two nearly sleepless days spent trying to get out of Sumatra, Kidby and McMillan slump by the Vimy. Stranded without proper tools, Kidby organized villagers to help clear a rough landing strip (below) for the team's support aircraft. The cause of the Vimy's downfall: a shattered piston (bottom).

for Chittagong, Bangladesh. Exhausted by the flight from Delhi, however, Lang, Dan, and I needed to rest. The next morning at four, everyone else gathered at the airport, only to spend three hours arguing with immigration officials. Eventually things were sorted out, and the two chase planes were allowed to take off. They'd been up barely half an hour, though, when the air-traffic controller in Calcutta radioed to say that permission to land at Chittagong had been withdrawn because of the plague. Rather than go back, they decided to keep flying all the way to Yangon (formerly Rangoon) in Myanmar. It would take every drop of fuel on board both planes. As they approached the Myanmar border, an officer in Yangon radioed to tell our pilots that they could not land in that city either. There was only one thing to do.

"I'm sorry, Yangon, I couldn't hear you," Mick said into the Nomad's microphone. "We seem to be having a problem with our radio."

"Same difficulty here," said Ian in the Islander. "Our radio's malfunctioning."

It was a desperate ploy, but with their diminishing fuel supplies our group had nowhere else to go. Only after the two planes were closing in on Yangon, did our pilots manage to "fix" the radios and ask for permission to land.

"We weren't sure what kind of reception we'd receive," Bev Kidby said later. "But they treated us very well. We were picked up in a bus, taken off for brief medical examinations, pronounced free of the plague, and released."

Lang, Dan, and I left Calcutta at dawn the next morning to catch up with the others. At the airport we had to wake up a young customs man, who groggily attempted to stamp our flight plans. The first four stamp pads he tried were bone-dry, so it was

good that he had a drawer full of them. In no time at all we were back up in the air and heading for Myanmar, with its spinach green jungle, hilly terrain, rocky outcroppings, and golden temples.

Symptoms of trouble with the starboard engine began to appear almost a week before our forced landing in Sumatra. When we took off from Yangon on Day 24, the motor sounded as if it was missing on a cylinder. As we were leaving Bangkok, the engine was so sluggish I wasn't sure we'd make it over downtown buildings. That afternoon, after dodging thunderstorms in the Gulf of Thailand, we made an unscheduled landing on the island of Langkawi in Malaysia because the engine started vibrating badly and the needle on the tachometer began to swing like a metronome.

Replacing a spark plug got us as far as Singapore, where Ian Snell suffered severe abdominal pains that put him in the hospital. We had all been hit with stomach ailments at one point or another, but Ian's problems were later diagnosed as cholera. Two days later the Vimy broke down over Lampung Province on Sumatra, and we belly flopped into the rice field 140 miles short of Jakarta.

By Saturday, October 15, six days after our crash landing, the formerly peaceful scene around us had been transformed into a one-ring circus. A steady stream of villagers in a holiday mood flowed in and out of the trampled paddy, directed by military police and army troops in green and camouflage uniforms. The noisy chatter of the crowd was punctuated by the *honk, honk* of bicycle horns

Airworthy again, the Vimy sails over Java's lush, densely populated farmlands. "By this time my face was raw, peeling continuously from sun and wind," says McMillan. Netted arm guards near the propellers help keep the rest of him intact.

from flavored-ice vendors, who were doing a brisk business in the stifling heat.

With little sleep, eyes stinging from the smoky air, and only the most basic of hand tools to work with, we were filthy, weary, and desperate to make an escape. But first we had to repair the landing gear, straighten the collapsed tail wheel strut, replace the starboard engine, and build an airstrip. We had determined by now that the engine was ruined: An exhaust valve had destroyed a piston, snapping the camshaft into three pieces. Fortunately a spare V8 was ready to be shipped from Brisbane, Australia. Mick delivered it from Jakarta in the Nomad, doing a carrier-style landing on the strip that had been cut through the paddy's matrix of low earthen walls by a hundred farmers under Lang's direction. Malcolm Wood, replacing Ian, followed in the Islander with tools and supplies.

After eight hours of manhandling the new engine into place, we wiped the thick layer of Sumatran dirt from the propeller, bolted the propeller onto the engine, and tightened the flying wires. The new motor barked to life. It was time to say good-bye.

The police managed to push back the crowd enough to let Lang taxi the Vimy to the south end of the landing strip, though the path through all the people was still

narrower than the aircraft's wingspan. As we slowly gathered speed, stirring up a blinding storm of dust behind us, people were diving out of the way. Our tires sank into soft spots as we bounced down the runway toward the Nomad, which was parked at the northern end. We lifted into the air, and Lang turned us abruptly to the left to clear the chase plane.

"We made it!" Lang shouted, grabbing my shoulder in celebration. "We got out!"

THE ODD THING WAS, I didn't share his jubilation. Though I was just as relieved that the Vimy had escaped, I was still nagged by doubts. I wasn't sure the aircraft could make it to Jakarta, let alone to Australia 1,700 miles away. Flying from now on would be an exercise in suspense.

The new engine ran smoothly, however, on the short flight to Jakarta, where we stayed three days to finish repairing the landing gear. Then we headed east across Indonesia, hopping from island to island—Bali, Sumbawa, Timor. Lang and I hardly spoke during these long flights, which told me that he was worried too. I found myself unconsciously tightening my seat harness, as if that would help.

At the village of Kupang on Timor we were met by schoolchildren, costumed dancers, traditional musicians, and chanting old men whose teeth had been blackened by decades of chewing betel nut. I tried to relax and enjoy the festivities, but I couldn't ignore the haunting voice of doubt. I wasn't looking forward to spending more than seven hours the next day flying over the shark-infested Timor Sea.

Our takeoff from Kupang on Day 42—the last of our journey—was not a confidence builder. Despite the fact that Lang and I were the only ones aboard the Vimy, it took us more than 20 minutes to reach our maximum altitude of 1,400 feet. As we left the coast behind, I kept looking over my shoulder, watching the last bit of green disappear on the blue horizon.

Our engines were running adequately, but each time we hit a bit of turbulence their note changed, making my pulse race. I had to trick myself into not looking every few seconds at the gauges—tachometer, fuel pressure, oil temperature, oil pressure, water temperature—because I knew that if I looked long enough, the needles would begin to wobble.

Three hours later I spotted a few sailboats on my side and marked their latitude and longitude in case we needed to come back and ditch near them later. We were still more than three hours from land. If an engine failed now, the aircraft would sink below the waves without a trace. I imagined what the skeptics would say then:

"What a pity, so close."

"Good effort. Too bad about the Vimy."

"Those fools should have quit in Sumatra."

With only 95 miles to go, I faintly heard the control tower in Darwin.

"Over there," I said at last, pointing to a thin white line in the haze on our left. "That's Bathurst Island, right?"

A whoop, a victory hug, and shouts of "Where's the beer?" marked the Vimy's jubilant touchdown in Darwin, Australia. Still clad in life vests after crossing the Timor Sea, the crew had plenty to celebrate: 42 days of bucking the odds against weather, breakdowns, the far limits of fatigue, and, occasionally, despair.

"Yep," Lang said. "Welcome to Australia."

We made landfall over Darwin within the hour, and I was looking down on Fannie Bay, site of the original landing field, as well as Ross Smith Avenue, Keith Lane, Shiers Street, and Bennett Street. As Lang banked us left toward the airport, cutting the power, I heard the song of the Vimy's flying wires and had to take a deep breath.

"Vimy 1, cleared to land," the control tower told us. "Welcome back to Darwin after all these years."

Our wheels touched down on Australian soil at 3:09 p.m. on October 22. Because of the storms in Europe, fog in Cairo, plague in India, and forced landing on Sumatra, we had taken two weeks longer to finish the flight than Ross Smith and his crew had in 1919. But we didn't really care. Lang was excited to be back on his native soil, and I was overwhelmed with relief and pride that our time machine had succeeded.

As Lang and I hopped down from the plane at Darwin to speak to a crowd of

Evoking a time when flight still sparked wonder, the Vimy basks in newfound glory at a Brisbane, Australia, air show. Largely forgotten today, the exploits of the Smith brothers heralded the birth of an era. "A machine properly attended and equipped," Ross Smith recklessly asserted, is "capable of flying anywhere."

television and newspaper reporters, someone handed me a magnum of champagne and I let the cork fly, bouncing it off the Vimy's upper wing. Administrator of the Northern Territory Austin Asche and the Acting Lord Mayor of Darwin, Robyne Burridge, stepped forward to welcome us, just as their counterparts had greeted Ross Smith 75 years before on December 10, 1919. After having patiently waited for her turn, Wendy Miles handed me a telegram of congratulations from Australian Prime Minister Paul Keating.

Mrs. Miles is the daughter of Sir Hudson Fysh, one of the founders of Qantas and the first person to shake Ross Smith's hand at Darwin, surprising him with a bundle of telegrams from around the world. The two young men had served together in the Australian Light Horse and Flying Corps in the Middle East.

"Seeing the Vimy today gave me a funny feeling inside," Mrs. Miles said. "It brought back memories of the small planes of my childhood. I was quite overcome."

The story of the Smith brothers has a bittersweet ending. Less than three years after their triumphant success, for which the two pilots were knighted by King George V, Ross and Jim Bennett were killed in the crash of an amphibious Vickers Viking in England. They had been testing the aircraft for a proposed flight around the world. Keith, who also would have been in the cockpit if his train from London hadn't been delayed by fog, arrived at the airfield in Brooklands as the plane struck the ground. Ross was dead by the time Keith sprinted to the wreckage. Benny died in his arms.

There had always been something reckless about the way Ross Smith lived. But there was also something inspiring about his pioneering spirit. Time and again he risked his life to advance the possibilities of aviation from idea to reality. I would like to think that our flight, in a more modest way, revived that spirit by showing that great adventures are still possible for those willing to pursue a dream and to trust in the skill and courage of their friends.

As we stood in the long shadow of our flying machine, I saw names and greetings in Arabic, Hindi, Malay, and other languages traced in the dust that still clung to the lower wings, and I recalled a thousand faces from our 11,000-mile flight. I understood then what Ross Smith had written about his moment of glory: *The hardships and perils of the past month were forgotten in the excitement of the present. We shook hands with one another, our hearts swelling with those emotions invoked by achievement and the glamour of the moment. It was, and will be, perhaps, the supreme hour of our lives.* □

Wild Mating of the Nurse Sharks

By HAROLD L. PRATT, Jr., and JEFFREY C. CARRIER
Photographs by NICK CALOYIANIS

Locked in a turbulent embrace, two nurse sharks mate off the Florida Keys—the first time scientists have documented in detail the sex life of sharks in the wild. To subdue his partner, the male must seize the female's pectoral fin, flip her, and carry her from the shallows to deeper water.

ANIMAL ATTRACTION

Under a blazing subtropical sky we wait, sometimes for hours. Our perch is a 20-foot-high tower made of scaffolding. From here we sweep our eyes over calm, coral-filled waters off the Florida Keys. Suddenly a spray of seawater erupts from the surface—it's a male shark lunging for a female's fin—and a tail slaps the water with a percussive boom. Another mating attempt begins.

Since 1992, when the two of us—along with Linda Martin of the Monterey Bay Aquarium—began studying the first known breeding ground of nurse sharks, we've documented 165 mating events here. What biologists previously knew about the reproductive behavior of wild sharks was limited to chance encounters in the open sea and the stories of local fishing guides. Now we were immersed in the real thing.

We owe much of our field success to the fact that we could practically touch the mating animals. Typically we were able to approach as close as two feet with our cameras, near enough to hear the male crunching down on the female's tough fin. The sharks, particularly in the final stages of mating, seemed almost oblivious of our presence.

Ginglymostoma cirratum, although tremendously strong, is a benign, relatively sluggish shark. Adults range from seven to ten feet in length and weigh between 250 and 400 pounds. Common in nearshore waters, it is the shark that divers are most likely to encounter off Florida and in the Caribbean. Despite their passive nature, nurse sharks will bite divers who annoy them—something we never allowed ourselves to forget, especially when in the company of big males.

The nurse shark spends much of its time in caves, leaving to feed on prey such as lobsters, squid, and crabs. The sucking sound of its powerful throat muscles probably explains the shark's common name.

During the five-week mating season some 20 adults congregated in the small area we were studying. When a commotion broke out on the surface, off we'd go, quickly, quietly, stalking the sharks with only snorkeling gear. Photographer Nick Caloyianis swam with us, making many hundred-yard dashes a day to capture these scenes.

We usually arrived in time to see a complex mating dance of acceptance or rejection. Amid a swirl of fins we watched as the male struggled to arch his body over the female, which here carries a red identifying tag (top right). Often one of his penis-like claspers poked out of the water, pointing skyward. All male sharks possess two claspers to deliver sperm. As we were able to verify, only one is used in copulation, the choice dependent on which side of the female he is able to grip.

The females do not submit readily. Less than 10 percent of the mating attempts ended in successful copulation. Often a female avoids a male by retreating to shallow water and digging her pectoral fin into the bottom (right). In the end, only the most aggressive and persistent males are successful.

HAROLD "WES" PRATT, a marine biologist at the National Marine Fisheries Service laboratory in Narragansett, Rhode Island, has studied shark reproduction for the past 26 years. JEFFREY C. CARRIER of Albion College, Michigan, is a physiologist specializing in nurse shark biology. "A Savage Kind of Love," coproduced by NICK CALOYIANIS, will air June 25 on EXPLORER on TBS Superstation.

GETTING A GRIP

More partners than rivals, two suitors approach a female (above), undeterred by her attempts to elude them. Probably the most surprising of our finds was how often small males seemed to cooperate when attempting to mate with a female. First one, then another, would literally inhale the female's opposite pectoral fins and together tow her to deeper water. In some cases we saw as many as six males working together to ambush a female. A savvy female might resist the males by arching her side to keep her fin away from them.

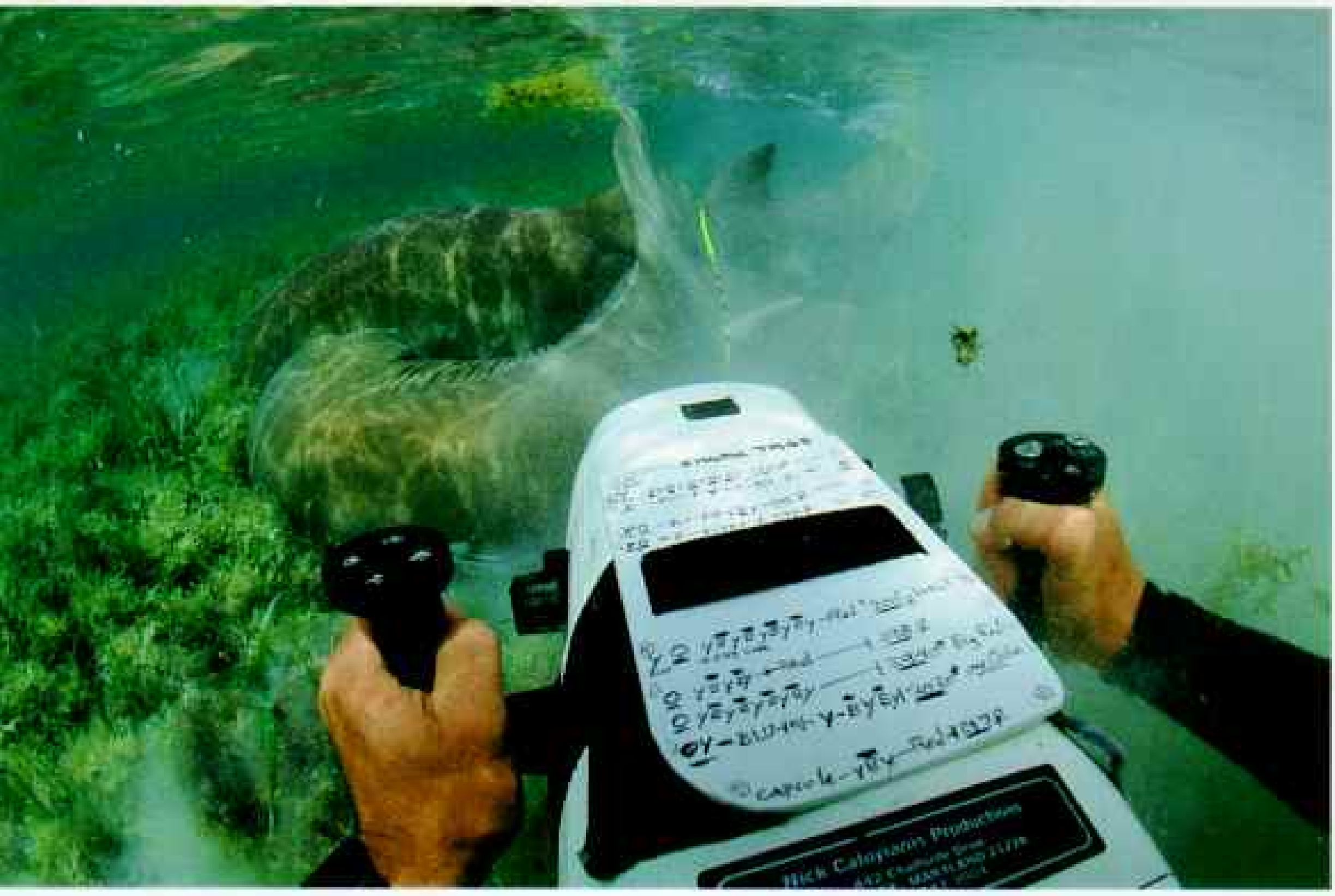
The beneficiary of this group behavior is the male that can manage the tightest grip on the female's fin and accomplish the tricky maneuver of aligning his body with hers. Thus anchored, he can roll the female over, flick his tail underneath her to brace himself, and insert a clasper

(above). Successful copulations last between one and two minutes.

Afterward, the male often collapses on the sea bottom. This evident fatigue may result from the fact that the male is deprived of oxygen the whole time he has his jaws clamped onto the female's fin.

After days of mating, the female swims away with a chewed-up pectoral fin (left). These "love bites" may look serious, but given the nurse shark's tough, thick skin, they quickly heal.

His stare as fierce as his bite, the dominant male we called Red Eye prepares to haul away a female, remoras and all. Whenever Red Eye approached, the behavior of the females visibly changed. Instead of resisting, they relaxed and allowed the big male to capture a fin. At least one must have struggled, however. Red Eye probably scratched his eye on the rocky bottom while wrestling for position.



SHARK SLEUTHING

Closing in on new discoveries, we tried to notice everything. We attached a list of codes to our video camera (above) so we could identify tagged individuals and begin to decipher group interactions. We even found a newborn pup near a sponge patch (below), confirming our belief that the mating ground also served as a pupping habitat and nursery.

Finding the newborn underscored how much we have to learn. While we know the young hatch from eggs inside their mothers' bodies, we can only guess at the gestation period, which is 6 to 24 months in other species.

Some answers may be on the way. Frank Murru, curator of Sea World of Florida, in Orlando, helped us capture two females we had observed. Sonograms suggest both are pregnant. During the sharks' captivity scientists are monitoring their progress. If the births are successful—litters number 20 to 30 pups—we will tag the young and release them with their mothers back into the wild.

As is the case with many shark species, nurse sharks are believed to be declining in number. They are killed for crab bait and caught incidentally with more commercially valuable shark species. Although federal regulations protect nurse sharks from heavy exploitation, the fact that so few coastal areas remain wild means that we must stay vigilant to protect the animals and their environment. If we are successful, this pair (right) and countless others will have many fruitful matings ahead. □

TOP SECRET

ESTIMATED GERMAN SITUATION 1 MAY 1945

100 50 0 100 200 300
STATUTE MILES

NORWEGIAN POCKET
11 DIVS

NORTH GERMAN POCKET
20-30 DIVS

NORTH SEA FORTRESSES

FORTRESS HOLLAND
5 DIVS

THURINGIAN POCKET
2 DIVS

BOHEMIAN POCKET
20-30 DIVS

BLACK FOREST POCKET
3 DIVS

ALPINE ITALIAN POCKET
40-45 DIVS

TOP SECRET

D. ANTHONY STEWART

Blueprints for Victory

Fifty years ago National Geographic maps helped win World War II, at home and on the front lines.

By **JOHN F. SHUPE** CHIEF CARTOGRAPHER

"Take out and spread before you a map of the whole earth," President Franklin Delano Roosevelt told radio listeners on February 23, 1942. "Follow with me the references which I shall make to the world-encircling battle lines of this war."

In the homes of 1.2 million National Geographic Society members that map would have been pulled from the December 1941 issue of NATIONAL GEOGRAPHIC magazine.

The government, too, relied on Society maps. In early April 1945 FDR was shown a map overlaid with taped outlines of Germany's shrinking positions (left). The map, which after 50 years hangs once again in the White House Map Room, was the last prepared for FDR. He died on April 12.

FRANKLIN D. ROOSEVELT LIBRARY, HYDE PARK, NEW YORK

Introduction by GEORGE M. ELSEY

TRUSTEE EMERITUS

IN APRIL 1942 I was assigned to President Roosevelt's Map Room as a young Navy ensign. I felt right at home. When the United States entered the war a few months earlier, one of my first acts as a Naval Intelligence officer had been to visit the headquarters of the National Geographic Society, obtain a supply of maps, and begin to master the terrain of war.

Like a lot of Americans at the time of Pearl Harbor, I knew little about the islands of Southeast Asia, where our British and Dutch allies were struggling, as we were soon to be in the Philippines, against the Japanese. But the National Geographic's accurate, timely maps brought me up to speed, and when I reported to work at the White House, the familiar maps were stuck on the walls all around me.

Those copies had clear plastic overlays covered with grease-pencil markings to show the locations of Allied and enemy troops. Large charts of the Atlantic and Pacific Oceans from the Navy Hydrographic Office were studded with tiny pins in a rainbow of colors: blue for United States ships, orange for Japanese, red for British and—most ominously—black pins placed in the Atlantic for the feared German submarines.

The small office, converted from what had been a ladies cloakroom on the ground floor at 1600 Pennsylvania Avenue, functioned as the President's intelligence and communications center. Coded messages came rattling in from our allies—Churchill, Stalin, and Chiang Kai-shek—and answers went back. Our office was so secret that its very existence was classified information. Those of us stationed there worked around the clock to keep the President's maps up to the minute. The Army and Navy kept us informed on our own Allied forces, and much information on the enemy was gleaned from Magic and Ultra, secret operations that deciphered enemy codes. We were under orders to answer no questions about our duties.

The President could drop in at any time, but he usually came in the morning, on his way to the Oval Office in the West Wing. He would come back on his return to the residence, two stories above us, in the late afternoon. Access was so strictly controlled that neither the

Ripping a map from a July 1941 GEOGRAPHIC (facing page), FDR defined a plan to protect Atlantic convoys: Britain and the United States would divide the ocean's defense.

Prior to the Cairo summit in November 1943, FDR sketched on a Society map an occupied Europe divided among the Allies (left).

Winston Churchill had his own ideas. In Quebec the following year (above) the leaders debated Europe's future using the July 1944 map supplement, "Germany and Its Approaches."

PAINTING BY ARTHUR SHILSTONE; NATIONAL ARCHIVES

U. S. NAVY

December 18, 1941: Unable to find a small island near Borneo on any White House map, FDR sent an aide five blocks up 16th Street to the National Geographic Society's library. The aide found the island—and a few days later Society President Gilbert H. Grosvenor sent FDR a case of maps mounted window-shade style. The case served as a backdrop during a 1942 visit from Soviet Foreign Minister Vyacheslav Molotov (above).

Throughout the war the Society's library was a key resource for the military (right).

Secret Service nor the President's valet, who pushed FDR's wheelchair everywhere else, could enter.

A bell would ring at the President's approach, and one of us would open the door and take over the wheelchair. Maneuvering carefully, we would push the chair first to the main desk, where the latest war news—or possibly the latest message from Churchill—awaited in a black-leather folder with "The President" stamped in gold leaf on the front. Then we would make a slow tour of the room, which was furnished with drab Navy desks, file safes, and metal chairs. Furniture was clustered in the center, leaving aisles on the four sides so FDR could study the maps at close range. He called the pace, stopping before any map that particularly interested him.

It helped to know your geography. I remember a flustered ambassador, just home from our London embassy, who tried to bluff his way through a Map Room session with FDR. When the President asked about wartime developments in Djibouti, the ambassador fell into embarrassed silence, then sidled over to me and whispered:

"Where—or what—is Djibouti?" Backing up, I discreetly pointed to the spot on a wall map of East Africa. With a twinkle FDR asked the red-faced envoy: "Now that you know where it is, what do you think?"

Since so many of the incoming messages had geographic implications, it was essential to have good maps on hand that could be sent along to the President with the messages. The Society's maps were ideal because they were the most accurate. We could not always rely on other maps—one from the Army, which was supposed to portray the eastern front, had Stalingrad grossly misplaced on the wrong river.

Furthermore, strategically important maps appeared from the Society at just the right moment. "Germany and Its Approaches," a July 1944 magazine supplement, was handy when we needed to lay out for the President the proposed areas of Germany and Austria that would be occupied by the Soviets, the British, and the Americans after the Nazi surrender. FDR was not happy with the American zone as proposed by a commission working in London. Poking his finger at the map we had carefully marked, he spoke about his bicycle tour of the region as a young man. "Too hilly, too far removed from good ports. I don't like it." But before he could persuade Churchill to switch zones, De Gaulle raised a ruckus from his London headquarters, demanding areas for his French forces to occupy. We went back to the Geographic maps, marking them up again and again until this thorny matter was settled—but never to anyone's satisfaction.

PRESIDENT TRUMAN'S USE of the Map Room was, of course, very much briefer than FDR's but no less critical. Coming suddenly into office in April 1945, woefully uninformed on war plans and the many diplomatic issues that were causing fissures in the alliance, the new President relied heavily on our maps and files to prepare for his conference with the British and Soviets at Potsdam. He studied with special intensity an enlargement of the Geographic's April 1944 map, "Japan and Adjacent Regions of Asia and the Pacific Ocean," which covered much of one wall of the Map Room. On this we had marked plans for an invasion of the home islands of Japan scheduled for the autumn of 1945. Truman was appalled at the magnitude of Japanese forces that our intelligence services estimated would be available to resist the invasion.

I often saw him standing before the maps in deep reflection, profoundly disturbed by the estimates of American and Japanese casualties. This reinforced his decision to press Stalin to declare war on Japan and persuaded him to accept the recommendation of his military and civilian advisers to use atomic bombs to bring the war to a close.

When the end of the war finally came and the Map Room was dismantled, I salvaged several maps in the interest of history. The one with the most emotional meaning for me after half a century is a section of the Geographic's June 1943 map, "Europe and the Near East." A plastic overlay is covered with red markings. Dated April 3, 1945, it forecast that the Nazi forces would disintegrate in less than a month. President Roosevelt did not live to see how remarkably prescient it was.

I recently returned this map to the White House. It now hangs above the mantel in what is still known as the Map Room. There it may serve future presidents as a vivid symbol of why a very special place came to bear that name during World War II.

GEORGE M. ELSEY is president emeritus of the American National Red Cross. He was a White House aide to Presidents Franklin D. Roosevelt and Harry S. Truman.

FRANCE AND THE LOW COUNTRIES

TOP SECRET

CHRISTIANSEN

ARNHEM

CLEVE

AACHEN

DUREN

COLOGNE

BREMEN

HANNOVER

ANTWERP

METZ

BELFORT

TOTAL DIVISIONS			
5	10	47	72

NATIONAL ARCHIVES (BELOW AND BOTTOM); FRANKLIN D. ROOSEVELT LIBRARY (LEFT)

HITLER'S LAST PUSH

Christmas 1944 found FDR grimly surveying Belgium's Ardennes region on "Germany and Its Approaches" (left). Overlays showed Hitler's final offensive, the Battle of the Bulge. Especially worrisome, the Fifth Panzer Army (Fifth PZ on the map) had pushed past Allied lines at night under "artificial moonlight" created by searchlights bouncing off low clouds.

By January, when U. S. troops were photographed in an Ardennes chow line, Germany's last major push had sputtered.

