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NATIONAL GEOGRAPHIC

October 1985

NOT LONG AGO I flew over the Caribbean off Cartagena, Colombia, with oceanographer Mike Costin, an expert on sunken ships along the Spanish Main. We spotted only one wreck, now marked with a light to warn other ships off the reef that doomed her, but we knew that below us were literally hundreds of colonial-period ships littering the ocean floor.

Like so many others, Mike is particularly captivated by the story of the richest treasure ship of all—*San José*, sunk by a huge explosion during battle with the English in 1708. Down with her went a manifested cargo of gold worth half a billion dollars at today's prices; other private treasure aboard could double that value. It is probably the richest cargo ever sent to the bottom, where it rests today at a depth that has thus far safeguarded her secrets.

Not a few of the colonial wrecks were the victims of pirates after treasure. In our day, opportunists using modern technology have succeeded where the old pirates failed—looting ships, and without firing a shot. But as Mike points out, the day of counting a ship's value in treasure alone is gone.

Fortunately, most nations have come to realize that the world's waters are stocked with untouched time capsules in the form of sunken ships that span almost the entire history of man. As technology picks the lock on Davy Jones's locker, scholars will increasingly turn to the study of this greatest historical archive on earth.

Colombia has made it clear to all comers that all wrecks in her waters are archaeological sites of great national importance and will be approached and salvaged as such.

Before too many years we hope to report on the scientific salvage of the *San José*, just as past articles have told of discovering such other Spanish shipwrecks as the *Atocha* (June 1976) and *Santa Margarita* (February 1982). But for now we bring you the saga of the salvage of a ship with no treasure of silver or gold but great historical riches. H.M.S. *Pandora* ripped open her bottom on Australia's Great Barrier Reef 194 years ago. Bound in irons in *Pandora*'s "box" were 14 *Bounty* crewmen being returned to England to stand trial for mutiny. GEOGRAPHIC veteran Luis Marden, who found the wreck of the *Bounty* in 1957, tells the story.

Wilbur E. Garrett

EDITOR

Wreck of H.M.S. *Pandora* 423

*Luis Marden, who found the *Bounty*'s remains 28 years ago, dives on the vessel sent in pursuit of the mutineers. *Pandora* foundered on an Australian reef with manacled prisoners still inside a deckhouse cell.*

The Two Samoas, Still Coming of Age 452

Sharing a common heritage, American and Western Samoa follow different paths. Robert Booth and Melinda Berge explore these South Pacific islands.

Frankincense Trail 474

Great kingdoms arose on wealth derived from the fragrant resin coveted throughout the ancient world. Thomas J. Abercrombie and Lynn Abercrombie retrace the route of the camel caravans through Arabian lands little changed since the trade's heyday.

Usumacinta River— Troubles on a Border 514

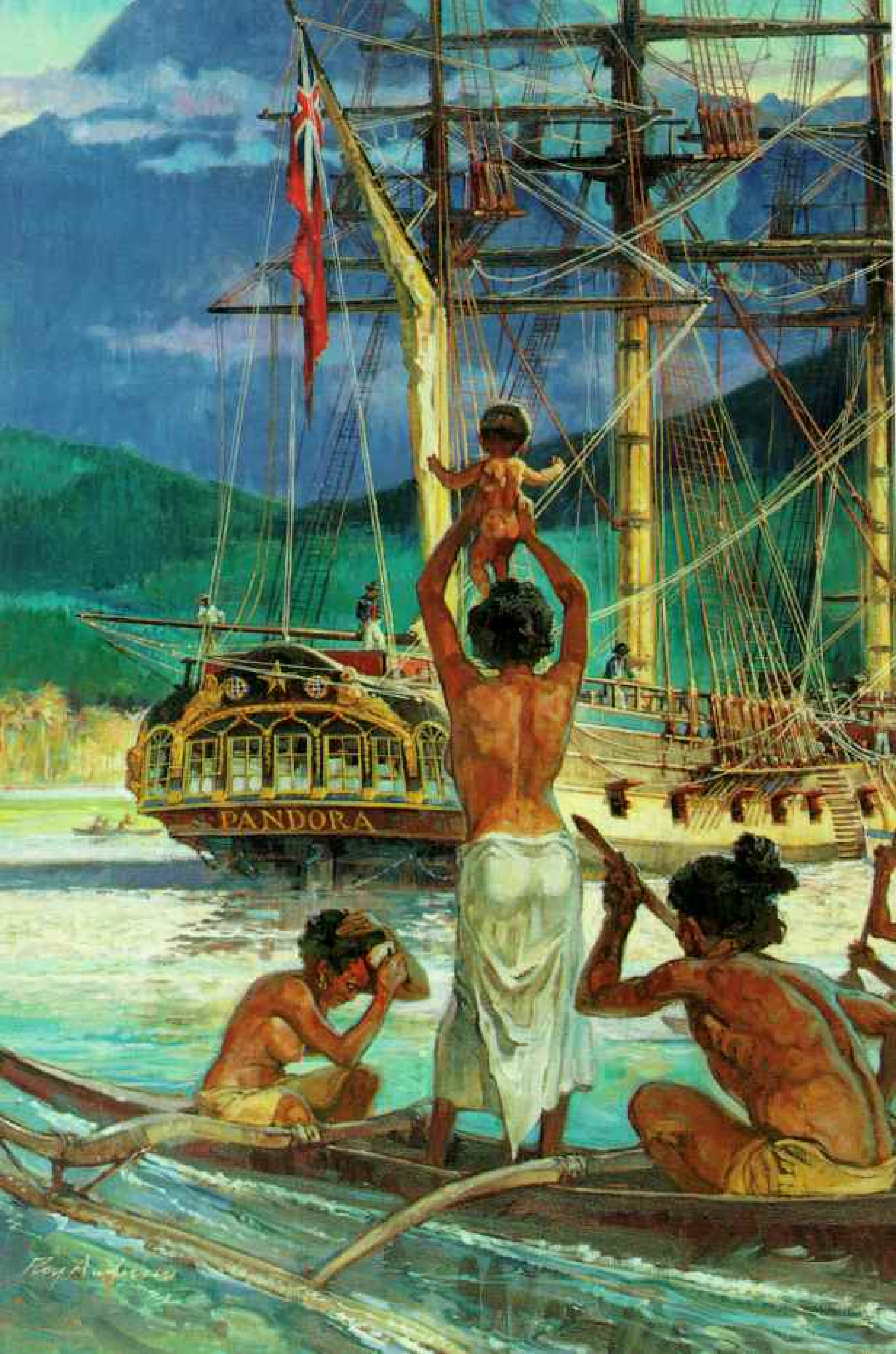
Exploring the river that separates Mexico and Guatemala, S. Jeffrey K. Wilkerson and David Hiser trek a dense tropical rain forest that shelters ancient Maya ruins and all-too-modern guerrilla bases. Proposed dams threaten the region's heritage and ecology.

The Triumphant Trumpeter Swan 544

The world's largest wild swan was thought to be nearly extinct 50 years ago. Charles A. Bergman and Art Wolfe relate its surprisingly successful status today.

COVER: *Dye motif adorns the hand of a woman in North Yemen on the ancient frankincense trail. Photo by Lynn Abercrombie.*

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Ray B. Jones



Tragic sequel to
Bounty mutiny

Wreck of H.M.S. *Pandora*

Found on
Australia's
Great Barrier Reef

By LUIS MARDEN

FORMER CHIEF, NATIONAL GEOGRAPHIC FOREIGN STAFF

From a prison box on the stern of a British man-of-war at Tahiti, 14 Bounty crewmen look their last on wives and children. Peggy, consort of George Stewart, holds aloft their daughter Charlotte, while her companion gashes her scalp in grief. Sailing home to Britain, H.M.S. Pandora struck Australia's Great Barrier Reef and sank with the loss of 35 men, four of them mutineers, two still in irons.

Author Luis Marden—who found the remains of the Bounty in 1957—dived with Australian archaeologists to study Pandora's remains.

"Never fear my Boys, we'll all go to hell together."

The crew had just time to leap over board, accompanying it with a most dreadful yell. The cries of the men drowning in the water was at first awful in the extreme; but as they sunk, and became faint, it died away by degrees.

—GEORGE HAMILTON, SHIP'S SURGEON

FAINTLY, across nearly two centuries and through one hundred feet of seawater, the cries echo in my ears, attenuated and distant like voices in a dream, until they fade and die in the tinkling bubbles of my breathing. I am sinking slowly, bathed in steel blue light, toward the silent seabed that received those drowning sailors of long ago.

Beneath me a dark arm of iron materializes in the blue. At 110 feet I bump gently on the bottom, raising puffs of silver sand. Small fish turn and flash like burnished pewter in the pearlescent light. I hook one arm round the gigantic fluke of a buried anchor to hold against the tugging current. Strewn along the seafloor, the dark shapes of anchors, guns, chain pump wheel, and other ship fittings recede into the glow of distance.

I am embracing a piece of history, the wreckage of H.M.S. *Pandora*, 24 guns, Captain Edwards, lost on Australia's Great Barrier Reef on 29th August, 1791. She took with her to the bottom 35 men, four of whom had lived through the most celebrated sea story in history, the mutiny and piratical seizure of His Majesty's Armed Vessel *Bounty*.

For more than three decades I have lived with the *Bounty* story. My fascination with that turbulent tale has continued to grow from the moment I found the remains of the *Bounty* off Pitcairn Island in 1957.

Now, by a turn of fortune, when I touch the remains of the vessel sent to capture the mutineers, I am the first to lay hands on both sunken ships of that tragic story.

Pandora found only the mutineers who were foolish enough to remain on Tahiti.

Leap for life will end in death for some manacled mutineers scrambling from "Pandora's Box," their prison on the quarterdeck, as the ship takes her last heel. Ten prisoners survived.





Fletcher Christian, acting lieutenant and ringleader of the mutiny, had taken *Bounty* and, with eight shipmates and Polynesian women and men, sailed into self-exile on Pitcairn Island, where a handful of their descendants live today.*

Hollywood and a bad press have unjustly given William Bligh, master of the *Bounty*, an evil name. He was irascible and often used "a great deal of abuseful words," but he took good care of his men, and he was a superb seaman and navigator, like his former chief James Cook.

EDWARD EDWARDS of the *Pandora*, on the other hand, was all that films and popular fiction have libeled Bligh. When this callous commander seized his 14 prisoners at Tahiti (some, believing themselves innocent, voluntarily gave themselves up), he clapped them, "Iron'd Hand and foot," into a wooden cell erected on the

*See "I Found the Bones of the *Bounty*," by Luis Marden, NATIONAL GEOGRAPHIC, December 1957, and "Pitcairn and Norfolk—The Saga of *Bounty's* Children," by Ed Howard, in the October 1983 GEOGRAPHIC.



Drawn by the moon, green turtles lumber ashore on Pandora Cay to lay their eggs (right). During unusually high tides in the austral spring of 1984, as many as 7,000 turtles a night came to islets on the Great Barrier Reef. On submerged coral north from this cay, Pandora ended her days.

Sheltered in makeshift sail tents (above) on a nearby cay, the surviving officers and crew evaded the torrid sun, as shown in a sketch by mutineer Peter Heywood. But Capt. Edward Edwards would neither permit the ten remaining mutineers to enter the tents nor give them use of an old sail. Although they buried themselves to the neck in sand during the day, the equatorial sun left them looking "as if dipped in . . . tubs of boiling water."



quarterdeck. One of the prisoners, James Morrison, former boatswain's mate of the *Bounty*, recorded:

"The Carpenters were set to work to build a kind of Round-House . . . this place, which we stiled Pandora's Box, was only 11 feet in length and 18 feet wide . . . in which were two small Scuttles of 9 inches, and one on the Top of 18 or 20 inches square, secured with a bolt . . . the heat was so intense, that the Sweat . . . ran in Streams to the Scuppers, and soon produced Maggots. . . . This and two necessary Tubs which were

kept in the Box, made it truly disagreeable.

"The box being built in a rough manner admitted the Rain freely. . . . This soon brought sickness amongst us, and the Surgeon a very humane Gentleman, gave all the Assistance he could, but at the same time informed us, that Capt. Edwards had given such Orders, as prevented him from being of any Service. . . ."

This is the accommodation that Edwards, in a self-serving letter to the Admiralty, described as an "airy and healthy situation." *(Continued on page 435)*

PATRICK BAKER



Bounty

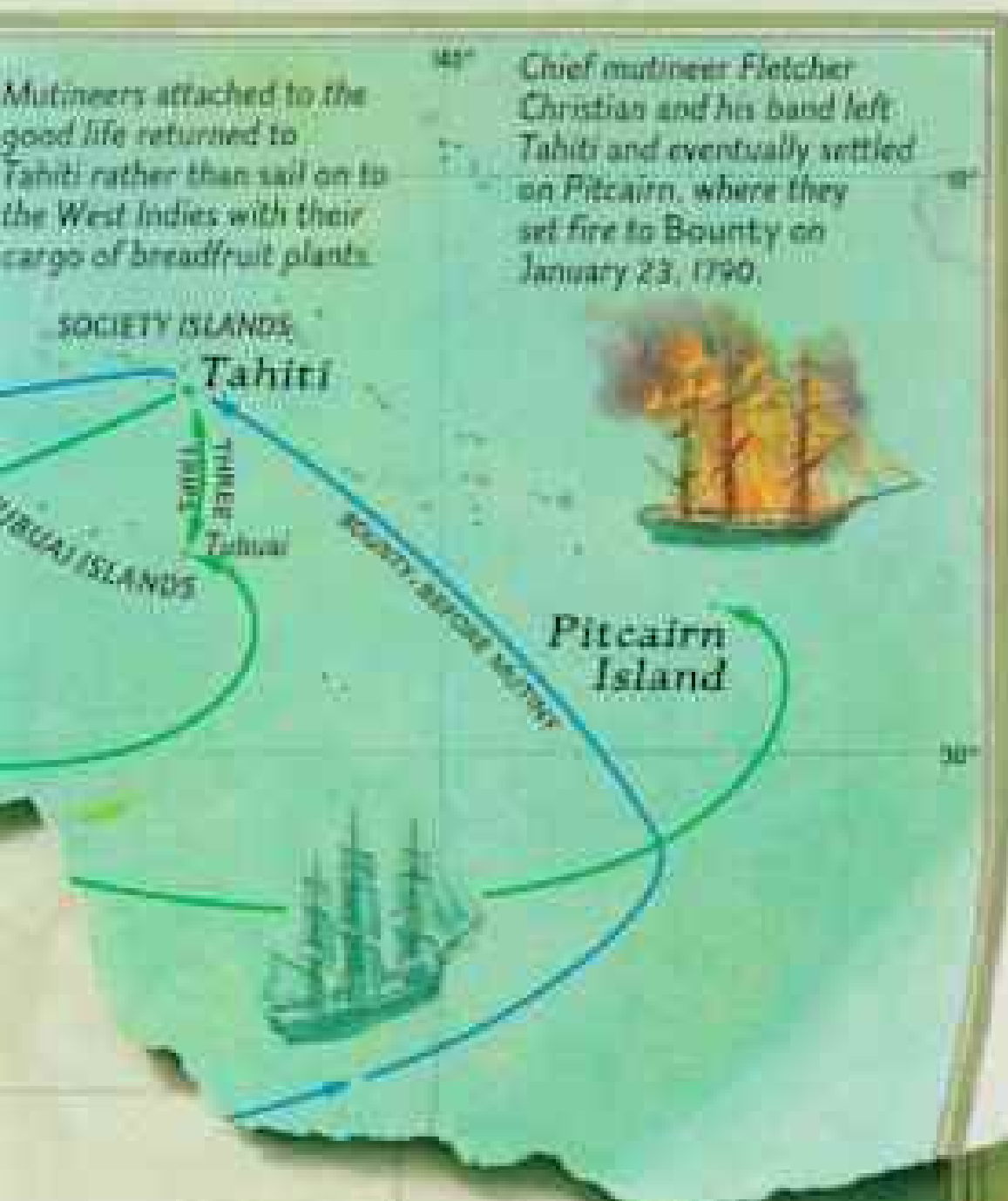
ON A BOTANICAL ODYSSEY, *Bounty* sailed from England in 1787 to Tahiti to gather breadfruit plants for transport to the West Indies as a source of food for slaves. *Bounty* tarried in Tahiti for five months while the crew "formed attachments with some of the native females, which had considerable influence upon their conduct." Finally departing, *Bounty* was seized off Tonga April 28, 1789, by acting lieutenant Fletcher Christian, beginning the most notorious mutiny in sea annals. Putting 16 crewmen ashore on Tahiti, Christian and eight shipmates, with Polynesian women and men, sailed to uninhabited Pitcairn Island, where they burned *Bounty* to escape detection and lived out their days.

Pandora

LONG ARM of the British Admiralty sent *Pandora* to Tahiti in November 1790 to capture the mutineers and "bring them to condign punishment." She took prisoner 14 surviving "pirates" foolish enough to have remained on Tahiti. After a fruitless search for *Bounty*, homeward-bound *Pandora* probed for a passage through the Great Barrier Reef. On the evening of August 28, 1791, she struck the reef and sank the next morning. Ninety-nine survivors in four ship's boats made their way to the Dutch settlement at Timor, 1,100 miles away, only a third of the distance sailed by Bligh to the same landfall.

The dive

CRADLED in the sandy deep, *Pandora* lay forgotten for nearly two hundred years. In 1977 two Australian divers found the wreck in 110 feet of water, close to the tip of Cape York in northern Queensland. The Australian government declared the site a protected wreck, and the Queensland Museum of Brisbane began excavation in 1983. For two seasons project director Ron Coleman has led some 20 diver-specialists who have recovered and preserved hundreds of artifacts. The hull is still buried in sand.





Last anchorage for a man-of-war

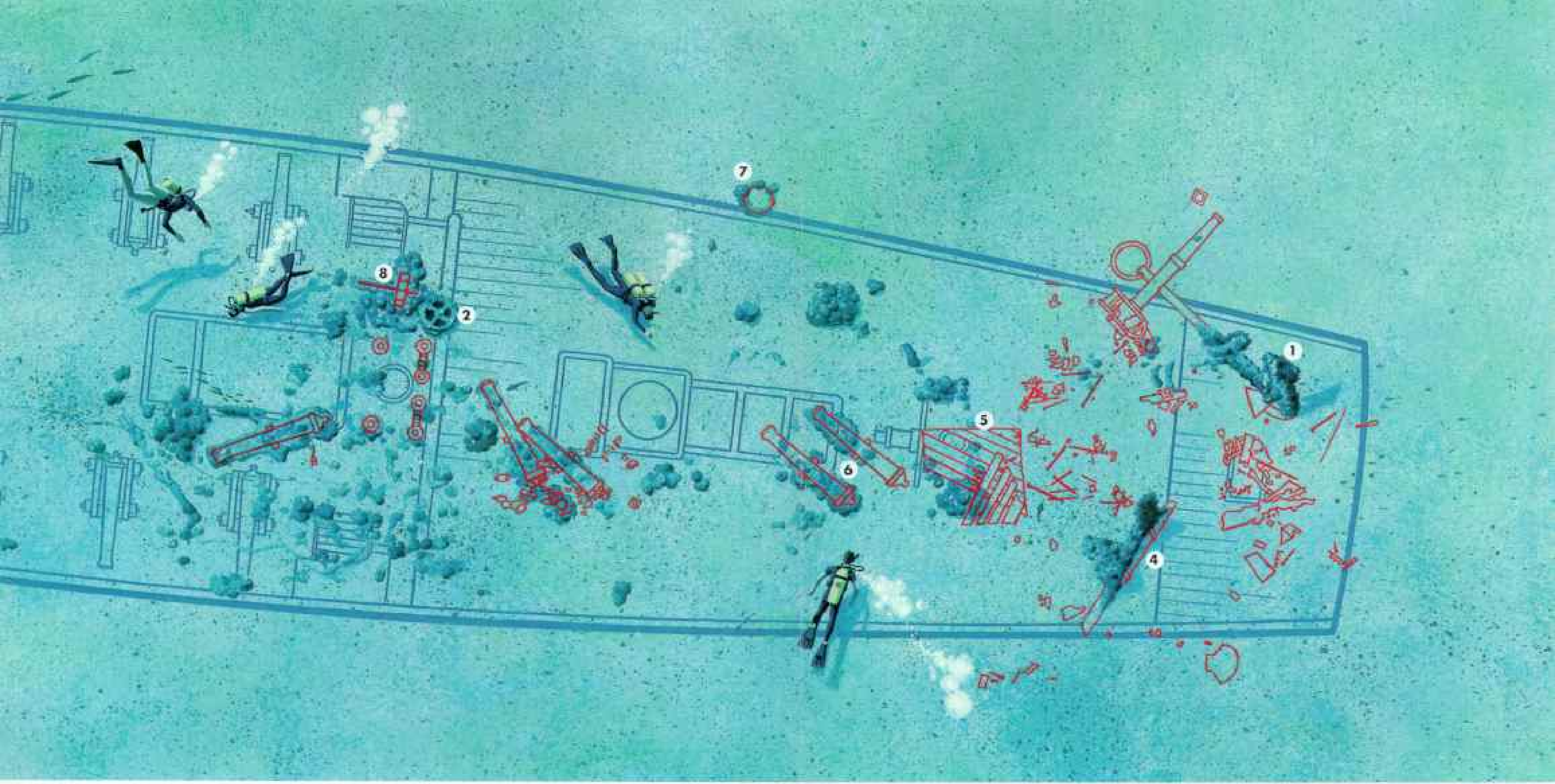
A FISH'S-EYE view of a sunken piece of history: Pandora, punitive ship of 1791, lies in a grave of sand at 110 feet. Using a mosaic of photographs taken by expedition photographer Patrick Baker, artist Pierre Mion painted the artifacts where they were found—metal and ceramic objects in relative order on the seabed. Their distribution shows that the

ship did not break apart after being torn on the reef, but gently settled in the sand. Outlines indicate the buried hull and the original placement of deck furniture.

Tons of sand will have to be shifted to reveal the hull timbers, which soundings indicate reach 20 feet below the seafloor. Meanwhile, divers recover isolated artifacts by excavating with water dredges

and airlifts, devices that suck away the overburden.

The most prominent objects visible on the seafloor are a large anchor **1** at the stern, the chain-pump drive wheel **2** amidships, and the galley stove **3** in the foredeck area. Items found under the sand are shown in red. From stern to stem: sternpost sheathing **4**, hull timbers **5**, cannon **6**, a copper caldron **7**, the chain-



PAINTING BY PIERRE MIGNON | PHOTOGRAPHS OF ARTIFACTS BY PATRICK MAKEN

pump drive wheel and shaft **8**, the galley-stove deck cowling **9**, earthenware storage jars **10**, and spare rudder fittings **11**.

Among the personal items recovered was a small pocket telescope (below), with draw-slide focusing. It probably

belonged to one of the ship's officers.

The boarding ax (right) was part of the ship's arsenal. Simpler versions were used as trade goods. South Sea islanders prized them highly, having only stone tools for cutting and hewing.

Bottles (far right) survive in

nearly pristine state when covered with sand. The square case bottles, so-called because their shape allowed packing in a box, customarily held gin, squat onion bottles wine or rum, and the long-necked bottles port.





(Continued from page 427)

I read Morrison's manuscript in an unpublished memorandum in the Mitchell Library in Sydney. Surprisingly for his time and station, Morrison seems to have been a man of some education, as well as irony and wit. He prefaced his memorandum with a Latin tag: *Vidi et Scio*—I saw and I know.

AFTER A FRUITLESS three-month search for *Bounty*, Edwards turned his bow toward home in August of 1791. He was seeking a passage through the Great Barrier Reef to Endeavour Strait when disaster struck. Says Morrison:

"On the evening of the 29th [28th] Aug. the Pandora went on a Reef, I might say how, but it would be to no purpose. It was between 7 & 8 in the Evening & she beat on it till between 11 or 12 when she got over, and brought up in 15 fathoms: while she was on the Reef she lost her rudder, and received many severe & repeated strokes, in so much, that every one expected the Masts would go overboard . . . hearing that there was 9 feet water in the Hold . . . gave us Reason to think, that the Ship was going down, and judging that in such a Case, everyone would think of himself first, we . . . broke our Irons. . . . But when Capt. Edwards heard it, he ordered us to be hand-cuffed and Leg-ironed again . . . & gave orders to the Centinals . . . to fire upon us, if they heard us make any motion. . . .

"The Boats were now hawled under the Stern, and we could observe the Officers . . . putting things into them, and heard one of the men say 'I'll be damned if they go without us.' This caused some of us to move our Irons, & I heard the Master at Arms say 'fire upon the Buggers.' Upon which I . . . 'begg'd for Gods sake not to fire.'

"About Sunrise . . . we begg'd of the Master at Arms to open the Scuttle, to which he answered 'never fear my Boys, we'll all go to hell together.' The words were hardly out of his Lips before the Ship took a Sally, and he and the Corporal rolled overboard; at the same instant I saw Capt. Edwards thro' the Stern Ports; swimming to the Pinnace, and the Boats shoving off as fast as possible. . . . the water flowing in on us, when the hand of God directed the Boatswains Mate to the Place, he was scrambling upon the



PATRICK BAKER (TOP AND LEFT), JIM BEANUCHURCH

Submarine grid covers the site of Pandora (foldout). A team of diver-archaeologists locks two-meter-square aluminum frames together to provide reference points for mapping and recording. Before recovery, each object was plotted on the grid to establish probable distribution at the moment of sinking. An A-frame for stereo photography stands in the background.

Rough seas made it impossible to anchor above the wreck, so divers rode an inflatable boat from the diving vessel to the site (top). Model maker Wayne Masters (above) fashions a small Pandora as the original was built, fastening planks to transverse frames.



Box & heard our Cries, had the presence of mind to haul out the Bolt, and take the Grating off . . . upon which all, except Hillbrant, got out. . . .

"I was . . . about an hour and an half in the water, when I was taken up . . . in the blue Yawl & soon after landed on a small sandy Key . . . 2 or 3 miles from the Wreck."

The ship's boats landed 99 men on the cay, ten of them mutineers. The prisoners, having been confined in the shade of the box for five months, were bleached white as a cod's belly, but Edwards would not allow them to enter the makeshift tents, nor give them an unused sail to cover themselves from the vertical sun.

Peter Heywood, one of the surviving prisoners, said in a letter to his mother: ". . . the only shelter we had was to bury ourselves up to the neck in the burning sand, which scorched the skin entirely off our bodies, for we were quite naked, and we appeared as if dipped in large tubs of boiling water."

Following that master mariner William Bligh, all 99 survivors, in four boats, eventually reached the Dutch settlement at Timor, although they had to sail only one-third the distance traversed by *Bounty's* launch after the mutiny. Bligh, together with 18 loyal seamen, had rowed and sailed 3,618 nautical miles in 41 days, an unparalleled feat of open-boat navigation.

Edwards eventually brought his prisoners home to England to stand court-martial. Of the ten, six were condemned. Two, Peter Heywood, midshipman, and James Morrison, boatswain's mate, received the king's pardon, and William Muspratt, steward, was released on a technicality.