Preparing for the war's end, planners at Supreme Headquarters Allied Expeditionary Forces (SHAEF) used "Germany and Its Approaches" to plot Operation Jubilant (above), a never used plan for paratroopers to rescue prisoners of war.

The British also relied on Society maps. The War Office reprinted 50,000 copies of "Germany and Its Approaches."

GERMANY'S COLLAPSE

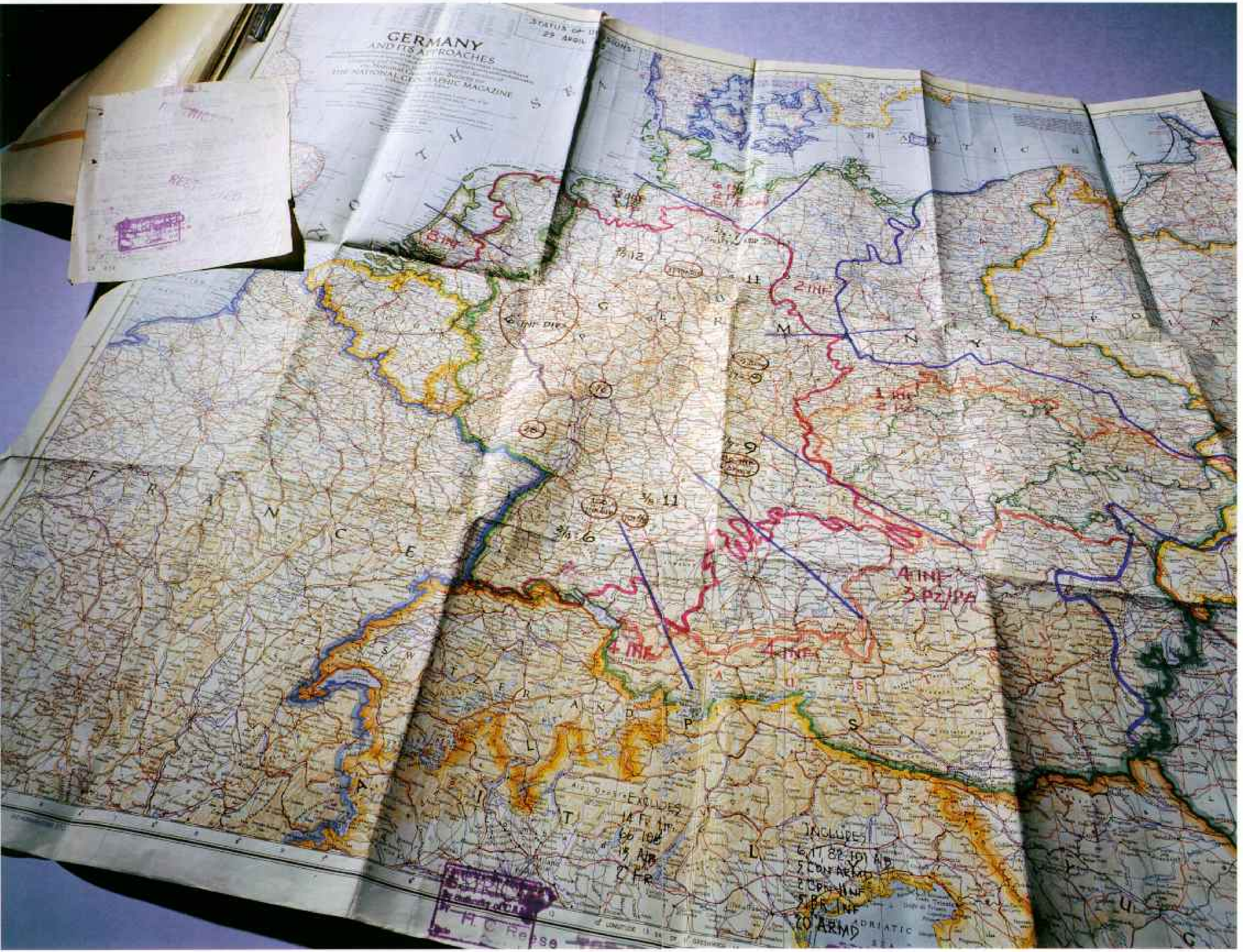
Crushing the enemy, Allied troops are shown as blue arrows swarming from the north, east, and west on a March 25, 1945, SHAEF markup of "Germany and Its Approaches" (above). Red hatching reflects fear that routed Germans would establish a redoubt in the Alps, delaying surrender indefinitely.

As the liberators rolled across Europe, they posted thousands of copies of this map. Even in a remote French village (below) convoys could get their bearings without asking directions.

The futility of Germany's final situation was clear on a briefing map (right) used by SHAEF Chief of Staff Gen. Walter Bedell Smith. Blue Allied lines penetrating red German defenses on the April 29, 1945, markup of "Germany and Its Approaches" showed the war was virtually won.

A week later in Reims, France, Smith confronted German commanders with this hopeless picture—adding two fictitious Allied attack plans for good measure. Germany surrendered within hours.

SUSIE BRIMBERG AT NATIONAL ARCHIVES (TOP AND RIGHT); U. S. ARMY SIGNAL CORPS


GERMANY
AND ITS APPROACHES
FRANCE
BELGIUM
NETHERLANDS
GERMANY
ITALY
SWITZERLAND
AUSTRIA
CZECHOSLOVAKIA
YUGOSLAVIA
ADRIATIC
2 INF
4 INF
3 PZ/IPA
EXCLUDES
14 T. BDE
66 INF
15 ARB
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INCLUDES
6, 11, 82, 101 A/B
1 CDN ARMD
2 CDN INF
5 BR INF
20 ARMD
H. C. Repse

A PLAN TO INVADE JAPAN

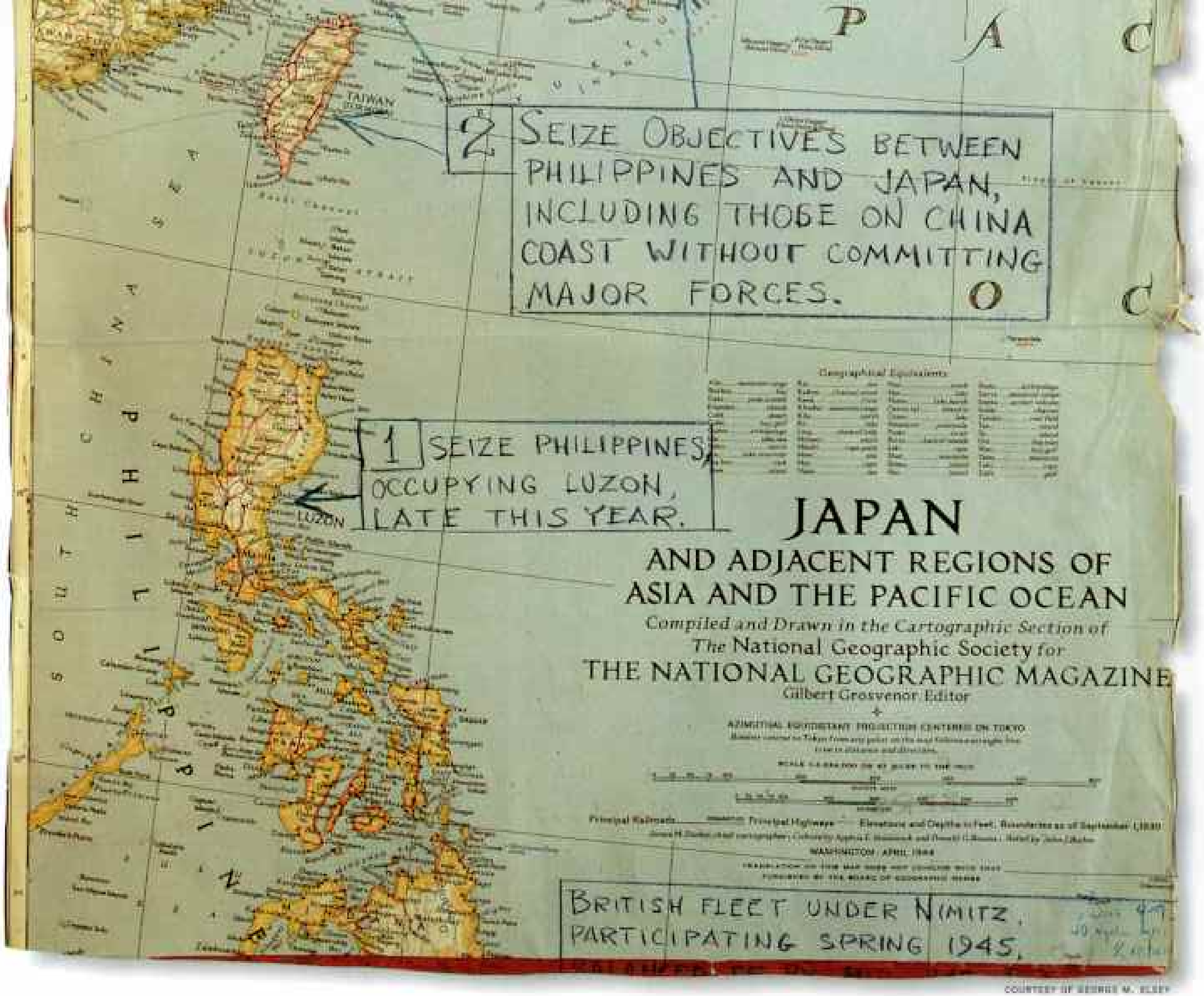
As victory in the Pacific drew near, President Harry S. Truman contemplated an operation to dwarf D day: the invasion of Japan.

Dominating one wall of the White House Map Room was this April 1944 Society map, torn in two as it was taken down. Conquest of the Philippines is the first of the

stepping-stone advances north (right). On the mainland the Soviets move toward the Sea of Japan. On the half of the map above, the area north of Tokyo is labeled "Invade Jap Homeland Fall of 1945."

Recalls George Elsey, who was on duty in Truman's Map Room, "I often saw him standing before the maps in deep reflection, profoundly disturbed by the estimates of American and Japanese casualties."

One of the alternatives facing Truman was the top secret atomic bomb. By August the decision was made to use this weapon. The invasion of Japan would never go beyond the plan shown on this map.



COURTESY OF GEORGE M. ELSEY

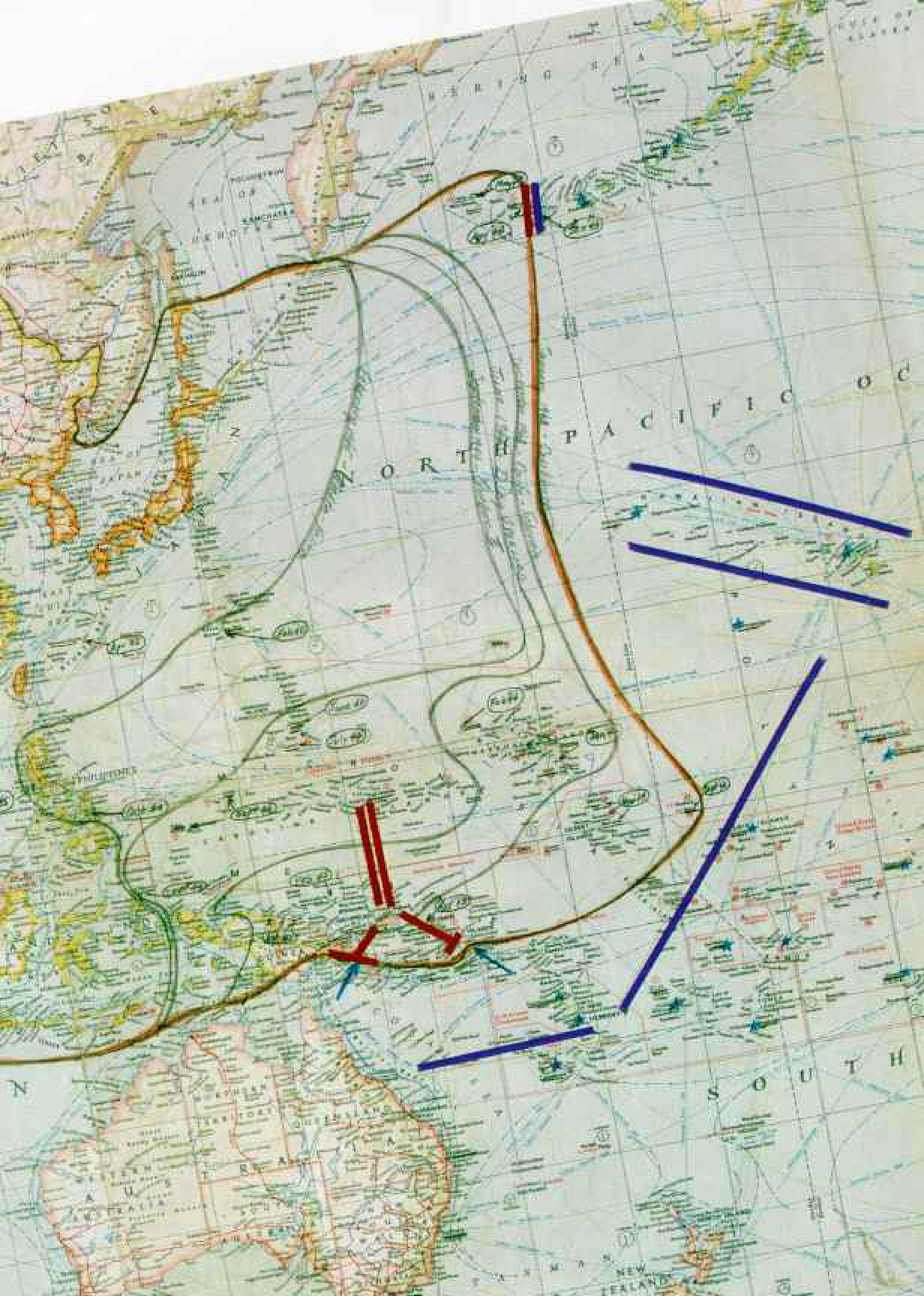
JAPAN'S EMPIRE SHRINKS

Guadalcanal, Tarawa, Guam, Iwo Jima, Okinawa: With dreadful resolve, Allied forces pushed back Japanese troops in bloody island-by-island combat. On Iwo Jima the monthlong mop-up required blasting Japanese defenders from caves (below).

For future studies the Army Historical Branch charted the Allies' progress in the Pacific with looping isolines on the Society's September 1943 map, "Pacific Ocean and the Bay of Bengal."

Briefed by Adm. William Leahy, Truman monitored the war from the Map Room, a converted cloakroom (above). Pacific theater maps hang on the east wall, European theater maps on the west.

PAINTING BY ARTHUR SHILSTONE; NATIONAL ARCHIVES (RIGHT); W. EUGENE SMITH, LIFE


NORTH PACIFIC O C
N
S O U T H
NEW ZEALAND

LOST AND THEN FOUND

Droning above the South Pacific, the Army Air Forces B-17 pilot knew only one thing for certain: He was lost. Worse still, sitting behind him was four-star brass—Adm. Chester W. Nimitz, Commander in Chief of the Pacific Fleet, headed for embattled Guadalcanal.

Nimitz's aide, Lt. Hal Lamar, was asleep among mailbags in back when an officer roused him, shouting, "You still got that Geographic map you showed me yesterday?" Lamar (right, in a B-17 with a reprint of the map) recalls, "I'd brought it along because I thought it'd be interesting.

"Interesting it was. We were flying over an enemy island! It took a half hour for the pilot to get oriented. Later, Nimitz told Gen. Hap Arnold of the Army Air Forces his pilots should get over-ocean training. He said, 'There are no railroad tracks to follow out here.'"

The February 1942 map that saw Nimitz to his goal, "Theater of War in the Pacific Ocean," helped countless others keep their bearings in a suddenly huge world.

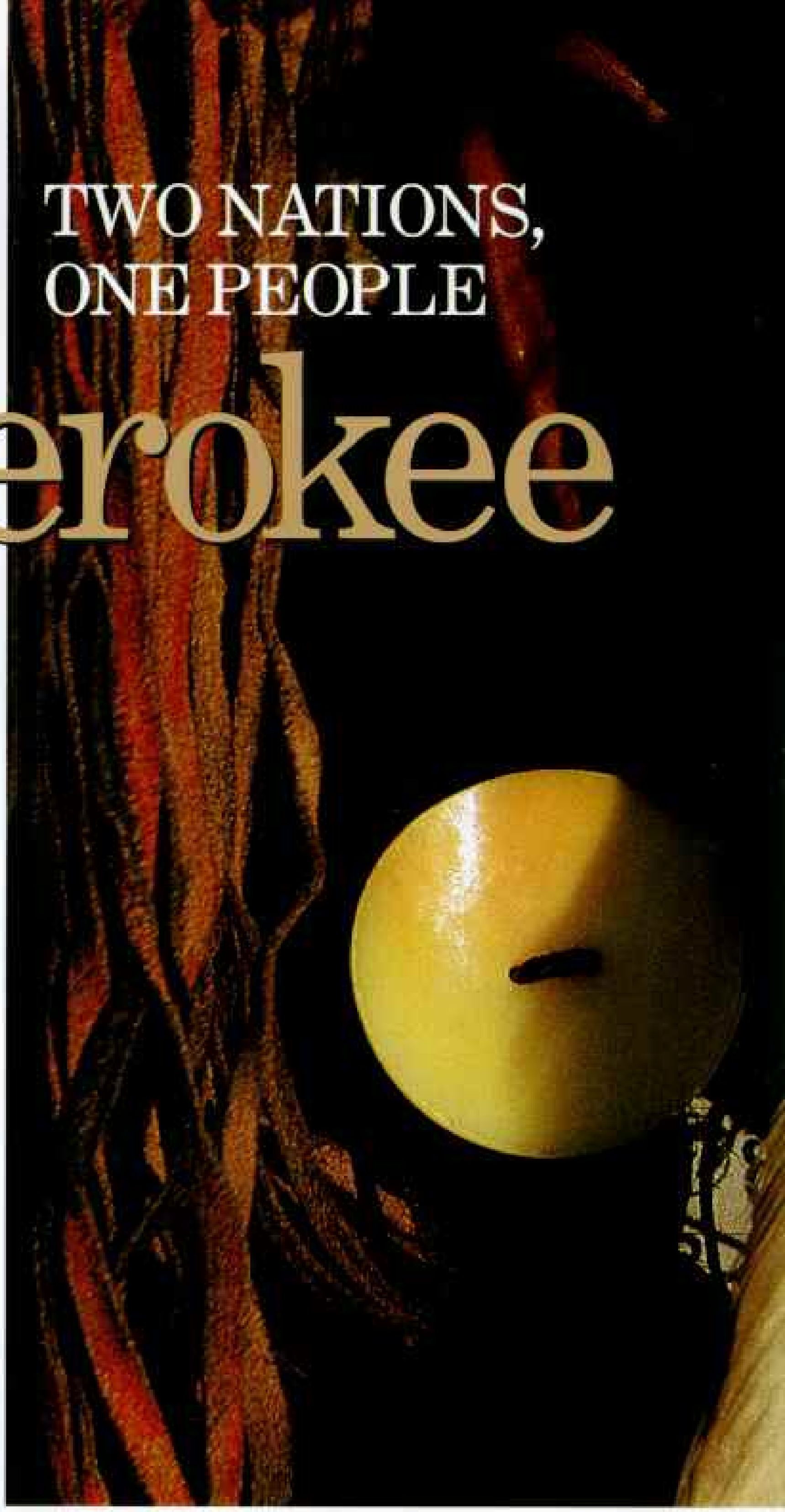
A whimsical confusion of signs on Saipan (left) called to mind FDR's words in February 1942: "This war . . . is different from all other wars of the past, not only for its methods and weapons but also in its geography." □

PAINTING BY ARTHUR SHILSTONE; NATIONAL ARCHIVES (TRACING PAGE); IRA BLOCK

The Cherokee

TWO NATIONS, ONE PEOPLE

Torn apart more than 150 years ago, the Cherokee of North Carolina and Oklahoma follow separate paths as they seek to keep their tribal soul while making their way in the outside world.



BY GEOFFREY NORMAN

PHOTOGRAPHS BY MAGGIE STEBER

◆◆ Of Cherokee descent—and Creek and Pawnee as well—ceremonial dancer Ron Moses wears paint and feathers adapted from the dress of his Plains forebears at the Cherokee National Holiday Powwow.

◆◆ Taking a break from truck repairs, Mike Grant plays with his niece, Raven. During the busy season in Cherokee, North Carolina, he earned cash posing for snapshots: "All tourists want is your Indian

face, so that's what you sell." Off-season work at home is scarce; when last heard from, Grant was headed for South Carolina, where friends think he may have landed a factory job.

A FEATHER HANGS from the rearview mirror of Hastings Shade's truck, a feather from the wing of a golden eagle. He calls it his "go-anywhere, do-anything" feather. It is a gift from one of the nation's elders. For Shade, it fetches good medicine, safe travel, long memory. Right now we are traveling down a backcountry road near a community called Lost City, in the county of Cherokee, in the state of Oklahoma. Shade, himself a Cherokee, is taking me to a place with boyhood memories so sensate they ring in his ears. "I can hear the water singing," he says. "I can sit down there on a rock by the creek and the riffles—they still sing me their song."

◆◆ **OKLAHOMA**
Agricultural savvy, sharpened over centuries, helps Cherokee farmers grow blueberries, peaches, and soybeans near Tahlequah, capital of the Cherokee Nation. To promote education and employment, the tribe works closely with a local university and recruits firms to open manufacturing plants in the region.

This whole country is a place of spring-fed creeks and riffled rivers, carving their valleys across the limestone face of Oklahoma's Ozark Plateau. A place, too, of wide, green bottomlands speckled with cattle; of undulant hills all buttoned up under forests of oak and hickory, ash and elm; of modest homes in scattered communities, though few quite so scattered as Lost City—"lost," some Cherokee say, because its original inhabitants turned into "little people," by which they mean that the originals inexplicably disappeared.

And this is Indian country, but not in the sense of its being a reservation. This is the home of the Cherokee Nation, a federally recognized sovereign nation, as it was by treaty with the United States for much of the 19th century. Then, before the treaties were broken and the territory opened to statehood, Oklahoma harbored the displaced remnants of more than 60 tribes. Most numerous of these were the Cherokee, and their dominance among Native Americans continues in the region to this day. Now, in 14 counties of northeastern Oklahoma, 165,000 full- and mixed-blood Cherokee count themselves members of this nation whose success in administering its own affairs is unsurpassed by any other Native American tribe.

Another 10,500 individuals, unaffiliated with the Oklahoma Cherokee, make up the Eastern Band. Most of them occupy a 56,000-acre reservation in North Carolina, in the heart of this once indivisible tribe's ancestral turf.

Apart from the intervening miles, Hastings Shade figures some five generations and more than 150 years separate him from that other country. But neither existing records nor familial memory serves to reveal which of his ancestors first arrived in these verdant hills at the edge of the great western prairie, forced exiles from the far Appalachians, gaunt survivors of the Trail of Tears.

Shade pulls his truck to the side of the road. "This was my grandparents' place," he says. "Back in the forties. I grew up here." Beyond a barbed-wire fence, an overgrown field of fescue and clover glistens with dew. A distant line of trees marks the way toward that creek with the musical riffles. "That used to be corn," he says, waving

a hand at the field. "And watermelons and peanuts. The house sat over there, two rooms with a porch. No vehicles then. A barn, a horse, and a wagon. There were big hickories and walnut trees up here. At night we'd play cards, used peanuts for betting money. Grandpa would say, 'Pile your hulls right here. I'll use 'em for kindling in the morning.' "

Remembrance weighs heavy on the mind of the Cherokee, as it does for most Native Americans seeking to affirm their cultural identity in a high-tech world. Success depends to some extent on knowing where one came from and never forgetting it. Unlike western tribes such as the Navajo and Sioux, the Cherokee in their eastern homelands got a head start learning to hone the racial memory while adapting to the white man's ways. Given that circumstance, the transplanted Cherokee of Oklahoma—of all the Indian groups in North America—have probably succeeded best in bridging the two disparate worlds in which, for better or worse, the 20th-century Indian must live. Nowadays, in fact, the Cherokee Nation looks to be almost as ready to go anywhere and do anything as Hastings Shade's feather.

◆◆ **NORTH CAROLINA**
Rusting visage of Sequoyah, the Indian scholar who in the early 1800s devised a writing system for the Cherokee language, rises above the tourist clamor in Cherokee, North Carolina. A gateway to Great Smoky Mountains National Park, the headquarters of the Eastern Band is a jumble of storefronts, neon signs, and tepees that draws nearly six million visitors each year to the Cherokee reservation.

GEOFFREY NORMAN, an Alabama native, is the author of eight books and numerous magazine articles on nature and the outdoors. This is his first assignment for NATIONAL GEOGRAPHIC. One-quarter Cherokee and raised in Texas, photographer MAGGIE STEBER visited her ancestral lands for the first time while covering this story. Her last assignment for the magazine was on the African slave trade (September 1992).

ONCE THEY WERE KNOWN to others as the warlords of the southern mountains, but among themselves they were the Principal People. Archaeologists sifting potsherds for hints of their origin have determined that they were living in the southern Appalachians as long as 2,000 years ago, and linguists conclude that they are related to the Iroquois, from whom they split at least 2,000 years before that. By the time of their first European encounter, with Hernando de Soto in 1540, the Cherokee had staked out a territory three times as large as the present-day state of Virginia, stretching from the Ohio River on the north almost to the Chattahoochee in what one day would be Georgia, from the valley of the Tennessee east across the Great Smoky Mountains to the Piedmont of the Carolinas. There may have been as many as 25,000 of them, in threescore villages set amid bottomland fields of corn, beans, and tobacco. One English trader allowed as how the Cherokee and neighboring tribes were so advanced they must be among the Ten Lost Tribes of Israel.

◆◆ **"We get what we need from the land," says Walker Calhoun of Big Cove, North Carolina. He and his grandson, Patrick, collect witch hazel bark for brewing a fever-breaking tea. Calhoun takes his knowledge of medicine, dance, and language to area schools: "I worry that our words will die out with the old people."**

Teacher Laura Hill's optimism runs as bright as the free-flowing Oconaluftee River (opposite). "Last year my students said the Pledge of Allegiance in Cherokee for the first time," she says. "Our language is in a period of rebirth."

In truculent times the Cherokee warred on their neighbors, the Choctaw and Creek; they fought with the English against the New World French and blue-coat Americans, but went over to the United States' side in the War of 1812. Cherokee braves distinguished themselves under Andrew Jackson's command at the Battle of Horseshoe Bend in Alabama, where one of their leaders was said to have saved Jackson's tousled topknot from a Creek tomahawk. Old Hickory, or Sharp Knife as the tribes would call him, went on to become the seventh President of the United States, in which capacity he ungratefully promoted and gladly signed the Indian Removal Act of 1830. The act banished the Cherokee and other eastern tribes beyond the wide Mississippi.

No matter that the Cherokee had already accepted Thomas Jefferson's earlier counsel to assimilate. No matter that they had established their own constitutional government with a senate, a house of representatives, and an elected chief; that they had schools and a written language devised by the tribe's syllabary genius, Sequoyah. From the Jacksonian perspective, the Indians had to go. Gold had been discovered in Georgia (as it would be discovered a half century later in the Sioux's Black Hills), white squatters itched for new lands, and the lords of the cotton kingdom looked upon the Indian cornfields and saw that they were good—for growing cotton.

So the Indians went: First the Choctaw, out of Mississippi in a winter blizzard, barefoot, short on blankets and rations; next the Creek from Alabama, some in chains, one overloaded steamboat capsizing en route, more than 300 drowned. Then the Chickasaw from Arkansas and Mississippi, and the Seminole from Florida. And then it was exile time for the Cherokee, who had successfully argued their case before the U. S. Supreme Court, who had heard Chief Justice John Marshall affirm their sovereign status and their right to remain in Georgia, but who now found themselves rounded up by Jackson's soldiers, incarcerated in detention

◆◆ Charmed by his act, a French tourist plants a kiss on Henry Lambert in the town of Cherokee. By "chiefing"—posing for visitors—for 44 years, he has earned enough money to educate six children and pay for

his home. Some criticize his costume: The ribbon shirt is Cherokee; the warbonnet, belt, and breechcloth are not. "The tourists love this look," Lambert says. "So I'll be chiefing this way until Gabriel blows his horn."

camps, and marched 800 circuitous miles to eastern Oklahoma.

Some 15,000 Cherokee followed the Trail of Tears west, from 1838 to 1839, separated in contingents of varying size, facing ordeals that ranged from dysentery to hypothermia, from measles to whooping cough. Soon a trail of graves marked the way west. Estimates placed the death toll, in camps as well as in transit, as high as 4,000, or about one in every four individuals rounded up for removal.

At least a thousand other Cherokee were more fortunate. Escaping the roundup by stealth or special exemption, they hunkered down in the Great Smokies to become the rootstock of the Eastern Band.

CHEROKEE, NORTH CAROLINA, 156 years after the exodus. Population: 7,500. Location: 50 miles west of Asheville, near the southern terminus of the Blue Ridge Parkway and a gateway to Great Smoky Mountains National Park. This is the hub of the Cherokee reservation, known as Qualla Boundary, the headquarters of the Eastern Band.

Though surrounded by striking mountain scenery and skewered by a sparkling trout stream, the town of Cherokee is not a picturesque place. It survives in large part on tourism. With its Oconaluftee Indian Village replicating tribal crafts and lifestyles of the 18th century and the outdoor historical pageant *Unto These Hills* playing six nights a week in summer to a full amphitheater, the community tries to give the tourist a brief, if somewhat blurred, glimpse into the Cherokee past. But elsewhere in town, the effort to snare the tourist can get commercial. Not even the excesses of Gatlinburg, Tennessee, on the north side of the national park, prepare one for this main street of Cherokee, with its souvenir shops filled with rubber tomahawks and "traditional" warbonnets made of dyed feathers from domestic turkeys. There are tepees here too—pitched on asphalt parking lots. Tepees and warbonnets, of course, are not of the Cherokee culture. They belonged to the tribes of the western grasslands—and now to Hollywood and the marketplace.

It would be easy to sneer at the mercantile face of Cherokee, North Carolina, were it not for the fact that the face is smiling. Having lived in poverty for almost a century, the Qualla Cherokee recognized a golden opportunity when, in 1934, Uncle Sam established his new national park in the Smokies, next door to their reservation. And over the years since, tourism has helped sustain them. If some undiscerning tourists are fooled, taking snapshots (for a price) of warbonnet chiefs beside ersatz tepees, the Cherokee are not. They know exactly what they're doing, and why they are doing it.

On a fine morning in October, with the hills around town a vivid patchwork of yellows, reds, and golds, I watched as Henry Lambert worked his trade in the parking lot of a small shopping center. Lambert has been "wearing feathers" in Cherokee for 44 years. After soothing a frightened child and persuading her to sit on his lap while her parents took pictures, Lambert said it was time for a break, and we walked across the lot to the coffee shop of a nearby motel. The waitress addressed him as "Chief."

"During peak season," he said, "I'll go from breakfast to sundown, seven days a week. It's hard work, but it beats cutting firewood. I've done that too."

Lambert said he had also worked construction jobs in the slack tourist seasons, in places as far away as Illinois and California, and

◆◆ **"I want to go pro, so I can show people that Indians are the best athletes in the world," says Number 78, Mark Ledford. He and his Cherokee High teammates quiet their spirits after losing the season's opener 12-0.**

Come spring Ledford and other boys will shed shoes and shirts to play an exhibition game of stickball, sport of their ancestors. Players wield sticks, bent and strung with hide, to swoop up a ball they then carry to the goalposts; the fierce contests of old settled scores between rival clans.

"When I was a kid, I played for money," recalls football coach Dude Davis. "I came out of one game with about 13 knots on my head—and 12 were bleeding."

that that was "something the men had to do to support their families."

Did he resent the tourists? "No," he said. "They provide a good living. I can't blame them for not knowing that Cherokee never lived in tepees. People get what they know about Indians from the movies. I've been in three myself. I've put my six children through school doing this and movies and a little construction. My son Patrick went to law school down at Chapel Hill."

Even as Lambert had to look elsewhere for income when tourism

ran thin, so did the tribe. It found a way to beat the calendar in 1982, when it discovered bingo.

On the Friday afternoon of a bingo weekend, cars, vans, campers, and chartered buses begin arriving in town, filling the parking spaces around Cherokee's numerous motels. Most of the vehicles bear out-of-state license plates.

The main bingo hall is a huge, artless building—it could be an armory—on the outskirts of town. The air inside is thick with tobacco smoke. Bingo is legal throughout North Carolina, but this Cherokee operation draws the biggest crowds, because its winner purses are unrestricted by state gaming regulations. The Super Jackpot goes for up to $100,000. The Warrior Game Special fetches its winner as much as $20,000. And what does it all fetch the tribe? Bingo here and at a smaller hall brings in about a million dollars a year and is used by the tribal council to finance police and fire services, housing programs, general assistance, and economic development.

"Our goal is self-sufficiency," *(Continued on page 88)*

◆◆ "Perhaps the mountains were . . . calling me to return, for I could get no rest in my soul until I agreed to follow," wrote Cherokee poet MariJo Moore of her 1992 move from western Tennessee to the Great Smoky

Mountains. Hiding in the highland forests to evade forced removal, predecessors of the Eastern Band planted the seeds of a separate nation. Cedar and oak sheltered them; deer and trout sustained them.

The Trail of Tears

Many white Americans acknowledged the agrarian skills of the Cherokee, Chickasaw, Choctaw, Creek, and Seminole—as well as their adoption of European customs—dubbing them the Five Civilized Tribes of the Southeast. Yet the settlers' desire for more farmland overcame their admiration. They demanded that the Indians go. President Andrew Jackson responded by signing the Indian Removal Act of 1830, setting the stage for a tragic saga—the killing exodus along the Trail of Tears to what later became Oklahoma.

A minority faction of Cherokee agreed to the emigration of the entire nation by signing the Treaty of New Echota in 1835. But news of calamities suffered by other tribes being forced west strengthened the resolve of some Cherokee to stay on their ancestral land.

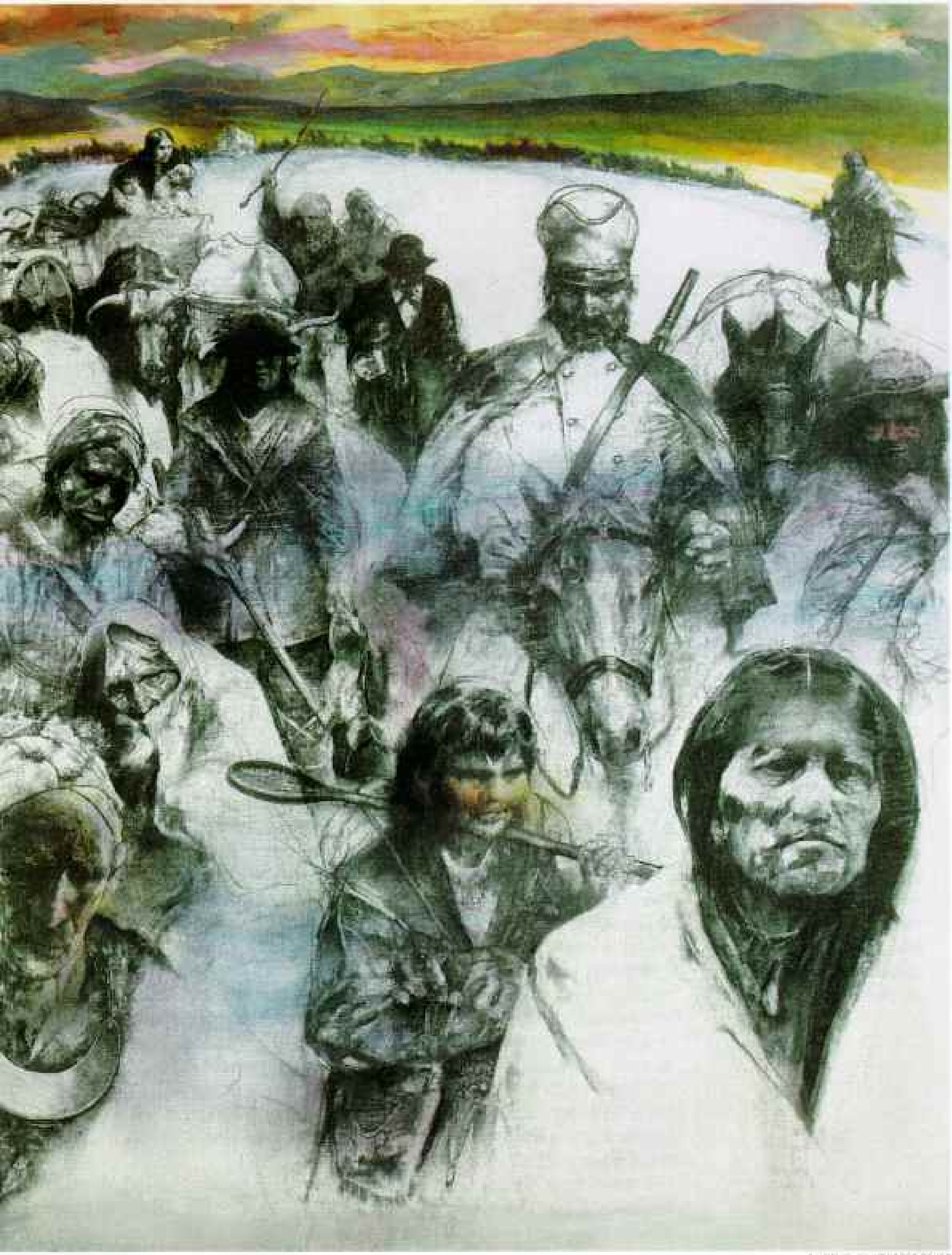
Despite a U. S. Supreme Court ruling that allowed the Cherokee to remain, most were rounded up by soldiers and detained in concentration camps. A thousand or more others fled into the Great Smoky Mountains and became the ancestors of today's Eastern Band. Following disastrous relocations by river under military control, Principal Chief John Ross negotiated with Gen. Winfield Scott to permit the Cherokee to conduct their own removal overland. Beginning in August 1838, the remaining detainees—12,000 in all—set out in 13 ragtag parties. By the time the last exiled Cherokee arrived in Oklahoma in 1839, the forced march had claimed as many as 4,000 lives.

June 6 – 19, 1838
Led by U. S. Army Lt. Edward Deas, the first group made the river journey to Fort Coffee in 14 days. Low water forced two military-led parties leaving later in June to continue overland from Arkansas; more than 200 people, mostly the very young and old, died. A group of elderly and disabled led by Cherokee John Drew set out on the river route in December.

Sept. 28, 1838 – Jan. 17, 1839
Cherokee John Benge led a group of 1,200, whose route has only recently been confirmed by scholars.

Oct. 11, 1838 – Jan. 7, 1839
John Bell led 660 supporters of the Treaty of New Echota on a different overland route, perhaps to avoid conflict with Cherokee angry over loss of land under the treaty.

Oct. 23, 1838 – Mar. 24, 1839
Peter Hildebrand's party of 1,766 camped a month by Missouri's Gasconade River, too sick to travel. Hypothermia and disease killed 55. Embarking separately in August and September, ten other Cherokee-led groups took roughly the same route.



PAINTING BY HERBERT TAUSS

◆◆ **Reverence and reminiscences draw 96-year-old Polly Jackson to the Old Baptist Mission Church near Westville, Oklahoma, founded by Cherokee settlers in 1839. "I used to stick my hand out the church window to hold hands with my boyfriend outside," says Jackson, who spent her childhood summers visiting from Tahlequah. "This place holds a lot of memories."**

(Continued from page 83)

says Richard Welch, editor of the weekly *Cherokee One Feather* and an active member of the tribal council. "Bingo helps, but the tribe has made a lot of progress in other areas. There is a tribal levy on everything that's sold here. We have invested money in a mirror factory and a fish hatchery. The Bureau of Indian Affairs—the BIA—used to run our schools, but the tribe has taken that over now."

After the bingo halls and tepees and tomahawks of Cherokee town, I found it reassuring to discover a small community of serious artists on Qualla Boundary. They are working in the old ways, making things of simplicity and power—baskets woven from strips of oak or honeysuckle vines, figures carved in wood or stone, the haunting faces of wolves and ravens and other icons of Cherokee cosmology. Some of this work is featured at the Cherokee Heritage Museum and Gallery, where I met artist Robert Ammons Maney.

Maney, a shy young man in blue jeans, had just brought to the museum a small piece of green soapstone on which he had carved in vivid detail the face of an owl. There was something in the owl's face—a mysterious, almost tormented quality—that made it hard to look at and, at the same time, hard *not* to.

"I live up in Big Cove," Maney told me. "About ten miles from here. This is about as far as I travel. I walk up in the mountains, looking for stone and just listening. I get most of my ideas up there and from what my grandpa used to tell me."

I asked how he managed to achieve such fine detail. "I use knives," he said. "I don't own any power tools. You can't do the detail with power tools, and you rush it and make mistakes. Everything comes

from the stone, and you have to let it tell you what it wants you to do. When I am working, I can feel it talking to me. Mostly it comes to me at night. I work from about 12 at night until I get finished, sometimes in an hour or two and sometimes not until dawn."

Maney thought about that for a moment. "I know when it is finished," he said, "because the stone won't let me do any more."

TAHLEQUAH, OKLAHOMA. Population: 10,400. Location: 66 miles southeast of Tulsa, near the western terminus of the Trail of Tears, near Zeb and Scraper and Lost City. This is the capital of the Cherokee Nation. Any physical resemblance between this city and Cherokee, North Carolina, is purely coincidental.

There is a studied *un*-Indianness about Tahlequah—a striking absence of extremes, either of tourist-trap tepees or the kind of poverty one finds at certain reservations in the West. The appearance of almost total assimilation, in fact, prevails throughout much of this most Indian of all the 50 states, with its quarter million descendants of Seneca and Shawnee and Ponca and Kickapoo and Kiowa and Comanche, to name just a few of Oklahoma's tribes. A stranger can zip right through Tahlequah on its main drag, Muskogee Avenue, and never guess that this is Indian country, unless he notices the Cherokee script on some of the street signs and storefronts or the arrow south of town that points to the Cherokee Heritage Center with its reenactments and replications of other times and other places.

A bit farther out toward Muskogee, you come upon the nation's command center, the W. W. Keeler Tribal Complex, a sprawl of brick

◆◆ Adding a golden moment to their memory books, cheerleaders in Tahlequah launch a parking-lot pep rally before Sequoyah High School's homecoming game. Originally an orphanage housing Indian children who lost parents during the Civil War, the school serves some 300 Native American boarding and day students, who take courses designed with an Indian perspective.

and stone buildings where some 1,300 workers administer the nation's affairs. Since the 1970s the western Cherokee have taken over almost all the programs formerly supervised by federal agencies—Head Start, Job Corps, public housing, drug-and-alcohol-abuse clinics.

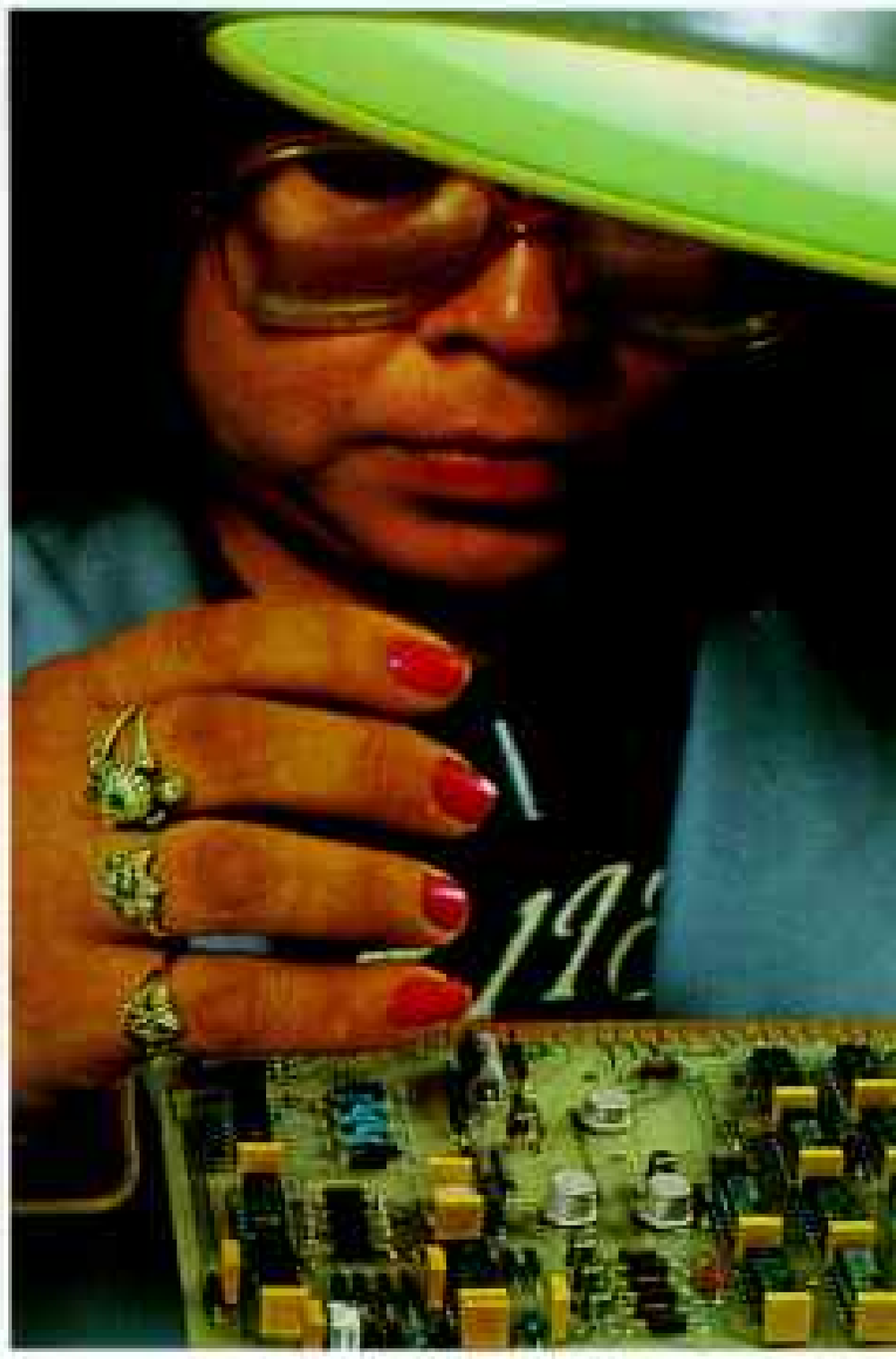
Despite all its positive appearances, the nation still faces substantial problems. As with most Native American groups, unemployment runs high. Substance abuse drops youths out of school, adults into jail cells. Services designed to soften the impact of these problems are funded by the federal government and account for about half the tribe's 78-million-dollar annual operating budget.

There is a kind of palpable energy about the Keeler Complex. People seem to want to be a part of what's going on here. A generation ago, individuals with all the physical characteristics of full-blood Cherokee might have denied their ancestry or downplayed it. Today people who look more like Robert Redford than Wes Studi (the Cherokee actor who played the Hollywood Geronimo) are claiming Indian blood and asking to be made members of the Cherokee Nation.

◆◆ Courting inspiration, Cherokee Nation prosecutor Chad Smith prepares for hearings in an attempted-murder case. A 1975 federal law granted the Oklahoma Cherokee self-determination. Today they maintain their own court system, legislature, and tax commission as well as managing many programs formerly

TO FULLY APPRECIATE what the western Cherokee are doing to rebuild their nation and help themselves, you have to get beyond Tahlequah and the Keeler Complex, out in the country, say, to Adair County on the Arkansas state line, where Cherokee Nation Industries, Inc., provides a solid base of employment for the people round about. And so one sparkling spring morning I did just that; drove east across the Illinois River toward Stilwell, out where the fields look wider, the farms greener, and the hills more densely wooded than those on the western side of the nation. It is big country, this portion of Oklahoma, with plenty of water, and the ranches with their herds of Angus cattle appear prosperous.

It was to such country as this that the Old Settlers first came, a handful of Cherokee who had voluntarily emigrated at the government's behest a full 20 years before the Trail of Tears. The old ones were followed by tribesmen who, at the Treaty of New Echota in 1835, had surrendered their claims to lands in the east. And those who resisted the treaty, the most numerous of the three groups by far, were the ones marched down the Trail of Tears.



After a time of settling old scores—and not often amicably; the resisters executed three of the treaty group's leaders—the Cherokee turned their attention to reestablishing a nation of homes and farms and courts and schools. Some of the most successful farmers settled an area near Tahlequah known as Park Hill, where they built fine homes in the Greek Revival plantation style of the cotton South. Many of the Park Hillers even owned slaves, an indication that they had learned the white man's ways entirely too well. By and by the community began to think of itself as a Cherokee Athens.

But the golden age of the Cherokee was not to last long, for the Civil War would sunder their new nation and force the people to choose sides. And after the war, the sons and daughters of the warlords of the mountains endured a succession of federal efforts to unhinge them from their land. The Dawes Severalty Act of 1887—named for its sponsor, U. S. Senator Henry Dawes of Massachusetts—struck the first blow. The act authorized the survey of Indian territories in the West, in order that the commonly held tribal lands might be broken up into property allotments of 40 to 160 acres. Each allotment was to be given to an individual Indian, and any land remaining after all the eligibles had received their shares would be sold to whites. The money from such sales was to be used to pay for Indian schooling.

At first the Cherokee were specifically exempted from the provisions of this act. After all, they already had schools. But the ink had barely

run by federal agencies.

Calling its own shots on the economic front, tribally owned Cherokee Nation Industries brings training and jobs to Stilwell, Oklahoma. Loretta Galcatcher (right), one of 280 workers who build parts for electronics and defense contractors, scans for defects in a circuit board destined for a rocket launcher.

dried on the Dawes decree when the government began to un-exempt them. Next, for roughly $1.40 an acre, Uncle Sam forced them to sell the Cherokee Outlet, originally an eight-million-acre swath extending from the edge of the nation west into the High Plains, a distance of more than 200 miles. The land had been set aside to guarantee that the tribe would have unobstructed access for hunting buffalo. But now the buffalo were long gone, and white homesteaders were massing along the border of the Outlet for what some Oklahomans still proudly hail as "the greatest land rush in the history of the American West."

So began the unraveling of the Cherokee nation as then constituted: Allotment without the nation's consent, federal mandates terminating tribal courts and tribal government, preferential treatment of white squatters on Indian land, leasing of tribal mineral rights by the secretary of the interior. And the final blow: Oklahoma statehood in 1907. After statehood the Cherokee would become an impoverished minority in their own land—though not quite their land, because, within a generation, they would lose almost all of it.

◆◆ Crafting ribbon shirts and buffalo grass dolls, Lorene Drywater of Tahlequah both sells her work and lectures on it at local high schools.

"The dolls are particularly close to my heart," she says. "My husband used to have to go way out somewhere to collect the buffalo grass for me. After he died, I didn't know what I was going to

do to get it myself. Then it started growing in my own front yard."

Learning the age-old craft from her mother, Drywater taught her own daughters and granddaughters. "It's messy, time-consuming work, and most of the girls are too busy to be bothered," she says. "I just hope they don't forget."

CHEROKEE NATION INDUSTRIES, a wholly owned manufacturing subsidiary of the nation, is located in a big warehouse of a building on the edge of Stilwell, the Adair County seat. The company employs some 280 workers, most of whom are Cherokee. It manufactures electronic components—cables, wiring systems, circuit boards—for such defense and aerospace giants as Boeing, General Dynamics, Martin Marietta, and Rockwell International. Skilled Cherokee hands have spliced wires for M1 Abrams tanks, multilaunch rocket systems, and NATO spy planes. A four-year contract from Rocketdyne puts Cherokee technicians to work on cables for the much delayed space station.

Annual sales overall hold at about 15 million dollars, despite cuts in defense spending and NASA appropriations. Profits are plowed back into the company; dividends of about $500,000 a year go directly to the tribe. Perhaps no other Cherokee entity or institution demonstrates so dramatically how far the nation has come in the past 20 years on the long road back from federal paternalism to self-determination.

The chief executive officer of Cherokee Nation Industries is Ross Swimmer, a tall, solemn, cordial man who for ten years had served as the tribe's elected chief when President Ronald Reagan summoned him to Washington in 1985 to oversee Indian affairs as an assistant secretary of the interior. In that capacity Swimmer preached a philosophy of substituting tribal accountability for federal largesse. Now, back in the private sector, he preaches it still.

"I think what you see here is a casebook study," Swimmer was saying as we sat in his office the day of my visit. "If we fail, we fail on our own. And if we succeed, we don't have to be grateful to anyone."

Increasingly, success for Cherokee Nation Industries will likely depend on how well it manages to diversify. Last year, for example, the company acquired a cabinet millwork business in Kansas.

Swimmer hastened to explain that building self-sufficiency through manufacturing will not happen overnight. In the meantime the nation must depend on other sources of revenue—on grazing fees (the tribe still owns 66,000 acres of land), on ranching operations, on a cigarette tax of 50 cents a carton sold at tribally licensed "smoke shops," and, inevitably, on gaming.

The Cherokee Nation's bingo operation is much larger than the Eastern Band's—three separate facilities instead of two, and wholly owned and operated by the nation rather than managed by professionals for a share of the profits. The nation's net take last year was nearly three million dollars.

But in Oklahoma the Cherokee face competition from other tribes with gaming operations, and sooner or later the toughest competitor may be the state. When Indian bingo halls first began to proliferate across the country a dozen years ago, big-time gambling "off the reservation" was legal in Nevada and New Jersey only. Now more than 20 states are in on the action, and Ross Swimmer is not alone among Native Americans who believe that once a state decides to roll its own dice, that will be the end of the easy-money bonanza for Indians.

"I like to kid the manager of our bingo operations," Swimmer said that day in his office. "Only I'm not kidding. I'm serious. I say to him, 'Just be sure, if you build any more of these bingo halls, that you build them so I can put a manufacturing business in there after the competition pulls the rug out from under you.' "

When Ross Swimmer went off to Washington a decade ago, the

◆◆ Down to the smallest flutter of sacred eagle feathers, Justin Muskrat learns a Cherokee dance from his grandfather Thomas. The elder Muskrat fashions buckskin and buffalo hide into fancy Plains

dress; traditional Cherokee dress was simpler and earthier in color.
"We mix up our Indian regalia and customs a lot," says Muskrat.
"But we've still got our old ways."

nation's deputy chief served out his unexpired term. The deputy was an articulate political activist named Wilma Mankiller, elected to the position in her own right in 1987 and reelected with 83 percent of the vote four years later—the first and only woman ever to have served as the Cherokee Nation's principal chief. I called on her at the Keeler Complex a few weeks before she announced that, because it was "time for a change," she would not seek reelection when her term expires at the end of this year.

A soft-spoken woman with dark, determined eyes, Mankiller in her decade as chief has presided over the nation's most explosive period of growth—a tripling of the tribe's membership, a doubling of its budget, the opening of three new health-care centers. "What we're trying to do here," she told me, "is to re-create a nation that was gutted by statehood in 1907. It isn't easy, and we don't always have the answers, but we're going to do it. If you look at Cherokee history and all the things that have happened to us over the years, you'll see that after every upheaval, we've managed to land on our feet. We're resilient and tenacious, and someday our communities will be whole again."

Sitting at a large desk smothered under stacks of files and assorted documents, Mankiller spoke with animation about the nation's efforts to preserve its language and improve its schools: "We have thousands who are fluent in Cherokee, and more are learning every month."

"When people talk to me about education," she said, "I talk to them about history. We need to know what we have done before, so that we can do it again, better. I want to reach the young people early enough to help them think well of themselves. I want to reach out before they are lost to us. I want them to grow up proud to be Cherokee, and determined that the Cherokee people will never disappear."