Three seamen, Burkitt, Millward, and Ellison, were hanged at the yardarm.

OVERSHADOWED by the infamy of the *Bounty* story, *Pandora* lay forgotten in her liquid grave for 186 years. In 1977 an Australian diver and filmmaker, Ben Cropp, together with a naturalist, Steve Domm, enlisted the aid of the Royal Australian Air Force, whose submarine-hunting aircraft carry a magnetometer, an instrument that detects anomalies in the earth's magnetic field caused by masses of ferrous metal.

They found the remains of the vessel

behind a reef off the remote north Queensland coast, close to New Guinea.

Cropp's and Domm's researches had narrowed the search to a few coral heads in the vicinity of a place marked Pandora Entrance on modern charts. The aircraft's commander, used to tracking submarines of one or two thousand tons, was dubious about locating a wooden ship whose iron guns and ballast might total 80 tons.

"I had anchored my dinghy in the center of the search area," Ben Cropp told me. "The Neptune made runs for more than an



JIM DRABENBURG (TOP); PHILIP BARRETT

Seagoing surgeon George Hamilton's instruments (facing page) were found near a gun: ivory urethral syringe, tourniquet clamp, and marble mortar (above). Glass-stoppered bottle, to the right of his portrait, held oil of cloves, still pungent after 200 years.



Sheathed in coral and calcium concretions, a silent gun lies on the seabed (right), where divers record its precise position. After winching it to the surface, the iron gun was wrapped in wet burlap and plastic and transported to the Queensland Museum.

hour and was running out of fuel for its return to Townsville. I radioed 'Try the seaward side,' and on the first run they crackled 'We've got something' and dropped a smoke bomb. On a second run they dropped another smoke candle 200 yards from the first.

"We ran over and dropped buoys, but although Steve and I both sent divers down, we found nothing. Next day we found the wreck just under my anchor chain.

"When we saw the big anchors and guns, I knew it was *Pandora*. I radioed the press and the commonwealth government at Canberra and two days later received word that the site had been declared a historic wreck."

For a year and a half the wreck awaited positive identification. In 1979 the Western

Australian Museum, pioneer in Australian maritime archaeology, was commissioned by the Australian government to send a team to the site.

Cropp had recovered pintles—U-shaped rudder fittings. On cleaning, one pintle revealed the figures 24 spot-punched into the metal, *Pandora's* number of guns; broad arrows, sign of British government property; and the name "Forbes," a founder who supplied fittings to the Royal Navy at the shipyard where *Pandora* was built.

In the last days of 1984 I flew from Cairns in northern Queensland by amphibian aircraft to join Ron Coleman, curator of maritime archaeology of the Queensland Museum, and his team on the *Pandora* site.



JIM BRANDENBERG (LEFT); PATRICK BAKER

There it soaked in caustic-soda baths for more than a year to stabilize it. Large lumps of coral were carefully hammered off. Ron Coleman (left, foreground) and Neville Agnew, Queensland Museum conservator, scrape away remaining foreign matter.

The state and commonwealth governments had appointed the museum in Brisbane the responsible authority for historic wrecks in Queensland waters.

We flew at 5,000 feet along a foreshore sage green with eucalyptus forest, beneath white cumulus clouds like merino sheep.

The Great Barrier Reef is not a continuous wall of coral. Separate, but often overlapping, curved reefs lie on the cobalt edge of deep water like boomerangs flung on the sea, convex faces to the prevailing southeasterly wind. The inner reefs are slipper shaped, brown paramercia rimmed with lashing white cilia of surf.

After three hours' flying, we saw the expedition's diving vessel, in the scant lee of a

low-lying islet at the southern edge of Pandora Entrance.

Livid breaking seas scalloped the indigo Coral Sea as we circled. We could see an unobstructed passage south of the anchored vessel, probably the one signaled by the ship's boat that had been sent ahead to sound by *Pandora*, shortly before she struck. Edwards recalled his boat and waited for morning; if he had made sail, he might have found his way through to the inner passage and safety.

Doubtless it was to this that old salt James Morrison referred critically when he wrote: ". . . the *Pandora* went on a Reef, I might say how. . . ."

The 35-knot winds corrugating the sea



would make a bumpy touchdown, but as we made a low-level run we saw something even more hazardous. All round the sandy cay swarmed big sea turtles in the hundreds, swimming toward Pandora Cay to lay their eggs. To strike the carapace of one of the 300-pound creatures at 75 miles an hour could flip us on our back. We had to land five miles off and transfer to the diving vessel by sailing catamaran.

ABOARD *WATER SPORT*, a 67-foot steel catamaran, I found a ship's company of 24. Ron Coleman, project director, was a soft-spoken man of encyclopedic marine archaeological knowledge.

I said I was glad to be over *Pandora* at last. "Sorry," said Ron, pointing to the northeast, "she lies about three miles off. We haven't been able to hold station over her for more than two days so far, owing to the constant strong southeasterlies. Each morning we motor to the site and try to moor as close to the buoyed wreck as possible."

November is early austral summer, when the southeasterlies begin to shift to the northern quadrant. "Then the whole reef shelters you; the sea is so flat you could comb your hair," said T. C. Good, diving master.

In my three weeks aboard *Water Sport* very little hair was combed; the whistling southeasterlies persisted, keeping polls and seas tousled.

Next morning I watched skipper Rudy Sondermeyer play a frustrating game with swift currents and high winds. He dropped his anchor to windward and drifted back to pick up a mooring, but the currents dragged the mooring and skewed the vessel to one side of the wreck buoys. Captain Rudy talked to himself in rich Australian.

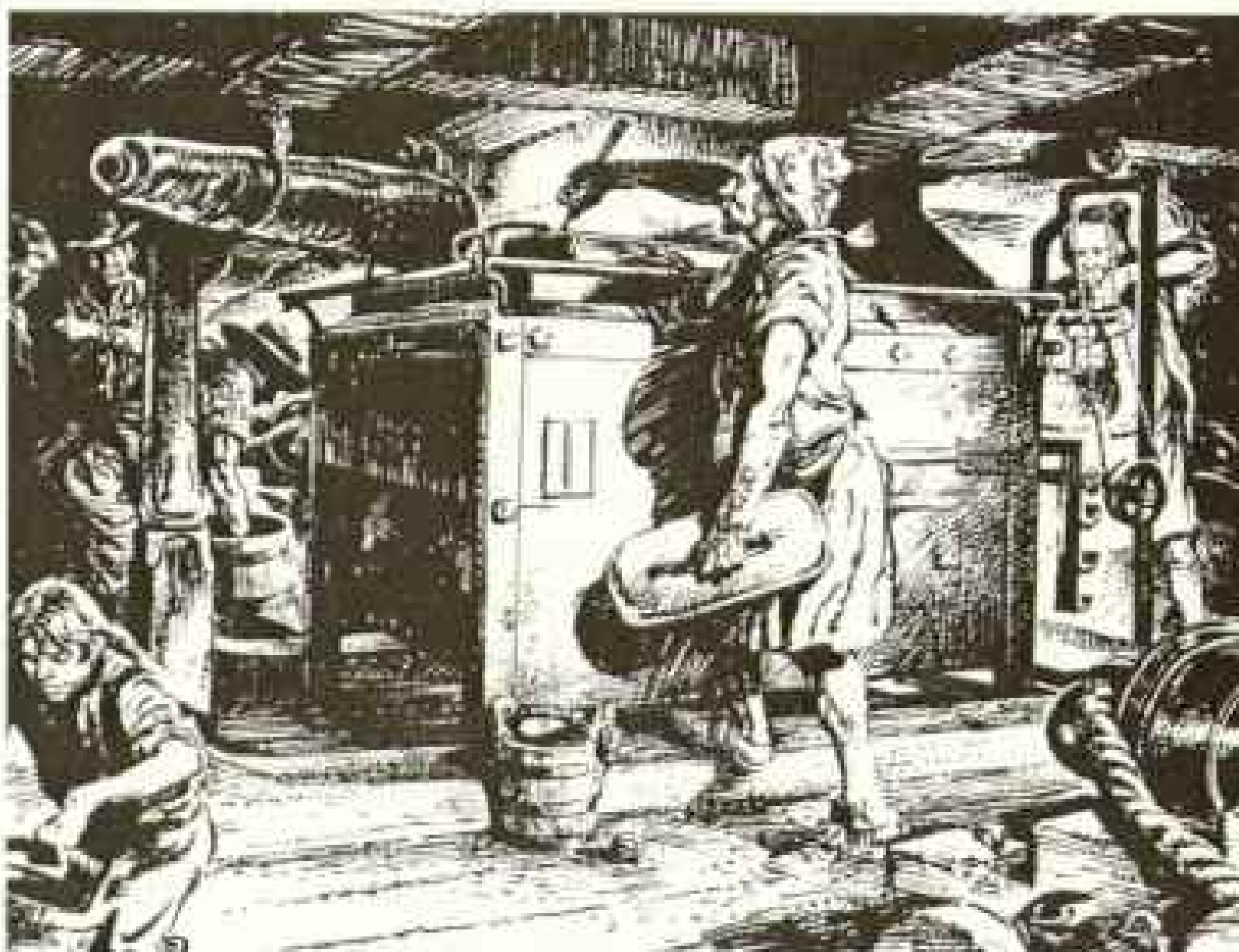
"Currents, my word! They come around the reef and divide just forward of where she lies. They're running at five knots now; in that narrow gut between two reefs they have been clocked at ten. That's what did *Pandora* in. She hove to on the outer face of the reef while her boat sounded for a passage to the south'ard. Before she could make sail, the current and high wind set her on the reef and pounded her bottom open."

On the screen of our satellite navigator a straight glowing green line led from our anchorage at Pandora Cay 2.8 miles to the wreck at latitude 11° 22' 21" South and longitude 143° 59' 21" East.

Water Sport finally settled down a hundred yards upwind from the wreck. Four divers and a boat handler climbed into a 19-foot Zodiac inflatable, motored to the heaving yellow wreck buoys, and made fast.

Diving master T. C. Good shook his head. "If we moored the diving vessel over the wreck and sent divers down, weather might force us to shift position while they are on the bottom; too dangerous. This way, the

Fires long dead, Pandora's galley stove stands on the seafloor in the foredeck area (left). Where seamen once jostled for prized slush, fat cooked out of salt beef and pork, fish now snap at crustaceans and sea worms. The Brodie stove (right), product of late 18th-century technology, also distilled fresh water, primarily for medical use. Unrelieved by fresh fruit and vegetables on long voyages, sailors' diet of salt flesh and biscuit caused scurvy, from lack of vitamin C. To cure it, the Royal Navy used rob (boiled-down juice) of oranges and lemons.



MATRICE BAKER (FACING PAGE), SKETCH BY ROY ANDERSEN

rubber boat is fast to the descending line so divers surfacing will always find a platform overhead.

"All our dives are strenuous working dives in deep water, digging, lifting, swimming against currents. This makes the job more risky. Each diver dives only twice a day, morning and afternoon. He—or she, we have six women—spends 15 to 26 minutes on the bottom, then ascends to 15 feet for a 3- to 15-minute decompression stop. On deck they breathe pure oxygen for 3 minutes, to flush nitrogen out of the system."

The deep-sea diver's enemy is pressure. On the *Pandora* site at 110 feet, the sea pressed on our bodies with a weight of nearly 79 tons, forcing nitrogen into the bloodstream. If a diver ascends too rapidly, the nitrogen forms bubbles that can press on nerves or block blood vessels to cause decompression sickness, the bends.

The remedy is to squeeze the bubbles back in solution under high pressure in a recompression chamber, then return the victim slowly to surface pressure. We had no chamber aboard, so we relied on extreme caution and oxygen.

The ship's diving doctor, Dr. Beryl Turner, former surgeon lieutenant and officer in charge of the Royal Australian Navy's School of Underwater Medicine, kept meticulous records of every dive and diver.

"We have added as many safety factors as possible without reducing bottom time unduly," said Dr. Turner. "I'd sleep better at night if we had a chamber, but this system has worked well."

She auscultated and percussed my chest, then stamped my Davy Jones passport.

I made my first dive to *Pandora* with Dick Porch, of *Water Sport's* crew. We fell backward off the Zodiac and swam to the buoyed descending line. Near the surface the racing current pulled us horizontal like streaming pennants as we clung to the line and moved hand over hand downward, but as we sank the current eased and we swam free. The dark shapes of *Pandora's* bones took form below us. The descending line was made fast to the upthrust fluke of a huge anchor on the seabed. The anchor and other ship's fittings were furred with green and brown sea growth: algae, sponges, and soft coral.

We swam along the length of the wreck for

more than 100 feet. Close to the bow a square dark shape lay, the remains of the iron galley stove, clouded with swirling fish that glinted in the wintry light. Within the oven dwelt a teeming microcosm of sea life. Blue-banded orange clown fish peered between undulating tentacles of sea anemones, tube worms unfurled gill umbrellas like miniature palms, and yellow damselfish darted aggressively at my masked face.

I knew the colors from shallow water; down here they were etiolated as in the light of a full moon. The thick filter of 100 feet of seawater absorbed all reds, oranges, and yellows, bleaching them uniform silver-gray.

Back on deck we breathed oxygen for three minutes while tenders took note of our remaining air under T. C.'s watchful eye.

"We use a modified version of the U. S. Navy diving tables," said T. C. "Basically, I slow the ascent rate from 60 feet a minute to 35 and recalculate the tables on that basis. Last year we did 686 dives with 100 percent success. We had a few incidents of pins and needles but no serious bends."

ON SEVERAL NIGHTS I awoke to go on deck and watch the green turtles crawling onto Pandora Cay by the light of the moon. Invariably at two in the morning someone was working under a shaded lamp in the saloon, drawing, measuring, or writing up notes.

Archaeological director Graeme Henderson of the Western Australian Museum smiled when I said I hoped we would find some evidence of Pandora's Box.

"I doubt it; the upper works would be the first thing to disintegrate. Morrison says the top floated away. Belowdecks and amidships, that's where I expect to find the bulk of the artifacts."

To overlay the site with a grid to plot artifacts, Henderson's team laid down a series of two-meter-square aluminum frames on legs that could be interlocked and moved from place to place. With a water dredge or airlift the divers excavated to a predetermined depth, one square at a time.

The water dredge pipe lay horizontally on the seabed, and I spent much of my bottom time sifting through the hillock of sand building up at the outfall. I had to compete



LYNN CROFF, BEN CROFF PRODUCTIONS (ABOVE); PATRICK SAEER (LOWER LEFT); JIM BRANDENBURG

An ounce of care is worth pounds of cure when raising sunken artifacts. Expedition conservator Jon Carpenter and associate Nic Clark (below left) pick sponges and small corals from

a copper cooking caldron. A diver (above) gently fastens a hitch around a clay jar used to hold oil or water. After cleaning, the caldron, pots, and clay jar become museum pieces (below).





Frozen in time, Pandora's hour of disaster may have left its record on the surgeon's pocket watch (below). The vessel actually sank at half past six in the morning, but she struck the reef the night before and "between 11 and 12" beat over into deep water and began to fill. Shocks against the iron-hard coral or rising water may have stopped the watch at 12 minutes and 20 seconds past 11 (left).

Few watches of this period, except doctors', bore second hands, making it probable that this silver, gold-washed specimen belonged to surgeon Hamilton. A stopwatch lever could set the second hand to zero, a feature useful to surgeon or



navigator. The remarkably preserved watch was skillfully cleaned by conservator Carpenter and rebuilt nearly to working condition by antiquarian watchmaker Hugh Whitwell (right). Silver inner case, gold-fired plates, and brass wheels survived in good condition, but steel parts had corroded and were replaced with contemporary parts or substitutes. Engraving and hallmarks on the case and movement (top right) showed the watch was made by J. & J. Jackson of London in 1786 or 1787, the latter by coincidence the year Bounty sailed on her last voyage.



JIM CARPENTER (FACING PAGE AND LOWER RIGHT); PATRICK BAKER (CENTER); JIM BRANDENBURG

with silvery goatfish with a yellow stripe and chin barbels and small green-and-red parrot fish that darted in and out of the billowing sand cloud, snapping at tasty bits of worm close to my probing fingers. I found nothing but sheathing and nail fragments, but divers at the working face laid bare the great anchor shank and its huge ring.

On the saloon bulkhead chief photographer Pat Baker had taped a photomosaic of the wreck site like an aerial map. Over the mosaic Pat laid tracing paper showing 250 grid squares. When I left the ship, divers were working on No. 55.

In a jumble of guns and ironmongery the dredge had uncovered what may have been the surgeon's cuddy, yielding an assortment of jars, pots, bottles, a mortar, instrument case, and medical instruments.

A notice on the saloon bulkhead said:

"Take precaution when handling unknown substances in jugs and bottles. The surgeon's supplies contained many nasty cures. NOTE! If fish or companions in your vicinity begin dying, move away and allow water to clear!"

Dr. Turner's colleague across the centuries was Dr. George Hamilton, ship's surgeon of *Pandora*. His sharp eye and salty pen left the best account of *Pandora's* last voyage, published after his return home.

Eleven days after leaving Tahiti, surgeon Hamilton entered in his journal:

"We now began to discover that the ladies of Otaheite had left us many warm tokens of their affection."

On the homeward passage *Pandora* "discovered" the island of Tutuila in the Samoan group. Here, says Hamilton:

"One woman amongst many others came on board. She was six feet high, of exquisite beauty, and exact symmetry, being naked, and unconscious of her being so, added a lustre to her charms. . . .

"Many mouths were watering for her; but Capt. Edwards, with great humanity and prudence, had given previous orders, that no woman should be permitted to go below, as our health had not quite recovered the shock it received at Otaheite; and the lady was obliged to be contented with viewing the great cabin, where she was shewn the wonders of the Lord on the face of the mighty deep."

Good old Edwards! Always thinking of the welfare of his people.

The sea is a conservative mistress, and sailors have changed little over the centuries. Among the surgeon's instruments was a beautifully made urethral syringe of ivory and ebony. It held silvery crystals, suggestive of mercury. Similar syringes were found on the *Mary Rose*, Henry VIII's ship of two centuries earlier.* Before the days of antibiotics there was a sailor's saying: "One night of Venus and six weeks of Mercury."

THE MOST SPECTACULAR FIND almost certainly connected with surgeon Hamilton lay near a gun, under only four inches of sand: a silver pocket watch with, astoundingly, the glass still intact.

Conservator Jon Carpenter described his treatment of the find:

"Conservation begins on the seabed. If you don't use care when recovering an object, you can do more harm in five minutes than the sea did in 200 years. We brought the watch up in a wet container. An X ray showed most of the works were still intact. We treated the watch with alkaline dithionite, a reducing agent that converts silver salts back to metallic silver. Though under water for 192 years, the hinge worked perfectly. We saw elaborate pierced work of scrolls and flowers, and the fire-gilt balance cock and plate, which read 'J. & J. Jackson, London.' Hallmarks on the silver case told us the watch had been made between May 1786 and May 1787."

The watch hands had stopped at 12 minutes and 20 seconds past 11. *Pandora* sank at 6:30 in the morning, so the watch must have run down some time before the shipwreck, or it may have been submerged the night before as the ship listed and filled.

As far back as 1707 an eminent surgeon had suggested that physicians' watches should have a second hand for taking a patient's pulse. The *Pandora* specimen was fitted with a stop lever for seconds setting.

Today the watch, conserved and restored by Jon Carpenter and reassembled by Hugh Whitwell, is almost in running condition.

I remarked on the astonishing state of

*See "Henry VIII's Lost Warship: *Mary Rose*," by Margaret Rule, NATIONAL GEOGRAPHIC, May 1983.

preservation of the finds to T. C. Good.

"Unless he had placed it in a packing box," said T. C., "Captain Edwards could not have left *Pandora* in a better place. Strong currents quickly covered the wreck with a soft sand that is less than 10 percent abrasive silica and coral.

"Also, there seems to be a stress ring around the wreck, within which few plants or animals grow. The actual cause is still being investigated. It could be caused by chemicals on board, or a weak electric field set up by dissimilar metals."

A SMALL BOTTLE from the surgeon's kit contained an oily liquid. When a few drops were withdrawn with a pipette, a sharp, spicy scent arose: oil of cloves, still identifiable after nearly 200 years beneath the sea.

I kept hoping for some sign of Pandora's

Box. One day Jon Carpenter handed me a concreted mass about the size of an opened hand. It looked unimpressive, but at Jon's urging I took a second look; beneath the limy crust I discerned the semicircle of a hasp and the unmistakable shape of a padlock.

This padlock could have secured the top scuttle or the prisoners' leg-irons. I recalled a passage from Peter Heywood's *Memoir*:

"Fortunately, the master-at-arms, either by accident or design, when slipping from the roof of 'Pandora's Box' into the sea, let the keys of the irons fall through the scuttle . . . and thus enabled them to commence their own liberation. . . ."

X rays showed the hasp to be partly open; it may be just as the mutineers dropped it as they slid their legs free. Handling the lump of lime and metal, I felt the horror of those last moments as water gulfed in through the scuttles on the manacled men.

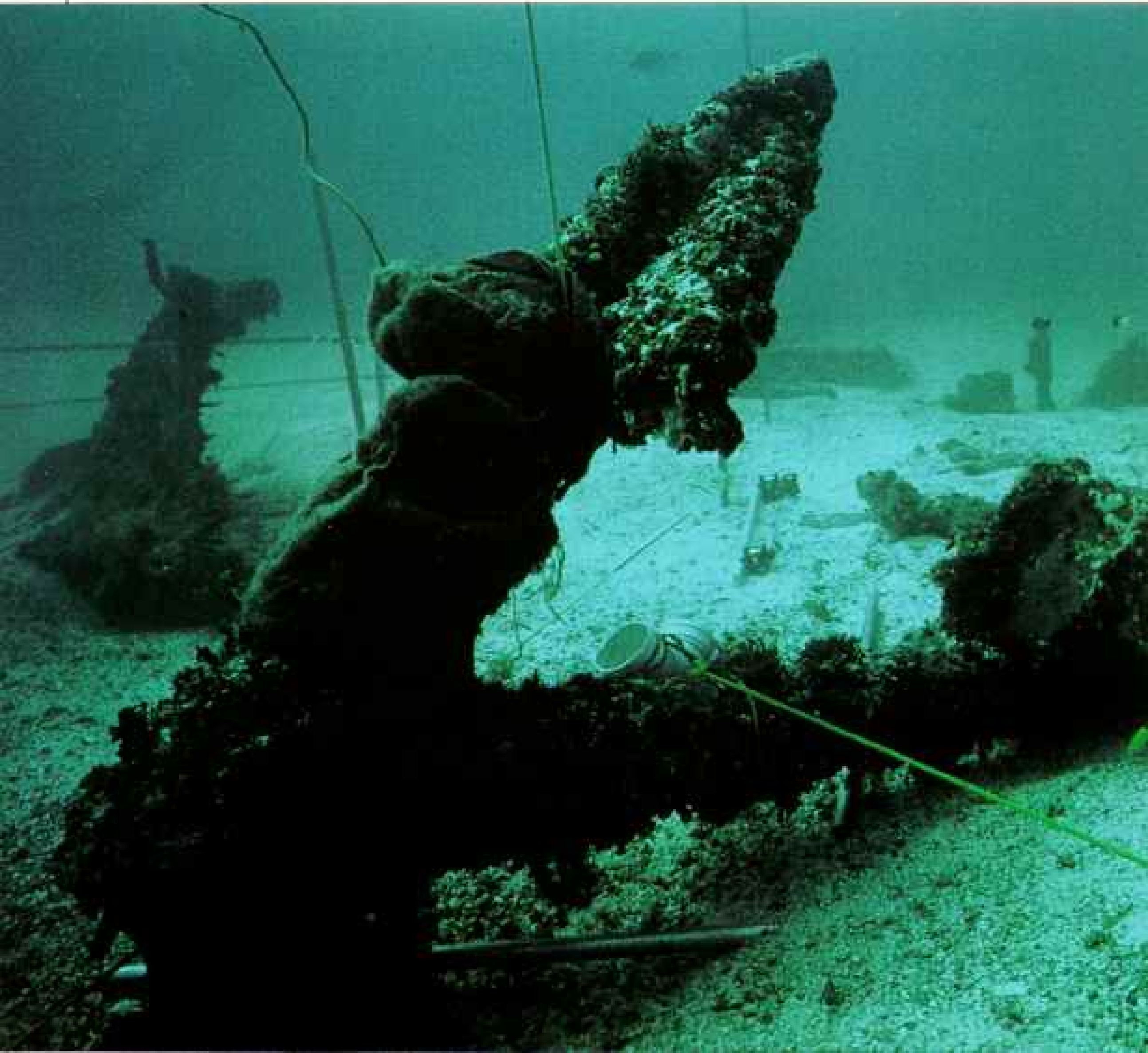


JIM BRANDENBURG

"I . . . have taken on board full three months' wine . . .," logged Captain Edwards. Remains of a stemmed wineglass and a glazed plate may have come from the captain's cabin, since lesser men drank and ate from wood and pewter. Wine and beer were carried by early sailing ships because alcoholic beverages kept well during a long voyage. Fresh water in wooden casks quickly went bad.



LUIS MARDEN'S PHOTOGRAPH OF THE BOUNTY ANCHOR IN 1907



Two sunken ships 5,000 miles apart meet in history

THE HUNTER AND THE HUNTED never met in their lifetimes. Pandora sought Bounty among the South Sea isles for three months without success.

Mutineer Fletcher Christian, conscious of the Admiralty's long reach, cut his anchor cable and sailed in the night from Tahiti. With eight shipmates, Tahitian women, and some Polynesian men, Christian settled on uninhabited Pitcairn Island. Soon murderous war flared between Polynesians and Englishmen, bringing violent death to all mutineers save two. When the first ship touched Pitcairn 18 years later, only one

mutineer, John Adams, was still alive, a Bible-reading patriarch to a flock of women and children.

The mutineers had set fire to Bounty on January 23, 1790, and the hulk sank in a small, turbulent bay. In 1957 author Luis Marden dived in these surging waters and found the bones of the Bounty—sheathing nails, copper fittings, a rudder pintle, and other relics. Shortly thereafter, the fluke of one of Bounty's anchors was discovered protruding from the sand in 50 feet of water (left).

Never losing his fascination with the mutiny, Marden joined the Australian underwater team as they explored the remains of Pandora. The anchor that divers found emerging from the sands off Australia's coast (below left) may be one from the Bounty, taken aboard by Pandora in Tahiti's Matavai Bay. Marden, examining a Pandora fireplace (below), 27 years after finding Bounty, thus became the first to lay hands on both wrecks.



BRIAN RICHARDS (LEFT); PATRICK BAKER

A few days before my departure I watched four divers sweep the bottom of a pit with the water dredge. Under the swirling clouds of glinting sand a dark oblong shape appeared. When the current dissipated the sand cloud, we peered closer and made out a filigree framing of brass, elegant and curved like the piecrust rim of a Chippendale table. A barred grating at the bottom told us it was a firebox or stove heater, probably from Captain Edwards's cabin, as it seemed much too grand for a lesser being.