BEFORE LEAVING the nation's adopted homeland, there was one more place I had to see—the Stokes Smith Stomp Grounds, about 40 miles south of Tahlequah in the roller-coaster hills between the Arkansas River and Sallisaw Creek.

The place is named for a son of Redbird Smith, the great Cherokee religious figure who helped keep traditions alive during the tribe's dark days at the turn of the century. It is five or six acres only, a large clearing in a grove of shady oaks, set back from an unpaved country road. It is a hard place to find, but visitors are welcome.

On occasional Saturdays, Cherokee and visitors alike gather here to celebrate and worship in the old Redbird Smith ways. In the center of the clearing is a mound of gray ash, the residue of countless sacred fires. Four large logs have been laid on the ash so that each points to one of the cardinal directions. After nightfall, the fire is kindled.

By now more than a hundred people have gathered in a wide circle around the fire. Some of them have brought folding chairs and coolers for food and drinks (no alcohol permitted). Two or three hours after dark, with stars cluttering a black sky and the full moon balanced on a treetop, the fire burns high and hot, sending sparks and clean gray smoke into the night. A man wearing blue jeans and a Stetson with a single feather affixed to its brim steps up close to the fire and begins to call the dancers—*Yo-hoh-hee-yay*—in a deep, mournful chant.

The man is William Smith, son of Stokes, grandson of Redbird. Well along in his 70s, he radiates strength, dignity, and composure. He chants softly beside the fire. The sacredness of his message bars

◆◆ **Sporting a haircut in praise of pro basketball idol Shaquille O'Neal, Zachary Chekelelee, at far right, is proof that pop culture is making inroads into Snowbird, North Carolina, among the most isolated and traditional of Cherokee communities. Two of his brothers wear mohawks,**

a hairstyle borrowed from the Iroquois of the Northeast. Yet, for the boys, custom stops there. "They don't like the traditional food we eat, like bean bread, mustard greens, and cornmeal," says their aunt, Edna Chekelelee. "They'd rather eat at McDonald's."

translation. Suddenly two dozen people, perhaps three dozen, move swiftly out of the shadows into the firelight. The dancers form a tight circle, shuffling behind Smith as he moves counterclockwise around the fire. Some of the women wear turtle shells strapped to their legs. The shells are filled with pebbles. The women shuffle, two-steps, two-steps; the pebbles go *shucka-shucka*.

I stare at the sparks from the fire, and the smoke rising, and the dancers' feet scuffing over the bare earth, one dance followed by another, on through the night into the early hours, *shucka-shucka*. The experience is hypnotic. Those single eagle feathers on the men's hats . . . does one dare suppose that, like Hastings Shade's go-anywhere, do-anything feather, they'll fetch good medicine, safe travels, and long memories for their owners? And for the nation?

Why not. Let's dare suppose it. Let's dare suppose that, putting tears and upheavals behind them, the tenacious Cherokee of both East and West will dance their way right out of the night to claim once again their heritage as the Principal People. □

POISON-DART FROGS

Lurid and Lethal

Text and photographs by MARK W. MOFFETT

As a bird flashes by high above him, Paulino Hueso lifts the mouth of a long blowgun to his lips and gives a quick puff. The snapping sound of a dart striking bark signals a miss.

Hueso's darts are tipped with one of the most potent toxins known. It is secreted by two-inch-long *Phyllobates terribilis* (right), a frog found only in a small area of lowland rain forest in western Colombia.

When one boldly hopped to within inches of my camera, I kept in mind the warning of John Daly, one of the scientists who discovered *P. terribilis:* The frog can be lethal even to the touch.

Frogs of a different color

King of the frond in its streamside Ecuadorian habitat, *Epipedobates tricolor* (above) exudes epibatidine, a chemical with analgesic qualities. Two hundred times as powerful as morphine, the substance shows great medicinal promise, especially for patients who do not respond to painkillers derived from opium poppies.

Despite their popular name, only 55 of 135 recognized species of poison-dart frogs are known to be toxic, and of those only three are used by hunters to tip their darts.

Ranging from a half inch to three inches long, toxic species flaunt neon colors that warn predators. The gallery of touch-me-nots at right includes species from habitats as diverse as lowland rain forest and semi-arid mountain terrain.

The sparring pair at far right are females of a threatened species now being successfully bred in captivity.

DENDROBATES SPECIOSUS, PANAMA

E. FANTASTICUS, PERU

E. HISTRIONICUS, PANAMA

D. TINCTORIUS, FRENCH GUIANA

E. AZUREUS, SURINAME (CAPTIVE SPECIMENS)

A matter of taste

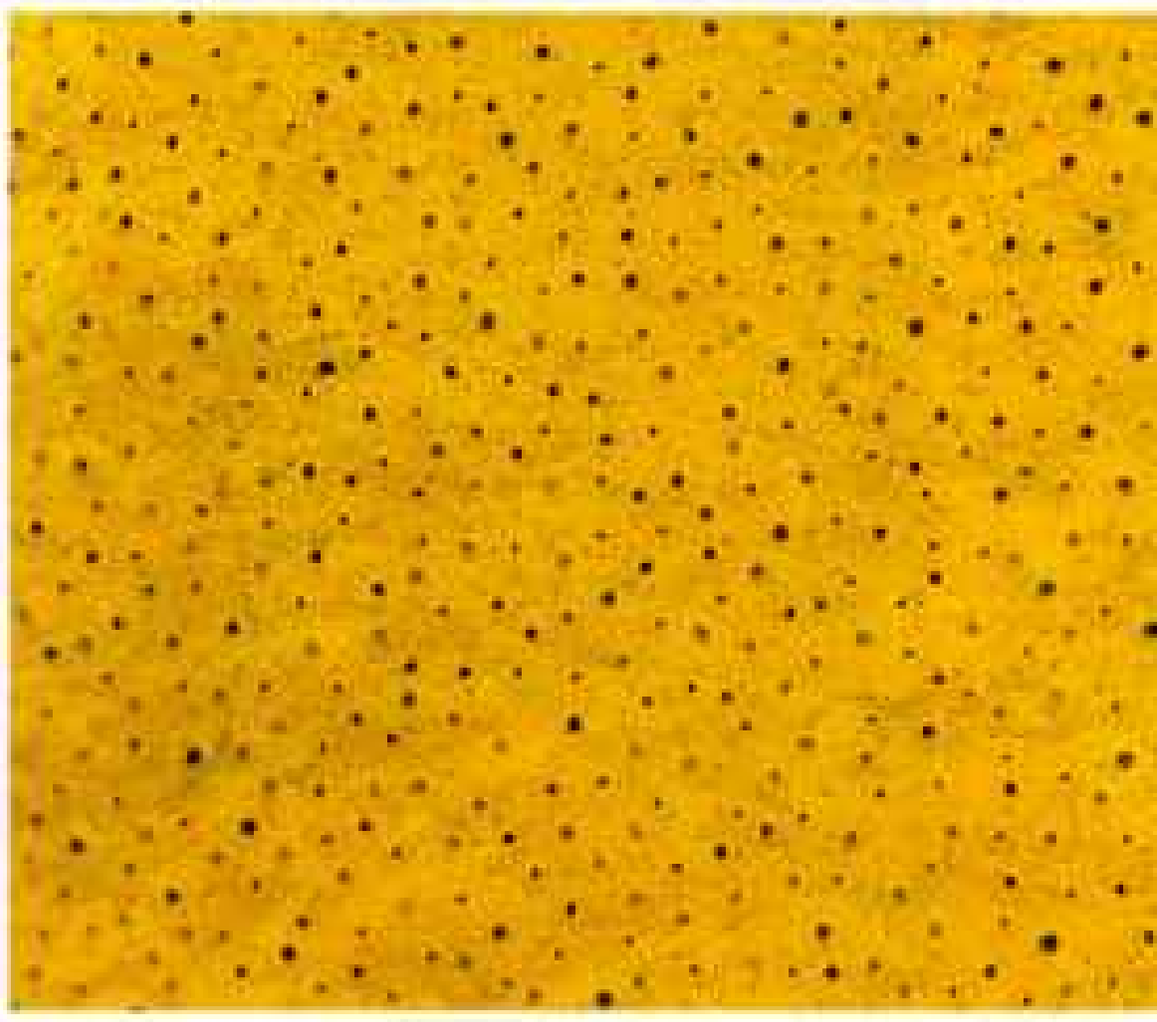
Across Central and northern South America, each species of poison-dart frog exudes its own potpourri of chemicals. in the forests of Taboga Island, Panama, *Dendrobates auratus* and a species of ground-dwelling tarantula frequently blunder into each other (left). Though it preys on other frogs, the spider will normally retreat from this situation. Every so often, however, I have seen a tarantula foaming at the mouth in its death throes. Did it make the mistake of biting the wrong kind of frog?

D. auratus may be bad news for tarantulas, but the pumiliotoxin it secretes may someday have a useful application as a cardiac stimulant for heart attack patients.

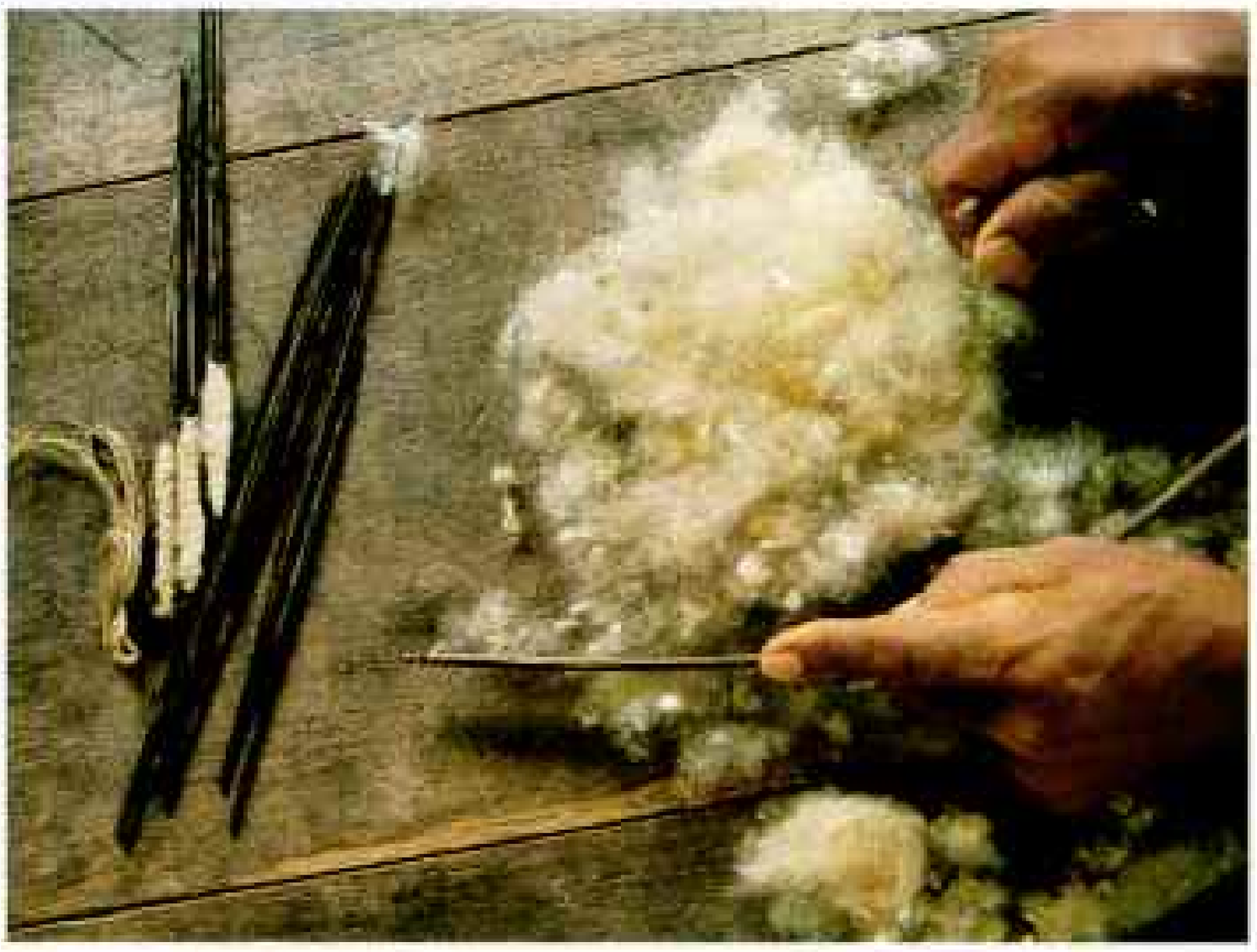
Researcher John Daly of the National Institutes of Health has identified nearly 300 alkaloid compounds secreted by poison-dart frogs. A class of chemicals including cocaine and morphine, alkaloids also include curares—extremely toxic compounds derived from plants and also used to tip darts.

A number of poison-dart frog species are bred at the National Aquarium in Baltimore. There curator Jack Cover (right, at left) holds a mildly poisonous species for Daly—who can gauge toxicity by taste. There's no danger here, for frogs caught in the wild gradually become less poisonous, and captive offspring are nontoxic. The change may be due to diet. The frog's natural menu—mostly insects such as tropical ants and springtails—cannot be duplicated in a terrarium.

Tasting the skin of a wild *P. terribilis* would be foolish in the extreme. Through minute skin pores (right) it secretes batrachotoxins that cause irreversible muscle contractions, leading to heart failure. Indian hunters, though, do taste it indirectly. Upon killing an animal, they lick its flesh to find the part of the carcass affected by the toxin and cut it away.



Poison-Dart Frogs 103



Last blowgunners

Since firearms arrived in the rain forest, the crafting of dart guns has become a dying art among the Emberá Chocó people of Colombia. Paulino Hueso begins with the trunk of a freshly felled palm. He splits it, then splits each of the halves (top left). His father, Camilo, sands the two best quarters to form the blowgun's shaft. Then he chisels the central bore with a gouge (center left). Finally, the two sections are mated and secured with bark strips.

Darts are made from the stem of a different palm, then fletched with fibers from kapok tree seeds. Though bows are not used for hunting in the region, a miniature one is twanged to fluff the kapok (bottom left).

Camilo rubs a dart tip on a *P. terribilis* (right) and is ready to hunt. The poison will be potent for more than a year.

This was the only time I saw him touch a frog—and then only on the toe. Normally he uses a leaf as a barrier, and he would never let the frog contact cut or broken skin.

Courtship and care

All puffed up, a male *Dendrobates pumilio* (right) courts a female with a song of insect-like chirps. The most aggressive males pounce on any others that dare to move. This forces subordinates to freeze. A dominant male (bottom middle, at right) pushes an immobile rival away from the female at rear.

After fertilization, the female is left to guard her batch of 2 to 16 eggs hidden in leaf litter on the forest floor. When the tadpoles hatch, she backs in among them, and one wriggles up onto her back (bottom right).

On a rare trip away from the forest floor she climbs into the canopy. The ascent is arduous, for most poison-dart frogs lack the well-developed toe pads of true tree frogs. She seeks little pools of water cupped in the leaves of certain plants. Into one of these pools she deposits the first tadpole.

Then she goes back for another. And another. One by one she carries her tadpoles to private water holes in the canopy.

In most species the male cares for eggs and tadpoles. When a *D. auratus* father visits his young, researcher Kyle Summers (below) follows to study paternal behavior.

A mother's work is never done

After her tadpoles are stashed in leaf pools, a *D. pumilio* mother returns to the canopy every few days to tend her scattered brood.

On her arrival, a tadpole signals with a quick upward flick of its tail. The mother

responds by backing into the pool, at right, and laying unfertilized eggs, rich in nutrients, to nourish the tadpole.

Tadpoles have not yet developed toxins and are easy marks for predators like canopy-roaming crabs, at left.

By spacing tadpoles around the canopy, a parent increases the odds that some of them will survive.

Frog-swapping frenzy

It's International Frog Day in the Netherlands, where collectors trade or sell rare varieties for top dollar. The Amsterdam event requires that all specimens be bred in captivity. Concern for wild populations of poison-dart frogs has also led to international regulations restricting exports.

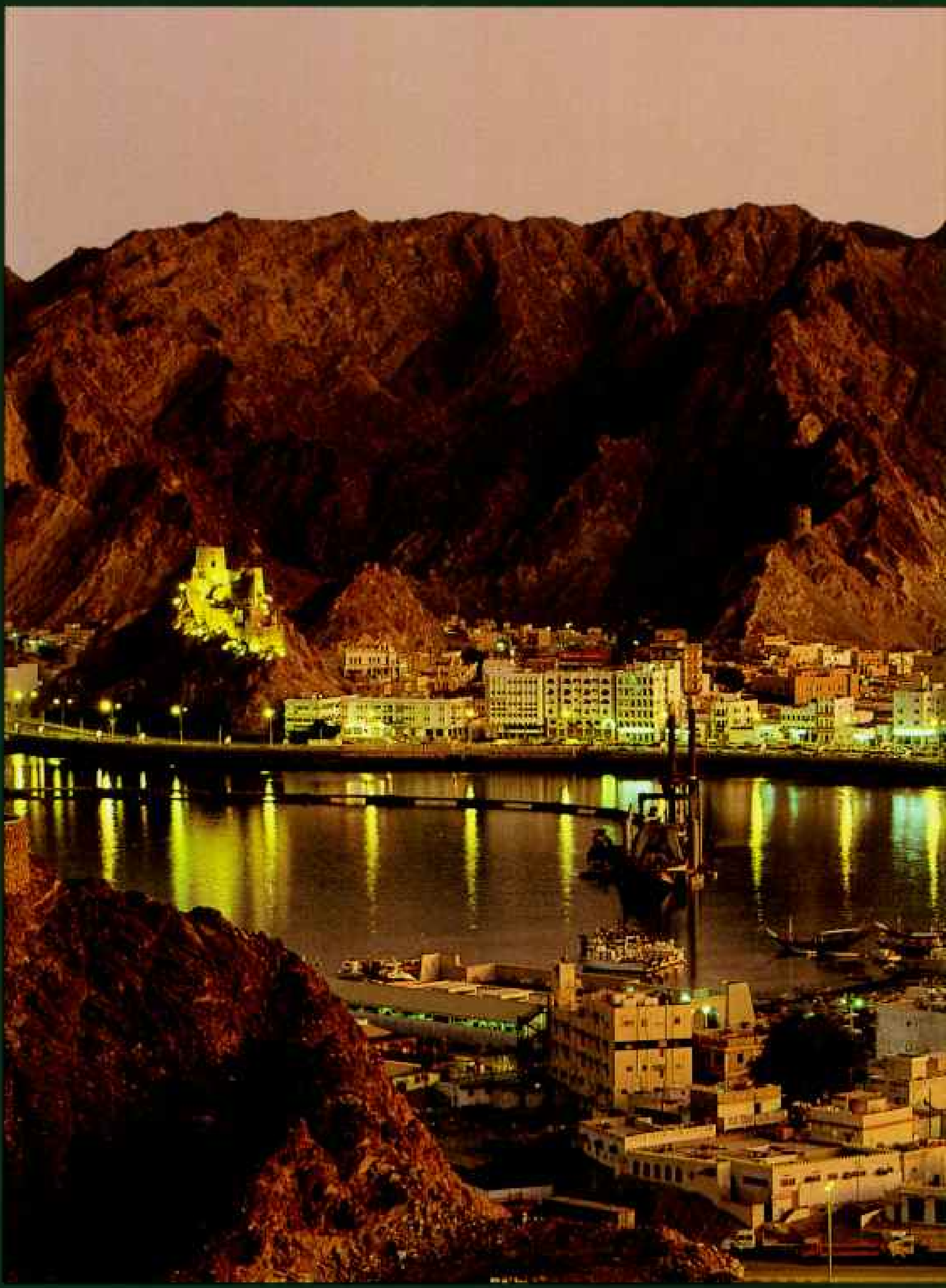
Many enthusiasts display their frogs in large climate-controlled terrariums. Robbert Kurpershoek (above) needs a flashlight to search for the *D. pumilio* that live in his Netherlands living-room forest.

For a wild *D. pumilio* there's no pampered life. This dominant male paused just briefly to lean on a snail—as if to give a motivational speech to his lethal amphibian colleagues. □

Oman

By PETER ROSS RANGE Photographs by JAMES L. STANFIELD

FLUSH WITH WEALTH from its oil fields, the Sultanate of Oman has catapulted from Arabian Peninsula backwater to modern nation—while keeping alive traditions such as *lailat al henna,* a women-only celebration to honor the bride on the eve of her wedding. Her hands bear fanciful filigrees executed in henna, which will wear off in several weeks.



GLITTERING CRESCENT on the Gulf of Oman, Matrah beckons west of Muscat, the capital. Most places are now reachable by motor vehicle; as recently as 1970 the nation had only six miles of paved road.

A GREAT BRAYING and howling rends the desert air as two Omani camel owners whip their racing camels to make them kneel. The animals finally sit with a fierce baring of their teeth, while two tiny boys—one seven, the other nine—hop nimbly onto saddles just behind each camel's hump. Suddenly the owners release the reins—and they're off!

I jump to the side as the camels burst into a gallop with surprising speed and grace. Now I'm faced with another desert danger: excited Omanis in pickup trucks. Camel owners and fans race alongside the berm track, screaming and honking to speed their favorite steeds toward victory. It's a race beside the race.

The track is straight and open-ended, so the owners must sprint to grab their camels as they roar past the finish. The owners are dressed in loose sandals and flowing *dishdashas*—the ankle-length robes that Omani men wear. But they are amazingly fleet as they rush the camels and snatch their reins; if they miss, the camels keep going.

This is oil-rich Oman on a Thursday morning, when the Islamic weekend has just begun. Here, in the Sharqiyah interior, is the town of Al Mintirib, the gateway to a vast and graceful dune sea known as the Wahiba Sands. And here on the hard desert floor outside the dunes, the men of Al Mintirib are disporting themselves in their time-honored way, until everyone involved is covered with dust and sweat.

Now comes the payoff. On a white Toyota pickup hood at the end of the track, an Omani named Salim Al Wahaibi flips open a leather briefcase, revealing stacks of Omani rials, a small fortune in prize money. Although gambling is forbidden in this Muslim country, prize money is paid for winning camels. Salim, the father of the two diminutive jockeys in this race, accepts money from those who wish to contribute to the prize pot and dispenses it to winners. "The winner gets up to a thousand rials [one rial is worth $2.62]," he tells me between fast-fingered counts of little piles of money on his truck hood. "But the important thing is that when a camel wins, his value goes up. A fast camel can be worth 50,000 rials."

While I'm absorbing this statistic—it comes out to $131,000—I hear the improbable sound of a phone ringing in the middle of the desert. Inside the pickup, Salim's seven-year-old—by now a seasoned camel jockey—answers the car phone.

This is Oman: camel races and car phones, goatherds and ATM machines. New wealth and stubborn tradition mingle casually as recently rich Oman charges toward the next

Veiled to all but her immediate family, a Bedouin woman pauses in her tent near the old inland capital of Nizwa. Bedouin females don the distinctive Omani burqa, *or mask, after reaching puberty. This woman also wears a heavy silver necklace, called a* hirz, *for both adornment and protection: Verses from the Koran are tucked in a compartment to ward off evil.*

While residents of some other oil-rich Arabian countries have adopted Western fashions, Oman preserves traditional garb by popular choice—and by decree of the sultan.

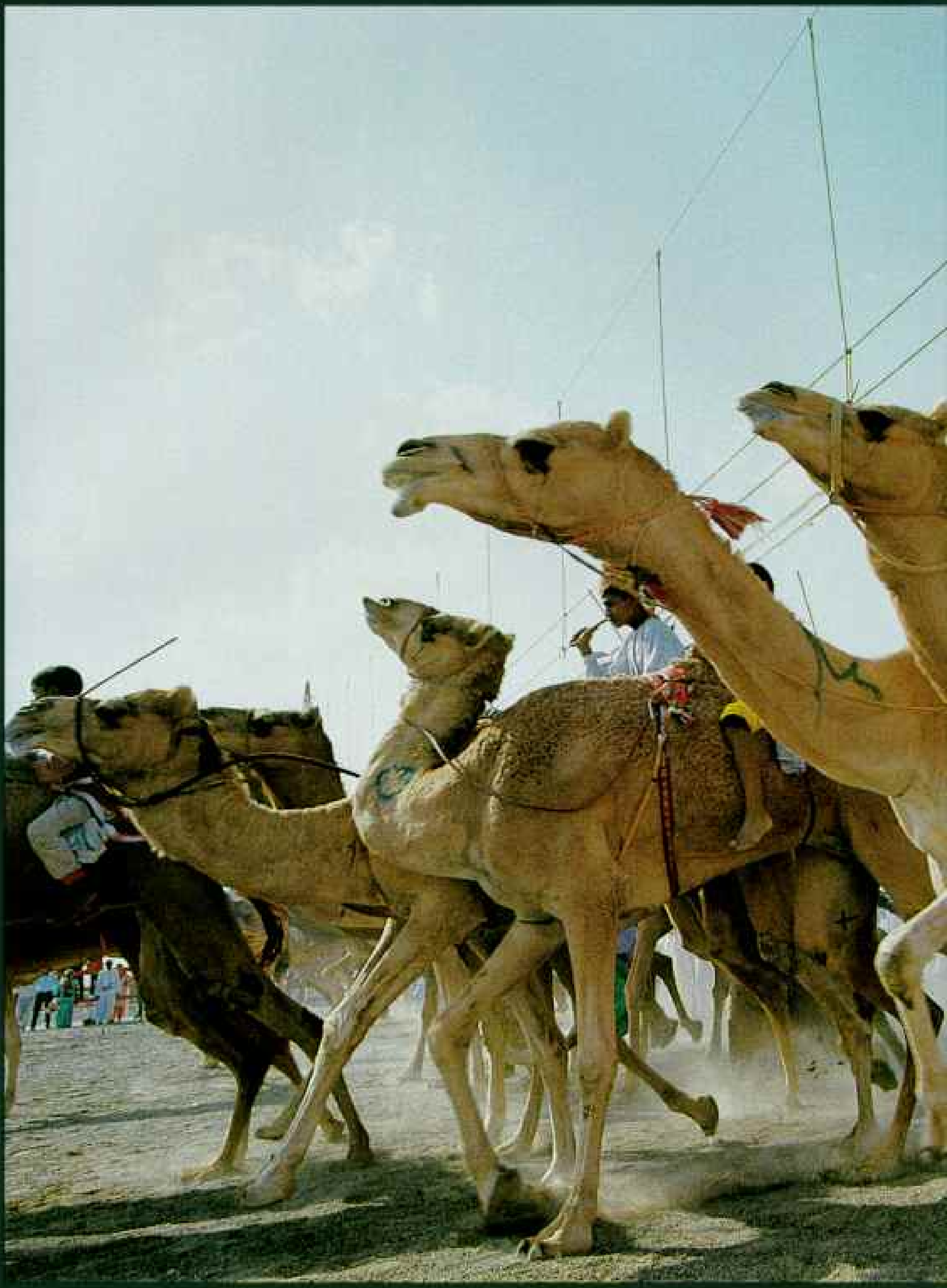
Washington-based PETER ROSS RANGE, a former newsmagazine correspondent, has reported from more than 40 countries. JAMES STANFIELD, a former GEOGRAPHIC staff photographer, has produced numerous articles as well as two books, the most recent—*Inside the Vatican*—in 1991.

century, not quite sure where its next hundred billion dollars is going to come from.

IN FACT, OMAN—a land the size of Britain and Ireland that wraps around the eastern nub of the Arabian Peninsula—has a few good years left before it runs out of money. According to current predictions, its oil wells will be pumped dry in about 17 years. Until then the black gold that has greased the country's rush from quasi-medieval backwater to prosperity in a brisk quarter century stands to bring in another 75 billion dollars or so at early 1995 prices.

In a country of only two million residents that sounds like a lot of weekends at the races. But it represents a total hard-currency intake of only 4.4 billion dollars a year, which is roughly the annual city budget of Los Angeles. Considering that oil income is what keeps the country afloat—fueling the government engine that drives the civilian economy and the elaborate social-welfare state—Oman is already feeling the pinch.

"We are trying to prepare for the next phase," says Sayyid Haitham bin Tarik Al Said. Sayyid Haitham, as everyone in Oman seems to call him, is a dignified 39-year-old



EXPLODING FROM THE GATE, young jockeys spur their mounts in a race outside Muscat. Though gambling is illegal, winners' purses are often hefty, and a top racing camel sold for stud can fetch $130,000 or more.

Oman

The Sultanate of Oman claims oil deposits of five billion barrels, extracted at wells like these at Nimr (right). Oman seeks to diversify its economy through manufacturing and tourism.

AREA: 120,861 sq mi. POPULATION: two million. CAPITAL: Muscat. RELIGION: Ibadhi and Sunni Muslim. LITERACY: 65%.

wearing an elegant cashmere turban and a ceremonial silver Omani dagger, called a *khanjar*; as secretary-general for foreign affairs, he is the number two man in the foreign ministry.

More to the point, Sayyid Haitham is a member of Oman's royal family, a first cousin of Sultan Qaboos bin Said Al Said, the country's benevolent and absolute ruler. Sayyid is said to be a close confidant of the reclusive sultan and hates being told that some people consider him a likely successor when the 54-year-old monarch, unmarried and childless, decides to step down.

As we talk in the fortress-like ministry with its grand marble corridors hung with chandeliers, the alluring fragrance of burning frankincense wafts through Sayyid Haitham's office—a reminder that thousands of years before oil was discovered, frankincense was Oman's historic source of wealth. "We should be prepared for a diminishment of income," says Sayyid Haitham. "People will survive but not at the same level of luxury as today."

Luxury, indeed. Like all oil states, Oman warmed quickly to the idea of being rich. Compared with its neighbors in the Persian Gulf (the Arabian Gulf in these parts), Oman came late to the oil game. It began production only in 1967. Until 1970 the country was kept isolated and backward by Sultan Said bin Taimur, the present ruler's father. The former sultan spurned Western ways: The country had only six miles of paved roads, three secular schools, and two hospitals, which were often without electricity. Illiteracy and infant mortality were common. Sultan Said banned most travel and trade, even prohibited the use of bicycles and sunglasses.

Many citizens fled abroad to find work.

In 1970, after six years under virtual house arrest in a royal palace, young Qaboos—with critical help from the British military—deposed his father in a nearly bloodless coup. (His father died two years later in exile in London.) As the new sultan, Qaboos urged Omanis to return home and, in the next two decades, turned Oman into a model of Third World development that makes it unique in the region, if not in the world. He dotted the country with health clinics and hospitals, attained one of the highest immunization rates in the world, and developed a school system that now has 478,000 students.

The sultan's government unified the land with more than 3,500 miles of paved roads and a dense telephone network, creating a cohesive state out of a fragmented tribal society. Today any Omani can call anywhere in the country from one of the ubiquitous phone booths—done in the style of a crenellated fortress—for the price of a local phone call, about ten cents.

"Never in history has a country developed so much so fast and done it in basically an orderly way," says Dr. Don Bosch, a former medical missionary who 40 years ago used to operate by flashlight in Oman's only general hospital. "This kind of change usually takes 200 years."

I'VE COME during the winter, the cool season—only 80 degrees during the day. As I speed along Sultan Qaboos Street, the main expressway from the airport to Greater Muscat, the capital, I have the feeling I'm entering a miniature Los Angeles: whitewashed houses everywhere, palm trees planted along the roadside, manicured greenswards in the traffic circles. The city hums with the rush of late-model cars and the sibilant sound of money changing hands.

Yet amid the modernity Omanis have managed to preserve a connection to their centuries-old culture. A former maritime trading power with a colonial empire along the coast of East Africa, Oman's fortress-like architecture reflects the country's embattled history as a strategic bastion on the mouth of the Persian Gulf. For centuries coastal sultans fought with inland imams, and for a time—1507 to 1650—the country's littoral was dominated by Portuguese adventurers, whose 400-year-old forts, Mirani and Jalali, still overlook the royal palace in Muscat.

In modern times Oman became an unofficial British protectorate, with the envoy's residence in a traditional building hard by the royal palace. In the early years of the "renaissance"—as Omanis call the period since 1970—British officers ran Oman's military while British civil servants occupied high posts in the government.

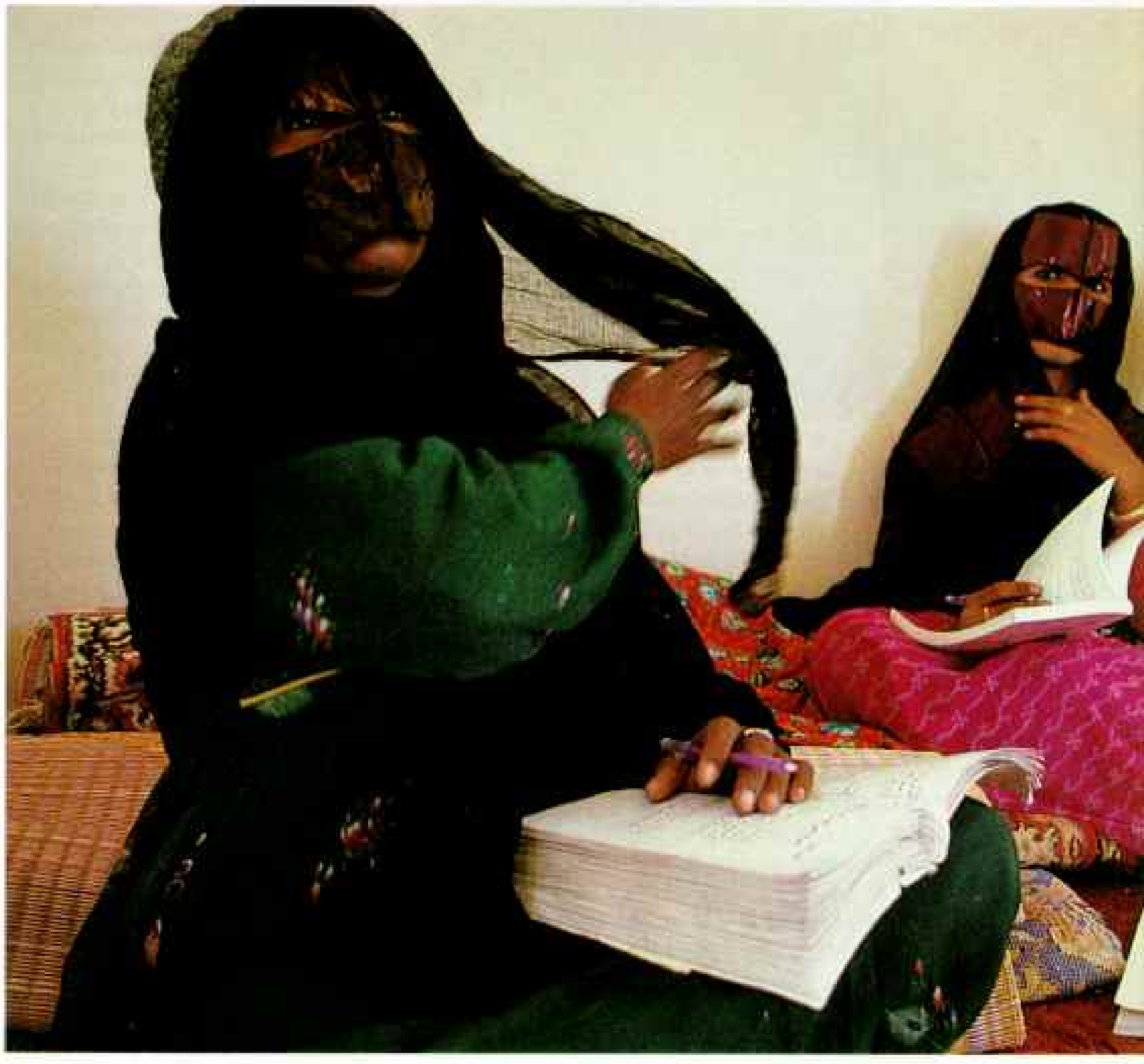
Since 1980, however, the influence of the United States has been growing. U. S. warplanes have access to air bases at Thamarit

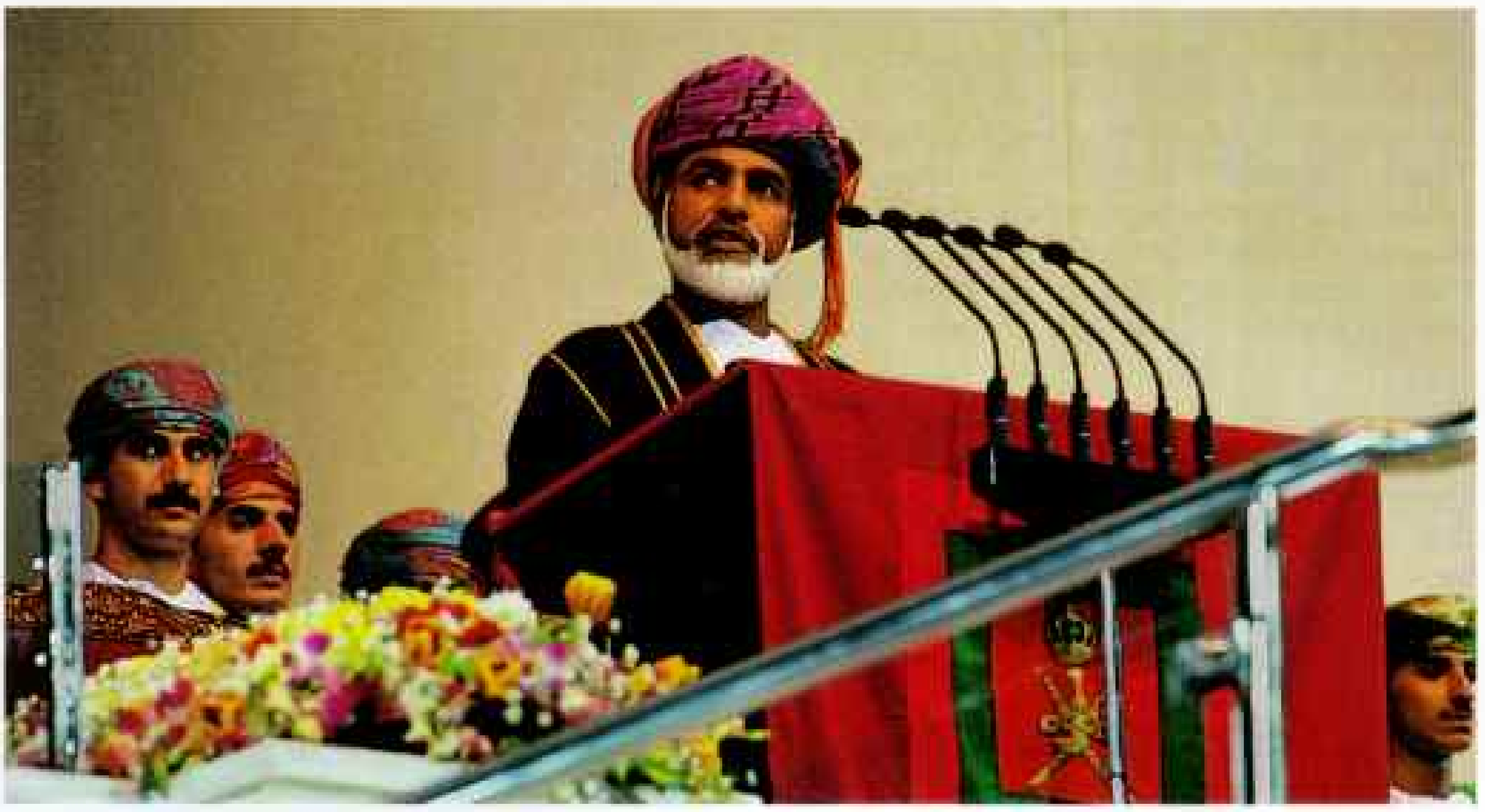
and Masirah island, where military supplies have been stockpiled in the event of a crisis. During the 1990-91 Persian Gulf war, Oman served as a key stepping-stone for U. S. and British forces, and Omani ground troops were dispatched to help protect Saudi Arabia from Iraq.

Today old customs reside close to the shiny surface. A businessman I know tools along every day in his sleek Mercedes-Benz, making deals on his car phone. When he arrives at the family villa in the suburb of Madinat Qaboos, he touches a remote control to manipulate dual satellite dishes on the roof—to receive CNN and BBC television. But at dinnertime he sits on the floor with his family and eats rice and meat with his fingers, like any Bedouin in the desert.

Omanis are comfortable with their easy mix of ancient habits and modern lifestyle. One reason for their contentment is that while the nation modernizes along Western lines, many Western influences—particularly the indignities associated with mass tourism—have been kept at bay. Over the years only Westerners offering specific technical assistance were granted "no objection certificates"—what passes for a work visa in Oman. Even many Arabs, especially those from poor and politically volatile regions such as Palestine and Jordan, were kept out. For cheap labor, Oman turned instead to India, Pakistan, Bangladesh, Sri Lanka, and the Philippines.

"The good thing about the 1970s was maintaining our identity," Sayyid Haitham tells me. "His Majesty asked us to wear the dishdasha. People were not allowed into





Prime mover of Oman's rush toward modernity, Sultan Qaboos bin Said Al Said (above) rules as an absolute monarch. In 1970 Qaboos deposed his isolationist father in a nearly bloodless palace coup.

Oman has since expanded trade and international relations and beefed up social services. The number of hospitals has grown from 2 to 51 and schools from 3 to 931. In a program to increase adult literacy, a woman recites lessons in a classroom near Hayma as her granddaughters look on.

Oman without a specific purpose. That allowed us to maintain our identity. Now people come and go, and it doesn't affect us.

"Look at our neighbors—Kuwait, Bahrain, Dubayy, Abu Dhabi. The cities are all high-rise buildings. You could be anywhere in the world. People wear anything. They don't care how they look and what they are. They have no identity anymore."

OMAN'S TRANSFORMATION from Arabia's poorest country to one of its most progressive is apparent even in remote villages and Bedouin encampments. I've driven 300 miles south of Muscat to the Jiddat al Harasis, part of the central desert that covers more than half the country. My Bedouin host for the night, Kanadish Al Harsusi, passes me an aluminum basin of frothy camel's milk. "This is as fresh as it gets," he says, his eyes twinkling in a dark face. "Makes everything digest. We drink it all the time." I took a long draft of the sweet milk—still warm from the camel—then passed the basin on.

The others around the campfire, all Bedouin who live in the desert, chuckle and nod their heads as they converse in the Harsusi language. We're 30 miles from the nearest town, sitting on a bright red carpet spread on the sand. Behind us in the moon glow, Kanadish's herd of 50 camels stirs in the night.

Off to one side, Kanadish's daughters, his wife, and a female guest—all wearing black head coverings—munch the remains of the

Sentinel of the past, the restored fort at Nakhl attests to Omani skill at military architecture: Built before A.D. 600, it has withstood many an army. Such fortresses strongly influence the design of Omani buildings—even telephone booths. Another institution, the camel, supplies milk to the Harasis tribe (below right). While the nomadic life endures, some Bedouin commute from camps to jobs in town.

savory goat-and-rice dish that has been our dinner: a desert feast cooked over the open fire. The men have eaten first in the traditional Arab style. And in the Omani Bedouin custom, the women cover their faces with dyed masks in the presence of men from outside the family.

Photographer Jim Stanfield and I gaze at the profusion of stars overhead. A cool winter breeze sweeps the dunes. Amid the livestock, the campfire, and lingering conversation, I am reminded of the glorious desert nights described by the legendary explorers of Arabia.

But these are not the Bedouin that T. E. Lawrence and Wilfred Thesiger knew. Today's desert dwellers no longer travel in camel caravans; instead we are surrounded by a motley assortment of pickup trucks and four-wheel drives. Headlights come bobbing through the night when word gets out to other camps that Kanadish has guests and one of his goats has been slaughtered for the feast.

While the Bedouin still herd camels and goats and move camp every three or four months to find forage, they no longer depend on them for subsistence. Almost all the Harsusi men have jobs working for the government or in the desert oil fields; Kanadish is a desert guide at the government center in nearby Hayma. Government trucks deliver water to fill portable tanks in many camps, and girls are driven by their fathers to a central school in Hayma every day. The boys board at the school.

"Before, life was very difficult," says Kanadish, who estimates his age at 40 to 45 but, like most men in rural Oman, looks older. "We didn't have enough food. We ate only animals we caught in the desert. We had no water. We drank only camel's or goat's milk. Now we have cars, water, rice—we have everything!"

The formerly isolated Bedouin are also served today by a small hospital in Hayma, the only one on a 600-mile stretch between Oman's northern cities and the southern city of Salalah. Like the schools, most of Oman's medical facilities are staffed by foreigners. At the hospital I meet chief doctor Shuja ul Latif, an Indian from Bangalore. He explains that the Bedouin, for all their bluff hardiness, have chronic medical problems.

"The most common problem is respiratory infection, because they live outside without proper housing in the winter," he says. "And their diet is just milk, meat, rice, some bread, and dates—no fresh fruit or vegetables."

At the opposite end of the medical spectrum from tiny Hayma Hospital stands Oman's Royal Hospital. Opened in 1987 on the outskirts of Muscat, the Royal Hospital is an advanced, 630-bed facility that routinely performs heart bypasses, kidney transplants, and vascular surgery.

GRACEFUL GEOMETRIES of Islamic architecture bedeck Al Bustan Palace Hotel outside Muscat. As tourism grows, "there will be no superficial entertainments like discos near the beach," a government official vows.

"You can feel secure here, whatever happens," says Mohammed Jaffer, the chief surgeon, as we hurry along the hospital's bustling corridors. An engaging man who speaks fluent English, Dr. Jaffer was raised and educated in Iraq. He repatriated in 1974 as one of the first Omani doctors in the country, back when Oman was just emerging from its dependency on missionary medicine.

Today there are more than 170 Omani doctors in the country, up from only 10 in 1985. The country's new medical school at Sultan Qaboos University has just graduated its second class, 46 doctors. The school hopes to replace most of Oman's 2,000 foreign physicians within 20 years.

SOMETHING IS ROARING over my head as I arrive at Mina al Fahl, the grounds of Petroleum Development Oman, Oman's national oil company. It is the gas burn-off from the adjacent refinery, a thundering reminder of the power of petroleum to drive an economy, shape history, revolutionize countries.

Inside, the oil terminal is stark simplicity: A windowless room filled with computers and pressure gauges that control the flow of Oman's crude oil through two floating buoys a mile offshore where tankers load. This room, I suddenly realize, is the spigot of the nation's prosperity. Through its pipes pass nearly 800,000 barrels of Omani oil—in exchange for many millions of dollars—every day. But there will likely be trouble when the oil ceases to gush here.

Oman's government ministries, lined up like palaces in the suburb of Shaat al Qurm, appear grand enough to run a country many times larger. But that is the luxury of an oil economy, which by itself does not create a significant number of jobs. In Oman it's the government that everyone wants to work for, and many of them do, leaving the private sector and service jobs, not to mention menial labor, to the country's gargantuan non-Omani workforce of 400,000.

To carry Omani nongovernment employees on the tide of prosperity, Oman reaches into their lives in other ways. In Sidab, a small fishing village outside Muscat, I meet Talib Shwain Al Maeini, a fisherman with a wife and eight children. Omani fishermen still catch their prized tuna and kingfish the old-fashioned way: one at a time, with deep lines worked all night by one or two fishermen in an open boat. The only difference is that today the boats are fiberglass, not wood, and they are powered by heavy outboard motors from Japan.

I find Talib, along with two dozen other men of the sea, playing well-earned rounds of beach checkers at dusk just as the muezzin's call to prayer echoes through the surrounding hills. "When I need a new boat, the government pays 500 rials and I pay 500 rials," says Talib, scooting pebbles around a rectangle of holes in the sand. "And it pays one-third the cost of a new motor."

Twenty-eight years after oil began fueling the great Omani renaissance, the country is beyond the halfway mark in its oil boom. Seeking a replacement for the oil, some government and business leaders have already

Low-tech playground entertains children in Alayjah, a section of Sur. Long famous as Oman's shipbuilding center, Sur still produces the wooden dhow, traditional vessel of the Indian Ocean. Most ship construction is done with Omani overseers and Indian workers—a trend seen throughout Oman, where foreigners do most of the unskilled labor. The government tries to persuade employers to hire Omanis instead—a tough sell, since foreigners are willing to work long hours for relatively low pay.

shifted their sights to the production of natural gas, of which Oman has modest reserves. Oman is also a partner in a potentially lucrative oil pipeline consortium that has contracted to pipe Russian and Kazakh crude to the Black Sea.

Stung by a 1994 World Bank report that accused the government of squandering its mineral wealth like "a large inheritance," Sultan Qaboos's administration is pushing diversification. By luring small and medium-size foreign firms with incentives—low rent, no taxes, cheap loans—the government hopes to create new jobs.

One morning I drive out of Muscat to the Rusayl industrial park. Here 70 companies manufacture a wide array of products from blue jeans to vegetable oil to car batteries. The air is redolent with baked goods from a cookie factory. Across the road the government provides housing and recreational facilities for more than a thousand workers, mostly foreigners.

"Whatever the businessman needs, we have it here," says spokesman Mohammed Al Maskari. "We'll build him a factory or give him land and he can build his own."

Rusayl seems to be a success, yet after nearly 20 years of trying, Oman's diversification program yields only 4 or 5 percent of the nation's gross domestic product.

Another potential source of income is tourism. After all, the country has a thousand-mile coastline, gorgeous beaches, constant sunshine, and a clean environment. But besides being several thousand miles distant from the key European and U. S. markets, Oman effectively cripples the growth of its

Nimble fingers of a rugmaker dance over his loom in Wadi Ghul, a center of traditional weaving. With many rugmakers growing old, government-sponsored weaving centers strive to preserve the craft. At a suq, or market, in Matrah (below) a dizzying array of kimah *hats for men share a shopwindow with a parti-color display of thread.*

tourism industry with a highly selective entry policy—accepting only a trickle of well-heeled tourists who book for pricey vacations through approved agencies.

Compared with some Persian Gulf countries, Oman is a tolerant land that permits alcohol consumption and has no religious police. But most Omanis still object to the disruptive influences that would come with a flood of tour groups and backpackers.

"We want clean tourists; we don't want rubbish," is how one businessman put it to me. "Now in Dubayy they have one flight a day from Russia. Women in bikinis are walking around half naked. I don't want to see that here."

DURING MY WEEKS in Oman, I encountered considerable hand-wringing over Oman's critical water shortage—"our major preoccupation," said Sultan Qaboos in a speech. Aquifers have dramatically dropped as farmers, beneficiaries of Oman's modernization, have replaced wooden buckets with diesel pumps to draw water from their wells. For years every Omani was entitled to a free parcel of rural land if he farmed it, and water-happy weekend farmers have depleted the aquifer along the fertile northern Batinah coast, leading to an environmental catastrophe: Seawater has seeped into the water table and killed date palms and lime groves. The problem is worsening as the already sparse rainfall decreases as a result of unpredictable monsoon patterns.

"We normally get only a hundred millimeters [four inches] a year, but for three and a half years, almost no rain," said an official of the Ministry of Water Resources whom I met in Tanuf, a dusty village in the mountainous interior. "We've banned the drilling of more wells without a special permit."

Tanuf's date palm farmers raise a rich crop of Oman's traditional staple, thanks to restoration of an ancient *falaj*, or irrigation system. Oman's falaj network, devised by Persian colonizers more than a thousand years ago, is an ingenious series of subterranean channels that tap mountain aquifers and guide water to village farms at the mouths of rocky wadis—stark gorges that roar with flash floods after a rare mountain rainfall. To harness the floods and recharge the falling aquifers, the government has also built dams on wadis in the interior, but with less success.

If water is short, people are plentiful. I was astonished to find families of six or eight children still common, even among city dwellers. With its successful immunization program and depressed infant mortality rates, Oman's growth rate is now among the highest in the world. In the past 24 years the indigenous population has more than tripled—from 435,000 to 1,480,000. A recent census revealed that more than half the Omanis are under the age of 15—a demographic bubble that will burst onto the glutted workforce in another decade. Yet it was not until 1994 that Sultan Qaboos began encouraging Omanis to cut their average family size to five.

For the first time, the medical establishment is publicly promoting the notion that birth control—from condoms to pills—is not incompatible with the tenets of Islam.

Oman's dependence on foreign workers, who make up about half the labor force, is another of the country's nagging problems. While Omanis hold almost all high-paying government jobs, every store, restaurant, and hotel is staffed overwhelmingly by low-wage foreigners, more than half of whom are Indians. Beginning at 6:30 a.m., Indians in orange work suits are seen sweeping streets and highways with hand brooms, watering the lush greenswards along the roads, climbing scaffolding at construction sites. Even in large companies run by Oman's savvy businessmen, most of the accountants, planners, secretaries, and drivers are foreign.

To reduce the presence of foreign workers, the government urges businesses to hire Omanis. It has even set quotas for key industries, such as communications, which must have 60 percent Omani workers by 1997. But businessmen don't want to hire Omanis when they can get competent and compliant foreigners for half the price. They also claim that Omanis are often unreliable.

"We get Omanis from the labor office," complained the managing director of a Salalah trading company. "With their hands on their hips, they say, 'Give me a job.' Some are untrained. Then, three or four days later, they leave for a government job. Everybody wants to work for the government."

The preference for a government job is understandable in a country where government salaries are higher than those in the private sector and the work hours are much

Ready for auction, freshly caught tuna await buyers at Sur, Oman's chief fishing center. From the 7th to the 19th centuries Sur was a hub for the slave trade that stretched from East Africa to India.

shorter. The streets of Muscat are clogged every day at 2:30 p.m., when the government closes, after opening theoretically at 7:30 a.m. Store clerks and service workers, by contrast, work 10 to 14 hours a day, six or seven days every week.

"Each month I have one day off," said Abdul, an Indian waiter from Kerala I met in the town of Ar Rustaq. "Every day I work seven hours in the morning and seven hours in the evening, until 1 a.m. In between, I only sleep."

We went for a look at Abdul's room. It was a seven-by-eleven-foot cell with a steel door and no windows. Abdul shares this stifling space with two other Indians. He told me his 60-rial monthly salary ($157) was three times what he could earn in India. Most employers I spoke with said an Omani would expect at least 300 rials a month.

POLITICALLY, Oman walks a delicate line between traditional tribal democracy—centered on an absolute monarch—and contemporary pressures for greater participation in decision-making. Under Sultan Qaboos's leadership, Oman is effectively run by a long-entrenched oligarchy of businessmen-politicians who make up his cabinet and circle of advisers.

Sultan Qaboos is trying to bring the country closer to democratic practices—though not at high speed. In 1991 he created the Majlis al Shura, a kind of consultative parliament. The sultan allows it to suggest, but not make, new laws and to refer key issues to committees for study.

More important, it can call certain government ministers on the carpet for their policies. The scrutiny of the ministers is carried on live TV, producing a form of electronic democracy as it brings public demands more directly to bear on government officials. This has created a rapt national TV audience in Oman on such issues as water, telephones, health care, and education.

Notably, however, certain topics are exempted from the scrutiny—finance, foreign affairs, defense, and petroleum. "All the most important ones," says one unhappy Omani I met.

Power sharing is moving too slowly for some. Last year the government foiled what it called a seditious plot by militants bent on

radically changing the system. High-ranking government officials, policemen, and military officers were said to be involved—a broad mélange of players with divergent motives, according to one observer. Several hundred Omanis were detained and dozens were later tried in secret and sentenced to varying prison terms. Several death sentences were handed down, though they were commuted by Sultan Qaboos.

The crackdown by Oman's Internal Security Service—reportedly the first such large sweep in 20 years—shook the country. A Washington, D.C.-based human rights group charged the Omani government with torturing detainees and ignoring due process. Many Omanis who are loyal to the sultan but believe the ruling oligarchy is mired in corruption and ripe for political change speak quietly, with glances over their shoulders.

"Were you followed here? Be careful," said one businessman to me after a conversation concerning conflicts of interest at the highest levels of government. "They could put me between four walls," said another as we sipped coffee in his office overlooking bustling Ruwi.