As artifacts came from the wreck, T. C. entered them in an NEC computer.

"We enter the finds as symbols; triangles for bottles and jars, for example. For larger objects like guns we use outlines. We superimpose these on the screen on a deck plan of a *Pandora*-class ship."

T. C. peeled *Pandora* layer after layer like an onion: main deck, gun deck, hold, and keel. The computer screen glowed with vivid red, green, yellow, and violet fittings on a blue ship's outline. Pressing keys, T. C. "windowed in" on a close-up of any part of the ship. After cogitating a few seconds, the computer brought the base of the mainmast into focus, then continued closing in until we looked at the touchhole of a single gun.

"We can keep on doing this, in larger and larger detail, down to *one-trillionth* of an inch, on the atomic level. The NEC is a powerful tool.

"When the dig is completed, we shall be able to reexcavate *Pandora* a hundred, a thousand times, and so give maritime archaeologists a guide for future work."

Captain Edwards's stove was the most spectacular find of the 1984 season, but the Queensland Museum has only scratched the bottom. Soundings with a subbottom profiler indicate a large mass some 20 feet below the seafloor. An enormous overburden of sand must be sucked away, but then surely they will find the bulk of the hull of *Pandora*, almost intact.

"*Pandora* is now the most important wreck in the Southern Hemisphere," said

Ron Coleman. "Her association with the *Bounty* story arouses wide interest, but, what is more important, she is a rich storehouse of Navy life in the 18th century. We shall be working here for several years.

"Ideally I'd like to bring her hull up, as was done with the *Mary Rose*. Someone with the funds and an eye to history could make a mark for himself and for Australia if he made it possible for us to do that."

ON MY LAST DIVE to *Pandora* I carry down a sheathing nail I recovered from the resting-place of the *Bounty* off Pitcairn Island in 1957, to compare with *Pandora's* fastenings.

As I sink beside the descending line, a shadow darkens the luminous skin of water overhead. A blunt-nosed whale shark swims slowly past. It is a baby, only 12 feet long, and just ahead of its flattened snout swims an echelon of juvenile golden trevallies in vivid sulfur yellow and purple.

When I jackknife to swim head down, three of the little golden fish appear in front of me, riding my bow wave a few inches from my face down to the seabed.

Since a first trial in 1761 many ships of the Royal Navy had been sheathed with copper plates below the waterline to protect the wooden hulls from teredos, wood-devouring mollusks.

When *Pandora's* rudder was ripped away and the ship sank to the sea bottom, teredos long ago ate away the exposed wood, but the shell of copper sheathing the sternpost still stands upright on the sand. The overlapping copper sheets, like scutes on a turtle's carapace, are stippled at the edges with a line of nail holes, some with sheathing nails still in place.

On an impulse I thrust *Bounty's* polished bronze nail into one of the empty holes. Against the umber alga-sheathed plates the golden nailhead gleams like a small sun.

One hundred and ninety-five years and 226 days after the mutiny, *Bounty* and *Pandora* have met at last. □

Epitaph for a ship: The "short Narrative" submitted by Captain Edwards at his court-martial for loss of Pandora asks the court to "exculpate me from Censure." They did. Lying on the document is the first known example of a mechanical pencil, found on the wreck. A graphite rod in the sliding case may be advanced as it wears. JIM BRANDEBURG

means supply
of Water for each
Boats, and with the small
of September and stood on the
desolate Straits for the Island of
and all fortunately arrived
at Loupang in that Island
between the 14th and 19th of September
191. I might have been much more
proudly - but I conceived that it would
be only intruding on the time
brought without throwing any
upon, or that would be used to
decided the subject before them,
and I therefore humbly leave to
submit this short Narrative to the
consideration of the Board and if they
find what I have stated is to
be true, I flatter myself they will
think it a sufficient vindication of
my conduct and exculpate me from
blame.

(Signed)

Edw. Edwards



THE TWO SAMOAS

STILL COMING OF AGE

By ROBERT BOOTH. NATIONAL GEOGRAPHIC SENIOR STAFF



United by culture, Western Samoa and American Samoa are separated by politics. U. S. aid pampers American Samoa, but the lure of the South Pacific emanates more strongly from Western Samoa's Savai'i, where a boy sails a double-hulled canoe reminiscent of those of his Polynesian ancestors. The H.M.S. Pandora sailed to the islands searching for Bounty mutineers, and here Margaret Mead made her famous observations of adolescents.

Photographs by MELINDA BERGE



IT WAS ALMOST MIDNIGHT when the moon at last escaped the cloud-capped mountain and turned its full glory on the sand and sea. The disembodied roar of surf became a line of brilliant white, marking the coral reef 200 yards offshore. A

American Samoa

warm breeze stirred the coconut palms, their long fronds shadowboxing on the sparkling beach. I took a deep breath of soft island air. This was Samoa! The earthly paradise proclaimed by author and anthropologist; the cradle of Polynesia, where care-free brown-skinned people laughed and splashed and made love all the day long.

Well, maybe this had been Samoa. And maybe some of it still was. But . . .

But now the delightful aroma of fish grilling atop coconut-shell embers distracted me. The small red fish, called *malou*, had been minding their own business just minutes before. And the green bananas baking deeper in the coals were hardly older.

My host, High Chief Taui'i'ili, handed me a brimming coconut and motioned me toward a banana-leaf platter piled high with fish and fruit. "This beats the microwave," he said.

We were on the tiny island of Ofu, one of three that form the Manu'a group, part of American Samoa, a United States territory. The capital, Pago Pago (pronounced PAHNG-o PAHNG-o), lay 60 sea miles to the west on the main island of Tutuila. Farther west still was Western Samoa, which became the South Pacific's first small island nation in 1962 (map, below).

One people, two Samoas, carved up by colonial powers at the turn of the century. Though charting different courses, both Samoas remain jealous of their 2,000-year-old culture, and—in pursuit of progress—both inevitably compromise it.

Not too surprisingly the 20th century, for good or ill, has collided hardest with American Samoa. In the past six years alone, the territory, with a population of 35,000, has received nearly 250 million dollars in federal funds. Most of those megabucks stayed on

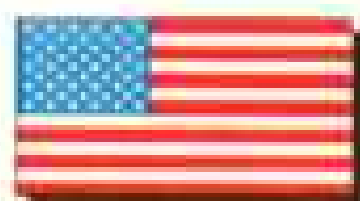


AREA: 2,849 sq km (1,100 sq mi).
POPULATION: 162,000. CAPITAL: Apia,
pop. 35,000. RELIGION: Protestant,
Roman Catholic. LANGUAGE: Samoan,
English. ECONOMY: Agriculture:
coconuts, cacao, taro.



FA'A SAMOA—the Samoan way of thinking and doing—has prescribed the rituals for social conduct for centuries. On American Samoa, the Samoan way collides with fa'a America (above) as a group of break dancers called the Famous Original Blood Brothers of Samoa perform in Fagatogo.

The U. S. Navy established a station in Pago Pago in 1900, when American Samoa became a United States possession. Western Samoa, once a German colony and later a mandate of New Zealand, achieved independence in 1962. It is listed by the United Nations as one of the least developed countries in the world.



AMERICAN SAMOA

AREA: 197 sq km (76 sq mi).
 POPULATION: 35,000. PRINCIPAL CITY: Pago Pago, pop. 3,075.
 RELIGION: Protestant, Roman Catholic.
 LANGUAGE: Samoan, English.
 ECONOMY: Industry: Fish canning.

TUTUILA TO SWAINS ISLAND
 225 MILES

TAU TO FOUE AND SANTI ISLANDS
 90 MILES

TUTUILA
 Pago Pago
 Matafao Peak 653 m 2,142 ft
 Leone
 Taputimu
 Fagatogo
 Faga'alu
 Nu'uuli
 Mt. Ploa (The Rainmaker) 524 m 1,718 ft
 PAGO PAGO INTERNATIONAL AIRPORT

OFU
 OLOSEGA

MANU'A ISLANDS
 TA'U

CYRAL BREEF

I F I C O C E A N

TV, beer, and a VCR are taken for granted by a family in Faga'alu. Nearly half the American Samoan work force is employed by the local government. The U. S. pumps millions into the economy.

Tutuila. Manu'a, still relatively remote, has seen fewer changes.

It was for that reason 60 years ago that a young anthropologist named Margaret Mead chose Manu'a for her research. In her famous book, *Coming of Age in Samoa*, she concluded that Samoan society in general and adolescent sexuality in particular were essentially stress free, and that stress in American society must therefore be a product of nurture, not nature. Her work has recently been disputed by other anthropologists, and Samoans themselves are divided about it.

But even Manu'a has undergone something of a transformation. "It has come very fast," said Taui'i'ili, known as Ili to his friends. Now 42, he was installed as the *matai*, or chief, of his extended family at the young age of 33.

"I was nine when my grandfather took me to Tutuila and I saw my first car. 'What's that,' I asked him, 'a large pig?' From here to Tutuila was a big step." After finishing high school, Ili returned to Ofu to join the *'aumaga*, the young men who serve the matai.

"Life was hard, but to me it was fun," he said. "Go up the mountain and work the plantation [in Samoa any cultivated plot large or small is called a plantation]; in the evening, paddle the canoe out and fish.

"There was no electricity in those days; kerosene was our light. Money wasn't common then, and we didn't have any use for it. We had our own food and everything we needed. And the customs were still strong."

Traditional Samoan society is both communal and authoritarian. Each village is composed of one or more *'aiga*, or extended families, some numbering hundreds of members. Each *'aiga* chooses its matai. Communal land is vested in the matai, who oversees its distribution. Matai belong to the village *fono*, or council, which sets policy and adjudicates grievances and once held the power of life and death.



"Today," continued Ili, "the younger generation has more knowledge of the outside. Fewer and fewer are looking to the land. They are dreaming of how to get money in their pockets. I am trying to think ahead, to see what we can do to match the times. The matai system has to change; it has to provide new solutions for new problems. But it will never disappear."

UNLIKE the traditional thatched-roof *fale*, open on all sides and bare but for woven floor mats, Ili's house in Ofu village, like those of many neighbors, was well furnished, had a solid roof, and doors and windows that locked—a so-called *fale palagi* (FAH-leh pah-LAHNG-ee).



Palagi is a form of *papalagi*, which means “sky burster”—the name given to the strange white men whose impossibly tall ships rent the horizon 250 years ago.

The first was Dutch explorer Jacob Roggeveen in 1722, though he passed by without landing. Half a century later the Frenchman Louis-Antoine de Bougainville arrived. According to one account, he found the people “less trusting than the Tahitians; they displayed no eagerness to get iron. But their canoes were skillfully made, with triangular sails, and followed the ships a good distance out to sea, [sailing] round them as easily as if they had been at anchor.” De Bougainville was impressed, and named the islands Les Îles des Navigateurs.

But surely the most influential palagi arrival was the Reverend John Williams of the London Missionary Society, who sailed into Samoan life in 1830 and changed it forever. As one contemporary Samoan put it, “The missionaries came here to do a job, and by God they did one!” Today every village has a church, often several. They are always the largest buildings, and pastors nearly always live in the largest homes.

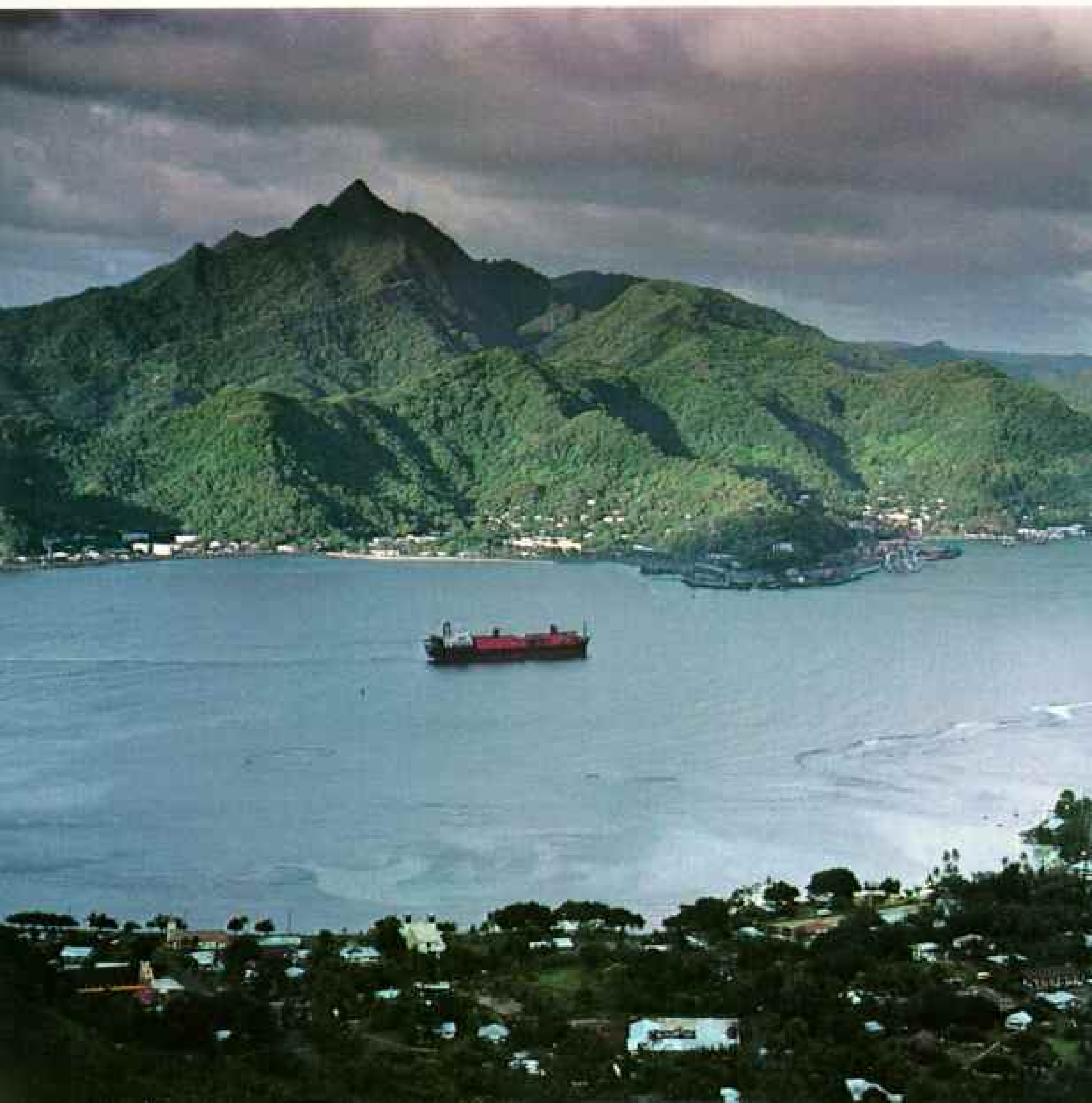
The last bell was still ringing in my ears as Ili and I slid into a pew in Ofu Congregational Church, bright and airy, with beautiful woodwork detailing. As the organ started up, the people swung into effortless four-part harmony. Samoans love to sing, and they sing loud and well.

This was the Sunday when a collection was taken for the pastor's monthly salary. Toward the end of the service, as is the custom, a deacon rose and read out the names of the donors and how much each had given. The total came to \$3,200. Later Ili told me that the pastor's house and food were provided by the village. "I don't know what he does with the money," he said. "There are people here who have a monthly income of \$200 and give the pastor half of that."

I spoke with the Samoan pastor, a Reverend Salatielu, a burly man in his 60s. His father and grandfather had been preachers before him. He liked Ofu. "The people are very generous," he said.

THE NEXT DAY I bade Ili *tofa* and boarded a boat for Tutuila. Seven hours later we nosed into Pago Pago's bay. Most imposing of the islands, Tutuila rises abruptly from the sea like the fabled Bali Hai. It is stunningly green; the bay area averages 200 inches of rain a year.

The bay, which nearly splits Tutuila in two, is actually the caldera from a series of prehistoric eruptions (all the islands are volcanic). The harbor, one of the deepest and best protected in the Pacific, was what originally drew U. S. interest and impelled the Navy to open a coaling depot here around 1900. In 1951 the Navy turned the territory over to the Department of the Interior.



Today the harbor remains central to the economy. The north shore is dominated by two tuna canneries, Starkist and Chicken of the Sea, that are the mainstays of the private sector. They get tax breaks (or they'd have to leave, they say), but they do employ 3,000 people, most of them Western Samoan aliens who will work for the \$2.82 minimum wage. This year the canneries will ship 250 million dollars' worth of tuna home to the U. S., one-fifth of all consumed.

On a spit of land near the harbor mouth, the 200-room Rainmaker Hotel sits across from the magnificent hulking mountain for which it is named. The rooms are only adequate, and the kitchen seems never to have

heard of local fish or produce, but the view is great and the cheeseburgers aren't bad.

Most food on this island is imported, because most Tutuilans no longer live off the land. And why should they? Nearly half the workers hold well-paying jobs in the local government. They may raise some taro and bananas, but mainly they stop by the supermarket on their way home from the office. Most households have color TVs and VCRs, and many people own cars.

There are some 50 miles of paved road on Tutuila—and 4,000 vehicles. Usually half are trying to get into Pago Pago while the other half try to get out. Gridlock in paradise.

The main road runs right by the hotel, a



Guarded by Matafao, a peak 2,142 feet high, Pago Pago's deep sheltered harbor (left) lies within an ancient caldera. A Taiwanese long-liner in dry dock (above) takes a respite from pursuing tuna, the island's chief export.

short walk from the business district. Like most villages, Pago Pago is squeezed between mountain and sea. In fact only 2 percent of bay-area land is level enough to build on. You stroll past the sprawling container dock, stacked three and four high, and realize there's nowhere else to put them. Farther along is a small museum with thatched fale outside, preserved for tourists. Inside, I don't know; the air conditioner was broken, so the museum was closed.

On the landward side of the street a modern two-story mall houses a score of shops and offices. Most of the other downtown buildings are relics from the Navy days. One such is the former boardinghouse in which slatternly Sadie Thompson seduced the self-righteous Reverend Davidson in Somerset Maugham's 1920 short story "Rain."

"Davidson was real, and so was Sadie Thompson," said Joe Theroux. "She lived here and [played] around quite a bit." We were talking over dinner at Soli and Mark's, Pago Pago's best restaurant. Theroux, 33 and stocky, with a thick mustache and a salty tongue, was a Peace Corps volunteer in Western Samoa ten years ago before coming here to teach. Like his (temporarily) better known brother, Paul, Joe is an author.

"The missionaries have gotten a raw deal," he was saying, "because people think of Davidson. I've met some great missionaries, honest to God."

I asked him about rich Samoan pastors. "Samoans have 'samoanized' Christianity," he explained. "The pastor has become a chief—a religious chief. He gets paid because he is a man of rank.

"Look at Samoan cricket," he continued. "It is unrecognizable to a British cricketer. If your team loses, you can buy your way back into the tournament. And don't play checkers with Samoans. They can jump backward when they're not kinged. They can jump over the whole *board*. You say, 'I've never played like this.' They say, 'This is Samoan checkers.' They've done the same thing with Christianity."

THEY'VE ALSO DONE the same thing with American-style government. The governor and 21-seat House of Representatives are elected, but the 18 senators are chiefs, selected, following Samoan tradition, by other chiefs. That doesn't sit well with 35-year-old former Representative Letalu Moliga.

"Our traditions should be practiced by the individual, by the family, by the village, but not by the government," he said, "because of the conflict with participatory democracy. I hear our leaders talking about preserving our culture. We need to think about what we are preserving and what we really want to preserve."

One of those leaders is Peter Tali Coleman, the governor who was first appointed in the 1950s and finished serving his second elected term last year. "I disagree that the matai system should stay out of politics," he said. "In my assessment, there is far more wisdom in the Senate than in that free-for-all in the House.

"And certainly, one of the most important challenges we face is the protection of our traditions. Among some of our younger people today there is a restlessness—an impatience with our system. But it has served us well for a long time."

I did hear frequent grumbling during my weeks in American Samoa, though usually affectionate and not exclusively by the younger generation: "We are an unimaginative, self-satisfied bunch of idiots!" exclaimed John Kneubuhl, 65, a retired writer and educator and now the territory's unofficial historian.

To visit with John, I had driven out the main road to the village of Taputimu. Winding along the coast, I passed a group of boys selling octopus, still dripping wet from the sea. Where there were breaks in the reef, big Pacific rollers, heaped up by the stiff trade winds, slammed into the rocky shore, sending spray above the palms. In Nu'uuli I passed the boutique that had sponsored the first island break-dance contest a few days

Bursting into exuberant dance, cannery workers—one wearing part of a sign as a collar—celebrate a vote against unionizing the Starkist tuna factory in Pago Pago. Most of the workers come from Western Samoa; the \$2.82 cannery minimum wage is too low to attract their American Samoan kin.





Signing up for U. S. Army enlistment, Michael Pale Taamilo (left) in Pago Pago joins the exodus of young people leaving the islands. Football, with its promise of a scholarship to a stateside school, provides another way out; high-school teams tangle in a downpour in Leone (below). Mosi Tatupu, running back for the New England Patriots, and Jack Thompson, "the Throwin' Samoan," a quarterback for the Tampa Bay Buccaneers, made it big.



earlier, and across the road, the Matai's Piz-za Fale.

"I don't think the matai system is going to last very much longer," said John, after we had made ourselves comfortable in his living room. "For one thing, there are too damn many of them now. That's cheapened the system. And centralized government is killing their power.

"In premissionary days the chiefs' word was final. They could be terribly cruel. Just a few months before John Williams landed, one of the most powerful chiefs in Samoan history took his army from 'Upolu to Savai'i [the main islands of Western Samoa] to attack another important family. The night before the attack they were resting in a village, and he saw a beautiful little girl, eight or ten years old. He said to his men, 'Prepare

her for me.' You might think it was sexual. No. She was roasted. He ate her. But his warriors became disgusted and clubbed him to death."

As the afternoon wore on, I asked John about the possibility of the two Samoas becoming one. "We all want reunification, I think," he said, "though it's a great question whether Samoa was ever unified. Tutuila was a subdivision of a district on 'Upolu; it was a place of exile. But Manu'a was never part of a historical Samoa.

"As it stands, American Samoa would have very little to offer. We are a hand-out society; we have no resources. 'Upolu and Savai'i are potentially wealthy islands. Savai'i is huge, and people forget that 'Upolu is nearly the size of Oahu and every bit as blessed in natural fertility."



POTENTIALLY WEALTHY, perhaps, but right now Western Samoa is classified by the United Nations as a least developed country, thus placing it among the poorest in the world.

Western Samoa

The flight from Tutuila to 'Upolu's expanded Faleolo airport takes only half an hour. The 20-mile drive to the capital of Apia takes longer. The first thing you notice is a lot fewer cars on the road and a lot more people—and chickens and pigs. You also notice the preponderance of traditional thatched-roof fale. All of which says more about the state of the economy than about preservation of the culture. And you notice the churches: Dozens of them line the road to the capital.

It's not really fair to compare Apia and Pago Pago, simply because Apia is so much larger. With 35,000 people (equal to the entire population of American Samoa), Apia feels like a small city. Like Pago Pago, its main avenue curves around a crescent-shaped harbor. Western Samoa's economy,

however, doesn't lie in its harbor, though some of its history does.

In March 1889, Germany, Britain, and the United States were about to come to blows over these islands. Seven warships lay at anchor, tensing their muscles. Then the barometer began to fall. It fell to 29.11 before the hurricane struck.

Six ships—three German and three American—went down. Only the British *Calliope*, which had put to sea in the teeth of the storm, managed to escape. In the sobering calm after the catastrophe, the three powers agreed to agree. Eventually Britain bowed out, the U. S. got the eastern islands, and Germany the western.

That's how things stood until World War I, when a New Zealand force landed and arrested the German nationals without a shot. New Zealand governed until January 1, 1962. On that day the Western Samoan flag flew over Apia for the first time.

Some people have called Apia cosmopolitan. Well, perhaps they were thinking of Aggie Grey's Hotel and of Aggie herself. Both certainly qualify.

"After my second husband died in 1940, I



Designs for manhood and status: The tattooer's mallet sends needle-like slivers of a carved boar's tusk into the flesh of Pitoa'i Tupou, a matai, or chief (right), in the village of Faleasi'u on 'Upolu. Ink made from soot enhances the design.

A complete tattoo on the lower back and torso and upper thighs may take 18 hours, split into several sessions of skin-rending pain that islanders equate with childbirth. "For a whole month you are in pain," says a tattooed Samoan. "You walk like a hunchback. If you can take the pain of tattoo, you can overcome any hardship in your life."

At a saofa'i, or title-granting ceremony, at Apolimafofou, newly designated matai (left) wear 'ula, or leis, decorated with money from friends and family. Expected to look after the well-being of their 'aiga, or clans, matai have the power to grant land, mediate disputes, and banish recalcitrants.



The tall trees of 'Upolu shelter small farm plots, where the smoke from stone ovens on a Sunday morning hangs heavy as fog. Western Samoans live mainly by subsistence farming, largely abandoned by their cousins on American Samoa.

was left with seven children and very little money," said this 89-year-old grande dame of the Pacific, daughter of a Samoan mother and an English father. Aggie denies being James Michener's inspiration for the character of Bloody Mary in *South Pacific*.

"I bought some whiskey and made a little bar," she said. "A few tables, a few mats on the floor, a kitchen out back. And I started to put people up."

Today the hotel has 120 pleasant rooms encircling a lush tropical garden. The dining room serves the best food in Samoa, including such local dishes as *palusami*—coconut cream baked in young taro leaves. After dinner Aggie often mingles with the guests and can be persuaded to dance the *siva*: "It makes me happy to dance. If I didn't, I think I'd be in a wheelchair."

Two years ago Aggie received a surprise from Queen Elizabeth: "When I read the letter that I was to get the QSO [Queen's Service Order], I nearly passed out. The New Zealand high commissioner came here and pinned me. We had a big party. The medal was so heavy, I said to him, 'You know I have only a small chest; now you flatten it more!' I always say what I think. That's my trouble.

"I'm frightened of the new airport," she told me. "The big planes with hundreds of people coming in—the island can't take them. This is a pretty little place. I don't want to see it spoiled."

Aggie is also disturbed by what she feels is a growing trend: "There are too many people sitting around relying on money from family overseas. They should be working the land."

So-called overseas remittances, 20 million dollars last year (much of it from American Samoa), are a big chunk of the economy. The country as a whole receives aid too—some 15 million dollars last year from a multitude of foreign sources. But the fact is that most people *are* working the land.



"**A**GRICULTURE is the backbone of our economy," said Prime Minister Tofi-lau Eti Alesana, a large cordial man. "In 1984 our exports totaled 15 million dollars, three times the 1981 figure. Growers are getting more for their products, but the cost of living is going up. We need to stimulate foreign exchange. That means we must curb imports and export even more."

The government controls extensive tracts of cultivated land, mainly in coconuts and cacao. It also controls prices paid to small producers, most of whom farm at or just above the subsistence level. There are a growing number of progressive farmers, however, who look at farming as a business.

One of those is Birdsall Ala'ilima, who



works 350 acres in the remote eastern uplands of 'Upolu that his matai father cleared in the 1950s. Birdie and his wife, Marlène, and their four small children live in a frame house not far from spectacular 228-foot-high Sopo'aga Falls. Staying with the family when I visited was Birdie's sister Sisilia, a medical student at the University of Hawaii.

"Cattle used to be our mainstay," said Birdie, as he showed me around the plantation. "But we were having problems with theft. So now it's coconuts. We've been making copra recently," he said, pointing to the drying shed, "though we would prefer to deal in whole nuts.

"Economic planning by the government has been terrible. Two major industries here

are a cigarette factory and a brewery. The tobacco is all imported, and the ingredients for the beer are all imported. The government should be developing local industry to encourage local products. Like integrated processing of coconuts—using the whole nut, not just the meat."

Back at the house, he and Sisi expanded on the idea. "The technology has been around," said Sisi, "but Third World countries have been slow to exploit it. The husk makes coir fiber, twisted fiber used in car seats. The shells make high-quality activated charcoal—industry uses it in anti-pollution equipment. And coconut milk has potential as a carbonated beverage."

"The price for a nut now is six cents," said

Birdie. "With integrated processing it could be 14 cents."

The Ala'ilimas had started a petition among nearby villages in support of the idea and planned to present it to the government. "In this place," said Birdie, "it's hard to get action as an individual."

The petition is the first act of what they hope will be a national grass-roots farmers association. "People haven't been getting a fair price from the government," said Birdie. A newsletter would inform villages about prices, markets, and new techniques.

Sisi had taken a semester off to help form the association, yet sounded a note of reserve: "By giving this information to the villages, we are implying that their lives have been incomplete. But as far as they're concerned, their lives are complete and always have been. If government and progress just disappeared, the villages would survive. But the farmers should know their options and decide the future for themselves."

As soon as the association got on its feet, Sisi was going back to Hawaii but vowed to return and practice medicine in the villages. "The country has need of doctors," she said.

Sisi's return will be an exception to the rule. Thousands of people leave Western Samoa every year for American Samoa, New Zealand, and the U. S. While that migration offsets a high birthrate (nearly half the population is under 15), many who leave are educated young adults—the hope of the future. Returning physicians are especially welcome and equally rare.

"The average salary for doctors here is something like \$5,000 a year," said Director of Public Health Dr. Walter Vermeulen in his Apia office. "And we are at the top of the wage scale. That's not much motivation to come back. The sirens of affluence are very strong."

Vermeulen, a warm, graying man in his mid-40s, is Belgian by birth but married a Samoan and became a naturalized citizen.



Worship wears white on Sunday morning as women in flowing puletasi escort children to the Congregational church at Sapapali'i on Savai'i (above). Praying youngsters close their eyes in rapt concentration (right). Here the Reverend John Williams of the London Missionary Society landed in 1830 to bring Christianity to Samoans, now among the most fervent churchgoers in the world.

"We are basically a healthy country," he told me. "Our biggest problems are no longer the communicable diseases. We seem to be catching the diseases of the West, like heart disease, hypertension, diabetes, ulcers. Food is one variable. People are relying more on imported food, much of it inferior—chicken backs, mutton flaps, low-grade corned beef—stuff that would never be eaten by most Americans."

One of the most alarming recent health trends is the high suicide rate among young people. It may well stem from the rather authoritarian life-style in the villages. "Typical," said Vermeulen, "is the son who has an altercation with his father and goes out and drinks weed killer. From the outside Samoa looks like a peaceful, pleasant society. Inwardly, we have conflicts."

But Vermeulen remains an optimist. "Samoa is blessed with a good climate and a healthy population," he said. "Poor but healthy. No one is farther than a 15-minute

drive from one of our health centers or district hospitals. That is true even for the most distant villages on Savai'i."

SAVAI'I. Samoa's big island, bigger than all the other islands combined. Some say it is the legendary Hawaiki, from which the great Polynesian navigators set sail to discover every habitable speck of land in the boundless mid-Pacific. It has been called the soul of Samoa. Here the 20th century has put down the shallowest roots, and the *fa'a Samoa*—the Samoan way—has the most meaning.

The ferry to Savai'i is a once-in-a-lifetime experience, I was told. That is, you should experience it once and only once. But it wasn't all that bad. The World War II landing craft had room for half a dozen vehicles, including my rental car, along with maybe 50 people and their assorted animals. We plowed across the potentially ferocious 13-mile channel in relative calm.





Until fairly recently, travel on Savai'i was restricted to either walking or paddling, but Australia put up the money and the expertise for paving a road around the island. When the ferry docked at Salelologa, I headed counterclockwise.

Savai'i has the feel of a large landmass. At its center is 6,095-foot Mount Silisili, highest point of all the islands, but the ground slopes so gradually that you don't notice it.

As I drove through village after village, I caught glimpses of Samoan life: boys returning from the plantation, weighted down with baskets full of coconuts; older men gathered in a *fale*, sitting cross-legged with their backs against the support poles—village chiefs, debating the day's business. In other *fale* I saw women tirelessly plaiting pandanus mats. Farther on, a group of men were fishing in a lagoon, beating the water as they converged on a central point. In one village a wedding was in progress, with much singing and dancing and exchanges of food and fine mats, the intricately woven units of ceremonial currency.

In many villages the *malae*, or town common, had become an athletic field, where young men were playing volleyball or cricket or rugby. Young Samoan men are seemingly always big and powerfully built. Dressed in their waist-to-knee wraparound skirts called *lavalava*, they look about as effeminate as the Los Angeles Raiders. Several Samoans, in fact, play professional football in the U. S.

Before rounding the island's northeast corner, the road cuts inland and crosses a bleak expanse of lava from the most recent eruption, which ended in 1911. Here and there a few green shoots poked up defiantly.

THE PAVEMENT temporarily runs out at the tiny north coast village of Manase. There Chief Taito Muese and his wife, Rasela, invited me to spend the night. They didn't speak much English, and I spoke less Samoan, but never was I made to feel more welcome.

Sixteen-year-old Auckland, one of four daughters and six sons, took me for a walk along a picture-postcard beach. Her English was unmistakable: "I want to get far away from Samoa," she said. Why, I asked her. "There is no money here," she replied.



Dexterous fingers weave pandanus leaves into fine mats (facing page, foreground) for ceremonial gifts. Fare for a feast (above) includes—clockwise from the roast pig—bananas, corned beef, breadfruit, palusami, or coconut cream baked in taro leaves, taro, opened palusami, fish, cocoa, and coconut.

A technician (top) dusts flowers of a coconut palm with pollen from Solomon Islands trees to produce a more fruitful strain. The United Nations Development Programme helps fund the project to bolster Western Samoa's economy.

At dawn I rose to watch the boys prepare the *umu*, or stone oven. After being heated white-hot in a coconut-shell fire, the fist-size stones were mounded together with taro and bananas; breadfruit and leaf-wrapped fish and palusami were placed on top. In an hour all was ready.

Taito and I ate first, as is customary. In Samoan fashion we sat on the floor and ate with our fingers. Fourteen-year-old Tivoli fanned flies from our plates, and another child brought finger bowls.

I ended up staying that day and night with Taito and his family, and set out again the following morning. On the southwest coast, at Fagafau, I passed a notorious lover's leap, still used occasionally, I was told. At the bottom of the vertical cliff it was not uncommon to see sharks slowly patrolling back and forth. At the village of Taga I turned the last major corner and headed for a shower and a hot meal at the Safua Hotel not far from the ferry landing.

The Safua is a charming cluster of ten private fale surrounding a large central sitting and dining area. The nightly buffet rivals Aggie Grey's. The hotel was designed and built by Moelagi Jackson and her late husband. "Now that my husband is gone, I have to widen my shoulders," she said. An articulate, no-nonsense woman, quick to smile, Moelagi holds the high title of Vaasiliifiti. Of 20,000 matai in Western Samoa, she is one of only 100 titled women.

"I am not worried about Savai'i being spoiled by tourism," she said. "If too many palagi lodge in villages, that will tend to hurt. But if we have a few small hotels, the tourists will come and go, and Savai'i will be the same.

"Samoans are a proud people," she said. "Look at what's happened to the Hawaiians and the rest of Polynesia. We still have our system. We have our language. And we have our land. You cannot sell communal land. As long as the land is held by the people, there will not be dramatic changes. They will take a long, long time."

The next day I said farewell to Savai'i and boarded the ferry for 'Upolu. My time

in Samoa was growing short, but I had one more appointment to keep.

OF ALL the paradise-starved palagi who ever found their way to these islands, Robert Louis Stevenson is held dearest in Samoan memory. He was already a famous man, author of *Treasure Island* and *Dr. Jekyll and Mr. Hyde*, when he arrived in 1889. He was ill, however, and had come, "only to grow old and die, but . . . it is a fair place for the purpose."

Stevenson built his home on the slopes of Mount Vaea, a few miles outside Apia. And his health improved: "I can walk," he wrote, "I can ride, I am up with the sun." As time passed, he developed a close bond with the Samoans. "I love the land," he told them, "and I love the people." They called him Tusitala—teller of tales.

He died suddenly, on December 3, 1894, at the age of 44. His Samoan friends worked around the clock hacking a path to the summit, where, as he had wished, they buried him.

In the cool of the morning I set out to visit his tomb. At first the trail climbed gently, past an occasional coconut palm ("that giraffe of vegetables," wrote Stevenson), but soon it steepened, switchbacking upward through the thick mountain rain forest. Small black lizards scattered from the path.

After about an hour I emerged on the summit. In the center of a clearing lay the simple limestone tomb. Far below, beyond the distant church towers of Apia, beyond the white fringe of reef, two tugboats were standing out from the harbor entrance, waiting to greet a cargo ship just coming into view. It was a marvelous panorama.

I turned to the tomb. Engraved on one face was Stevenson's poignant elegy, which ends with these lines:

*Here he lies where he longed to be;
Home is the sailor, home from the sea,
And the hunter home from the hill.*

I lingered with the Tusitala for a few minutes more, then started back down the mountain. □

"The first love, the first sunrise, the first South Sea Island are memories apart," wrote Robert Louis Stevenson, whose tomb lies atop Mount Vaea on 'Upolu.





The riches of Arabia once traveled by caravan through landscapes unchanged in centuries. Here an ilb tree overlooks the forbidding hills of South Yemen. The author and photographer are the first American journalists to gain access to the Marxist

Arabia's Frankincense



nation. They found the area almost as isolated as in the first millennium B.C., when herbs, spices, and incense were coveted throughout much of the ancient world. Today those magic aromas—particularly frankincense—still permeate everyday life.

Trail

By THOMAS J. ABERCROMBIE

NATIONAL GEOGRAPHIC SENIOR WRITER

Photographs by LYNN ABERCROMBIE



Rearing out of South Yemen's desert, mud-brick "skyscrapers" of Shibam, many of them centuries old, hark back to the power of the Hadramawt kingdom.

National Geographic, October 1985



The Hadramis grew rich in the frankincense trade's heyday, controlling flow of the resin to the Greeks and Romans who craved it.



Where traders once hauled incense through the ancient kingdom of Main, North Yemenis lead camels laden with tanbark north into Saudi Arabia.

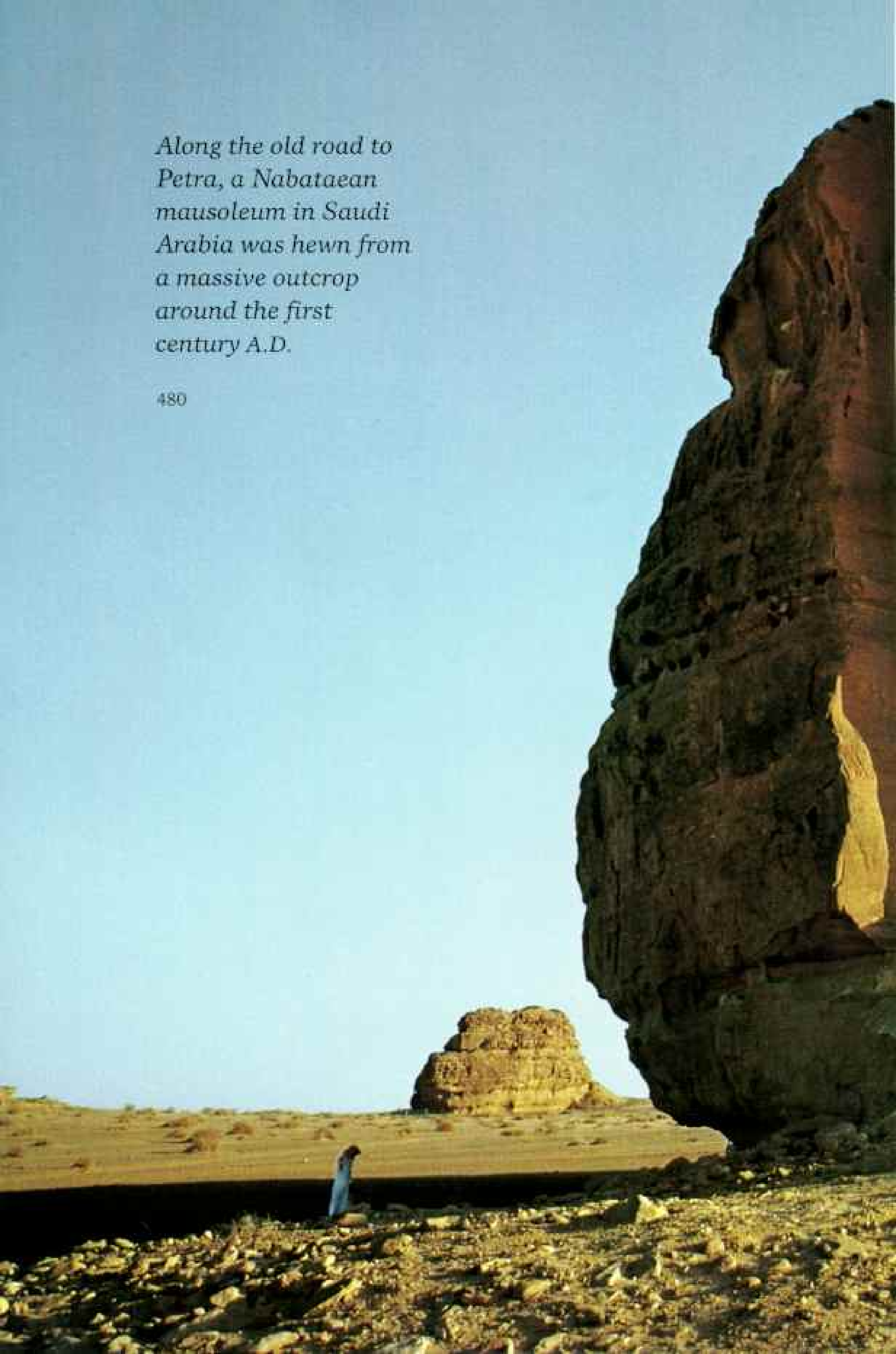
National Geographic, October 1985

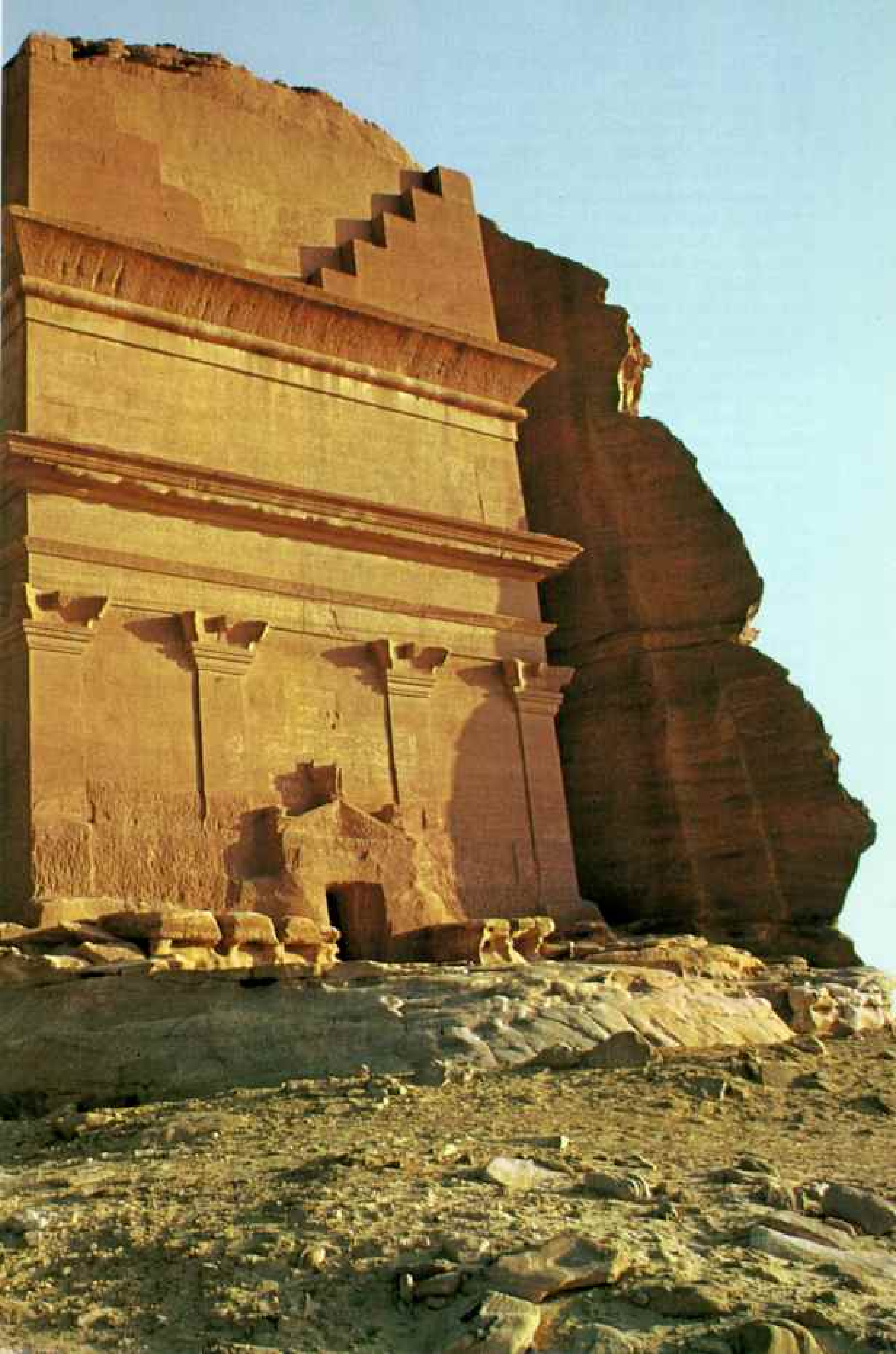


The frankincense trail depended for its existence on the camel, domesticated by 1300 B.C., probably first in Arabia.

*Along the old road to
Petra, a Nabataean
mausoleum in Saudi
Arabia was hewn from
a massive outcrop
around the first
century A.D.*

480





WITH A FEW deft strokes of his spatula-like chisel, Haj Mahana bin Salem chipped away the gray, papery outer bark, smoothing a patch the size of his hand. Magically, milk white tears welled on the green wound. The old Bedouin began scraping another branch.

With his bowl he moved from tree to tree, pursuing a harvest unchanged for thousands of years. At some trees, tapped three weeks earlier, Haj Mahana collected handfuls of precious ooze, now hardened to a translucent golden hue: pure frankincense.

All morning I followed him through the fabled groves. Each a clump of thick trunks, the trees (*Boswellia sacra*) seemed from a distance more like large bushes, barely taller than the camels that nibble on their sprays of small, succulent leaves. Here grows the world's best frankincense, in the narrow strip of Oman's desert plateau that borders the green mountains of the Dhofar region (map, page 485). Only here do the trees find conditions ideal: a steady tropical sun, pale limestone soil, heavy dew from the monsoon.

At midday we dined on a tender young goat that Haj Mahana's nephews had roasted. The fragrant firewood was gleaned from derelict frankincense branches. After the meal Haj Mahana scooped coals into a small clay censer, sprinkled on a few beads of his frankincense, then passed it around. Following local custom, we fanned the white smoke into our clothes and beards. Coiling its way heavenward, the subtle aroma of balsams recalled a pine forest or prayer-worn altars of some distant shrine.

"There is no better frankincense than this," Haj Mahana said, "but cheaper incense from India and Somalia gluts the markets these days. I am one of the last of the harvesters here. It is barely a living. Our young men will not follow the trade; they look to the army or the oil fields."

The old man poured me a souvenir handful from the battered bowl it takes him a day to fill. His harvest for the season totaled barely 50 pounds, netting him scarcely 55 rials (about \$160) this year.

From such small streams rose the river of incense that in ancient times flowed north on caravan camels from Arabia Felix—Happy Arabia—to distant Greece and Rome. Along the route a succession of kingdoms prospered for nearly two millennia: Fabled names like Main, Hadramawt, Sheba, Qataban, Nabataea. They forged their own languages and alphabets, laws and religion, art and architecture, and engineered dams to farm hundreds of thousands of acres of desert before slipping into the dust of history.

Recently, with Lynn, my photographer-wife, I followed remnants of the once crowded incense road some 2,400 miles through Arabia, from southern Oman, through Yemen's high mountains, across the dunes and black volcanic deserts of Saudi Arabia to Petra, a wealthy Nabataean entrepôt lying in today's Jordan.

Along the way I slept at Bedouin camps and remote army posts, climbed the mud-brick towers of Wadi Hadramawt, made stone rubbings among ruins where, legend has it, the Queen of Sheba reigned. I interviewed archaeologists, caravanners, and truck drivers and visited holy Mecca, last of the world's forbidden cities.

In Roman times a rugged journey of some 80 marches, the trail still offers challenges. People along the way, although hospitable, have their reasons to be chary of outsiders. Pro-Western countries astride the ancient route share it uneasily with a Soviet-backed regime in South Yemen; Saudi Arabia militantly guards strict Islamic traditions. Many areas bow to no government except local renegade sheikhs. Here submachine guns are part of everyone's kit. All in all the



AN OMAM INCENSE BURNER RELEASES THE ESSENCE OF FRANKINCENSE.

journey was probably more convenient back in the first century.

Thousands of years earlier, Egyptians were using the "perfume of the gods" for temple rites as well as a base for perfumes. The first recorded mention is on the 15th-century B.C. tomb of Queen Hatshepsut, who had sent an expedition to the land of Punt (probably the Somali coast) to fetch frankincense.

In 450 B.C., with Athens at its peak, Herodotus, the Greek Father of History, mentioned Arabia's aromatics. "The whole country is scented with them," he wrote, "and exhales an odor marvelously sweet."

Across the Roman world incense perfumed cremation rites. Nero, it was said, lavished the equivalent of a year's Arabian production on the funeral of his consort Poppaea. To the Magi who bore gifts to the Christ child, frankincense symbolized divinity, an offering on a par with gold and myrrh, another Arabian incense also prized for medicine. A darker, richer aromatic, myrrh perfumed the royal mummies of Egypt and was a main ingredient specified by the Old Testament in the sacred anointing oil of the Jews.

ON MY WAY BACK to the Omani coast from Haj Mahana's frankincense grove, the Arabian desert did a quick change. A roof of monsoon clouds suddenly quenched the blinding sun. The air chilled as the road climbed gently.

At 3,500 feet the road started down again, and the mists parted briefly on a timeless tableau—a dark-skinned girl in robes of red and yellow hurling pebbles to drive her cattle across the rolling green meadows.

I stopped near an intersection to check my way on an old British Army map. From a hazy grove of oaklike *meelan* trees, a pair of mountain militiamen materialized, clad only in loincloths and cotton sport shirts, carrying their rifles casually.

"Salaam!"

We exchanged greetings in Arabic, and I asked for directions. Conferring between themselves, they spoke Jeballi, a mountain language with unfamiliar lisps and nasals—relic of ancient South Arabian dialects—but turned back to me in Arabic. "*Ala al-shemal*," the tall one said: "Keep left."

Skidding and sloshing in four-wheel drive down a muddy hillside track, I stopped to photograph a traditional Jeballi village, a score of thatched, blister-shaped huts and cow sheds surrounded by low stone corrals, and was invited to tea.

Sheikh Issa Mesaoud, an elder of the Mashini tribe and headman of Khajim village, poured the thick, sweet glassfuls from his thermos as we sat around the fire pit of the dim, windowless room. Tin trunks lined the walls. Overhead hung blankets, clothes, and strips of drying goat meat. Flies buzzed everywhere.

"They are the curse of the wet season," Sheikh Issa sighed. "They can cause a cow to wither and die." He brightened. "But the monsoon is over. In a few days the clouds will lift; then it is paradise here. Skies are warm, pastures thick, and the milk flows."

I continued down through green hills and a confetti of wildflowers, past a duck-filled lake at Wadi Darbat. The road broke through the belly of the clouds into dry desert again just above Khor Rori, a deep cleft in the shoreline of the Arabian Sea where once stood Dhofar's major incense port, Sumhuram.

A ruined hilltop fortress commands the long harbor, haven for a fleet in the first century A.D. but now landlocked by the shifted sands. I found the remains of houses, shops, storerooms, and a small tower, studied by a team of American archaeologists in 1952-53. I ran my fingers lightly over a stone inscription in the north gate: "ASDUM THALAN . . . SERVANT OF ILADHDH VALUT, KING OF HADRAMAWT . . . WAS IN CHARGE OF THE CITY. . . ."

The destination of the incense ships, and now mine, was the port of Qana, 400 miles down the coast. The *Periplus of the Erythraean Sea*, an ancient manual of sailing directions compiled by an unknown Greek, tells that frankincense was brought "to Qana on rafts held up by inflated skins after the manner of the country, and in boats."