In conversations I had with leading businessmen, allegations of corruption and of a "cancer" in the body politic resounded, along with complaints about the slow pace of democratization and the lack of free speech and a free press. One Omani lamented the "complete marriage between business and politics." Others accused the men at the top, who control both the government and the country's largest companies, of funneling most government contracts—the main engine of domestic commerce—to themselves and their friends. The proliferation of palatial villas dotting the Muscat landscape was cited as proof of corruption at the top.

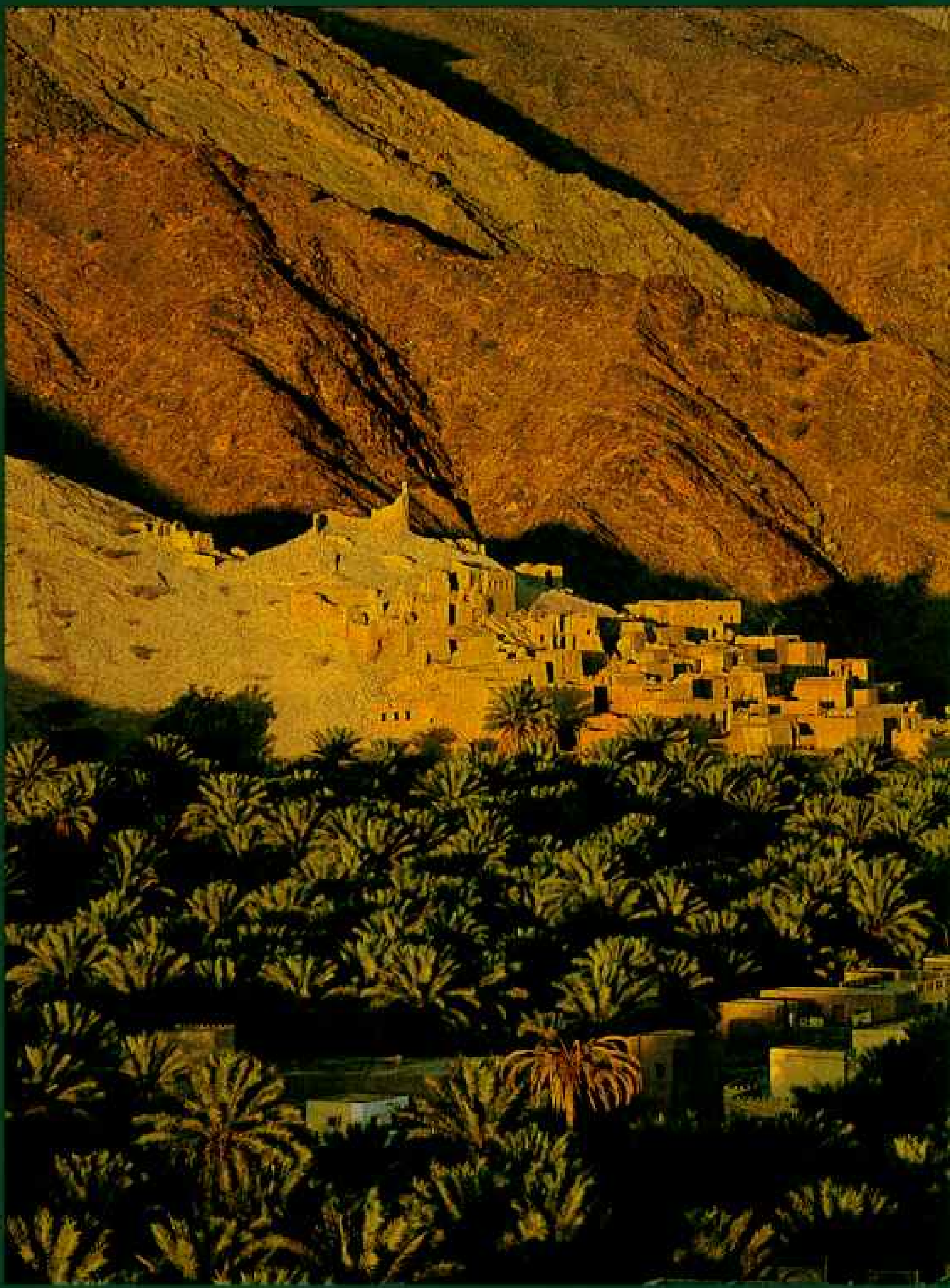
"Everybody knows that government officials take kickbacks for every project," said one man. "Everybody takes commissions. When high government officials have businesses, you have a conflict of interest. They are not looking at the country's interest with these projects. They look at their own interest first. They didn't become so rich without their government titles."

Asked how many people he thought shared this gloomy view, the man said: "If people are willing to talk frankly, at least 50 percent of the people in Muscat."

The people I met spoke frankly enough, but asked me not to use their names for fear of reprisals by the security service. Yet the businessmen insist that their views are not a threat to the monarchy or national stability, but rather express concerns that the country's preparations for the 21st century—and the coming oil depletion—are seriously compromised by lagging ethical and political standards.

"These are not radical points of view," lamented one high-ranking banker who complained bitterly about the prohibition on open debate of public issues a quarter-century after Oman's leap into the modern era. "We're 24 years old now. We're grown up. But the

Spirited haggling enlivens a livestock sale in Nizwa as a Bedouin woman (left) dickers over the price of a goat. Among Bedouin, women handle all livestock except camels, the province of men. Unlike their counterparts in Omani villages, women of the nomadic Bedouin tribes take a more visible role in public life. In the town of Ar Rustaq (right) a sad-eyed youngster embraces his pet, soon to go on the auction block.



EVOLUTION OF A VILLAGE: At Birkat al Mawz boxy concrete homes have replaced the old mud-brick housing beyond. Mountain runoff irrigates dense groves of date palms, source of a staple food.

growth of our system does not match the growth of the people."

None of the frustrated men I spoke to placed blame for the country's failings on Sultan Qaboos. "I prefer this monarch one thousand times to any other in the Middle East," said one. "He is a genuine reformer," said another. "But he has limited knowledge of the economy. He is surrounded only by a certain class of people who take advantage of his limited knowledge to give him a wrong picture. They don't allow anyone to come close to him."

It was impossible for me to test the veracity of all these claims. A promised interview with the sultan went unfulfilled because of scheduling problems, I was told. Officials of the royal court were not available, according to Anthony Ashworth, a high-ranking official in the Ministry of Information. Ashworth denounced the complaints of the businessmen as out-of-context reporting by a journalist bent on finding trouble in Oman. In fact, the criticism—a *cri de coeur* by the men I met—came as a great surprise to me.

The ministry is itself one of the most powerful—and feared—in Oman. It exercises draconian control over press and television, which permits little open discourse on topics the government does not want to discuss. The ministry can censor advertisements and close down publications for any reason. In 1993 businessman Essa Al Zedjali was jailed for a week when one of his newspapers, the English-language *Times of Oman*, inadvertently published a hotel ad for a Christmas party that contained a vague likeness of Sultan Qaboos riding a camel—considered insulting to the sultan and therefore a crime under the country's information laws, which are made by royal decree.

The lack of free expression struck me as the most unhealthy part of Oman's political impasse. Ironically, the country is open enough that a foreign journalist, once admitted, can have unimpeded access to almost anyone. But it is sufficiently repressed that the Omani public cannot have the same access. "I wouldn't speak out like this to an Omani journalist," one man confided to me.

The bottled-up discontent cast a dark nimbus around the otherwise bright picture of progress that Oman presents. Yet the dissent finally struck me as healthy. At least some members of the country's elite are seriously concerned about the problems on the near horizon.

As I watched the buttery winter light wash Oman's skies from my hotel balcony for the last time, it seemed to me that nothing could diminish the country's impressive achievements since Sultan Qaboos ushered in the modern age one generation ago. Clearly, most Omanis I met shared a belief in the country's development and a sense of a common destiny. Still, I couldn't help feeling that Oman has ended an era—the golden years of oil growth and basic nation-building—without yet adjusting to the fact that it has already entered another, less certain one. The question now is whether Sultan Qaboos can lead the country into a time of austerity—and modern political aspirations—as skillfully as he carried it into the age of prosperity. □

Prize symbol of masculinity, the dagger called the khanjar was once as common in Oman as the necktie is among Western men. Wrought in silver and now used mainly in ceremonies, this artifact shows no sign of fading in the face of Oman's hunger for progress.

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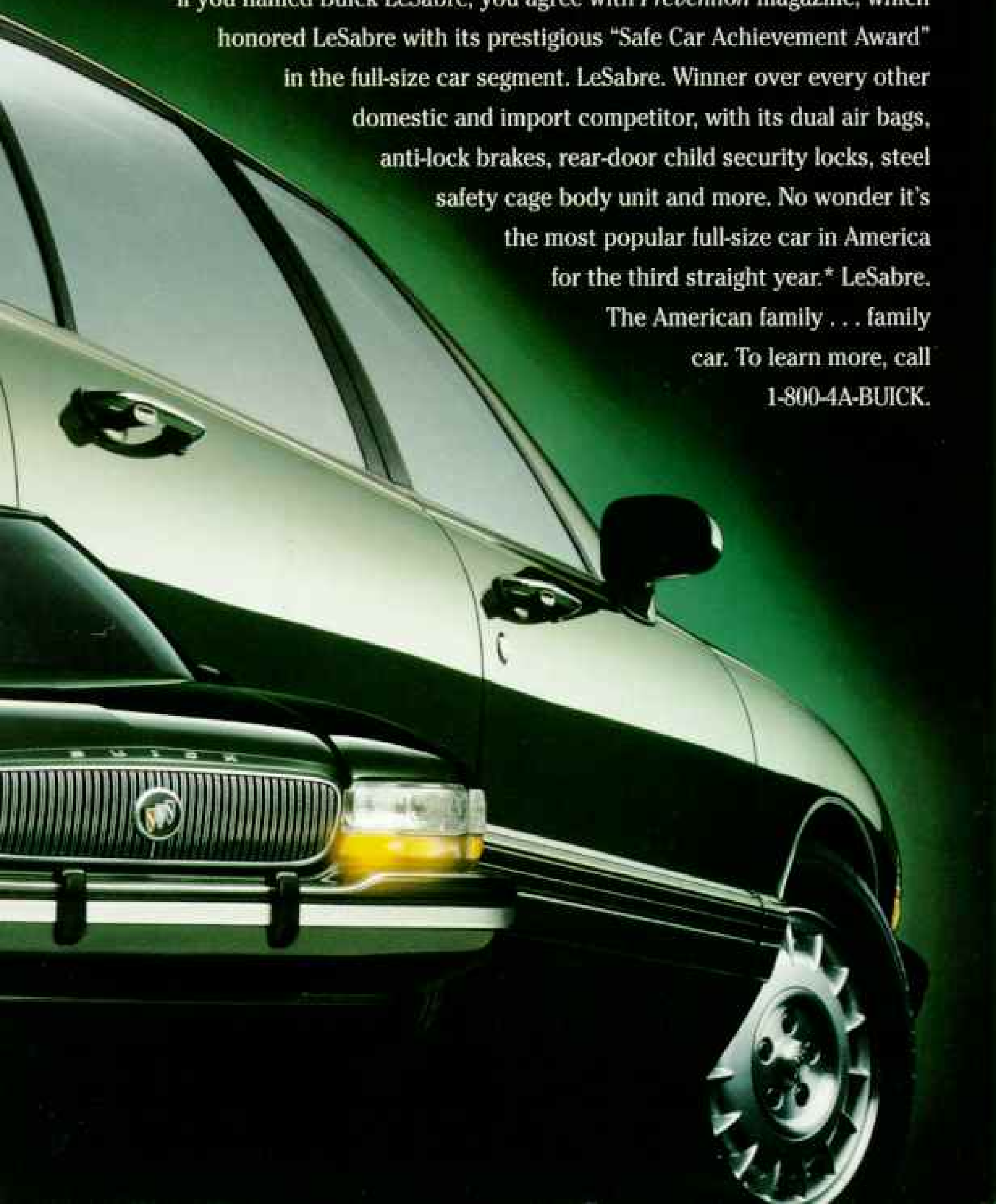

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Forum

Egypt's Old Kingdom

The "Age of Pyramids" in the January 1995 issue is very helpful for those of us in the academic profession, but I have a minor problem with calling Egypt's Old Kingdom "the first great nation-state." The nation-state was a European development of the late 18th and 19th centuries, when sovereignty was stripped from absolute kings and vested in the people themselves as the nation. I would describe Egypt's Old Kingdom as the first great territorial state, in contrast to the city-states created by the Sumerians.

ROBERT J. KOVARIK
Department of History and Political Science
Chicago State University
Chicago, Illinois

As a student of African history, I disagree with your paintings that depict ancient Egyptians as Euro-Asians. New discoveries by anthropologists and archaeologists have suggested Nubian Negroid origins of the Old Kingdom of Egypt.

LEE M. ROBINSON
Florissant, Missouri

The figures resemble people of ancient Central America more than of Africa. Egypt's legacy strongly demonstrates a mixed society of dark and light-skinned peoples.

ABU KABBAH
Mount Vernon, New York

I am sensitive, as an African American, to the early 19th-century "whitening" of the ancient Egyptians. Your artwork was an attempt at fairness, but the ancient Egyptians were a racially inclusive people; some resembled Egypt's president Hosni Mubarak, others the late president Anwar Sadat. Ancient Egypt was devoid of the racial hangups of today.

In the sculpture of the high priest Rahotep (page 11), there is a fair resemblance to members of my own family, arbitrarily classified as black in 20th-century America. Indeed, most modern-day racial classifications, whether imposed on modern or ancient peoples, are arbitrary.

SOLOMON LANDERS
Clinton, Maryland

Regarding ancient breadmaking, it is believed by some experts that the ancient millers added sand to the wheat to get a fine grind. Unfortunately, their sieves were too coarse to remove the impurities, leading to a gritty baked product. Analysis of bread samples found in tombs shows the contamination occurred through all the ages of ancient Egypt. It is more than likely responsible for the undue wear observed on mummies' teeth.

ED MORRELL
Regina, Saskatchewan

Reading the article made me feel as if I were truly in a 4,500-year-old Egyptian kingdom. I have never been to Egypt, but through this article I am stimulated to go. The color map of the Nile River was a good helpmate to orient one to memorials and places of interest.

PAVOL HORŇÁK
Košice, Slovakia

Arctic Trek

As far as I could tell, this was an expedition without a purpose, undertaken without sufficient planning or preparation, the innocent victims of which were faithful and courageous sled dogs that the author drove and starved to death.

LESLEY WILSON
Saratoga, California

In Canada any person who willfully allows a dog to starve to death or become so ill that it must be shot is guilty of a criminal offense, whether it occurs in a backyard in suburban Toronto or on an adventure in the Arctic.

KELLY A. MULHOLLAND
Branelea, Ontario

I hope this story will serve as a lesson rather than as an inspiration to others.

CYNTHIA HENRY
Manteca, California

New Orleans

Your article on offbeat New Orleans is a disgrace. You portray it as being this trashy, trigger-happy slum, and I am writing to say that it is not. I have been living here all my life, and I have never seen or touched a gun. I have met some of the most beautiful, most respectful people walking the streets of the French Quarter. Whether it is on Bourbon Street on Fat Tuesday or Decatur on a Sunday afternoon, it's the greatest place in the world, and I will love it until the day I die.

STEPHANIE YOUNG
New Orleans, Louisiana

This article was the most honest I have read on this subject. When Priit Vesilind stated that it sucks you in, he is right. And very often in the end it costs you your life. I lost a 29-year-old granddaughter and a 37-year-old son. I had a business there, not dreaming that the danger was so acute. It is sad that this gracious, old, southern city is so poor and has become so inundated with crime. Gambling has proved it will bring more crime, with little monetary benefit.

DORIS ROWLEY
Mobile, Alabama

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Paul Kelley Engineer, Karen H. Peryla Jr., Tania Fragoso, Mike Foster

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You talk about streetcars and mention Tulane University but fail to note the presence of Loyola University next to it. Home to about 5,000 students, including my extremely proud son, this Jesuit university is one of the top 12 regional universities in the South. With the problems mentioned prominently, you might have noted that there are universities there that are trying to help. And with all the recipes for voodoo stuff, how could you not do a paragraph on the best soup around, good ole gumbo?

J. A. Banasick
APO AA

Visiting New Orleans over the Christmas holidays, I discovered yet another source of entertainment, Preservation Hall. The public can listen to Dixieland jazz for four hours in the original house of jazz for three dollars. Where can you beat that? There is a rotation of local jazz musicians and the Preservation Hall Jazz Band when they are not touring. Absolute fun.

Sherry Preston
Asheville, North Carolina

Reef Sharks

Bill Curtsinger's stunning photos and moving text renewed my fascination with sea life. I have decided to make diving my next hobby.

Rose Gorman
Silver Spring, Maryland

What you see in the shark's mouth on pages 60-61 are not its gill slits but its gill arches, the cartilaginous structures that support the gills themselves. Gill slits are the externally visible portions of those structures.

Thank you for allowing me to contribute to the knowledge you make available to your public. The magazine contributed substantially to my becoming a marine scientist.

Robyn Mellon
Escondido, California

While stationed at Johnston Atoll in 1991-92, I had the great fortune to dive with these magnificent creatures. In my first meeting I popped my head up from a coral canyon to see a small gray shark approaching. It slowed and began to display the humpbacked, fin-down behavior mentioned. Excited, I expelled my breath more forcefully than normal, blowing two lungs' worth of compressed air into the water. The resulting sound and display of bubbles scared the young shark, who disappeared. Our mutual inexperience resulted in a win-win situation. I had many subsequent meetings with older siblings but none as dramatic.

Michael W. Guzman
Bellevue, Nebraska

Sharks are magnificent and dangerous creatures, and it does no justice to bait the water to show them at their most vicious. I also thought it unnecessary to kill a gray reef shark to show the "event" of sharks eating other sharks. National Geographic states that its photographs are not posed; to me this philosophy should include taking photos of animals in their natural state, not in a man-induced, frenzied one.

Carolyn Opsomer
Ithaca, New York

It is impossible to pose sharks. Photographer Curtsinger used their regular food as bait to record a normal feeding frenzy.

Australian Wildflowers

As artist, filmmaker, and collector of National Geographics, I finally began a subscription in January. That stunning photograph of *Banksia* by Cary Wolinsky on page 80 is alone worth the price. No architect, painter, or sculptor can equal nature's symmetry.

Purvis Evans
Jacksonville, Florida

Earth Almanac

A report in January describes Serengeti lions in the throes of canine distemper. As a veterinarian formerly involved there in the annual vaccination of cattle against rinderpest (cattle plague), I would point out that distemper, rinderpest, and human measles, among others, are believed to be closely related viruses, capable of jumping from species to species. Vets, for instance, use human measles vaccine to protect puppies too young for distemper shots when they go to dog shows with their mothers. It seems possible that these unfortunate lions caught their virus from humans or cattle and related wild game, as well as from dogs.

John F. Callear
Somerset, England

Geographica

Regarding your article on dwarf mammoths, I think that these smaller herbivores evolved because, free of mainland predators and with faster reproductive cycles, they were able to outreproduce more massive kin. The currency of evolution is reproductive success. Faster baby making, not starvation, probably resulted in the mammoths' eventual diminutive stature. Dr. J. H. Brown covers this topic in his new book, *Macroecology*, University of Chicago Press, 1995.

Filip Bryant Furlow
Department of Biology
University of New Mexico
Albuquerque, New Mexico

Letters for Forum should be sent to National Geographic Magazine, Box 37448, Washington, D. C. 20013-7448, or by fax to 202-828-5460, or via the America Online computer network to ngsforum@aol.com. Include full name, address, and daytime telephone. Letters selected may be edited for clarity and space.

An interesting thing happe
people about their idea of a
You end up building it.

A couple of years ago, we asked literally thousands of people what they were looking for in a mid-size sedan. Turns out what they wanted more than anything was, well, everything: The comfort and features of a more expensive sedan. A comprehensive list of safety features. Exceptional quality. And getting it all at a price they could afford was mentioned more than once.

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June. The perfect time for a wedding. Outside. With flowers. It was your dream. But with your seasonal nasal allergies, it could be a nightmare. That's why you may need the reassurance of Seldane-D.

The Seldane-D difference

Seldane-D can give you relief from a full range of major allergy symptoms, including your congested nose—the most common complaint of allergy sufferers. That's because Seldane-D contains a nonsedating antihistamine *plus* a decongestant. Even more importantly, Seldane-D can give you all that relief while letting you stay alert*—unlike over-the-counter remedies that may leave you feeling spacey or drowsy. (In clinical studies, Seldane-D caused no more drowsiness than a placebo [sugar pill].)

Who should not take Seldane-D

Seldane-D isn't for everyone. There are risks for some people. So read this message thoroughly to find out specifically who should not take Seldane-D.

WARNING: YOU MUST NOT TAKE SELDANE-D if you are also taking the prescription antifungal medicines itraconazole (Sporanox®) or ketoconazole (Nizoral®) or the prescription antibiotics erythromycin, clarithromycin (Biaxin®), or troleandomycin (TAO®), or if you have liver disease. DO NOT TAKE MORE THAN the amount prescribed by your doctor. Seldane-D has been associated with rare occurrences of abnormal heartbeats, heart attack, and death under these conditions. Please see important additional information on an adjacent page.

Due to similarities in the drugs, it is also recommended that the antifungal drugs fluconazole, metronidazole, and miconazole, and the antibiotic azithromycin, not be used with Seldane-D.

Tell your doctor before taking Seldane-D if you have any liver or heart problems. Also, while using Seldane-D, tell your doctor if you ever feel faint, become dizzy, or have any irregular heartbeats.

Do not use Seldane-D with any other prescription or nonprescription medicine without first talking to your doctor. If you become pregnant or are nursing a baby, talk to your doctor about whether you should take Seldane-D. Your doctor will decide whether you should take Seldane-D based on the benefits and risks.

It is important to know that a decongestant may produce unwanted side effects or drug interactions, or may complicate existing medical problems.

Pseudoephedrine, the decongestant in Seldane-D (as well as in many over-the-counter allergy medicines), may cause nervousness, dizziness, or significant levels of insomnia. Seldane-D must not be taken with MAO inhibitors, prescription medicines that treat depression. Also, before taking Seldane-D, tell your doctor if you have high blood pressure, heart disease, diabetes, glaucoma, thyroid disease, or symptoms of an enlarged prostate such as difficulty urinating.

It is always important to tell your doctor about any medicines you are using, including MAO inhibitors, antifungals, antibiotics, diet pills, and drugs to treat asthma and lung disease.

Your doctor knows what is best for you

Because Seldane-D is a prescription medicine, only your doctor, or other health care professional authorized to prescribe, can decide if you're a candidate for it. Ask if you can join the millions of people who trust their allergies to Seldane-D. So on your wedding day, if your eyes well up, they'll simply be tears of joy.

* In clinical studies involving over 800 patients, the reported incidence of drowsiness with Seldane-D * 2% did not differ significantly from Placebo [1.4%]. In 2 clinical trials, 25.5% of patients taking Seldane-D experienced insomnia compared to * 2% of patients who received placebo.

SEE ADDITIONAL IMPORTANT INFORMATION ON AN ADJACENT PAGE.

SELDANE-D®

(terfenadine 60 mg and pseudoephedrine HCl 120 mg)

EXTENDED-RELEASE TABLETS

AVAILABLE BY PRESCRIPTION ONLY

SEASONAL ALLERGY RELIEF. CONGESTION RELIEF.

THE FIRST COMBINATION THAT LETS YOU STAY ALERT.

Brief Summary of
Prescribing Information as of January 1993

SELDANE-D®

(terfenadine and pseudoephedrine hydrochloride)

Extended-Release Tablets

WARNING BOX

QT INTERVAL PROLONGATION/VENTRICULAR ARRHYTHMIA

RARE CASES OF SERIOUS CARDIOVASCULAR ADVERSE EVENTS, INCLUDING DEATH, CARDIAC ARREST, TORSADES DE POINTES, AND OTHER VENTRICULAR ARRHYTHMIAS, HAVE BEEN OBSERVED IN THE FOLLOWING CLINICAL SETTINGS, FREQUENTLY IN ASSOCIATION WITH INCREASED TERFENADINE LEVELS WHICH LEAD TO ELECTROCARDIOGRAPHIC QT PROLONGATION:

1. **CONCOMITANT ADMINISTRATION OF KETOCONAZOLE (NIZORAL) OR ITRACONAZOLE (SPORANOX)**
2. **OVERDOSE, INCLUDING SINGLE TERFENADINE DOSES AS LOW AS 360 MG**
3. **CONCOMITANT ADMINISTRATION OF CLARITHROMYCIN, ERYTHROMYCIN, OR TROLEANDOMYCIN**
4. **SIGNIFICANT HEPATIC DYSFUNCTION**

TERFENADINE IS CONTRAINDICATED IN PATIENTS TAKING KETOCONAZOLE, ITRACONAZOLE, ERYTHROMYCIN, CLARITHROMYCIN, OR TROLEANDOMYCIN, AND IN PATIENTS WITH SIGNIFICANT HEPATIC DYSFUNCTION.

DO NOT EXCEED RECOMMENDED DOSE.

IN SOME CASES, SEVERE ARRHYTHMIAS HAVE BEEN PRECEDED BY EPISODES OF SYNCOPE. SYNCOPE IN PATIENTS RECEIVING TERFENADINE SHOULD LEAD TO DISCONTINUATION OF TREATMENT AND FULL EVALUATION OF POTENTIAL ARRHYTHMIAS.

(See CONTRAINDICATIONS, WARNINGS, CLINICAL PHARMACOLOGY, AND PRECAUTIONS: DRUG INTERACTIONS.)

DESCRIPTION

SELDANE-D (terfenadine and pseudoephedrine hydrochloride) Extended-Release Tablets are available for oral administration.

Each tablet contains 60 mg terfenadine and 120 mg of pseudoephedrine hydrochloride in an outer press-coat for immediate release and 120 mg pseudoephedrine hydrochloride in an extended-release core. Tablets also contain as inactive ingredients: colloidal silicon dioxide, ethylcellulose, glycerin, hydroxypropyl cellulose, hydroxypropyl methylcellulose 2208, hydroxypropyl methylcellulose 2910, lactose, magnesium stearate, microcrystalline cellulose, polysorbate 80, precipitated calcium carbonate, pregelatinized corn starch, sodium lauryl sulfate, sodium starch glycolate, talc, titanium dioxide, and zinc stearate.

INDICATIONS AND USAGE

SELDANE-D is indicated for the relief of symptoms associated with seasonal allergic rhinitis such as sneezing, rhinorrhea, pruritus, lacrimation, and nasal congestion. It should be administered when both the antihistaminic properties of SELDANE (terfenadine) and the nasal decongestant activity of pseudoephedrine hydrochloride are desired (see CLINICAL PHARMACOLOGY).

SELDANE-D has not been studied for effectiveness in relieving the symptoms of the common cold.

CONTRAINDICATIONS

CONCOMITANT ADMINISTRATION OF SELDANE-D WITH KETOCONAZOLE (NIZORAL), OR ITRACONAZOLE (SPORANOX) IS CONTRAINDICATED. SELDANE-D IS ALSO CONTRAINDICATED IN PATIENTS WITH DISEASE STATES OR OTHER CONCOMITANT MEDICATIONS KNOWN TO IMPAIR ITS METABOLISM, INCLUDING SIGNIFICANT HEPATIC DYSFUNCTION, AND CONCURRENT USE OF CLARITHROMYCIN, ERYTHROMYCIN, OR TROLEANDOMYCIN. QT PROLONGATION HAS BEEN DEMONSTRATED IN SOME PATIENTS TAKING TERFENADINE IN THESE SETTINGS, AND RARE CASES OF SERIOUS CARDIOVASCULAR EVENTS, INCLUDING DEATH, CARDIAC ARREST, AND TORSADES DE POINTES, HAVE BEEN REPORTED IN THESE PATIENT POPULATIONS. (See WARNINGS and PRECAUTIONS: Drug Interactions.)

SELDANE-D is contraindicated in nursing mothers, patients with severe hypertension or severe coronary artery disease, patients receiving monoamine oxidase (MAO) inhibitor therapy, and in patients with a known hypersensitivity to any of its ingredients (see DESCRIPTION section).

WARNINGS

Terfenadine undergoes extensive metabolism in the liver by a specific cytochrome P-450 isoenzyme. This metabolic pathway may be impaired in patients with hepatic dysfunction (alcoholic cirrhosis, hepatitis) or who are taking drugs such as ketoconazole, itraconazole, or clarithromycin, erythromycin, or troleandomycin (macrolide antibiotics), or other potent inhibitors of this isoenzyme. Interference with this metabolism can lead to elevated terfenadine plasma levels associated with QT prolongation and increased risk of ventricular tachyarrhythmias (such as torsades de pointes, ventricular tachycardia, and ventricular fibrillation) at the recommended dose. SELDANE-D is contraindicated for use by patients with these conditions (see WARNING BOX, CONTRAINDICATIONS, and PRECAUTIONS: Drug Interactions).

Other patients who may be at risk for these adverse cardiovascular events include patients who may experience new or increased QT prolongation while receiving certain drugs or having conditions which lead to QT prolongation. These include patients taking certain antiarrhythmics, bepridil, certain psychotropics, probucol, or astemizole; patients with electrolyte abnormalities such as hypokalemia or hypomagnesemia, or taking diuretics with potential for inducing electrolyte abnormalities; and patients with congenital QT syndrome. SELDANE-D is not recommended for use by patients with these conditions.

The relationship of underlying cardiac disease to the development of ventricular tachyarrhythmias while on SELDANE-D therapy is unclear; nonetheless, SELDANE-D should also be used with caution in these patients.

Sympathomimetic amines should be used judiciously and sparingly in patients with hypertension, diabetes mellitus, ischemic heart disease, increased intraocular pressure, hyperthyroidism, or prostatic hypertrophy (see CONTRAINDICATIONS). Sympathomimetic amines may produce CNS stimulation with convulsions or cardiovascular collapse with accompanying hypotension.

Use in Elderly

The elderly are more likely to have adverse reactions to sympathomimetic amines.

PRECAUTIONS

General

SELDANE-D should be used with caution in patients with diabetes, hypertension, cardiovascular disease, and hyperreactivity to ephedrine.

Information for Patients

Patients taking SELDANE-D should receive the following information and instructions. Patients should be advised to take SELDANE-D only as needed and NOT TO EXCEED THE PRESCRIBED DOSE. Patients should be questioned about use of any other prescription or over-the-counter medication, and should be cautioned regarding the potential for life-threatening arrhythmias with concurrent use of ketoconazole, itraconazole, clarithromycin, erythromycin, or troleandomycin. Patients should be advised to consult the physician before concurrent use of other medications with terfenadine. Patients should be questioned about pregnancy or lactation before starting SELDANE-D therapy, since the drug is contraindicated in nursing women and should be used in pregnancy only if the potential benefit justifies the potential risk to the fetus. Patients should be directed to swallow the tablet whole. Patients should also be instructed to store this medication in a tightly closed container in a cool, dry place, away from heat, moisture, or direct sunlight, and away from children.

Drug Interactions (see CONTRAINDICATIONS)

Monoamine oxidase (MAO) inhibitors and beta-adrenergic agonists increase the effect of sympathomimetic amines. Sympathomimetic amines may reduce the antihypertensive effects of methyldopa, mecamylamine, and reserpine. MAO inhibitors may prolong and intensify the effects of anticholinergics.

Care should be taken in the administration of SELDANE-D concomitantly with other sympathomimetic amines because combined effects on the cardiovascular system may be harmful to the patient.

Ketoconazole

Spontaneous adverse reaction reports of patients taking concomitant ketoconazole with recommended doses of terfenadine demonstrate QT interval prolongation and rare serious cardiac events, e.g., death, cardiac arrest, and ventricular arrhythmia including torsades de pointes. Pharmacokinetic data indicate that ketoconazole markedly inhibits the metabolism of terfenadine, resulting in elevated plasma terfenadine levels. Presence of unchanged terfenadine is associated with statistically significant prolongation of the QT and QTc intervals. Concomitant administration of ketoconazole and SELDANE-D is contraindicated (see CONTRAINDICATIONS, WARNINGS, and ADVERSE REACTIONS).

Itraconazole

Torsades de pointes and elevated plasma terfenadine levels have been reported during concomitant use of terfenadine and itraconazole in clinical trials of itraconazole and from foreign post-marketing sources. One death has also been reported from foreign post-marketing sources. **Concomitant administration of itraconazole and SELDANE-D is contraindicated** (see CONTRAINDICATIONS, WARNINGS, and ADVERSE REACTIONS).

Due to the chemical similarity of other azole-type antifungal agents (including fluconazole, miconazole, and econazole) to ketoconazole and itraconazole, concomitant use of these products with SELDANE-D is not recommended pending full examination of potential interactions.

Macrolides

Clinical drug interactions studies indicate that erythromycin and clarithromycin can exert an effect on terfenadine metabolism by a mechanism which may be similar to that of ketoconazole, but to a lesser extent. Although erythromycin measurably decreases the clearance of the terfenadine acid metabolite, its influence on terfenadine plasma levels is not under investigation. A few spontaneous accounts of QT interval prolongation with ventricular arrhythmia, including torsades de pointes, have been reported in patients receiving erythromycin and troleandomycin.

Concomitant administration of SELDANE-D with clarithromycin, erythromycin, or troleandomycin is contraindicated (see CONTRAINDICATIONS, WARNINGS, and ADVERSE REACTIONS). Pending full characterization of potential interactions, concomitant administration of SELDANE-D with other macrolide antibiotics, including azithromycin, is not recommended. Studies to evaluate the potential interaction of terfenadine with azithromycin are in progress.

Carcinogenesis, Mutagenesis, Impairment of Fertility

No studies have been conducted to evaluate the carcinogenic potential of SELDANE-D.

Oral doses of terfenadine corresponding to 42 times the recommended human daily dose, in mice for 78 months or in rats for 24 months, revealed no evidence of tumorigenicity. Microbial and mammalian test assays with terfenadine have revealed no evidence of mutagenesis.

Reproduction and fertility studies with terfenadine in rats showed no effects on male or female fertility at oral doses of up to 21 times the human daily dose. At 63 times the human daily dose there was a small but significant reduction in implants and at 125 times the human daily dose reduced implants and increased post-implantation losses were observed, which were judged to be secondary to maternal toxicity. Animal reproduction studies have not been carried out with pseudoephedrine.

Pregnancy Category C

The combination of terfenadine and pseudoephedrine hydrochloride (in a ratio of 1:2 by weight) has been shown to produce reduced fetal weights in rats and rabbits at 42 times the human dose, and delayed ossification with wavy ribs in a few fetuses when given to rats at a dose of 63 times the human daily dose. There are no adequate and well-controlled studies in pregnant women. SELDANE-D should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

Nursing Mothers (see CONTRAINDICATIONS)

Terfenadine has caused decreased pup weight gain and survival in rats given doses 63 times and 125 times the human daily dose throughout pregnancy and lactation.

Pediatric Use

Safety and effectiveness of SELDANE-D in children below the age of 12 years have not been established.

ADVERSE REACTIONS

Cardiovascular Adverse Events

With terfenadine, rare reports of severe cardiovascular adverse effects have been received which include ventricular tachyarrhythmias (torsades de pointes), ventricular tachycardia, ventricular fibrillation, and cardiac arrest, hypotension, palpitations, syncope, and dizziness. Rare reports of deaths resulting from ventricular tachyarrhythmias have been received (see CONTRAINDICATIONS, WARNINGS, and PRECAUTIONS: Drug Interactions). Hypotension, palpitations, syncope, and dizziness could reflect undetected ventricular arrhythmias. IN SOME PATIENTS, DEATH, CARDIAC ARREST, OR TORSADES DE POINTES HAVE BEEN PRECEDED BY EPISODES OF SYNCOPE. (See WARNING BOX.) Rare reports of serious cardiovascular adverse events have been received, some involving QT prolongation and torsades de pointes, in apparently normal individuals without identifiable risk factors. There is not conclusive evidence of a causal relationship of these events with terfenadine. Although in rare cases there was measurable plasma terfenadine, the implications of this finding with respect to the variability of terfenadine metabolism in the normal population cannot be assessed without further study. In controlled clinical trials in otherwise normal patients with rhinitis, small increases in QTc interval were observed at doses of 60 mg t.i.d. In studies at 300 mg b.i.d. a mean increase in QTc of 10% (range −4% to +30%) (mean increase of 46 msec) was observed.

General Adverse Events

In double-blind, parallel, controlled studies in over 300 patients in which SELDANE-D was compared to extended-release pseudoephedrine, adverse reactions reported for greater than 1% of the patients receiving SELDANE-D were not clinically different from those reported for patients receiving pseudoephedrine (see Table below).

Frequently (>1%) Reported Adverse Events for SELDANE-D in Double-blind, Parallel, Controlled Clinical Trials*

Adverse Event	Percent of Patients Reporting		
	SELDANE-D (n=374)	Pseudoephedrine (n=287)	Placebo (n=193)
Central Nervous System			
Insomnia	26.9	26.8	4.2
Headache	17.4	17.1	22.3
Drowsiness/Sedation	7.2	4.9	11.4
Nervousness	5.7	8.4	1.6
Anorexia	3.7	3.8	0.0
Fatigue	2.3	1.4	2.1
Restlessness	2.3	1.0	0.0
Irritability	1.1	0.0	1.0
Disorientation	1.1	0.0	0.5
Increased Energy	1.1	0.0	0.0
Hyperkinesia	1.1	1.0	0.0
Autonomic			
Dry Mouth/Nose/Throat	21.7	21.3	11.4
Blurring of Vision	1.1	0.3	0.5
Gastrointestinal			
Nausea	4.3	6.6	5.2
Skin			
Rash	1.1	0.0	0.0
Cardiovascular			
Palpitations	2.4	3.8	0.5
Allergy Symptoms			
Sore Throat	1.9	1.7	1.0
Cough	1.6	0.3	1.0
Other			
Infection, Upper Respiratory	3.2	2.4	0.5
Taste Alterations	1.1	1.0	1.0

*SELDANE-D B.I.D., pseudoephedrine 120 mg B.I.D.

Pseudoephedrine may cause ephedrine-like reactions such as tachycardia, palpitations, headache, dizziness, or nausea. Sympathomimetic drugs have also been associated with certain untoward reactions including fear, anxiety

drowsiness, nervousness, mental weakness, pallor, respiratory difficulty, dysuria, insomnia, hallucinations, convulsions, CNS depression, arrhythmias, and cardiovascular collapse with hypotension.
In controlled clinical trials with terfenadine, using the recommended daily dose of 60 mg b.i.d., the incidence of adverse events in patients receiving terfenadine was similar to that reported in patients receiving placebo. These effects included:
Central Nervous System: Drowsiness, headache, fatigue, dizziness, nervousness, weakness, appetite increase
Gastrointestinal System: Abdominal distress, nausea, vomiting, change in bowel habits
Eye, Ear, Nose and Throat: Dry mouth/nose/throat, cough, sore throat, epistaxis
Skin: Eruption (including rash and urticaria) or itching
Also reported spontaneously during the marketing of terfenadine were alopecia (hair loss or thinning), angioedema, bronchospasm, confusion, depression, galactorrhea, insomnia, menstrual disorders (including dysmenorrhea), musculoskeletal symptoms, nightmares, paresthesia, photosensitivity, rapid rise of psoriasis, seizures, sinus tachycardia, sweating, thrombocytopenia, tremor, urinary frequency, and visual disturbances.
Also in clinical trials, several instances of mild or, in one case, moderate transaminase elevations were seen in patients receiving terfenadine. Mild elevations were also seen in placebo treated patients. Marketing experience include isolated reports of jaundice, cholestatic hepatitis, and hepatitis. In most cases available information is incomplete.

OVERDOSAGE
Information concerning possible overdosage and its treatment appears in Full Prescribing Information.

DOSAGE AND ADMINISTRATION
Adults and children 12 years and older: one tablet swallowed whole, morning and night.
USE OF DOSES IN EXCESS OF ONE TABLET B.I.D. IS NOT RECOMMENDED BECAUSE OF THE INCREASED POTENTIAL FOR QT INTERVAL PROLONGATION AND ADVERSE CARDIAC EVENTS. (See WARNING BOX.) USE OF SELDANE-D IN PATIENTS WITH SIGNIFICANT HEPATIC DYSFUNCTION AND IN PATIENTS TAKING KETOCONAZOLE ITRACONAZOLE, CLARITHROMYCIN, ERYTHROMYCIN, OR TROLEANDOMYCIN IS CONTRAINDICATED. (See CONTRAINDICATIONS, WARNINGS, and PRECAUTIONS, Drug Interactions.)

HOW SUPPLIED
SELDANE-D Tablets, containing 60 mg of terfenadine and 120 mg of pseudoephedrine hydrochloride in an outer press-coat for immediate release and 180 mg of pseudoephedrine hydrochloride in an extended-release core are supplied as follows:
NDC 0068-0722-61 Bottles of 100 tablets.
Tablets are white to off-white, biconvex capsule-shaped, debossed "SELDANE-D". Store at controlled room temperature (59-86°F) (15-30°C). Protect from moisture.

Prescribing Information as of January 1993

Merrell Dow Pharmaceuticals Inc.
Subsidiary of Marion Merrell Dow Inc.
Kansas City, MO 64114

U.S. Patents 3,878,217; 4,829,605; 4,996,001; 4,254,129

sel001093R

Harris' Mimic Swallowtail *(Mimoides lysithous harrisianus)* **Size:** Forewing length, 40mm **Habitat:** Areas adjacent to lowland swamps in Rio de Janeiro state, Brazil **Surviving number:** Estimated at 300–400 Photographed by Luiz Claudio Marigo

WILDLIFE AS CANON SEES IT

The nontoxic Harris' mimic swallowtail resembles, in color and wing pattern, the toxic Fluminense swallowtail. This type of evolved mimicry affords protection to the nontoxic species from predatory birds. Only one known colony remains of Harris' mimic swallowtail. Natural habitat along Brazil's beautiful coast has steadily declined from development since its colonization centuries ago. To save endangered species, it is vital to protect their habitats and understand the role of each species within the earth's ecosystems. As a global corporation committed to social and environmental concerns, we hope to foster a greater awareness of our common obligation to ensure that the earth's life-sustaining ecology survives intact for future generations.

Geographica

PAINTING BY WILLIAM H. BOND

PAMELA WEISS, ST. MARY'S UNIVERSITY

Trove of Maya Jade Recovered in Belize Shaft

His eyes turned skyward, a Maya noble presents his gods with an offering after the death of a ruler 1,500 years ago: pieces of a jade necklace ritually "killed" to release its life force. A kneeling assistant prepares to hurl other jade jewelry into an 18-foot-deep stone-lined shaft. The men will then cover the layer of jade with dirt and repeat the dramatic ritual again and again.

This scenario is based on a discovery last summer at the ruins of a Maya city near the village of Blue Creek in Belize. Archaeologist Pamela Weiss uncovered five layers of jade artifacts in the shaft. The 900 items—beads, pendants, and ear spools—represent the second largest trove of Maya jade yet found, after that unearthed in 1984 at Calakmul in Mexico. The 3.5-inch ear spool (bottom, at left) and the tube beside it belonged to a Maya noble.

"Blue Creek had at least 5,000 residents, a ball court, stelae, courtyards, and all the other trappings of an independent city," says project director Thomas Guderjan of St. Mary's University in San Antonio, Texas. On an escarpment separating the interior jungle of Belize from its coastal plains, the site was a major trading center for nearly a thousand years, beginning just after the time of Christ.

The jade-bearing shaft was well concealed, covered by a large stone disk with a hole in the center—"like something that came off Fred Flintstone's car," says Guderjan.

Over the disk a stela had been laid flat. Neither bore glyphs or other identifying carvings. Among the jade objects were pendants bearing the likenesses of gods often linked with Maya kingship.

"All the iconography and symbolic acts reflect the funeral ceremony of a king," Guderjan explains. "There may be a big burial down below. Everything we found reads death, death, death."

National Geographic, May 1995

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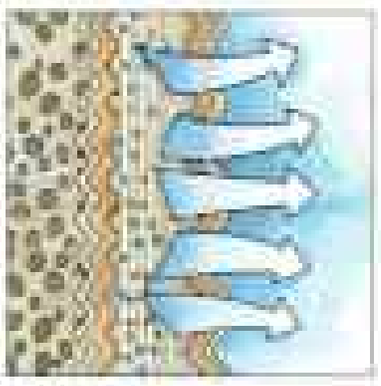

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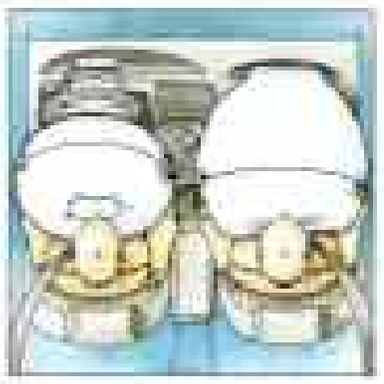

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NITSAN SHORER, BLACK STAR

Carvings Preserve a Polish Memory

Vigorous at the age of 90, Aharon Bilu devotes hours each day to a mission: keeping alive the memory of the wooden synagogues that once served a thriving Jewish community of 3.3 million in his native Poland. "I don't want things like this to disappear," says the retired carpenter, whose home in Pardés Hanna-Karkur, Israel, is crowded with 18 models he has created so far. "I want to rebuild what I know was there." Some 300 wooden synagogues were destroyed, most during World War II.

Bilu, who emigrated in 1925 to what was then Palestine and last visited Poland in 1935, began to carve his synagogue models in 1945. He duplicated from memory the structure in Kurów, the village of his birth. Then he found a book with photographs and drawings of others.

The Holocaust that ravaged Poland's Jews claimed most of Bilu's family. After Nazi occupation and decades of communist rule, only some 5,000 Jews remain in Poland (NATIONAL GEOGRAPHIC, September 1986). Now Bilu works six to nine hours a day on his carvings. "I live with my solitude," he says, "and these models."

The Unlikely Guide Who Mapped Mammoth Cave

When tourists flocked to Kentucky's Mammoth Cave in the 1840s, they were guided by a short, wiry young man named Stephen L. Bishop. Self-educated, conversant with Latin and Greek, a witty storyteller who dreamed of becoming a lawyer, Bishop was a slave.

"All the leading geologists of the time had private tours with him," says James O'Connor, a University of the District of Columbia geologist who is researching Bishop's life.

First seen by whites in the 1790s, Mammoth Cave was purchased in 1838 by Franklin Gorin as a tourist attraction. Bishop, one of Gorin's slaves, spent the next two decades exploring the caverns. Clutching an oil lantern and sometimes a ladder, he worked his way through narrow crevices and over dangerous shafts, naming prominent features, such as Mammoth Dome and River Styx, in this, the world's longest known cave system. His sketch map (left), the first comprehensive depiction of the cave, was published in 1845.

Freed in 1856, Bishop used $400 from his tips as a down payment for land adjoining the Mammoth Cave estate. He died a year later and was buried near the cave's original entrance.

PHOTO ILLUSTRATION BY SUSIE BRIMBERG; MAP FROM CAVE RESEARCH FOUNDATION

National Geographic, May 1995

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Geographica

CRAIG PACKER (BOTTOM); MICHAEL S. YAMASHITA

Fog Sculpture Honors Japanese Scientist

Youngsters frolicking in this museum garden would have pleased Ukichiro Nakaya. "When one wishes to use science to enrich our culture," said the scientist who first created artificial snow crystals, "one should view science as a form of art."

That linkage of art and science is reflected in the garden of the new museum dedicated to Naknya's study of snow and ice, in his home city of Kaga. His daughter Fujiko, an artist, designed the Greenland Glacial Moraine Garden, using her trademark, artificial fog. Underground pipes release moisture intermittently; atmospheric conditions create different effects each day, like this misty landscape.

Fujiko Nakaya brought the rocks from Greenland, where her father had studied snow and ice. "He spent four summers on the Greenland ice cap before his death in 1962," she says.

"He loved the land. It talked to him. He regarded a snow crystal as a letter sent from heaven."

Dominant Baboons Have Reproductive Woes

Rank has its privileges among female baboons. In this matrilineal society the most aggressive females garner the most fruit and seeds. Usually they mature and breed sooner than other females, their young are more likely to survive their first year, and their daughters join them at the top of the hierarchy.

"But high rank may exact some high costs," says Craig Packer of the University of Minnesota, who has studied olive baboons in Tanzania's Gombe National Park with Jane Goodall for 25 years. For example, this high-ranking female (left) nurturing a healthy infant has suffered four miscarriages.

Some matriarchs lose twice as many fetuses as subordinate females. Dominant females may also have reduced fertility.

Miscarriages and infertility may limit the number of aggressive females in the long run—unlike the situation with female spotted hyenas, all of which "are incredibly aggressive and suffer serious reproductive problems," Packer says.

He plans to investigate whether abnormal hormone production underlies the reproductive difficulties of high-ranking female baboons.

New Look at Victims of the *Vasa* Shipwreck

Filip may have been the helmsman. He was found near the *Vasa*'s rudder, and his diseased elbows reflect hard work at the helm. Adam (below) suffered from a broken nose and jaw. Was this sailor a brawler? Perhaps Beata was a seamstress; a notch in one of her front teeth was worn smooth, as if by thread pulled over it.

The names are fictitious, but details concerning 25 of the men and women who went down with the *Vasa* in Stockholm's harbor in 1628 have emerged from new studies by Ebba During, an osteologist at Stockholm University.

BROOKS WALKER

The *Vasa* was the most expensive and richly ornamented warship of its time in Sweden, but she capsized and sank on her maiden voyage. Most of her crew, and many visitors on board, survived. When she was recovered in 1961 (GEOGRAPHIC, January 1962), skeletal remains found in the hull were buried, then exhumed in 1989 by the Vasa Museum for During's study. The bones revealed that most of the victims had good medical care, she says. "The surprise was that they were in such good shape when they died."

—BORIS WEINTRAUB

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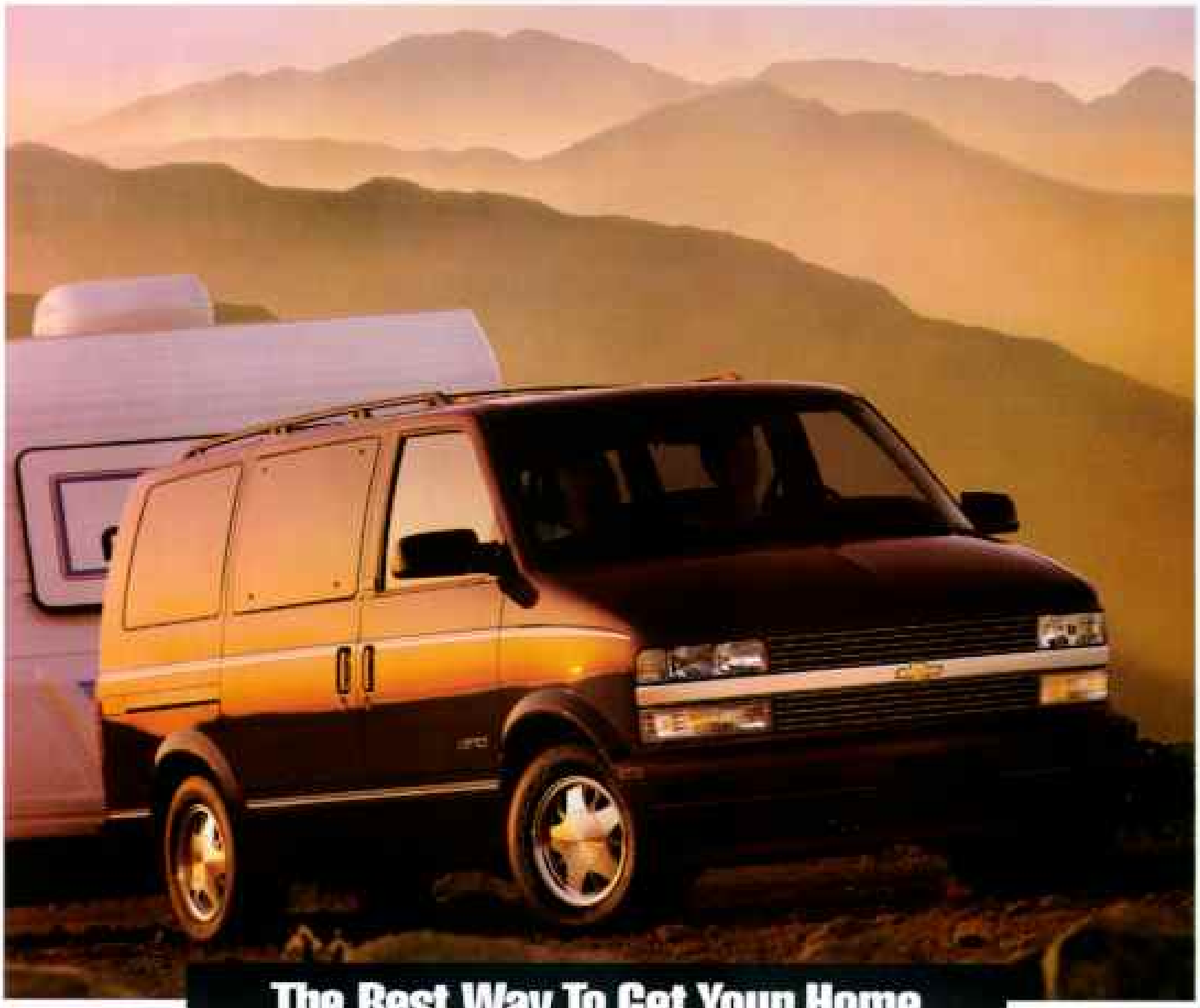

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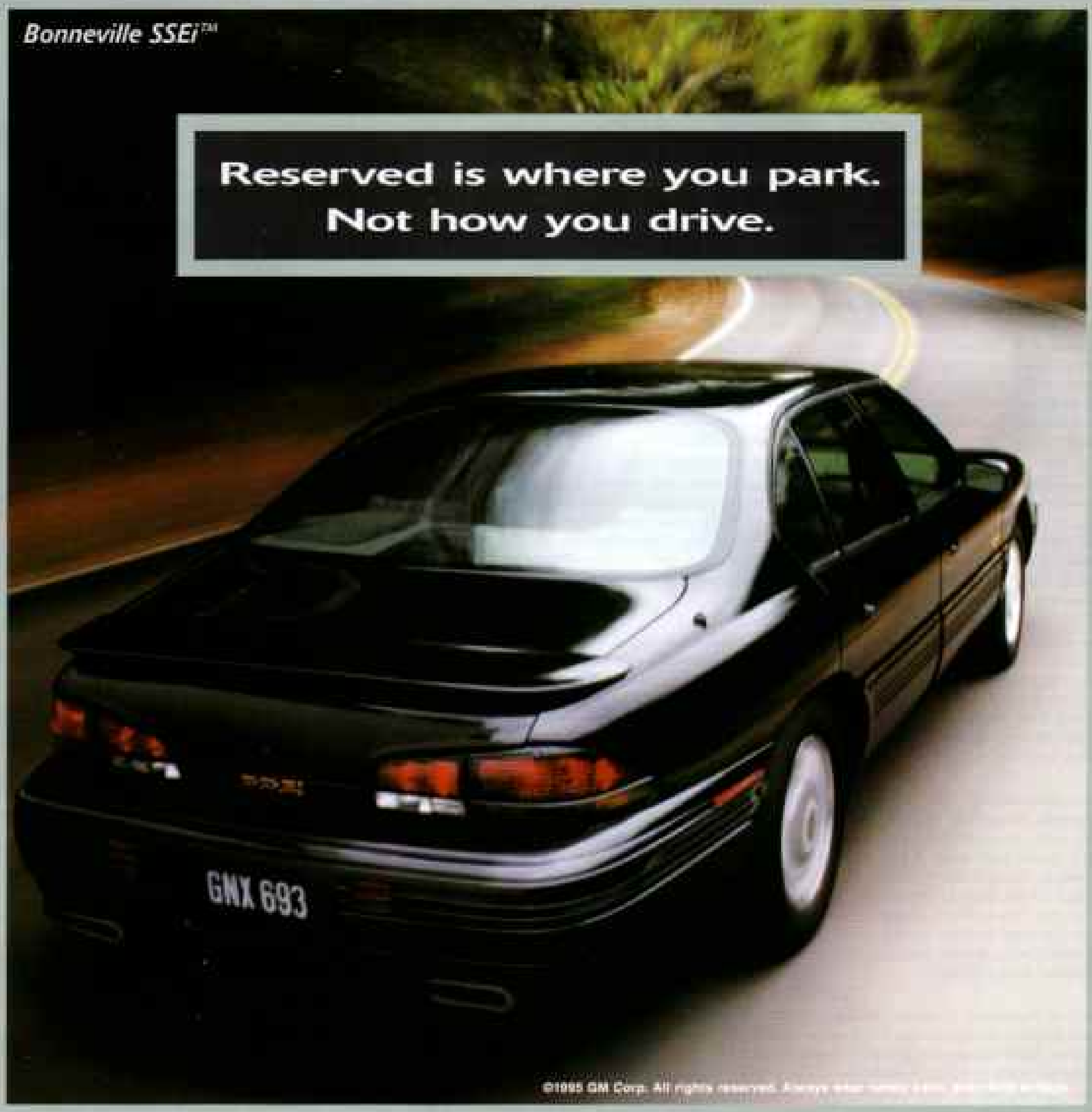

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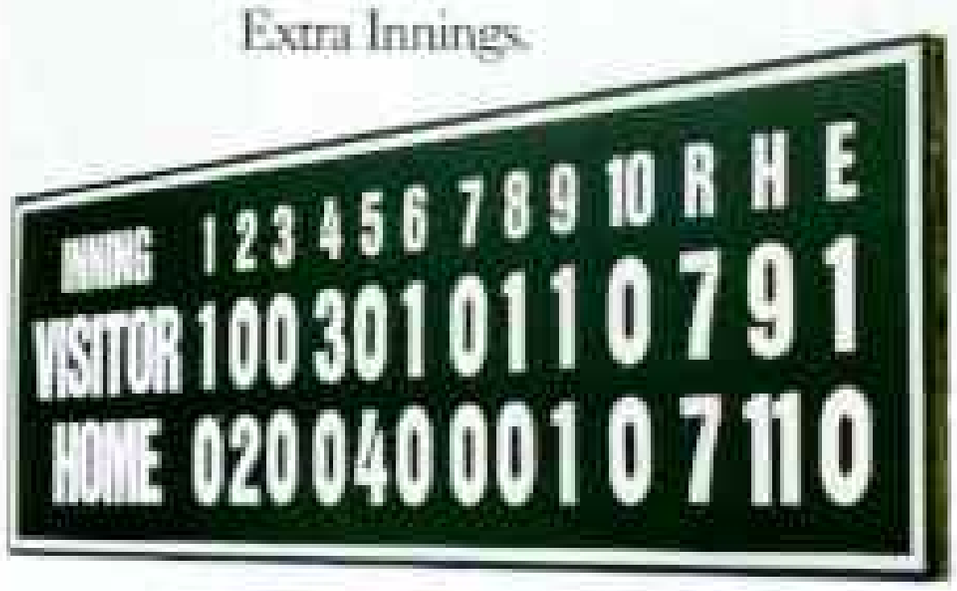

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CADE MARTIN (BOTH)

On the Rails in India: The Last Days of Steam

Visits to his father's workplace—the steam locomotive shed at Madurai in southern India—fired ambition in 11-year-old Pandu Raguraman (right) to become an engineer. The steam tradition in his family goes back to his great-grandfather, but it cannot go forward. Steam locomotives—workhorses of Indian railways since 1853—have all but given way to diesel and electric trains.