The voyage today involves a long detour. Arab dhows, now diesel powered, still ply the Arabian coasts, but since a war between Oman and South Yemen ended in 1975, no Omani vessels call in South Yemen. Indeed, since Marxist revolutionaries took over the Crown Colony of Aden and the surrounding



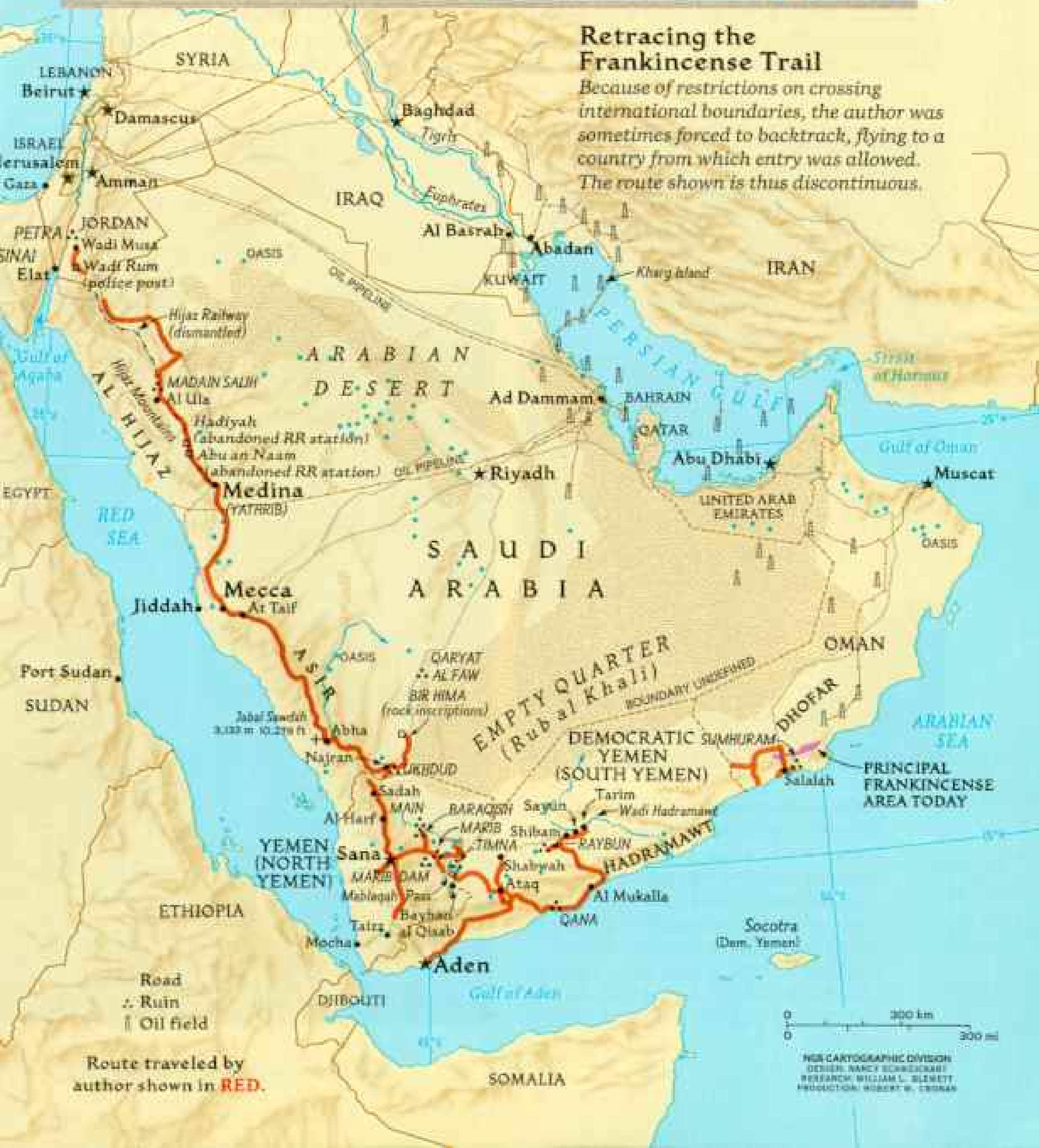
THOMAS J. ARBESCHUMBE (ABOVE)

A tree of substance

SCRUBBY and unpretentious, a tree of the genus *Boswellia*—one of several species that yield frankincense—offers its treasure to Haj Mahana bin Salem (above), an Al Kathir tribesman of Oman's frankincense-famed Dhofar region. Scraping the bark produces gum-resin droplets (below left). "We throw away the first scrapings," he says. "A second cutting weeks later gives low quality. Only the third cutting produces real frankincense." The branches flower in late September (left); harvesting takes place nearly year-round.

The best of the storied trees grow in southern Arabia. Today just a few tons of frankincense are produced each year, mainly for rituals and health uses. At the time of Christ—celebrated at birth with frankincense—more than 3,000 tons may have been exported annually to consecrate temples, mask the odor of cremations, make cosmetics, and treat every conceivable ill from gout to a "broken head." At Alexandria, a major processing center, Pliny the Elder described a security system as strict as any today: "Good heavens! No vigilance is sufficient to guard the factories. . . . before [the workers] are allowed to leave the premises they have to take off all their clothes. . . ."





NES CARTOGRAPHIC DIVISION
 DESIGN: NANCY SCHRECKENGAR
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Aden Protectorate from Britain two decades ago, travel there has been tightly restricted. Arriving in Aden, now South Yemen's capital, by air from a third country, Lynn and I found we were the first American correspondents allowed into the People's Democratic Republic of Yemen.

NEW RED BANNERS in Arabic called for "Immortality to the Martyrs of the Revolution" and "Glory to the People and the Party." But little had changed in Aden's crowded Suq al Tam. There the bouquet of frankincense and myrrh, of rose attar and sandalwood mingled with cloves, cinnamon, coffee, cardamom, and thyme. Shop No. 37 specialized in perfumes and

folk medicines; in the back room I found proprietor Salim al-Qusais weighing incense on a rusty iron scale. Nearby a trio of Somali women chanted an African lament as they cleaned and sorted raw frankincense in wide baskets.

Salim laid out handfuls of the three varieties: an amber-colored powder to be boiled as an infusion for an upset stomach; the lighter-tinted incense for burning; *shihri*, almost white in color, that is chewed throughout Arabia. "It is good for the teeth and gums," Salim said. "And it helps clear the brain."

Patiently he explained other wonders in his pharmacopoeia: goatskins of resin from the dragon's blood tree; bright yellow turmeric, used by village women as a makeup



Monsoon-greened hills feed cattle in Dhofar (right), timeless land where a camel herder (above) still welcomes the evening campfire for coffee and camaraderie. Although Dhofar, unlike most of Arabia, is blessed with regular rainfall, its frankincense trees draw sustenance mainly from early morning mist. Monsoon winds governed the timing of the ancient seaborne trade.



and sunscreen; myrrh, a medicine for female disorders; *hilf*, small red seeds to treat kidney stones; ground red coral to heal cuts; and various other curative barks, galls, herbs, seaweed, and fish scales.

Salim leaned closer. "Believe me, these old medicines I trust more than all the new doctors and their hospitals. They have kept me robust—and my 17 children as well."

Although Aden is the leading frankincense market, the trade has declined since Salim's grandfather wholesaled 20 to 30 tons a year. Nowadays the shop's output is, as Salim put it, "measured in pounds."

It has been estimated that, at its peak in the second century A.D., South Arabia sent more than 3,000 tons annually to Greece and

Rome. At the Aden museum I compared notes with Abdullah Muheirez, director of South Yemen's Center for Culture, Archaeological Research, and Museums.

"Our ancestors in the Hadramawt grew wealthy on the trade. It was a giant industry," said Professor Muheirez. "The whole civilized world craved incense for their altars; South Arabia controlled the source. It developed a powerful cartel, a kind of OPEC of its time."

The "pipeline" began at Qana, a 300-mile drive east of Aden, probably the same Canneh mentioned in Ezekiel 27:23. There I pitched my tent below the black volcanic promontory Arabs call Hisn al Ghurab, "fortress of the ravens."



Scooping out a fire pit on the beach where the ships once loaded, I detected a familiar scent. Digging deeper, I brought a handful of the white sand to my nostrils. The sweetness was there. Just barely. Frankincense!

On the deserted beach I pondered the drama played here centuries ago: a small port chockablock with creaking wooden ships; sacks and goatskins of incense piled on the shore; spices and silk bales from India and beyond; half-naked longshoremen sweating and cursing; bellowing camels; shouting soldiers, scribes, and money changers. All had long ago vanished; all but the durable dust of frankincense.

During the Middle Ages, Al Mukalla—today a sleepy town of some 70,000—replaced Qana as the chief port of Hadramawt. And, despite South Yemen's new

socialism, medieval Mukalla still harks back more to Muhammad than to Marx.

"*Allahu akbar! Allahu akbar!*" calls the muezzin in his minaret at 4:30 each morning: "God is great." The loudspeakers outside my window jolted me awake and onto the balcony under the last stars; pale moonlight bathed the minaret next door. "Come to prayer; prayer is better than sleep. . . ."

I watched dawn warming the town to life. A drover from the meat suq marched a flock of bleating sheep toward their doom; from a radio an Egyptian popular song wailed to the first customers of the Freedom Café. Just below, a blacksmith at his clay forge began hammering red-hot iron into grappling anchors and eyebolts for the port's wooden fleet. Along the quay small cranes unloaded lighters stacked with Burma teak, pine lumber from the northern Soviet Union, bags of flour from France.

On Mukalla's narrow main street, clogged with small cars and pickup trucks, busy shops offered diesel pumps, generators, TV sets, auto parts. I was more taken with the spice sellers' wares: frankincense, myrrh, and international sundries such as Woodward's Celebrated Gripe Water from England; Fang-Fang Baby Powder from China; Indian-made Sugandha Incense Sticks "for prayer or pleasure."

By noon prayer the streets empty and shutters close as the blinding sun bakes the narrow shore. A staggering tidal blend of sewage, garbage, dung, and the remains of dead sharks does to the nose what a blood-curdling scream does to the ears. Such stench plagued even the noblest cities in antiquity; not all the frankincense was burned in pious offering to the gods.

FROM THE SWELTERING COAST the incense road led inland to Shabwah—ancient Sabota, capital of the Hadramawt kings who for centuries controlled the trade. "Frankincense . . . is conveyed to Sabota on camels . . ." the Roman scholar Pliny the Elder wrote in the first century A.D. "The kings have made it a capital offense for camels so laden to turn aside from the high road."

Travelers still stick to the road today. Permission to visit Shabwah is granted only reluctantly. Tribal feuds, I was told, make the



Prodigious mud-brick spire of Al Mohdar Mosque, 150 feet tall, juts from Tarim in South Yemen's Hadramawt region (facing page). The city holds 300 mosques. Near neighboring Shibam an image of a grim reaper proved to be a shrouded woman cutting alfalfa (above).



journey hazardous. Too, Shabwah lies in a politically sensitive area where North Yemen, South Yemen, and Saudi Arabia meet, although borders have yet to be marked. Not far to the west, Americans were drilling for oil; nearer Shabwah, the Russians.

Everywhere in South Yemen I traveled with a government driver and escort. Now, at the remote desert outpost of Ataq, we took aboard a policeman named Muhammad, trained in East Germany, with a revolver in his belt and submachine gun in his hand, for a nonstop, 70-mile dash across the featureless desert to Shabwah.

There, under a burning sun, I walked through sand-drifted streets lined with the rubble of what once was one of the most powerful cities in Arabia. A 30-foot-deep trench by French archaeologists near the remains of a temple showed 2,000 years of continuous occupation, ending with a fire around the third century A.D.

Shabwah art graces Aden's new National Museum: fine ivories, fresco panels, stone incense burners, pillars inscribed with fierce griffins. In Aden I had met Jean-François Breton, director of the Mission Archéologique Française in South Yemen, who had just completed his sixth season digging in Shabwah and the Hadramawt.

"The city covered about 500 acres, housed probably 5,000 people," Dr. Breton had said. "Around it we traced hundreds of fields with a sophisticated irrigation plan."

THE MOST FERTILE LANDS of the Hadramawt lay farther east, where the isolated valley of Wadi Hadramawt narrows and curves in a long jagged arc toward the sea. There, around the sister cities of Shibam, Sayun, and Tarim, live most Hadramis today.

A majestic mirage formed above the palms. Some 500 tall houses, wall pressed to wall, rose seven and eight stories above the desert—a Manhattan in mud brick,

Arabia's most spectacular settlement, Shibam (pages 476-7).

Armed with introductions from Aden, I made my way on foot through the canyon-like streets to the white "skyscraper" of retired merchant Salem Muhammad Baobed. At the sixth-floor reception rooms, Mr. Baobed bade me be seated on a fine Persian carpet beside him. He was a spare man with the typical long, thin Hadramawt face of light complexion; finely clothed, he was a man of means. We exchanged puffs on his gurgling water pipe. Although most of his 72 years were spent far from his native land, his Arabic was flowing and precise.



Bulbous tombs of the pious draw a follower who recites the Koran in Sayun, sister city of Shibam and Tarim. Sayun's sultan fled after South Yemen's Marxist revolution began in 1967, and his former palace is today a museum.

"By tradition Hadramawt men leave the valley while still young to seek their fortunes. We have more than 100,000 living in Indonesia. Nowadays more are choosing Saudi Arabia or the oil states.

"For generations the Baobeds have been merchants—spices, tobacco, indigo, clothing, fish," he said. And, like most, he had retired, wealthy, to his homeland.

"The new socialist government monopolizes the import-export trade business in this country now," Mr. Baobed sighed. "But I live comfortably on the income from my properties in Malaysia."

Mr. Baobed's nephew led me on a brief

tour of the 370-year-old Baobed domain that, counting attached family dwellings, totaled 78 rooms. The ground floor was used for stables and storage. Offices of the family business occupied the second; the third, more storage. The fourth floor housed the men's living quarters. The fifth was the domain of the harem and a new kitchen, complete with freezer, washing machine, and gas stove. I emerged, puffing, on the top floor: a place for wash to dry and children to play and—on the hottest nights of summer—a cool retreat for sleeping.

Since 1960 a network of water pipes has served nearly every house in Shibam. No

THOMAS J. ABBECROMBIE



longer do the women trudge with goatskins to distant wells. But the blessing of running water has proved a curse as well.

"Shibam has no sewers. Wastewater is building up, weakening its foundations," explained Abdul Qadr Sabban, a turbaned Hadramawt writer and historian who lives in nearby Sayun. He wore thick glasses over which he stretched a second pair to read the fine print in the papers on his desk.

"Already 14 houses have collapsed, and large sections of the city walls," he said. "A United Nations team has surveyed the town. Their experts, working with our local builders, will devise repairs—and drains—to save the town."

Traditional Hadramawt builders still create wonders, rococo minarets and gracefully domed tombs of holy men. In Tarim, a pious town of 300 mosques, I climbed what must be the tallest mud-brick building on earth, the fragile 150-foot-high minaret of Al Mohdar Mosque (page 489).

At Raybun, an ancient Hadramawt site excavated by a Soviet team, all that remained of the former mud-brick metropolis was a mound of silt. But, by a deep, stone-lined well, the Soviet archaeologists had uncovered the remains of a small stone temple with several small inscriptions. Nearby I picked up sherds of pottery incised with the South Arabian letters φ and ϕ . Similar markings, perhaps a merchant's monogram, were found on vessels discovered recently at the other end of the incense route—at Gaza—on the Mediterranean coast.

NEXT MAJOR STOP for the caravans was Timna, capital of the Qatabanian kingdom, second of five powerful city-states along the prosperous route I would travel. Around Timna's South Gate I found the scattered, half-buried stone inscriptions that proclaimed laws of the city in 200 B.C. Murder was punished by banishment; dishonest merchants were fined 50 pieces of gold. Other fragments list a dozen trade laws promulgated by one King Shahr Hilal of the period. The regulations established a monopoly for Timna, ordered taxes, allotted market space, and installed overseers to control the caravans.

Near Timna, with the local inspector of antiquities, Khayran Zubaidi, I visited an

ancient enterprise that still survives in Wadi Bayhan. "Indigo has been used for 40 centuries," Khayran said. "It was one of the luxury goods traveling north with the incense."

Until a few decades ago dark blue indigo loincloths were preferred by the tribes of "blue men," the Bedouin of southern Arabia. Even during the chilly highland winters, they claimed, a mixture of indigo and sesame oil rubbed on their naked chests and legs kept them warm. On small farms around Bayhan the indigo bushes (*Indigofera tinctoria*) still grow.

At one of the last indigo workshops in Yemen we watched an old bluebeard soaking and stirring crushed leaves to extract the dyestuff. Nearby, in rows of clay jars, rolls of cotton cloth soaked in the finished dye, thick as porridge. Later a beater would pound for hours with a heavy hardwood mallet to work dye into the cloth.

In another quarter of Bayhan, drawn by what sounded like the buzz of a giant bee, I looked in on Ali Abdullah Mbarak's mill, grinding away at full capacity—one camel power. Here Ali's blindfolded *naqah*, or she-camel, plodded in endless 16-foot circles, hauling a beam counterweighted with stones and a hitchhiker, Ali's young son. Hub of the merry-go-round was a pestle of polished hardwood. It turned in a mortar hollowed from a desert acacia, to squeeze oil from sesame seeds.

Camels were domesticated by 1300 B.C., possibly first for milking herds. Small clay figurines found in North Yemen and dating from 1000 B.C. are among the earliest depictions of the animals. Thriving on harsh vegetation that would starve other beasts, the camel provides milk, wool, meat, and leather. And, as the Koran notes, "on them, as well as in ships, ye ride." Only on these "ships of the desert" could the early incense trade have grown.

Out of Bayhan al Qisab, Khayran and I followed one fragment of 2,000-year-old pavement that zigzags up to 5,000-foot Mablaqah Pass, halting at the narrow defile ancient traders had hammered through the ridge. Possibly a control point on the old incense road, the pass still surveys a stretch of border between North and South Yemen.

Here a Yemeni soldier climbed aboard, wearing a loincloth and curved dagger, the

same costume his ancestors, 150 generations back, wear on stelae of bronze and alabaster now found in Arabia's museums. He also carried a Kalashnikov that rattled against my knee as the jeep bounced down the mountain's far side.

"*Habaytik, wa na arifti . . .*," the jeep's cassette player poured out a Yemeni song. "I loved you, but you never knew. . . ."

At the bottom of the ridge we turned south into Wadi Nuqman, a gash in the brittle desert landscape that soon brought us to a verdant grove of tamarisks shading the ruins of a long-abandoned caravansary. On foot we continued along a path, partly paved with red stones, to the head of the granite-walled valley and a pool fed by a lofty spring. We rested under the high ashlar-laid walls of an impressive ruin, some 40 feet on a side, that overlooked the pool. A temple? A fort? Nuqman was not on any of my lists of archaeological sites.

"We are off the main track. No one stops here but the Bedouin," Khayran said. "As far as I know, you are the first foreigner to visit Nuqman."

RETURNING through the late afternoon colors, we overtook a dozen loaded camels filing through thickets of myrrh alongside the rough jeep track. The caravan leader doffed his turban in salute. We stopped.

"Salt. To Marib. Five days," he answered my inquiries. About once a week small salt caravans leave Wadi Bayhan for the towns of nearby North Yemen, perpetuating what may be man's oldest commerce. His destination was the same as mine, Marib, capital of Saba (biblical Sheba). His troop plodded slowly, but his journey would be swifter than mine—foreigners are not allowed to cross here.

First I made the two-day desert drive back to Aden, to spend three days more clearing for a flight to North Yemen—the Yemen Arab Republic. Several more days in that country's capital, Sana, to hire another jeep, arrange travel permissions, and locate an armed *rafiq*, or traveling companion, and I was ready for another grueling drive back to the border area. Altogether, my journey across the border—a distance of 15 miles—cost two weeks.

From Mablaqah the caravans left behind the granite hills that soon floated like dark, low clouds on shimmering mirages. Camels, with their soft padded feet, moved easier on that soft sand that skirts the southwest edge of the Empty Quarter, a great blank on Arabia's maps almost the size of Texas. Driving fast to avoid bogging down in the sand gave us a roller-coaster ride, rising, then plunging over the hundred-foot dunes. Ancient ghost towns—Haribat, Al Jubah, Al Masajid—marked the way.

Ancient Marib was the largest of the incense cities. An American archaeological team worked on the site in 1951-52. Before being driven away at gunpoint by local tribes hostile to outsiders, they deciphered hundreds of inscriptions and excavated the



With a modest peek, a woman in a Sayun suq displays a costly embroidered thawb, the loose everyday garment worn by men and women.



oval-shaped temple of the moon god Ilim-
quh—a showpiece of South Arabian archi-
tecture. They also studied the remains of
Marib's giant dam. Built to harness runoff
from Yemen's high mountains to the west,
the dam and its canal network greened thou-
sands of acres around the capital.

Scriptures testify that, in husbandry as
much as trade, Saba prospered. The Koran
(XXVII:20-44) tells how King Solomon,
who spoke with all God's creatures, dis-
patched a bird—a hoopoe—with an invi-
tation to the famous Queen of Sheba. The
Bible (I Kings 10:2) lists tribute the queen
brought to the Hebrew king: "spices and
very much gold, and precious stones."



THOMAS J. ABERCROMBIE (LEFT); PHOTOGRAPHED
AT YEMEN NATIONAL MUSEUM, SANA-YARUVEI

Only salt remains of Shabwah's riches.
The crystals are still mined under the
ruins of the Hadramawt capital that
monopolized and taxed the frankincense
trade. An alabaster votive offering from a
first-century A.D. tomb at Al Jubah
(above) bears South Arabian characters.

The Koran (XXXIV:15-16) reveals Saba
as a land with "Two gardens on the right
hand and the left. . . . A fair land and an
indulgent Lord!" But the people of Saba
turned away from Allah, and they were
cursed with "gardens bearing bitter fruit,
the tamarisk and here and there a lote-tree."

FROM MARIB'S RUINS I drove five
miles west to the damsite across fields of
dusty silt 20 feet deep. My guide was
Saud Muhtim, an elder of the Bani Ash-
raf tribe. Highly respected, the Bani Ashraf
often serve as go-betweens in tribal disputes
that sometimes draw blood even today. The
government had appointed Saud to guard
the scores of historic sites around Marib.

"It was the silt, building up slowly over
the centuries, that doomed Saba," Saud ex-
plained as we climbed the massive stones of
the dam's southern sluice. "As the silt grew
higher, the dam was raised at least twice."

From the top I could make out sections of
the earthen dam that once stretched across
the valley to the towers of the northern abut-
ment nearly half a mile away. Sixty feet be-
low me the brief stream from a distant
mountain cloudburst flowed past to spend
itself in the talcum-fine dust.

Returning, I was surprised by a tall Ye-
meni, wading toward me across the shallow
spate. He wore a purple plaid *fuuta*, or skirt,
cinched with a belt of gleaming bullets that
buckled over the massive J-shaped scab-
bard of his curved dagger. His eye sockets,
shaded with kohl, were as dark as his point-
ed beard. He carried a submachine gun, and
a pistol holster flapped on his hip as he
walked. I too was armed, carrying Saud's
Kalashnikov back to the jeep.

"*Mumkin sawirak?*" he shouted, reaching
for his—I didn't believe it—his Instamatic
camera. "Can I take your picture?"

He was a tourist, he explained, a moun-
tain Yemeni from Sana on his Friday off. He
wanted a snapshot of the exotic foreigner at
his country's most famous historical site.

I spent the night at Saud's house, set
among fields of wheat, stands of lemon
trees, and great plots of tomatoes and on-
ions. Beautiful striped and crested hoopoes,
descendants perhaps of Solomon's feathered
messenger, flitted through the foliage, their
familiar "hoo-poe" calls mingling with

the *tump, tump, tump* of diesel well pumps.

"Bore wells have reclaimed hundreds of acres of rich soil," Saud said, "but the water table is 80 feet down and dropping."

Although underground water is limited, the North Yemeni government, with a sentimental grant from the oil-wealthy United Arab Emirates, is building a new dam, upstream from the ancient site. Legend has it that an ancestor of Sheikh Zayed al Nahayan, ruler of Abu Dhabi, migrated to the Persian coast from Wadi Nahayan, near Marib, after the great dam failed 1,400 years ago. Sheikh Zayed is personally sponsoring a 90-million-dollar reconstruction.

"It will double the area the ancients cultivated," Saud told me, "and make electricity as well."

OIL AS WELL AS WATER will float Saba's renaissance. I joined an armed convoy of mammoth Kenworth trucks loaded with caustic soda and drilling mud for their two-hour desert run to Yemen Hunt Oil Company's Alif-1, a lonely, 135-foot derrick spiking the endless horizon at latitude 15° 30' N, longitude 45° 56' E. Here, in the middle of nowhere, I supped on pot roast and ice cream with a handful of Americans, the only ones I would find along the frankincense trail.

"It's a wildcat all right," drilling foreman Phil Powell said. "Maybe the biggest wildcat since the Daisy Bradford back home in Texas. The nearest oil well is 600 miles away—on the other side of Arabia."

At his trailer by the noisy drilling platform, Yemeni geologist Fadel Haimi showed me the drill plan. The big diamond-toothed bit was already grinding downward nearly two miles under our feet, past the Cretaceous, the Upper Jurassic, and, as Fadel put it, "into the unknown."

He had spent three years plotting the desert formations with seismic equipment. "We have a winner, I am sure—a whole new oil basin," he said. "We are at 9,760 feet. Oil is flowing right now. We will keep on past 10,000 feet."

The long shot paid off. A month farther along the incense trail I heard news that Alif-1 had come in, a 10,000-barrel-a-day bonanza. A refinery and a multimillion-dollar pipeline are now planned to handle

the Arabian Peninsula's newest oil field.

Main, another powerful ancient kingdom, took control of the caravans as they plodded north from Saba. I continued up Wadi Jawf, where the Minaeans' ten walled cities once thrived. Most of the 57 stone bastions of Baraqish, their commercial center, stood proudly intact. Domed ruins of a small mosque and scattered potsherds showed the town was occupied until at least the mid-1700s A.D. Below the walls of the stronghold of Main, a small masonry temple bore time-worn scenes, barely visible. Covering the stone with rice paper and rubbing with crayons brought a lost ritual magically to life: sacrificial ibex and gazelles, dancing girls, offerings of wine, and files of birdlike men carrying lyres and war clubs.

It was near here that Europe's only invasion of inland Arabia played itself out. A legion under Aelius Gallus in 24 B.C. marched southward to seize the wealthy incense lands for Rome. But before reaching Saba, ravaged by thirst and hunger, betrayed by local guides, the Romans despaired and limped back to Egypt.

Veering off the incense route briefly, I detoured into what was Saba's fairest province, the high mountains and cool fertile valleys to the west, where the majority of the seven million North Yemenis live today. When I first visited the mountains 20 years before, coffee beans ripened on the green slopes. Yemen invented the beverage that took Europe by storm in the 1600s. The richest variety grew in these hills, although it took its name from a Yemen seaport: Mocha. Now only a few groves remained.

Today the country's most profitable crop is *kat*, the habit-forming leaf most Yemenis chew. Outlawed during the work week throughout most of South Yemen, *kat* is still part of the daily ritual in the North, at once a joy and a curse. Soon after midday the whole country closes down as men begin to shop for packets of leaves, then gather with friends for the camaraderie of the chew.

NORTH OF SANA, the capital, near the small village of Al Harf, the old caravan trail joined the new asphalt route leading to Yemen's northernmost outpost, Sadah. Not far from the junction a small commotion halted us. Two tribal



Modern caravans find tension in Dhofar near the South Yemen border. The Omani checkpoint is manned by a Baluchi soldier recruited from Pakistan (above). In the mid-1960s Dhofari rebels supported by South

Yemen rose against the Sultan of Oman. Fighting continued for a decade. Recently the strained relations have improved between Oman and South Yemen, where Marxist-trained Young Pioneers perform at a school (below).



THOMAS J. ARCHER/REUTERS



Glory of Sheba, or Saba, seems to linger in the ancient capital of Marib, where the fabled queen who brought to King Solomon "such abundance of spices" may once have ruled. Atop the tell that partially entombs the city, which declined as its renowned dam became choked by silt in the sixth century A.D., a successor arose (below). A new dam is under construction upstream, and an oil boom may also help fuel Marib's revival.