A new National Geographic film, "The Great Indian Railway," visits one of steam's last gasps—the 1993 Black Beauty Contest in West Bengal. With its mimic elephant trunk (above), the engine named Airavat, for a Hindu god's mount, took third place before making the sad last trip with other contestants to the dismantling yards.

Still one of the world's largest systems, each day India's trains carry more than 12 million passengers and one million tons of freight over 40,000 miles of track. The two-hour PBS documentary, produced by Bill and Jeanne Livingston, takes us on a journey.

Indians ride the *Grand Trunk Express* between New Delhi and Madras—a thousand miles—for a ticket price equivalent to ten dollars. Families pile aboard this "everyman's train" to visit friends and kin for weddings and festivals. Aboard the *Palace on Wheels* from Delhi, tourists pay vastly more to voyage in luxury to see the splendors of the Taj Mahal and the desert fortresses and palaces of Rajasthan.

The "toy train" to Darjiling climbs Himalayan foothills along its two-foot-gauge track as it has for more than a hundred years, still puffing, still steam.

"The Great Indian Railway" airs May 17 at 8 p.m. ET on PBS. A resource guide for young viewers is included in the May issue of WORLD magazine.

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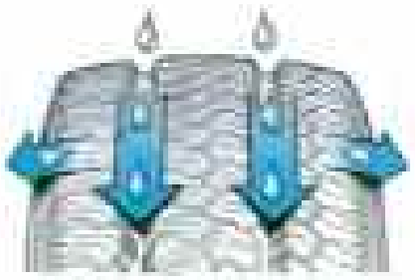

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GUS VAN DYK, ABPL PHOTO LIBRARY

What Killed the Rhinos? Elephants Suspected

Huge corpses were piling up last year in South Africa's Pilanesberg National Park north of Johannesburg. Seventeen adult white rhinos were found dead, including this one with her 18-month-old calf, which died a few days later, probably of trauma. A dozen of the victims bore unmistakable evidence of the killers: gaping penetration wounds that could only have been made by elephant tusks.

Finally, near the scene of one attack, park staff found three young bull elephants. They were judged responsible and shot. The assaults on rhinos ceased. But authorities were still stuck with a mystery—what had triggered such extremely rare behavior?

During the 1970s adult elephants in Kruger National Park were culled and 80 orphans moved to Pilanesberg. This gives Greg Stuart-Hill, the region's chief ecologist, some clues. For example, Pilanesberg has no mature bull to dominate young males as they grow up. So when these three drifted away from their group of females and calves at about age 15, they may have come prematurely into musth—the frenzy of the mating season—and taken out their aggression on the rhinos.

Powerboats Will Soon Leave a Cleaner Wake

Labor Day crowds of motorboats on the Colorado River near Lake Havasu don't do air and water quality any good. A typical two-stroke outboard motor releases as many unburned hydrocarbons in one hour as a car engine does in 40 hours. Almost a third of the gasoline that goes through such outboards does not burn; it is vented into the water.

More than 12 million outboard motors operate in U. S. waters. In 1998 new Environmental Protection Agency regulations, framed with the cooperation of marine-engine manufacturers, will go into effect. They aim to reduce hydrocarbon emissions 75 percent by 2006. Today's two-stroke outboards are prime targets. Future two-strokes will be direct-injection engines—a much cleaner design—or will be replaced by four-stroke engines.

RICK RICKMAN, MATRIX

National Geographic, May 1995

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CLARITIN®-D contains pseudoephedrine sulfate, which also is in many over-the-counter (OTC) and prescription medications. Too much pseudoephedrine sulfate can cause nervousness, sleeplessness, dizziness, and other related side effects. Therefore, be sure to tell your health-care provider if you are taking any OTC or prescription medications, including decongestants.

There are some people who should not take CLARITIN®-D. Other people need to be especially careful using it. Therefore, be sure to tell your health-care provider if you have high blood pressure, heart disease, diabetes, glaucoma, thyroid or liver problems, or difficulty urinating, or if you are taking MAO inhibitors (prescription medicines that treat depression), or if you become pregnant or are nursing a baby. Also, CLARITIN®-D must not be chewed or broken.

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CONTRAINDICATIONS: CLARITIN-D Tablets are contraindicated in patients who are hypersensitive to this medication or to any of its ingredients.

This product, due to its pseudoephedrine component, is contraindicated in patients with narrow-angle glaucoma or urinary retention, and in patients receiving monoamine oxidase (MAO) inhibitor therapy or within fourteen (14) days of stopping such treatment (see **Drug Interactions** section). It is also contraindicated in patients with severe hypertension, severe coronary artery disease, and in those who have shown hypersensitivity or idiosyncrasy to its components, to adrenergic agents, or to other drugs of similar chemical structures. Manifestations of patient idiosyncrasy to adrenergic agents include insomnia, dizziness, weakness, tremor, or arrhythmias.

WARNINGS: CLARITIN-D Tablets should be used with caution in patients with hypertension, diabetes mellitus, ischemic heart disease, increased intraocular pressure, hyperthyroidism, renal impairment, or prostatic hypertrophy. Central nervous system stimulation with convulsions or cardiovascular collapse with accompanying hypotension may be produced by sympathomimetic amines.

Use in Patients Approximately 60 years and Older: The safety and efficacy of CLARITIN-D Tablets in patients greater than 60 years old have not been investigated in placebo-controlled clinical trials. The elderly are more likely to have adverse reactions to sympathomimetic amines.

PRECAUTIONS: General: Because the doses of this fixed combination product cannot be individually titrated and hepatic insufficiency results in a reduced clearance of loratadine to a much greater extent than pseudoephedrine, CLARITIN-D Tablets should generally be avoided in patients with hepatic insufficiency. Patients with renal insufficiency (GFR < 30 mL/min) should be given a lower initial dose (one tablet per day) because they have reduced clearance of loratadine and pseudoephedrine.

Information for Patients: Patients taking CLARITIN-D Tablets should receive the following information: CLARITIN-D Tablets are prescribed for the relief of symptoms of seasonal allergic rhinitis. Patients should be instructed to take CLARITIN-D Tablets only as prescribed and not to exceed the prescribed dose. Patients should also be advised against the concurrent use of CLARITIN-D Tablets with over-the-counter antihistamines and decongestants.

This product should not be used by patients who are hypersensitive to it or to any of its ingredients. Due to its pseudoephedrine component, this product should not be used by patients with narrow-angle glaucoma, urinary retention, or by patients receiving a monoamine oxidase (MAO) inhibitor or within 14 days of stopping use of an MAO inhibitor. It also should not be used by patients with severe hypertension or severe coronary artery disease.

Patients who are or may become pregnant should be told that this product should be used in pregnancy or during lactation only if the potential benefit justifies the potential risk to the fetus or nursing infant.

Patients should be instructed not to break or chew the tablet.

Drug Interactions: No specific interaction studies have been conducted with CLARITIN-D Tablets. However, loratadine (10 mg once daily) has been safely coadministered with therapeutic doses of erythromycin, cimetidine, and ketoconazole in controlled clinical pharmacology studies. Although increased plasma concentrations (AUC 0-24 hrs) of loratadine and/or descarboethoxyloratadine were observed following coadministration of loratadine with each of these drugs in normal volunteers (n=24 in each study), there were no clinically relevant changes in the safety profile of loratadine, as assessed by electrocardiographic parameters, clinical laboratory tests, vital signs, and adverse events. There were no significant effects on QT_c intervals, and no reports of sedation or syncope. No effects on plasma concentrations of cimetidine or ketoconazole were observed. Plasma concentrations (AUC 0-24 hrs) of erythromycin decreased 15% with coadministration of loratadine relative to that observed with erythromycin alone. The clinical relevance of this difference is unknown. These above findings are summarized in the following table:

Effects on Plasma Concentrations (AUC 0-24 hrs) of Loratadine and Descarboethoxyloratadine After 10 Days of Coadministration (Loratadine 10 mg) in Normal Volunteers

	Loratadine	Descarboethoxyloratadine
Erythromycin (500 mg Q8h)	+ 40%	+46%
Cimetidine (300 mg QID)	+103%	+ 6%
Ketoconazole (200 mg Q12h)	+307%	+73%

There does not appear to be an increase in adverse events in subjects who received oral contraceptives and loratadine.

CLARITIN-D Tablets (pseudoephedrine component) are contraindicated in patients taking monoamine oxidase inhibitors and for 2 weeks after stopping use of an MAO inhibitor. The antihypertensive effects of beta-adrenergic blocking agents, methyldopa, mecamylamine, reserpine, and veratrum alkaloids may be reduced by sympathomimetics. Increased ectopic pacemaker activity can occur when pseudoephedrine is used concomitantly with digitalis.

Drug/Laboratory Test Interactions: The *in vitro* addition of pseudoephedrine to sera containing the cardiac isoenzyme MB of serum creatinine phosphokinase progressively inhibits the activity of the enzyme. The inhibition becomes complete over 6 hours.

Carcinogenesis, Mutagenesis, Impairment of Fertility: There are no animal or laboratory studies on the combination product loratadine and pseudoephedrine sulfate to evaluate carcinogenesis, mutagenesis, or impairment of fertility.

In an 18-month oncogenicity study in mice and a 2-year study in rats loratadine was administered in the diet at doses up to 40 mg/kg (mice) and 25 mg/kg (rats). In the carcinogenicity studies pharmacokinetic assessments were carried out to determine animal exposure to the drug. AUC data demonstrated that the exposure of mice given 40 mg/kg of loratadine was 3.6 (loratadine) and 18 (active metabolite) times higher than a human given 10 mg/day. Exposure of rats given 25 mg/kg of loratadine was 28 (loratadine) and 67 (active metabolite) times higher than a human given 10 mg/day. Male mice given 40 mg/kg had a significantly higher incidence of hepatocellular tumors (combined adenomas and carcinomas) than concurrent controls. In rats, a significantly higher incidence of hepatocellular tumors (combined adenomas and carcinomas) was observed in males given 10 mg/kg and males and females given 25 mg/kg. The clinical significance of these findings during long-term use of loratadine is not known.

In mutagenicity studies with loratadine alone, there was no evidence of mutagenic potential in reverse (Ames) or forward point mutation (CHO-HGPRT) assays, or in the assay for DNA damage (Rat Primary Hepatocyte Unscheduled DNA Assay) or in two assays for chromosomal aberrations (Human Peripheral Blood Lymphocyte Clastogenesis Assay and the Mouse Bone Marrow Erythrocyte Micronucleus Assay). In the Mouse Lymphoma Assay, a positive finding occurred in the nonactivated but not the activated phase of the study.

Loratadine administration produced hepatic microsomal enzyme induction in the mouse at 40 mg/kg and rat at 25 mg/kg, but not at lower doses.

Decreased fertility in male rats, shown by lower female conception rates, occurred at approximately 64 mg/kg of loratadine and was reversible with cessation of dosing. Loratadine had no effect on male or female fertility or reproduction in the rat at doses approximately 24 mg/kg.

Pregnancy Category B: There was no evidence of animal teratogenicity in reproduction studies performed on rats and rabbits with this combination at oral doses up to 150 mg/kg (885 mg/m² or 5 times the recommended daily human dosage of 250 mg or 185 mg/m²), and 120 mg/kg (1416 mg/m² or 8 times the recommended daily human dosage), respectively. There are, however, no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of human response, CLARITIN-D Tablets should be used during pregnancy only if clearly needed.

Nursing Mothers: It is not known if this combination product is excreted in human milk. However, loratadine when administered alone and its metabolite descarboethoxyloratadine pass easily into breast milk and achieve concentrations that are equivalent to plasma levels, with an AUC_{milk}/AUC_{plasma} ratio of 1.17 and 0.85 for the parent and active metabolite, respectively. Following a single oral dose of 40 mg, a small amount of loratadine and metabolite was excreted into the breast milk (approximately 0.03% of 40 mg after 48 hours). Pseudoephedrine administered alone also distributes into breast milk of the lactating human female. Pseudoephedrine concentrations in milk are consistently higher than those in plasma. The total amount of drug in milk as judged by the area under the curve (AUC) is 2 to 3 times greater than in plasma. The fraction of a pseudoephedrine dose excreted in milk is estimated to be 0.4% to 0.7%. A decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the mother. Caution

should be exercised when CLARITIN-D Tablets are administered to a nursing woman.

Pediatric Use: Safety and effectiveness in children below the age of 12 years have not been established.

ADVERSE REACTIONS: Experience from controlled and uncontrolled clinical studies involving approximately 10,000 patients who received the combination of loratadine and pseudoephedrine sulfate for a period of up to 1 month provides information on adverse reactions. The usual dose was one tablet every 12 hours for up to 28 days.

In controlled clinical trials using the recommended dose of one tablet every 12 hours, the incidence of reported adverse events was similar to those reported with placebo, with the exception of insomnia (16%) and dry mouth (14%).

REPORTED ADVERSE EVENTS WITH AN INCIDENCE OF ≥2% ON CLARITIN-D IN PLACEBO-CONTROLLED CLINICAL TRIALS

PERCENT OF PATIENTS REPORTING

	CLARITIN-D n=1023	Loratadine n=543	Pseudoephedrine n=548	Placebo n=922
Headache	19	18	17	19
Insomnia	16	4	19	3
Dry Mouth	14	4	9	3
Somnolence	7	8	5	4
Nervousness	5	3	7	2
Dizziness	4	1	5	2
Fatigue	4	6	3	3
Dyspepsia	3	2	3	1
Nausea	3	2	3	2
Pharyngitis	3	3	2	3
Anorexia	2	1	2	1
Thirst	2	1	2	1

Adverse event rates did not appear to differ significantly based on age, sex, or race, although the number of non-white subjects was relatively small.

In addition to those adverse events reported above (≥2%), the following less frequent adverse events have been reported in at least one CLARITIN-D treated patient:

Autonomic Nervous System: Abnormal lacrimation, dehydration, flushing, hypoesthesia, increased sweating, mydriasis.

Body As A Whole: Asthenia, back pain, blurred vision, chest pain, conjunctivitis, earache, ear infection, eye pain, fever, flu-like symptoms, leg cramps, lymphadenopathy, malaise, photophobia, rigors, tinnitus, viral infection, weight gain.

Cardiovascular System: Hypertension, hypotension, palpitations, peripheral edema, syncope, tachycardia, ventricular extrasystoles.

Central and Peripheral Nervous System: Dysphonia, hyperkinesia, hypertonia, migraine, paresthesia, tremors, vertigo.

Gastrointestinal System: Abdominal distension, abdominal distress, abdominal pain, altered taste, constipation, diarrhea, eructation, flatulence, gastritis, gingival bleeding, hemorrhoids, increased appetite, stomatitis, taste loss, tongue discoloration, toothache, vomiting.

Liver and Biliary System: Hepatic function abnormal.

Musculoskeletal System: Arthralgia, myalgia, torticollis.

Psychiatric: Aggressive reaction, agitation, anxiety, apathy, confusion, decreased libido, depression, emotional lability, euphoria, impaired concentration, irritability, paroniria.

Reproductive System: Dysmenorrhea, impotence, intermenstrual bleeding, vaginitis.

Respiratory System: Bronchitis, bronchospasm, chest congestion, coughing, dry throat, dyspnea, epistaxis, halitosis, nasal congestion, nasal irritation, sinusitis, sneezing, sputum increased, upper respiratory infection, wheezing.

Skin and Appendages: Acne, bacterial skin infection, dry skin, eczema, edema, epidermal necrolysis, erythema, hematoma, pruritus, rash, urticaria.

Urinary System: Dysuria, micturition frequency, nocturia, polyuria, urinary retention.

The following additional adverse events have been reported with the use of CLARITIN Tablets: alopecia, altered salivation, amnesia, anaphylaxis, angioneurotic edema, blepharospasm, breast enlargement, breast pain, dermatitis, dry hair, erythema multiforme, hemoptysis, hepatic necrosis, hepatitis, jaundice, laryngitis, menorrhagia, nasal dryness, photosensitivity reaction, purpura, seizures, supraventricular tachyarrhythmias, and urinary discoloration.

Pseudoephedrine may cause mild CNS stimulation in hypersensitive patients. Nervousness, excitability, restlessness, dizziness, weakness, or insomnia may occur. Headache, drowsiness, tachycardia, palpitation, pressor activity, and cardiac arrhythmias have been reported. Sympathomimetic drugs have also been associated with other untoward effects, such as fear, anxiety, tenseness, tremor, hallucinations, seizures, pallor, respiratory difficulty, dysuria, and cardiovascular collapse.

OVERDOSAGE: Somnolence, tachycardia, and headache have been reported with doses of 40 to 180 mg of CLARITIN Tablets. In the event of overdosage, general symptomatic and supportive measures should be instituted promptly and maintained for as long as necessary. Treatment of overdosage would reasonably consist of emesis (ipecac syrup), except in patients with impaired consciousness, followed by the administration of activated charcoal to absorb any remaining drug. If vomiting is unsuccessful, or contraindicated, gastric lavage should be performed with normal saline. Saline cathartics may also be of value for rapid dilution of bowel contents. Loratadine is not eliminated by hemodialysis. It is not known if loratadine is eliminated by peritoneal dialysis.

In large doses, sympathomimetics may give rise to giddiness, headache, nausea, vomiting, sweating, thirst, tachycardia, precordial pain, palpitations, difficulty in micturition, muscular weakness and tenseness, anxiety, restlessness, and insomnia. Many patients can present a toxic psychosis with delusions and hallucinations. Some may develop cardiac arrhythmias, circulatory collapse, convulsions, coma, and respiratory failure.

The oral LD_{50} values for the mixture of the two drugs were greater than 525 and 1839 mg/kg in mice and rats, respectively. Oral LD_{50} values for loratadine were greater than 5000 mg/kg in rats and mice. Doses of loratadine as high as 10 times the recommended daily clinical dose showed no effect in rats, mice, and monkeys.

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Earth Almanac

Leapin' Lizards Can't Get a Grip

Surely the world's most arboreally challenged reptile is the western fence lizard of California. In Monterey County the trees rain lizards, as a trio of botanists inadvertently discovered. While they were studying the nutrient cycle of an oak woodland, they placed buckets around trees to collect falling leaves and twigs. Besides the litter fall, they got "lizardfall."

In two years 198 lizards turned up in buckets covering an area of 422 square feet. That works out to 30,000 lizards a year on an acre. Many lizards take the plunge repeatedly; by marking individuals, the researchers found that the average western fence lizard falls six times a year.

"In spring, most that fall are males," says William H. Schlesinger of Duke University. "They do push-ups on tree limbs, a courtship display females find attractive. Perhaps some overdo it and fall." Another possibility: An insect flies by and an overzealous lizard pursues it—right into space.

DAVID CLARK

Though Namibia's Seals Starve, Culling Continues

Bedraggled and hungry, this Cape fur seal pup on Namibia's coast probably did not survive—more than half the 200,000 pups born in late 1993 have not. At least 120,000 starved when normally cold offshore waters turned warm, and stagnant algal blooms drifted near shore. Fish vanished, depriving the pups' mothers of nutrition and the ability to nurse their young.

But Namibia's seals face double trouble. The government targeted 55,000 male seals and pups for culling last year—most by clubbing—to protect fishermen from competition and to sell seal pelts and male genitals as aphrodisiacs. Officials want to reduce the colony to 500,000, down from a million in 1993, which stirs international protest.

"South Africans no longer cull the seals," says David Lavigne, executive director of the International Marine Mammal Association. "Their research shows that killing seals could harm fishing interests—the seals eat fish that prey on some commercial species. The Namibians haven't examined such questions."

Seagoing Ships in Paraguay? Wetland at Risk

Teeming with more than a thousand species of animals, a vast wetland known as the Pantanal lies in western Brazil, eastern Bolivia, and northern Paraguay. Each year this labyrinth of rivers, lakes, and ponds is flooded by torrential rains, becoming a watery wilderness the size of Nebraska.

The Pantanal is threatened by a massive river-channeling project, the Hidrovia. It would allow freighters to travel more than 2,000 miles from Buenos Aires up the Paraná and Paraguay Rivers to trade in Brazil, Argentina, Uruguay, Paraguay, and Bolivia. The proposed waterway cuts through the Pantanal and would drain much of it. Unless the plan is revised, "we could have another Everglades on our hands," says Gonzalo Castro, a World Wildlife Fund ecologist. A three-million-dollar study by the Inter-American Development Bank will assess potential environmental impacts.

—John L. Elliot


LARRY C. PRICE

National Geographic, May 1995

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On Assignment

JAMES L. STANFIELD

This could have been JIM STANFIELD's last picture. The veteran GEOGRAPHIC photographer snapped the self-portrait 2,000 feet over Sumatra as he sat in the gunner's seat of a re-creation of a 1919 Vickers Vimy bomber, featured in this issue. Moments later the plane's starboard engine failed.

"I knew we were going down," says Jim, "but I wasn't worried. The pilot, Peter McMillan, really knew what he was doing. There wasn't a chance to panic; I was making pictures the whole time—until Peter landed us safely in a rice field."

Making Geographic pictures for nearly three decades, Jim has covered everything from rats to royalty. His article on the Vatican (December 1985) won kudos from Pope John Paul II and grew into a book, now translated into 11 languages.

But is a plane crash part of a day's work? "Well, I was in a helicopter crash in New Orleans in 1971; that was a mess of spewing oil hoses. The Vimy crash was cleaner."

"The one time I accidentally touched a *Phyllobates terribilis* frog my finger went numb," recalls biologist MARK MOFFETT (below, at right). Both he and assistant Essdras Suarez wear gloves as poison-dart maker Paulino Hueso releases a deadly yellow hopper.

"Lucky for me, skin contact alone doesn't kill; the frog toxin must enter your bloodstream through an abrasion or cut to work." Unlucky for Mark, a sunburn blistered his legs as he dragged his dugout canoe up Colombia's Saija River. "For a week I couldn't stand up unassisted," he says. "That pain was bad enough, but the possibility of a *terribilis* bumping into my open sores made me very nervous."

More of Mark's adventures appear in *The High Frontier: Exploring the Tropical Rainforest Canopy* (Harvard University Press).

MARK W. MOFFETT

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Geoguide

THE VIMY FLIGHT

• Because the earth's axis of rotation is tilted with respect to the sun, seasons south of the Equator are the opposite of those north of it. In what season of 1994 did the pilots take off from England? In what season did they land in Australia—41 days later? What season is it in Australia today?

• The map on pages 10-11 shows the four continents visited by the Vimy. On which one did the pilots make the fewest stops? Which three continents did the mapmaker omit from the map?

• In 1919 the prime minister of Australia challenged fliers to make the 11,000-mile trip from England to Australia within 30 days. If you were to challenge aviators to make the same trip today, roughly what time limit would you allow? (Assume they fly a jet at 600 miles an hour nonstop and refuel in flight.)

• Using the map in the story and following the marked route, can you list the three countries in Europe, the one in Africa, and the ten in Asia where the Vimy landed between its departure from Farnborough and its arrival in Darwin? (Hint: Remember that Singapore is both a city and a country.)

• The Vimy article shows many different aerial views of the earth. What kinds of human impact on the environment—such as agricultural clearing, roads, towns, and monuments—are apparent in the photographs?

• How many degrees of longitude did the pilots travel as they flew eastward from England to Australia? About what fraction of the earth's 360 degrees did the Vimy cover?

• How many degrees of latitude did the Vimy cover in its southward course from departure to Melbourne, Australia? What fraction of the earth's 180 degrees, measured Pole to Pole, does that represent?

ALL BY JAMES L. STANFIELD

REPLICA OF A WORLD WAR I-VINTAGE BRITISH BOMBER, THE VICKERS VIMY (TOP) MAKES ITS WAY FROM ENGLAND TO AUSTRALIA ALONG THE ROUTE OF THE ORIGINAL 1919 FLIGHT.

GATHERED ON A SWELTERING AIRSTRIP IN MALAYSIA (ABOVE), CHILDREN ENJOY A BLAST OF PROPELLER-DRIVEN WIND. COPILOT LANG KIDBY (LEFT) REPAIRS THE TAIL-WHEEL ASSEMBLY, DAMAGED DURING AN EMERGENCY LANDING IN A RICE FIELD IN INDONESIA.

USE THE GEOGUIDE PAGE ALONG WITH THE ARTICLE "THE VIMY FLIES AGAIN" IN THIS ISSUE TO HELP CAPTURE THE INTEREST OF YOUNG READERS AND STIMULATE DISCUSSION WITH THEM. GEOGUIDE IS FEATURED FOUR TIMES A YEAR.

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