Limestone pillars rear from a temple of the Sabaean moon god Ilumquh (left). In a bronze statue found near Marib, a woman proffers incense in one hand, an oil lamp in the other (right). "The Sabaean race . . . is the greatest throughout Arabia," proclaimed one Greek historian. "There tall trees rise up which produce myrrh and frankincense . . . many . . . suppose that they are partaking of ambrosia."



PHOTOGRAPHED AT YEMEN NATIONAL MUSEUM



gunmen were manning low bluffs beside the road while their confederates rolled out empty oil barrels to block our passage. With smiles and salaams my young Yemeni driver, Salih, talked us through.

"They were not after us," Salih said, as we sped away. "It is a local dispute."

The local jeeps and pickups were easy to spot; they wore no license plates. Toyota station wagons loaded with Yemeni expatriates returning from Saudi construction jobs traveled in convoys here, their roofs piled high with the baggage of new prosperity—blankets, air conditioners, television sets.

The mud-walled town of Sadah has a difficult job. It tries to administer an upland desert province the size of West Virginia plagued with pockets of anarchy. Here local sheikhs hold sway, and the Yemeni govern-

ment treads lightly. Just past the town we pressed into the crowds at the liveliest emporium I encountered in Arabia, or anywhere else for that matter, the Suq al Talh. Every Saturday an animated, mile-wide festival to free enterprise materializes on the sands, its ambience a blend of Oriental bazaar, duty-free shop, army-surplus store, county fair, and supermarket.

Among the stalls I priced local pottery, laundry soap, sewing machines, refrigerators, videocassette players, stained-glass windows, dishes and crystal, spices and frankincense. Salih haggled over a large Belgian-made "Oriental" carpet to fulfill a pledge to his village mosque. "The price is half what it would cost me farther south," he said as we bundled it into the jeep.

Contraband pickup trucks were lined up



Three times the price of frankincense was commanded by myrrh, harvested from a tree near Mablaqah Pass in South Yemen (above), where a paved stretch of the frankincense road remains. Demand for frankincense, however, was five times as great. Traditionally myrrh has been used as an anointing oil and a fumigant, in cooking and embalming, and medicinally. Near Sana a weekly suq's offerings include both frankincense and myrrh and a heady array of spices (facing page).

in dusty rows. Gasoline was going for half price, direct from the tank truck sneaked across miles of desert from Saudi Arabia by what must be the boldest of smugglers.

Nearby, arsenals were changing hands as tribesmen crowded around the cage-like stalls of the gunrunners to check out the latest in small arms, feeling the heft, ramming bolts home, squinting through the sights. One dour merchant offered me a Soviet AK-47 assault rifle for the equivalent of \$1,400, an American automatic gun for half that. To make conversation, I inquired about his hand grenades.

"Which do you want, American or Russian?" he asked dryly. "We also have these detonators. . . ."

AT NAJRAN, just across the border in Saudi Arabia, I headquartered at the government's new provincial museum near the ramparts of Ukhdud, with its ruined South Arabian temple that may once have served as a church. Christianized during the sixth century, Najran was briefly the seat of a bishopric. An Arabian ruler converted to Judaism, a King Yusuf, destroyed the town and massacred its inhabitants in 523.

Some 60 miles to the north at Bir Hima, ancient caravanners, passing the time, left thousands of inscriptions on the sandstone outcroppings that shelter the ample well. They date from 900 B.C. to A.D. 500. Mostly the simple graffiti of rustics, some are illustrated with scenes of camel herds, a date harvest, ibex, hunters wielding spears, and female dancers with long plaited hair.

At a busy Najran truck park I encountered a 20th-century caravanner, Muhammad Abdullah, selling bags of Turkish wheat off the tailgate of his truck. In the long tradition of the carrier-merchants, Muhammad had hauled the grain south from the Saudi port of Ad Dammam, on the Persian Gulf. His big Mercedes was adorned with paintings of crossed swords, butterflies, and mystic symbols to deflect the evil eye.

"As a boy, I worked on my father's caravans," Muhammad said. "As Allah is my witness, the desert was wide, the marches long. For a load this size, 550 sacks, we would have to take"—he did some quick arithmetic on his fingers—"as many as 135

camels. Each would have to be loaded and unloaded every day.

"The camels would take 50 to 60 days from Dammam to Najran," Muhammad said. "My Mercedes does it in two!"

IN SAUDI ARABIA, all roads lead to Mecca. And the billions in oil profits have financed a modern 17,000-mile network connecting the farthest corners of the kingdom. From Najran oasis the highway to the holy city first wound back into the mountains of Asir, west of the desert camel routes. Like fields on the Yemeni side of the range, the terraces of Asir were seared by long drought. Only the highest mountaintops were green.

Above the blue reservoir of the small dam at Abha, the provincial capital, I detoured a





few miles to the summit of 10,000-foot-high Jabal Sawdah, scented by forests of juniper bearded with moss, for breathtaking views down through the clouds to the steaming coastal plain and the Red Sea shimmering beyond. Here, where eagles soar, bright red aloes bloom, and clans of saucy baboons scurry among the high gray rocks, the Saudis have set aside their first national park.

With me was a young, Michigan State-educated Saudi, Hamad al-Badr, from the Saudi antiquities department. We passed several cars with Bedouin tribesmen at the wheel, obviously taking their first driving lessons. And on the stretch north from Abha I counted 62 automobile wrecks, some bashed beyond recognition. "The new drivers still do not understand the dangers of high speed," Hamad said. "The police leave the damaged cars there as warnings."

JUST PAST At Taif our road quit the cool mountains to switchback down the granite escarpment onto the warm Meccan sands. We sped into the city on the eight-lane expressway, nearly empty now but built to handle the world's biggest traffic jam, the annual Muslim pilgrimage.*

Quiet, too, was the wide square approaching the marble walls and soaring minarets of the Haram Mosque—Bayt Allah, or House of God—Islam's holiest shrine (pages 508-509). On my first visit to Mecca during the pilgrimage, 20 years before, more than a million of the faithful had swelled these sacred precincts. Now, in the off-season, there were only a few hundred. Most were arriving on the city's red double-deck buses, garbed in simple pilgrims' robes to perform the rites of the Umra, or lesser pilgrimage. Hamad and I shed our sandals and followed a group into the mosque.

"O, Lord Allah," each prayed as he stepped over the sacred threshold, right foot first, "we have come from distant lands. . . . Open the door of Thy mercy and Thy forgiveness."

Dominating the vast marble courtyard of the mosque stands the cube-shaped Kaaba, some 50 feet high and draped in black silk. Neither temple nor shrine, the stark monument stands empty, merely symbolizing the

*Muhammad Abdul-Rauf described the "Pilgrimage to Mecca" in the November 1978 *GEOGRAPHIC*.

abstractness, the oneness of Allah. It marks the spiritual center of the Islamic universe.

A major religious center long before Islam, Mecca attracted the ancient caravans with trade fairs and a pantheon of 360 idols housed at the Kaaba. They included al Uzza—the Arabian version of Aphrodite—and celestial gods from ancient Sheba: the sun, the moon, and the morning star. The Prophet Muhammad cast out the pagan idols forever.

The bazaars around the great Mosque offer mementos of the pilgrimage: carpets, prayer beads, finely printed Korans. Vendors dispense holy water from sweating pottery jugs. In Judariyah Street I found a practical prayer compass that orients itself toward Mecca from any spot on Earth.

Now a city of half a million people and growing, Mecca has been overwhelmed by cloverleafs and overpasses, by tall office



THOMAS J. ABERCROMBIE

Wary of rival clans, cragtop hamlets perch near Sana (facing page). Crops grown on stepped terraces include kat, a mild stimulant chewed by a wealthy Yemeni (above). He wears a traditional curved dagger—a jambiyya.



buildings, supermarkets, parking garages, and deluxe hotels.

"But the eternal values of Islam endure, even as the world changes," said Sheikh Abdullah ibn Suleiman ibn Obeid, deputy director of holy places for the ministry of pilgrimage. "We apply the new technologies to further Islam. Live coverage of the prayers here is televised throughout the kingdom five times each day," he said. "We have purchased electric wheelchairs and installed elevators in the mosque for the handicapped."

FEW PILGRIMS to Mecca fail to visit Medina, some 250 highway miles north. It was at this oasis and caravan town, then called Yathrib, that Muhammad founded his small Islamic nation that soon burgeoned across the medieval world, from Spain to the doorsteps of China. Yathrib became known as Madinat al Nabi—City of the Prophet—and, finally, simply Al Madinah, "The City."

Mecca awes, overpowers; Medina is more to human scale. Despite comfortable modern suburbs, it retains the pious charm of a religious scholars' town, a retreat where the pilgrim can rest his spirit after the cosmic experience of Mecca. Many linger, lending a cosmopolitan air to Medina's cobblestone streets. In the lively markets I chatted with a Pakistani merchant of precious stones and prayer beads, Sudanese women selling Arabic flat bread, a dentist from Casablanca, a carpenter from Chinese Turkistan.

The Prophet's Mosque remains Medina's focus—the very emblem of the city. Inside, around the gold and silver grillwork that fences the green-draped bier of Muhammad, pilgrims stood, palms upward in prayer. Even at the Prophet's grave the oneness of Allah prevails; suppliants pray *for* Muhammad, never *to* him.

While Hamad searched the bazaars for boxes of the famous Medina dates, I browsed a perfumery near the mosque. Along the way I had collected a variety of censers, some of simple unbaked clay, others

of stone or brass—as well as the typical Saudi burners made of wood and decorated with small mirrors. Now, for 60 Saudi riyals (about \$18), I acquired the latest in aromatic technology: an aluminum, electric-fired import from Taiwan, complete with cord.

Under Ottoman suzerainty for centuries, Medina is sprinkled with jewels of Turkish architecture. Muhammad's mausoleum was renovated by the Ottoman Caliph Abd al-Majid in 1860. The wooden latticed balconies along the narrow streets of Aguwat, the former Eunuch's Quarter, recall Istanbul. At a small, domed library endowed by a Turkish savant, scholars sit cross-legged, scrutinizing rare Islamic texts.

During my last days in Islam's second city, Saudi Arabia's King Fahd ibn Abdul-Aziz visited Medina. Preceded by an incense bearer and video cameramen, His Majesty led a robed delegation into the Prophet's Mosque to hear the Friday sermon and, at the urging of local dignitaries, to pray for rain. Watching on color television at my hotel, I was struck by how smoothly the Saudis straddle the centuries. Praying for rain?

Archaic or not, the royal appeal proved effective. Next night, camped in the desert once more, I was awakened by thunderclaps and a violent dust storm. As I struggled with the tent, it began, sweet giant drops of rain, then a deluge—*khayr Allah*, Hamad called it: "God's bounty"—the first good soaker in nearly three years.

A well-worn caravan route, still untamed by asphalt, reaches north through the Hijaz from Medina. Traveled long before the incense trade, it later swelled with the Muslim pilgrim traffic. With help from German engineers, the Turks laid the Hijaz Railway from Damascus to Medina, and in 1908 the first trains chugged into Arabia.

World War I doomed the Turkish sultan's empire and his railroad. Lt. Col. T. E. Lawrence and his Arab irregulars harassed the line, burning stations and blowing up trains, isolating the 10,000-man Turkish garrison at Medina. *(Continued on page 510)*

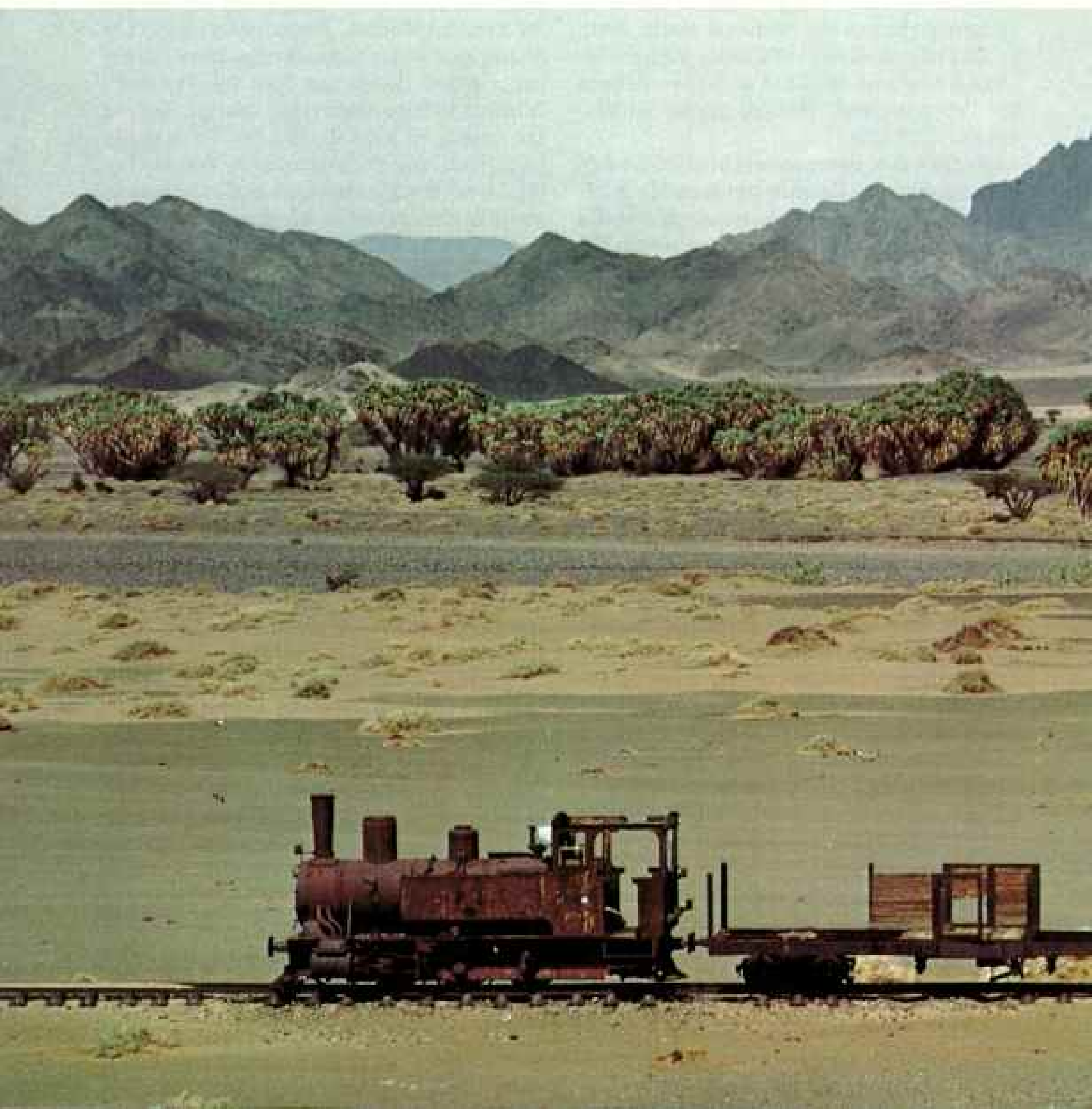
A tender moment is shared by a three-day-old infant, eyebrows painted with kohl, and her mother. They camp with their Bedouin tribe in North Yemen near Main, known as Qarnaw when it was the capital of the Minaeans. Through their territory "the export of frankincense is along one narrow track," Pliny noted.

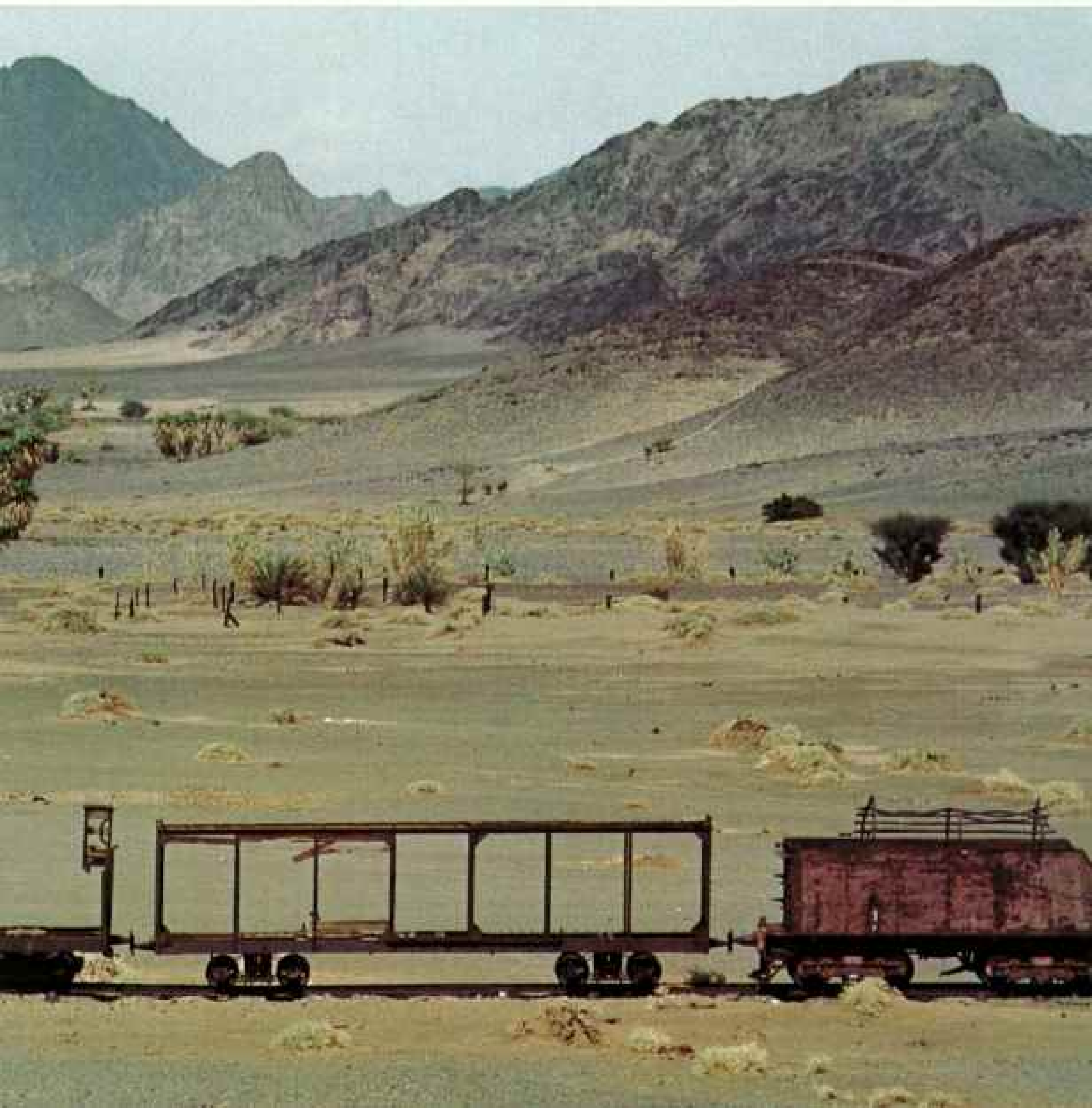
Breathless tales of adventure are footnoted by a forlorn train abandoned on the Hijaz Railway from Medina to Damascus (below). It was one operated by the Ottoman Turks, allies of Germany during World War I when the rails and stations were harassed by the storied T. E. Lawrence and his Arabian irregulars.

Lawrence wrote of mining the rails in 1917 at nearby Abu an Naam station: "We lay like lizards . . . upon the hill-top, and saw the garrison parade. Three hundred and ninety-nine infantry, little toy men, ran about. . . ." On another raid

in the area he led his men under fire to the rail line in a ruse. "We made our camels kneel down beside it, and . . . performed a sunset prayer quietly. . . . from a distance we passed muster, and the Turks stopped shooting in bewilderment. This was the first and last time I ever prayed in Arabia as a Moslem."

To the east a new road rolls toward the Hijaz Mountains (right) and the holy cities of Mecca and Medina. Crossing the frankincense trail, it bears traffic that succeeded the incense traders—the pilgrims of Islam.









In Islam's holiest city lies the Haram Mosque (left), lifetime goal of all Muslims. Mecca is the culmination of the hajj, an annual pilgrimage commanded by Allah to Abraham and later mandated to the Prophet Muhammad.

Amid such venerated tradition, development has arrived in an oil-enriched whirlwind, and Mecca is thoroughly mechanized with tunnels, parking garages, and a maze of expressways. New mosques burgeon beside new hotels, some with \$200-a-night rooms. Beaming the faith, the Saudi state network televises the five daily prayers, showing minarets of the Haram Mosque (top). Within, pilgrims circle the Kaaba (second from top), believed to have been erected by Abraham, and try to touch its gold-and-silver door (third from top).

Though Mecca lay off the main incense road, trade probably flourished on a side route. To the north at the Prophet's Mosque in Medina, site of Muhammad's tomb, King Fahd ibn Abdul-Aziz of Saudi Arabia dedicates an extension (bottom).

After A.D. 622 the rise of Islam, whose rituals seldom require incense, further reduced the frankincense trade—already in decline after the Romans espoused Christianity and banned pagan practices in the fourth century.



ALL BY THOMAS J. ABERCROMBIE

Gold rode along with the incense caravans. Portraits adorn a necklace (below) dating from before the fourth century A.D., found in South Yemen. Now as then, investors put their faith in gold. At a suq in At Taif (right), on a side road to Mecca, the goods that buyers seek are contemporary and 22-karat. Set in the highlands, the city of some 200,000 is the traditional summer retreat where the Saudi royal family flees the heat.



PHOTOGRAPHED BY THOMAS J. BERGCRONDIE AT ADEN NATIONAL MUSEUM

For two days we followed the abandoned railbed. One of the fortified depots, Abu an Naam station, was still pockmarked with Lawrence's bullets. We cooked lunch at Hadiyah station, where a complete train has stood rusting on a siding for the past 70 years (pages 506-507). Collecting Stone Age tools on a nearby hill, Hamad picked up a small brass button bearing a star and crescent, lost by a Turkish soldier.

As we drove northward, gradually the black basalt cones and hills, stygian islands in a gravel sea, gave way to reddish sandstone rounded smooth by the wind. Through a narrowing labyrinth of bluffs and boulders we crossed an ancient frontier.



Here, north of the mud-walled palm groves of Al Ula, began the domain of Nabataea, the last Arabian kingdom on the frankincense road.

Time has buried the Nabataeans' southernmost outpost, Madain Salih, except for the tombs of its nobles. But the grandeur of the necropolis, the skill of its architects, leave little doubt that here once flourished a town of consequence.

We parked our dusty jeep at a row of tomb facades exquisitely carved from rock, huge bas-reliefs suggesting temple columns, some decorated with urns and rosettes, eagles and griffins. G. R. H. "Mick" Wright, a tall, soft-spoken Australian archaeologist, was



overseeing work here for the Saudi antiquities department.

"Inscriptions on some of the 150 tombs here date from the early first century A.D.," Dr. Wright said. "But the site has never been excavated. Until it is, we won't know the full story of this important caravan center."

THE STORY of the Nabataeans, still blurred and fragmented, best unfolds at Petra, their capital. For centuries it profited as middleman for Arabia's incense trade with the Roman Empire.

North of the Jordan border I closed on Petra in style, over smooth asphalt in a rental

Mercedes. Fawzi Zayadine, assistant director of Jordan's antiquities department, joined me at the Desert Police fort in Wadi Rum to show me the nearby spring and the ruins of a Nabataean temple that marked a smaller caravan stop. At the town of Wadi Musa (Musa is the Arabic form of Moses), we stopped at another sacred spring. It is said that Moses started its flow, striking the stone with his staff. This ancient watercourse led us down to Petra itself.

Caravans still crowd Petra's main entrance, noisy caravans of tourists on horseback filing into the Siq, the cool cleft that winds for a mile through solid rock hills. In places sheer walls overlap above the trail.



THOMAS J. ABERGROMBIE (FACING PAGE)



PHOTOGRAPHED AT SAIYAN MUSEUM

Awed, even the tourists hush, and one hears only the clatter of hooves on the pebbles.

No approach I know of, to any city modern or extinct, can compare to that first view of Petra. In a blaze of warm, rosy light the chasm opens on a magic facade, the Nabataean Khazneh (Treasury). Whether tomb or temple, archaeologists still disagree; local Bedouin credit it to the sorcery of the pharaohs. One hundred thirty feet high, the finely sculptured Treasury dates possibly from Hadrian's time, early in the second century A.D. The defile widens on a Roman theater surrounded by dozens of smaller facades hewn from the wine-colored rock. Simpler of line, these reflect motifs from Assyria and Egypt.

"Petra was a major caravan crossroads," Dr. Zayadine said. "Six routes converged on this fortress city. I have hiked them all.

"From here the incense traveled on to Gaza, across the Sinai to processing plants in Alexandria, north to Palmyra and Damascus, east to the Euphrates."

From the desert dust I stepped onto the polished Roman pavement, lined with broken columns, that led into Petra's cosmopolitan heart. Past the ruins of a palace, past temples, markets, and baths, I counted the last steps of my 2,400-mile odyssey.

The journey had been a voyage of discovery. But it raised more questions than it answered. Who were those early Arabians? When, exactly, did they emerge? How did they organize such a far-flung trade? What were the details of their daily life? How much culture did they borrow from the early Europeans?

One thing certain: Half-buried along the frankincense trail, from the sacred groves of Oman to the fragrant altars of Rome, waiting to be read, lies a compelling chapter in the history of man. □

Cameleers reach the home stretch of the frankincense road (top left), paved by the Romans in Petra. The city is graced by ruins such as the Khazneh, a Nabataean tomb or temple (right). An alabaster carving from South Yemen (left) memorializes the incense trade's indispensable beast of burden.



The Usumacinta River: Troubles on a Wild Frontier

By S. JEFFREY K. WILKERSON

Photographs by DAVID HISER

ASPECTACULAR WILDERNESS, the Usumacinta. The meaning of its name lost in antiquity, the river (pronounced oo-soo-mah-SEEN-tah) drains the largest surviving rain forest in North America. Here during the first millennium A.D. the Maya raised great cities and forged a brilliantly complex civilization—most of which had reverted to jungle long before the Spanish conquest. With the colonial societies of Mexico and Guatemala confined largely to neighboring highlands, the region and its small remnant Maya groups remained in virtual isolation. Much of the river became an

international border in the late 1800s, as explorers and archaeologists were probing the jungle for Maya sites throughout the region. About ten years ago the river's frontier status took on an ideological stripe as Guatemala's aggressive Marxist guerrilla forces found the remoteness suited to their survival. Pawns in this struggle, thousands of displaced Guatemalans crossed the Usumacinta in the early 1980s for refuge in Mexico. Today the two populous nations race to develop the region for electricity, oil, and settlement. These plans, says cultural ecologist and archaeologist Jeffrey Wilkerson, threaten both the priceless legacy of Maya antiquity and the fragile ecological balance of North America's last great tropical redoubt.

A YOUNG GUATEMALAN SELLS PARROT CHICKS ALONG THE USUMACINTA.







Through a mountain spur, the Usumacinta cuts like a knife beneath 1,000-foot cliffs. After long runs of white water, it will leave its gorge and Guatemala behind. Emerging wide and as placid as a fishpond, it then meanders lazily through



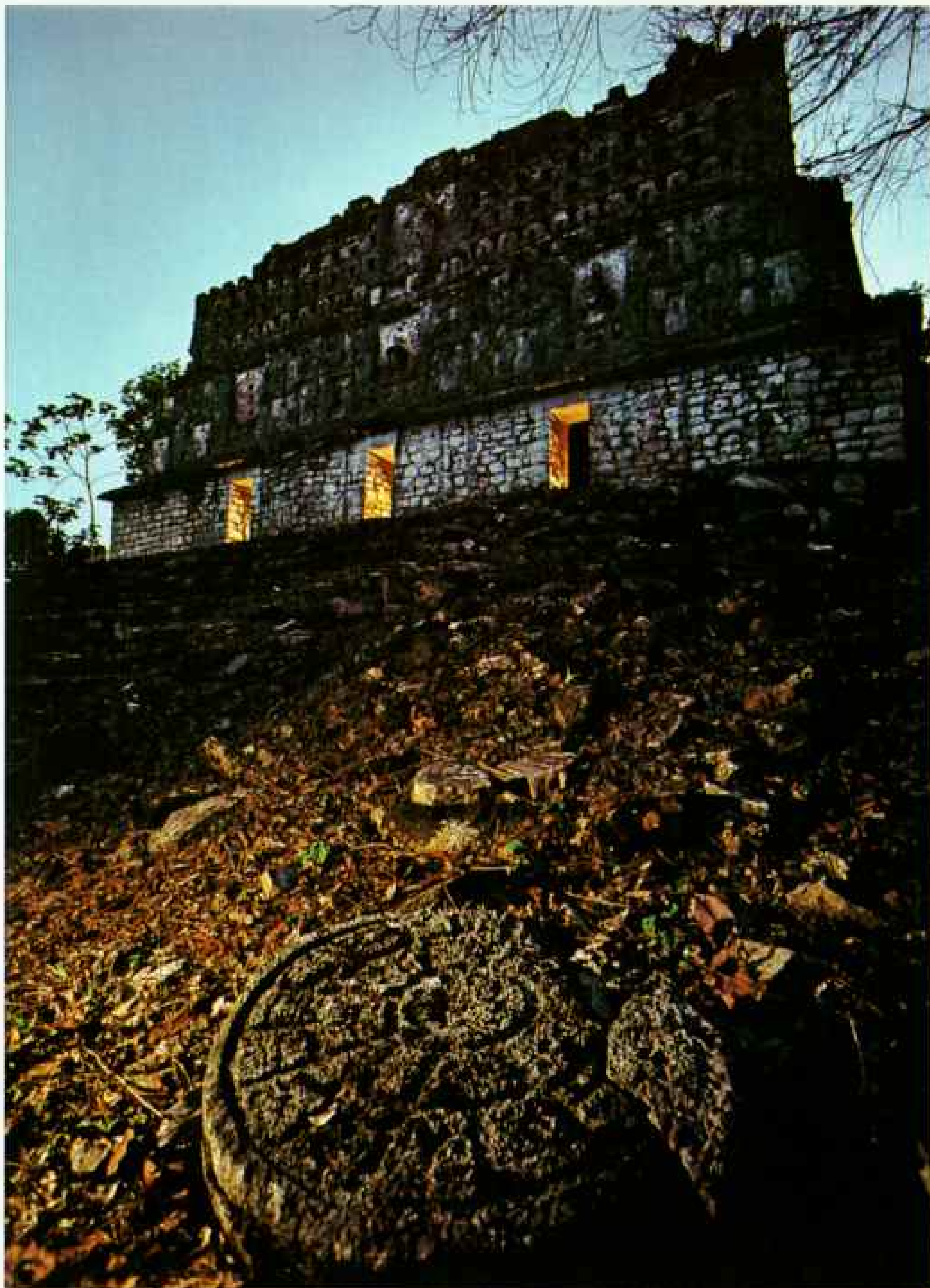
Mexican farmsteads and the mangrove swamps of the Tabasco plain on its way to the Gulf of Mexico. If dammed for hydropower as planned, North America's longest tropical river may soon be placid along much of its upper reaches also.



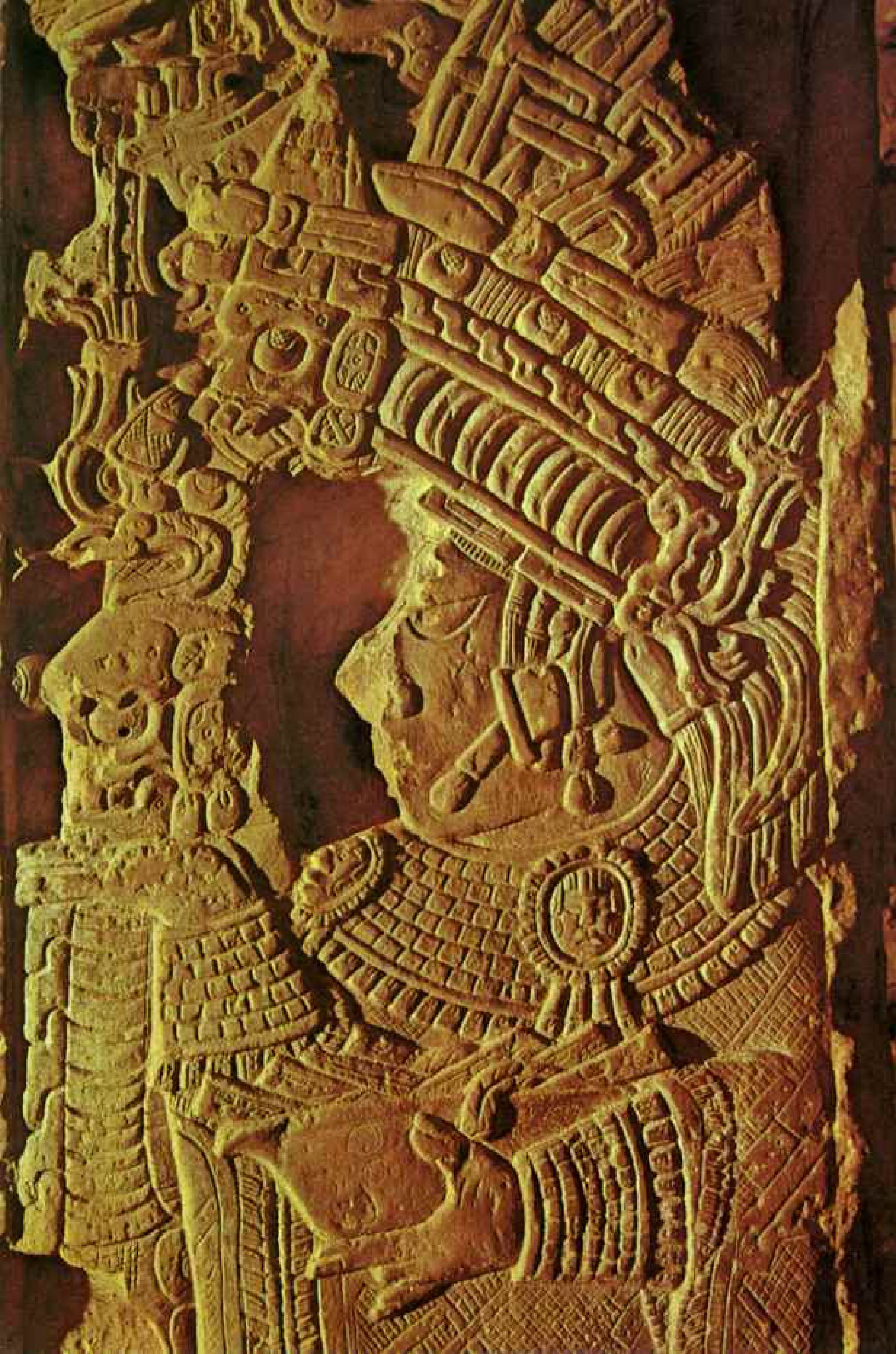
Like a human hurricane, settlers come to the forest with machete and torch, felling the great trees in pursuit of a frontier dream. The palms they spare for roof thatch. From the shallow soil in much of the region they will be lucky to get three good crops.



Then they turn to cattle. But that too will fail, as the clay cracks and turns as hard as concrete. And so they will clear more land and try again. Meanwhile, much of the rain forest—which needs 400 years to mature—will have been lost.



Sacred to the local Lacandon Indians, who believe their Maya ancestors lived here, the temples of Yaxchilán have weathered 12 centuries of tropical rains. A sculptured altar stone (above) and exhumed stela (right) bespeak the artistry of a civilization at its peak.



PUT YOUR HANDS UP—do not move!" Facing the menacing weapons of the Guatemalan guerrillas, we did as we were told. In the stifling tropical heat the minutes seemed like hours as we awaited the arrival of an officer to decide our fate.

Shortly before, photographer David Hiser and I had been rafting down the Usumacinta River, which for part of its length forms an isolated stretch of border between Mexico and Guatemala (map, pages 524-5). Suffocating humidity had subdued all sounds except the powerful swish of the current against jagged limestone rocks. The towering rain forest was quiet, too quiet.

The surging current swung us wide around a bend, past high sandy banks. We saw footprints on both shores and glimpsed moving figures amid the trees—a situation not to be ignored on this wild frontier. If they were armed men. . . .

It occurred to me that we, and our supply rafts a mile or so behind, were bobbing down the river like ducks in a shooting gallery. I decided that we had better land and identify ourselves.

While the others remained in the raft, David and I clambered up the steep bank—and only a few steps into the jungle found ourselves staring into the muzzles of these M16 rifles (right).

Clearly we had chanced upon a force of Guatemalan guerrillas crossing the Usumacinta between the two countries, as they commonly do in this wilderness.

Our arms were aching, and we were drenched with sweat before a fatigue-clad officer arrived and allowed us to drop our hands. I briefly explained our mission:

We were traveling the Usumacinta and several of its tributaries to study the state of the tropical forest, to meet the region's inhabitants, and to examine its archaeological vestiges—particularly in areas threatened by proposed massive hydroelectric dams between Mexico and Guatemala.

Warily they accepted our explanation. Gradually we were able to converse with our well-armed, well-equipped captors. Or were they our hosts? We were not yet sure.

They told us proudly that they were members of the Rebel Armed Forces—Fuerzas Armadas Rebeldes (FAR)—the most active







CAMPECHE

TABASCO

MAYA RUINS
Heart of a great civilization during its Classic period – from A.D. 250 to 900 – the Usumacinta's middle reaches are studded with hundreds of ruins, lost for a millennium under a jungle shroud. Only the best known sites are marked; emblem glyphs depict major cities, such as Palenque.

SETTLEMENTS
Encouraged by government land grants, especially in Mexico, peasants from the overpopulated highlands follow each new road deep into the wilderness, carving farms and settlements along the way.

DAMS AND RESERVOIRS
From six sites yet to be determined, two to four dams could flood as much as 500 square miles of forest (blue shading), partially covering Piedras Negras and Yaxchilan and obliterating dozens of other archaeological sites and river settlements.

REFUGEE CAMPS
Motivated by fear and force, more than 40,000 Guatemalans have sought sanctuary in scores of camps on Mexico's side of the river. Some camps are being abandoned as the Mexican government relocates thousands of refugees farther north, in the Yucatan Peninsula.

MEXICO

CHIAPAS

- Potential reservoir – using highest proposed dam heights
- Potential damsite
- Archaeological site
- Settlement
- Refugee camp
- Oil (exploration and production)
- Road (dashed – under construction)



THE USUMACINTA: Cradled by rugged mountain ranges to the west and south, the river and its tributaries drain a great basin of 41,000 square miles. Saturated with rain for over half the year, up to 200 inches annually, a towering rain forest with a 120-foot canopy blankets much of the lowlands. Along the banks scores of Maya ruins await future archaeologists to unlock their secrets. Many sites could find a watery grave, as Mexico and Guatemala plan to harness the river's vast hydroelectric potential.



Marxist guerrilla organization in the region. Their political officer, an intense man with a pistol, delivered by rote a long harangue condemning their country's government, accusing army troops of atrocities, and pronouncing ultimate victory for the insurgents. "We will not stop no matter how many lives it will cost," he said. "It is the same as with the Sandinistas."

"The army is afraid of the jungle," another declared. "For us it is home!"

Several of the group spoke favorably of Mexico but warned that "Mexico too will have its revolution." It was a sobering thought: That country of nearly 80 million people is already suffering its worst economic crisis in 60 years.

After more than three hours I suggested diplomatically that we would like to move on down the river, toward the gorge where one of the largest dams is planned. The guerrillas made no move to hold us. But they made it clear that no government-sponsored dam would have their approval. Before we pushed off downstream, one of their officers promised: "We will sabotage it!"

AS ALWAYS in its history, the future of this river basin on both sides of the border rests with people and events beyond the forest periphery. The Usumacinta traverses a tangled region, ecologically and politically. It was considered a "vast uninhabited and unexplored tract of country" by explorer and photographer Teobert Maler at the turn of the century. Today it has become a beleaguered wilderness.

As part of the last major forest bastion in tropical North America, it is torn by guerrilla warfare and pressured by new settlements and swollen refugee camps. It is threatened by the social and environmental havoc of large-scale oil exploration and hydroelectric projects. The forest itself is disappearing under the onslaught of roads, lumber mills, and agriculture.

Like Africa's Nile, the Usumacinta flows northward (an oddity among rivers in North America), and it, too, flowed for centuries at the heart of a great civilization. At the peak of their Classic period (A.D. 250-900) the Maya thrived and raised ornate cities here. Sites like Palenque, Piedras Negras, Yaxchilán, and Altar de Sacrificios were



adorned with some of the most complex art and monuments in the New World.

The Usumacinta and its larger tributaries, the Salinas (Chixoy in Guatemala), Pasión, Lacantún, and San Pedro, have served for centuries as a great unifying network. Even after the collapse of Classic Maya civilization by the tenth century, when the Usumacinta urban centers reverted to rain forest, the region was never uninhabited.

Small groups of Maya speakers survived in the wilderness, and others fled there, eluding more powerful neighbors and Spain's conquistadores; the largest group remained independent until 1697. Some descendants of those Maya groups, the few hundred Lacandon Indians in the Mexican state of Chiapas, have lent their name to the broad swath of forest on the Mexican side of the river and to the parallel mountain ridges in Guatemala's department of the Petén. For centuries the name has been synonymous with trackless impenetrability.

Long fascinated by this complex region, I have probed it many times by truck and mule, afoot and by boat. This journey, largely by raft, was made in the company of National Geographic archaeologist George Stuart, who also knew the Usumacinta from previous visits; his son David, an accomplished Maya scholar; photographer Hiser; research assistant Victoria Velasco; and a Mexican and U. S. support crew.

WE MET APOLONIO early in our trip, along the Mexican bank of the Salinas. "You *can't* stop the machete!" he exclaimed, with an enthusiastic slashing motion in front of my face.

A middle-aged Tzeltal Indian from the overpopulated, eroded highlands of Chiapas, he spoke with reverence of his principal tool, the machete, and with pride of his recent arrival to clear 375 acres of forest for farming. The government had brought him to this riverbank as a charter member of

a brand-new *ejido*, a cooperative village.

Migration into the Usumacinta basin has been encouraged by both nations, to help cope with land scarcity in populous areas or with natural disasters, such as the 1982 eruption of El Chichón volcano.* Mexican officials estimate that some 28,000 families now occupy the Lacandon Forest alone. Most have settled here in the past ten years, but the transition has not been easy.

Names given to settlements mirror the diverse motivations for migration: Dreams of Gold, Last Effort, Abundance, Revenge, Liberty, Free America. Others reflect renovation or religious conviction: New World, Good Faith, United Hands, Flower of Hope, New Canaan, Mount Sinai. Such names are a roll call of man's aspirations and faith in a future of less hardship. They mark not only primitive settlements on tentatively drawn maps but also desperate efforts to escape a past of poverty and old problems.

Most newcomers arrive after long journeys, with few possessions and fewer skills for frontier life in the humid tropics. As Tomás Hernández, who settled on the Lacantún River a decade ago, described it: "Our major battle was against nature and the emotional shock of the change, and diseases. At first we subsisted on herbs, the meat of animals in the jungle, fish, and turtles."

At sweltering Manos Unidas (United Hands) on Guatemala's Pasión River, we found Quiché and Mam Indians maintaining the customs and dress of the highlands; after 17 years the cooperative store still sells men's coats suitable for the chill mountains. Here the head of one family, Cipriano Ixmay, told me of the "lack of work and many people" that motivated his move to the jungle, and the early difficulties: "There were many insects, as well as jaguars and other animals in the forest. But now we have our own land, and there is food."

*See "The Disaster of El Chichón," by Boris Weintraub, NATIONAL GEOGRAPHIC, November 1982.

Less than a boatful, a shipment of Guatemalan corn awaits transport from the Pasión River canoe port of Sayaxché to Mexican markets on the Usumacinta and Lacantún Rivers. Carved from the region's huge trees, some canoes can hold as many as 300 sacks. Pockets of rich alluvial soil bordering the rivers, unlike the thin clay inland, have supported farmers in the Petén since pre-Maya settlers arrived here early in the first millennium B.C.



Caught in the vise of food, sport, and profit, the wild creatures of the rain forest are suffering rapid depletion, warns the author. They include the small brocket deer (top), valued for venison, and carnivorous cats, whose pelts bring high prices. On the Lacantún River, new settlers from the Mexican state of Guerrero seek buyers for illegally taken ocelot skins (above) before they rot.

For now, at least. But the future of agriculture in much of this extraordinarily green region is problematic, at best.

In karst areas, underlain with porous limestone, fertility is quickly lost once the forest cover is removed. Without shade and the humus from decomposing vegetation, the thin soils are leached by water and baked by sun. As the cycle continues, the remaining surface water evaporates, slopes erode, rivers silt and flood; even local rainfall becomes more erratic.

Soon crop yields drop spectacularly. Fields are abandoned after only a few years. Some farmers turn to raising livestock, clearing even more land for grazing. Higinio Padilla, head of the forestry department in Chiapas, estimates that "10,000 hectares [24,000 acres] are converted to cattle raising in the Lacandon Forest every year."

I have flown over Chiapas in the dry season and encountered smoke billowing up to 2,000 feet above virgin forest that had been cut and burned to make pastureland. Not infrequently the fires burn out of control and damage broad areas.

Eventually the fields become useless for either crops or cattle. This sad end was in sight along the Mexican bank of the Usumacinta near the village of Arroyo Jerusalén.

Here families of Chol Indians transplanted from a sierra town described their great effort to clear the rain forest. They told us how their new fields produced excellent corn crops the first year—"One metric ton per hectare"—and how "it dropped to only one-fifth of a ton the second year." Now many fields have been abandoned, and erosion proceeds unchecked.

IN ITS PRISTINE STATE, the Lacandon Forest is awesome. It seemed cathedral-like as we motored our raft far up the Lacanjá River beneath the overarching canopy. Crocodiles basked on the banks; turtles scrambled off logs as we passed. Scarlet macaws and parrots screeched overhead.

Yet this profusion of wildlife, I knew, is anything but secure. Everywhere there are settlements, animals and birds are hunted for food, sport, or profit.

Before we set out from our island base camp, where the clear Lacanjá meets the muddy Lacantún, Victoria had watched a

dugout approach. Soon its occupants, settlers from the Mexican state of Guerrero, jumped out and offered to sell her an infant spider monkey; they had captured it by shooting its mother.

Crocodiles, deer, peccaries, otters, even toucans are hunted for their skins—as, of course, are the beautiful jungle cats, the ocelot and jaguar. Mexican zoologist Miguel Alvarez del Toro warns that “almost any animal whose natural habitat is the rain forest of Chiapas is now in danger of extinction.”

Along the banks immense trees—mahogany, ceiba, cedar—stood on great gothic buttresses, sheltering animals, insects, orchids, and a profusion of other plants in a multitiered universe. All are interdependent, and all depend on the water circulating through this stratified environment. Botanists have found more than a thousand plant species in a square mile of such forest, many of great use to mankind, but most have never been studied.

Exploring upstream became more difficult with each mile as we pulled our rafts past rapids and over travertine falls five and six feet high. Exhausted, at sunset we sought a campsite.

We were astonished to find, within a few yards of the river in this wilderness, fresh survey lines and trees marked for cutting. Next morning we discovered a brand-new lumber camp and an access road that had been bulldozed only the day before!

Officially both Mexico and Guatemala control timber cutting and marketing in the Lacandon region. Guatemalans have reduced their lumber-mill quotas substantially and have attempted to set aside the entire northern third of the Petén as a reserve. But the giant Mexican mill at Chancalá, which can process nearly 17 million board feet annually, continues to run at nearly full capacity. About 30 million board feet were cut in Mexico's part of the forest in 1984, largely valuable mahogany and red cedar.

But that is only the tip of the iceberg, as Gustavo Calleros, head of Mexico's planning department for the Lacandon Forest, pointed out to me: Nearly twice that much wood is consumed each year for cook fires, house building, and other domestic uses. And, said Calleros, “more than 200 million board feet is burned or left to rot in the

course of clearing operations.” Put another way, trees destroyed in the Lacandon Forest from all causes each year would produce a single timber one foot square and more than 4,500 miles long!

MEXICO'S PORTION of the forest cannot withstand such an onslaught much longer, says Gertrude Blom, an outspoken environmentalist who has long championed the preservation of the Lacandon Forest. Encroaching settlements and new cattle ranches alone “threaten to destroy the forest in five years,” Trudy believes. By then, according to conservative projections, the Lacandon Forest will be reduced to some 1,500 square miles—less than a third of its 1960 size.

An English tropical ecologist, Nicholas Guppy, observes that “the great mass of vegetation in the virgin rain forest is, in reality, exceptionally delicate and the product of at least a 400-year-long growth cycle.” At current levels of exploitation it will have no chance to regenerate.

Even areas officially protected remain endangered. A 1977 Mexican presidential decree set aside 1,278 square miles of the Lacandon Forest as the Montes Azules Biosphere Reserve. But seven years later, ecological investigator Juan Manuel Mauricio told me, the proposal is still mired in controversy: “Large areas have already been cut, numerous expanding communities still exist within the reserve, and its precise limits have never been established.”

Oilman Richard Raines, reflecting upon the decline of the rain forest during his 26 years of petroleum exploration in Guatemala, mused candidly: “The first mistake is building a road.” Judging from the Mexican experience, he is quite right.

Exploratory drilling in a half-million-acre tract known as the Marqués de Comillas Zone by Pemex, Mexico's national oil company, led to the extension of the only major road through the Lacandon Forest. Even while it was being built, it was used for extensive lumbering, clearing for cattle pastures, and resettlement. Now a perimeter road is being constructed around the entire zone. A similar road may encircle the entire Petén of Guatemala in the next few years.

The determined quest for oil can as easily

move massive forests as mountains. Drilling in the Usumacinta basin has been sporadic over the past quarter of a century but has resulted in three producing fields in Guatemala near the Chixoy tributary. Now drilling operations have increased in both Mexico and Guatemala in a major effort to close the broad gap between the large gas and oil reserves near the mouth of the Usumacinta and the smaller upstream pockets near the Sierra Madre. Still more settlements and clearing cannot be far behind.

RAFTING ALONG the Lacantún one afternoon, we heard an earthshaking crash, like a clap of thunder. George, David, and I clambered up the bank to investigate and quickly came upon a 100-foot tree lying on dozens of smaller trees

crushed in its fall. The measured cadence of chopping led us to a bare-chested axman standing on a high platform, working on another forest giant. Red sap oozed like blood down its trunk.

The axman told us he was expected to cut two of these big trees a day. "I am fortunate," he said. "I earn 300 Mexican pesos a day, and some cornmeal." That represented about a dollar and a half, only one-half of the official minimum wage. He was, we learned, a Guatemalan refugee.

Along the Salinas, the Lacantún, and the Usumacinta itself, we passed many clusters of thatched houses at the edges of the expanding new settlements. These were refugee camps filled with Guatemalans, mostly from the highlands, who had fled the political strife in their country.

Jungle boomtown, the Mexican settlement of Frontera Corozal sprawls where once only small logging centers existed. Red cedar and mahogany logs were floated here from upstream tributaries, destined for overseas markets. Today a constant



Life in the river camps has not been easy for them. Buffeted by competing political ideologies, prohibited from cultivating fields of their own, they can feel little of their traditional sense of community. They depend on an overstressed food-distribution system and poor-paying local jobs for any cash income. At the same time, they provide cheap labor that has accelerated land clearing and prompted an agricultural boom.

There may be as many as 90,000 such expatriates. Estimates by Mexican authorities, church officials, and humanitarian groups vary widely. Guatemalan officials charge that the refugee camps are controlled, and used as havens, by guerrillas. Mexico denies this, and counters that Guatemalan troops are crossing its border.

In an effort to defuse this tense situation,

the Mexican government in the summer of 1984 began to move the refugees, many against their will, to the dry and sparsely populated states of Campeche and Quintana Roo. A year later the UN indicated that of the 42,000 people it aids, 18,000 had been resettled and that the 99 camps in Chiapas had been reduced to 75.

Mexico is touchy about visitors to any of the refugee areas. When our party arrived at Boca Lacantún, where the only road in the region meets the Lacantún River, we were promptly arrested and detained by pistol-waving officials in civilian clothes.

Released 24 hours later from our broiling campsite, we pushed off gratefully down the Lacantún toward its merger with the Usumacinta. In half an hour we approached a great sheet of limestone sloping into the river

stream of newcomers is pouring in and clearing the surrounding forest. Occupying a crowded camp, at the upper right corner, are an undetermined number of Guatemalan refugees. Guerrilla territory, the opposite bank has few villages.

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from the jungle-choked north bank. Here was Planchón de las Figuras—"flatiron with figures." George Stuart calls it "surely the most unusual Maya site of all."

Several local fishermen squatted on the rock beside their dugouts. We negotiated for five fine robalos, a tasty river fish, for that night's dinner, then set about examining this unique remnant of Maya culture.

Its first known European visitor was the persistent Teobert Maler in 1899. A few archaeologists had stopped here briefly, but none had the benefit of our generator, lights, and photographic equipment to record its fascinating carvings (page 537).

George let out a shout. Near a spring he had found engraved in the rock slab a large ancient patolli board—a Parcheesi-like game played by American Indians. Similar ones have been found on temple floors throughout Mesoamerica.

Brushing aside seasonal flood debris, David Stuart uncovered the figure of a crocodilian and a carved spiral. Within minutes our entire crew was finding figures: birds, animals, a strange, striding monkey-like creature, eroded glyphs. Many carvings depicted temples.

After darkness had fallen, we moved across the rock slab with floodlights for a view of Planchón de las Figuras as it probably had never been seen before.

The dazzling beams brought moth swarms of biblical-plague proportions, but incredible images emerged on the stone surface. In all we counted 68 carvings. Most remarkable were the maplike representations of pyramid temples, the architectural hallmarks of Maya cities of the Classic period. The largest of these, some of them 10 by 15 feet, strongly reminded me of the main plaza at Tikal.

Wrapped in mystery today, Planchón must have been an ancient stopping place for canoe travelers on the vast Usumacinta network. We speculated about its function. Conceivably it was a shrine, or perhaps a commercial center, since it lies near a major river junction. It was a place where cool springwater could be found, where boatmen could while away hours playing board games and perhaps carve stone "maps" of their cities. Some were talented sculptors, others may have utilized this appealing

blank stone surface simply for graffiti.

We loaded our rafts and left Planchón behind. Shortly we entered the mainstream of the Usumacinta, a far swifter and rockier waterway than its meandering affluents. Drifting downstream past a beautiful waterfall named El Chorro, we put ashore to visit the Guatemalan settlement of El Arbolito.

We found utter desolation. A few of the houses had been burned, the rest abandoned. Inside the schoolhouse, benches lay overturned; papers and books were scattered everywhere (page 535). On blackboards Guatemalan guerrillas had scrawled support of their "Brother Revolutionaries in El Salvador." Most ominous was a warning to visitors to "stay away or be summarily executed by the Revolutionary Movement."

Later we learned that the army and guerrilla supporters had clashed here. Today El Arbolito is a no-man's-land, where the FAR chalks defiant slogans and government troops leave notes offering amnesty.

THIRTY MILES DOWNSTREAM at Frontera Corozal on the Mexican bank, a boatman hesitantly approached our campsite on a sandbar. He offered to guide us to "recently found ruins" in the Guatemalan jungle. His furtive manner suggested that the site had been found by looters but not yet by archaeologists. Sadly, this major Maya region, a true archaeological frontier, has been the target of organized looting for the lucrative international antiquities market.

Though efforts by the concerned countries have reduced this illegal trade in recent years, it still occurs. During our entire river trip we encountered no site, however remote, that had not been visibly plundered.

Next day at a nearby village our guide's eyes widened and he hastily departed when we presented local authorities with our letter of authorization from Guatemala's Institute of Anthropology and History. A villager knew about the site, but it lay many miles away, over rough terrain, in guerrilla territory. Still we were determined to see it; perhaps David Stuart might be able to find its ancient name on remaining carvings.

Providentially, a muleteer was then passing through the village. Yes, he would rent us his animals—for an exorbitant fee. The

gathered villagers murmured over the outrageous price. Experience had taught me that mule skimmers are not always models of reliability. For safety's sake I employed a stratagem that has often served me well.

Jaws dropped and the muleteer beamed when I agreed to the terms. Then I slowly counted out the money—and handed it to the village schoolmaster. “Keep this in trust until we return,” I told him. “If this man

does not come back with *all* of us and our equipment within three days, it will be a donation to the village school.”

The muleteer's face froze in disbelief. The jubilant villagers already were talking of repairing the schoolhouse roof. To earn his money, he would have to cooperate fully, and he did.

We rode all day through the lofty forest, macaws scolding us overhead. The trail



More roads mean fewer guerrillas. Or so believes the Guatemalan Army, which suffers substantial casualties while connecting new towns throughout the rain forest. Treading lightly near the Xacbal River, army road builders diligently guard against ambush and snipers.



Disarmingly polite behavior marks the Guatemalan Army's new approach to civilians living near guerrilla strongholds. At La Ceiba, a new town in the southern Petén, soldiers search villagers for weapons (above). Later, the company's commander, with emergency powers, will mediate the inevitable land disputes. To mend the army's reputation for undue violence, Gen. Oscar Mejía Víctores, who assumed command of the government in 1983, ordered sweeping changes in military conduct and opened the way for the drafting of a new constitution earlier this year. Democratic elections are scheduled for this November.

The army, which appears to be gaining the upper hand in its decade-long battle with the guerrillas, is proud to point out

that it is doing so without U. S. aid. After a pitched battle on the Pasión River this past February, a soldier guards captured weapons (top right), which often include East European grenades and guerrilla-made Claymore mines. The U. S.-made automatic rifles bear serial numbers indicating service in Vietnam. A how-to manual, published by the FAR, the most powerful guerrilla faction in the Usumacinta region, instructs novices on "What You Should Know About Explosives." Also found was a guerrilla's notebook including a quote from a U. S. major in Vietnam on the demoralizing effects of ambushes.

Under Guatemala's previous three regimes, human rights were frequently abused, and the army was often as feared



as the guerrillas. In the abandoned settlement of El Arbolito, whose residents fled in 1980, the floor of the schoolhouse—once the pride of the village—is littered with books and government leaflets (left) offering amnesty and incentives to rebels who surrender. On the door the author reads revolutionary slogans proclaiming solidarity with El Salvador's Marxist movement and warnings of death to all who venture here. The big losers in these conflicts, he maintains, are the villagers, who are generally more interested in corn than politics. He found some of El Arbolito's former inhabitants living as refugees in Mexico, where guerrillas reportedly seek haven and recruits—a fact denied by Mexican officials.

became more rugged as we started up into the Sierra del Lacandón. Intense heat enveloped us like a sweat bath when we emerged from the forest into several small overgrown cornfields. The muleteer said they had been abandoned after only one year of use.

A thunderstorm overtook us, and we trudged onward through deepening mud. We camped beside a stream not far from a lumber camp recently burned to the ground by guerrillas. That night another storm caved in our tent and drenched our supplies.

In the morning we continued on foot through the dripping vegetation. At last we reached the site and marveled at the tameness of the brocket deer browsing there.

The ruins tumbled down a broad slope. We saw terrace after terrace surmounted by stone mounds that once had been elaborate buildings. Virtually every structure had been pulled apart by looters. Many of the larger stones had been smashed.

We wandered over the site, perhaps 50 acres in extent, surveying the damage. We found a carved door lintel left behind because it had broken in two. It bore glyphs surrounding two elaborately garbed personages; one was probably an ancient ruler. Left with its face upward, the soft limestone slab had rapidly eroded. The glyphs were already too worn to be read, but David Stuart made careful drawings, and David Hiser photographed the vestiges.

We left the tumbled ruins with a sense of sadness and anger, wondering how much more priceless knowledge had been lost to destructive greed.

When we reached the village again, the muleteer, much relieved, was given his pay. To the villagers' delight, we left an equal amount as a donation to the school before returning to our boats.

THE USUMACINTA is not a river to be trusted, even by experienced canoeists and raftsmen. A jagged, uneven bottom and variable depths make for boiling rapids and dangerous pulsing currents. Just a few days before we arrived, my young friend Luis Cuevas, guardian of the archaeological site of Yaxchilán, had drowned crossing the river he had known perhaps better than anyone else.

Like an almost perfect Greek letter omega (Ω) the river loops around Yaxchilán. This large site, accessible only as we had reached it or by grassy airstrip, contains some of the most beautiful architecture and sculpture in the hemisphere. As George Stuart said, the city "gives the impression that it was made to be looked at rather than used."

Two explorers, the Englishman Alfred Maudslay and Frenchman Désiré Charnay, reached the ruins almost simultaneously in 1882 and soon acquainted the world with its wonders. In the past decade Mexican



To shed some light on a long-obscure Maya site, the author and his party (left) camp overnight at Planchón de las Figuras on the Lacandón River. Using flashlights, they illuminate eroded carvings for a time exposure (right). A temporary outline of chalk brings the faintly visible figures vividly to life. Perhaps the graffiti of Maya traders, nearly 70 carvings depict animals, humans, mysterious spirals, and large temple pyramids—possibly those of Tikal, says the author.





archaeologist Roberto García Moll has achieved a transformation here. Mounds and fallen buildings and monuments have been converted to an array of cleaned, consolidated structures and reerected stelae. The quiet, open jungle park reveals both the ancient city and its incredible setting.

Many of the stone buildings, the ball court, patios, and monument platforms occupy the narrow flatland along the riverbank. Trails and staircases lead to hillside temples high above the river (above).

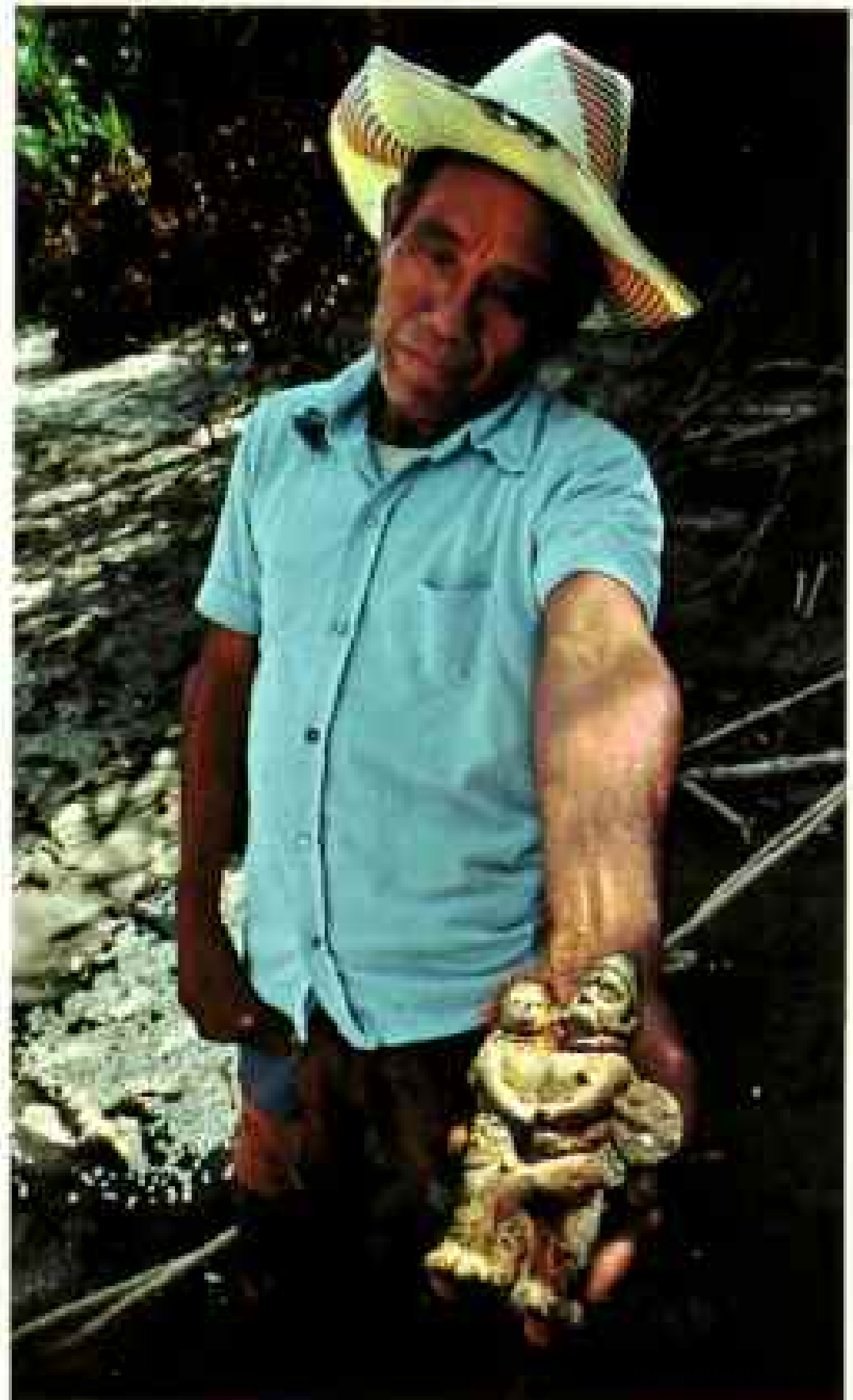
García Moll has made wondrous finds here in recent years—scenes of a cosmic ball

game where gods and rulers are shown together in the ritual; a monument made from a stalactite engraved with a portrait of the eighth-century ruler named Bird Jaguar; five elite tombs laden with jade beads, alabaster and pottery vessels; and intricately carved antler awls—perhaps ritual blood-letting instruments—bearing inscriptions and portraits of Maya gods.

David carefully examined the most recent lintel found in structure 12 and yelled excitedly: “The first kings of Yaxchilán!” Here indeed was a rare find: an early roster naming the first four rulers of this dazzling city,



Safe from future floods, the highest temples of ancient Yaxchilán occupy a ridge that overlooks a great ceremonial plaza. Its renowned buildings and sculptures may one day be under water if an expected dam rises nearby. Trading on their Maya legacy, local settlers frequently find artifacts near the river. Painted by his child, this man's find (below) shows two gods in clay.



a dynasty that began in the fourth century.

We could only wonder what other treasures lay beneath the high forest canopy.

From the great omega loop the Usumacinta took us through constricted rocky stretches and swept us into powerful whirlpools. We sped through the treacherous Chiczapote Falls, the bane of river travelers for centuries, and reached longer stretches of open water. Here the forest is denser, and howler monkeys roared their disapproval as we passed. It was here, too, that David Hiser and I spent several uncomfortable hours with the Guatemalan guerrillas.

The Usumacinta River

JUST BEFORE DARK we found the boulder-strewn beach that gives Piedras Negras ("black stones") its name.

Studied by many but visited by few, this major Maya site is one of the most remote in Middle America.

During the 1930s the University of Pennsylvania conducted major excavations here, and much of the site's beautiful sculpture has been removed to Guatemala City for safekeeping. We found that the forest that had shrouded the city for a millennium has once more largely reclaimed it.

We also found something more ominous.

Fresh survey lines for a massive dam project had been cut through the underbrush, converging on a base mark in front of a huge stucco mask of a Maya god that peered blindly from a pyramid facade. From out of the undergrowth this face from the past, now disfigured by a careless machete, stared somberly at a most uncertain future.

In the Mexican portion of the Usumacinta basin, 16 different hydroelectric projects are in the planning stages; in Guatemala two are under study. One huge international project would radically alter the core of the Usumacinta region.

This joint venture proposes to dam the river in two to four places to generate as much as 2,890 megawatts of shared hydroelectric power—more than can be produced by Egypt's enormous Aswan High Dam. Mexico would probably send most of its electricity to Mexico City, which now teems with more than 18 million people; Guatemala, with less need, might sell part of its energy to Mexico or to other countries in Central America.

The financial cost of construction would be enormous; estimates, in 1982 dollars, range between two billion and 3.7 billion dollars. The environmental price—and the cost to history—would be incalculable.

Long before the dams could be completed in the 1990s, the project would require numerous access roads, support communities, and forest clearings. Thousands of workmen converging on the area would create inflationary havoc, as has occurred at other large dam projects in Chiapas. And damming the Usumacinta would bring about major changes in the river system.

As currently contemplated, the Mexico-Guatemala joint project could flood more than 500 square miles, depending on the dam heights selected, and could alter at least 320 miles of the river network. Should the underlying limestone prove too porous to contain the water, major flooding, especially in Guatemala's Petén, could result. Deforestation near the dam basins would result in increased runoff, and with the Pasión and Lacantún tributaries already flooding spectacularly each year, the impact of major dams must be weighed carefully.

A majority of villages along the Usumacinta would be affected. At the Guatemalan

cooperative of Bethel, Don Benjamín Rosales told me in a tone of disillusionment: "No one has talked to us about the dams. They are just a rumor here. But what will happen to us? We came here 17 years ago and have made our fields and our livelihood with our own hands." Without doubt, even these few farming communities on rich alluvial soils would disappear.

Again depending on the height of the dams, archaeological treasures could suffer tragically. The lowest dams under consideration would doom most of Guatemala's Piedras Negras; only its highest buildings would survive as an island in the dam basin. Yaxchilán in Mexico could lose its large, ornate ceremonial plaza. The enigmatic carvings of Planchón de las Figuras might also vanish from view forever.

Nevertheless, both governments appear determined to proceed with the damming of the Usumacinta. As Renato Fernández, head of Guatemala's National Electrification Institute, expressed it: "We must control the waters or lose them."

TAMING THESE WATERS, especially downstream from Piedras Negras, may be no easy matter. Scarred rock walls and forest debris reminded us that the river in yearly swirling flood climbs 50 feet or more. As we approached the San José canyon, the river grew rockier and swifter. At Busiljá ("smoking waters" in Maya) a tributary plunged some 80 feet into the mainstream amid great clouds of spray. Farther on, curious about the depth of one pool, we tried to measure it; a 112-foot sounding line found no bottom.

We stopped at La Linea, one of the principal proposed damsites. The blackened remains of a large engineers' camp still smoldered on the Guatemalan side, the result of a guerrilla raid.

Our rafts slipped into a final dark defile between awesome, thousand-foot-high cliffs. A growing roar and wind whipping through the canyon warned us to hold on. Whirlpools plucked at our bucking craft, and white water leaped aboard, drenching us. Then the rapids abated to racing currents. We emerged at last into dazzling sunlight and into a wider, almost sluggish river.

Hernán Cortés discovered this part of the

Chronicle of kings, a carved door lintel at Yaxchilán is examined with great eagerness by young Maya scholar David Stuart (below, at left) and the author. Discovered two years ago by Mexican archaeologist Roberto García Moll, the lintel names the first four of ten rulers thought to have reigned in Yaxchilán from the fourth through the early sixth centuries A.D. The names of the fifth through the tenth members of the dynasty were inscribed on three previously discovered lintels.

David, who began learning to read Maya glyphs when he was ten, realized immediately that García Moll's discovery was the missing piece. His rendering (right) is a valuable addition to recorded Maya monuments.

The names are included in groupings of three or four glyphs, which read in pairs from top to bottom starting at the left. Preceding each name glyph is one indicating the order of succession, followed by the title glyph, Lord of the Seating, which is easily spotted by two crouching legs. The first ruler, at upper left, is known as Progenitor Jaguar, since a male sex organ tops the familiar jaguar symbol. The second, whose name employs two glyphs, is Deity Jaguar. The third is Bird Jaguar, and the fourth is named Yax-Deer Antler-Skull. Many of the remaining glyphs are understood individually, but their combined meanings have yet to be deciphered in detail.





Usumacinta in 1525 on his epic march to Honduras with an amazing hybrid army of Spaniards and Aztecs.* After great effort he got across, losing equipment and a horse to the current. Soon, however, he encountered the San Pedro tributary and found himself "in such difficulty that I cannot find words to express it; to cross it seemed impossible . . . to turn back meant certain death."

The expedition was starving and unable to retrace its steps because of other swollen waterways. To the Spaniards' dismay, local guides said that crossing the river would require another 20 days' march upstream. In four days 3,000 well-disciplined Aztecs, using a thousand huge tree trunks, built a bridge permitting the desperate army to cross the broad torrent.

Today a long steel bridge spans the Usumacinta near the former lumber capital of Tenosique, where we hauled our rafts ashore for the last time. Beyond here the muddy river meanders lazily through Mexico's Tabasco coastal plain, eventually to enter the Gulf of Mexico after joining the Grijalva River through a series of mangrove swamps.

I PONDERED the riverine wilderness we had explored. Where not long ago only Lacandon Indians roamed, we had encountered many people and ceaseless change: paths becoming highways; forests being cleared for lumber and crops; worn-out cornfields turned to pastures; abandoned grazing land gullied and eroded; oil fields sprouting in virgin jungle; and, most alarming of all, rivers being measured for vast dam basins.

Efraín Aguilera, an earnest engineer studying potential damsites for the Guatemalan government, summed up the official view of both countries—and perhaps the future of the entire region—while discussing the possible flooding of ancient Piedras Negras. "Its fate," he said, "will have to be

*The author traced Cortés's "Path to Conquest" in the October 1984 NATIONAL GEOGRAPHIC.

decided by the national interest." So it will. One can only hope that those who decide the national interest—on both sides of the border in this truly single region—will have the wisdom to strike that crucial balance between utilization for the present and preservation for the future.

My friend Moisés Morales, who has lived for 25 years at the edge of Mexico's Lacandon Forest, expressed concern during a meeting with regional authorities: "One has to view the Usumacinta as a geographical area and realize that what happens on one side of the river will affect the other too. Although we have reduced the forest to a critical limit, we have not yet reached the point of no return. But, if we are to have preservation, officials must become aware of ecological values."

Guatemalan environmentalist Marta Piñón de Pacheco holds a similar view: "We have to admit that the conservation of the environment is eminently a political decision. There should be no mistake: The environment can be utilized, but what should not be done is to abuse, wear out, and destroy." Such values will have to be taken into account if the challenge of the Usumacinta is to be met.

I RECALL a visitation one moonless night, while camped beneath an immense ceiba tree near the ruins of Piedras Negras.

Muffled steps on dry leaves woke me—a large, four-footed creature within the circle of our tents. There were inquisitive snuffling sounds as the interloper knocked over and nuzzled a soap dish, then sat for a time, apparently surveying our camp. Eventually, inspection completed, it padded off into the darkness.

At first light we checked the tracks. Unmistakably they were those of a large adult jaguar. We marveled at what seemed its brazen display of curiosity. But I wondered, too, whether he was leaving us a message: that, for the moment, it is still *his* jungle—and *we* are the intruders. □

Time out for play, the author's party cools off at a travertine falls where Mexico's Busiljd River empties into the Usumacinta. Along 320 miles of the river system being considered for hydropower development, the falls may disappear under a vast lake, along with untold other treasures of nature and history.



Nature's magnificent trumpeters fill the skies in increasing numbers. This swan.

The Triumphant



and its offspring take wing above Washington State's Skagit Valley.

Trumpeter

By CHARLES A. BERGMAN
Photographs by ART WOLFE



Graceful flotilla of trumpeters cruises Lonesome Lake, a wintering ground in British Columbia. This congregation of adults and gray adolescents gathered for handouts of grain. Named for their distinctive hornlike voice, the sometimes highly vocal birds can be heard for two miles when calling in unison.



The giant swans, with wingspans of eight feet, were once hunted intensively as a source of quills, decorative feathers, and down for powder puffs. The known world population totaled less than 100 in the 1930s, but with improved census methods and conservation, that number has risen to an estimated 10,000.

ONE OF THE EGGS was about to hatch. We could hear it happening. A baby trumpeter swan—a cygnet—was pecking at the inside of the shell with a sound like timid knocking on a door. As we listened, we could imagine the swan moving inside.

Biologists had helped photographer Art Wolfe and me find this nest in Alaska's Kenai National Wildlife Refuge. The Kenai Mountains loomed in the background, snow still streaking their flanks in late June. Hidden beside an islet in a meandering stream, the nest mounded out of the water in a sort of marshy haystack. It cradled five eggs, each as big as a cupped hand.

While the mother was away, we approached the nest to learn how close her clutch was to hatching. Now in our blind, a tent covered with grass, we had waited seven hours for the first cygnet to emerge. After pipping and kicking free, it dried quickly, its wet down fluffing out in the sun. Tentatively the nestling rose to its feet, like a flower breaking into bloom.

The mother, staying close, looked up and honked a powerful *ko-hoh!* at her mate as he flew low over the nest. The resonant, brassy call, from which the trumpeter takes its name, had a ring of triumph.

That cygnet in the Kenai refuge signaled a success not only for the family bringing off a brood. For us, it was also a symbol of the rebirth of the entire species. We had come to Alaska to study a landmark event in recent natural history, the resurgence of the world's largest wild swan—pure white, six feet long, with a wingspan of eight feet, weighing 25 to 35 pounds.

Only 50 years ago biologists feared the worst for *Cygnus buccinator*—imminent extinction—even though it had been legally protected since 1918. Centuries of hunting the majestic bird for its skin and feathers apparently had reduced the once widespread population, found only in North America, to small pockets of survivors. A 1932 horseback census, mostly in Wyoming, Montana, and Idaho, found 69 birds, believed at the

time to be all that remained in the United States. We now know that additional birds survived in Canada and Alaska.

Early in this century the trumpeter had become an emblem of our vanishing wilderness. But a swan song was premature. By 1980 its status had registered a significant turnaround. Estimates place its numbers today at about 10,000. This is a stunning reversal, although the trumpeter has a long way to go to regain its historical abundance.

What has happened? Conservation saved those swans in the tri-state area of the Rocky Mountains. Biologists focused their efforts on a remote valley in southwestern Montana, where Red Rock Lakes National Wildlife Refuge had been established in 1935 specifically to protect trumpeters.*

It is in Alaska, however, that astonishing increases in trumpeter numbers have been recorded. On aerial surveys between 1959 and 1980, wildlife biologist Jim King saw nesting populations grow from 1,100 to 8,000 in a wide area from Haines in the southeast to locations north and west of Fairbanks in the center of the state. Former supervisor of waterfowl investigations for the U. S. Fish and Wildlife Service in Alaska, Jim has observed a trumpeter population explosion past all expectation.

THE DE HAVILLAND Beaver banked over southern Alaska's Copper River Delta. The boggy flats sped by below us, aglow with the pink bloom of fireweed. White swans dotted cobalt blue ponds that glittered in the sun like shattered mirrors. Trumpeters feed mainly on a variety of submergent vegetation in marshes, lakes, and ponds.

"Many of these lakes have swans on them now," Jim King said. Wearing an old blue hat, my easygoing host was flying Art Wolfe and me over the trumpeter census areas of southern and central Alaska. "This is as high a density as I've seen as long as we've been plotting swans," Jim said. Yet only 30 years ago no one was sure that trumpeter swans were here.

We flew up the Copper River Canyon, past the place where in 1954 wildlife biologist Melvin Monson positively identified a

*Frederick Kent Truslow reported the "Return of the Trumpeter" in the July 1960 *Geographic*.

Charles A. Bergman is an English professor at Pacific Lutheran University in Tacoma, Washington. Art Wolfe has photographed and written on long-eared owls for *NATIONAL GEOGRAPHIC*.

Trumpeter swans

With the Migratory Bird Treaty Act of 1918, the United States joined Canada in protecting these once widely hunted birds. Human encroachment and loss of habitat had driven them from wintering grounds along the East and Gulf coasts and in the Mississippi Valley. Refuge sites in Wyoming, Oregon, Nevada, South Dakota, and Minnesota were stocked from Red Rock Lakes National Wildlife Refuge.



Champion of the trumpeter, wildlife pilot Jim King took to the air over Alaska with other biologists in the 1950s and discovered many previously unknown nesting sites in isolated regions. Their improvements in survey methods helped raise the count of known summer population in that state from 1,100 to 8,000 in just over two decades.

Now retired, King served 32 years with the U. S. Fish and Wildlife Service in Alaska. He keeps a captive breeding stock of swans on his private four-acre preserve adjacent to the Mendenhall State Wildlife Refuge near Juneau, where he and his wife take in sick and injured birds. Here he cares for a young tundra swan, close relative of the trumpeter. Because of deformed legs, the cygnet was unable to fend for itself.



trumpeter nest in Alaska for the first time.

"The trumpeter swan probably was never endangered in Alaska," Jim told us. "But it wasn't until biologists began flying that we could begin to comprehend just how many trumpeters there were. From the air you can see swans you would never find by bog-stomping on the ground."

FROM a hundred feet up at a hundred miles an hour, Jim and others distinguished trumpeters from the similar tundra swans (also called whistling swans) by observing differences in habitats. Trumpeters build their nests in shallow water with emergent rushes and grasses, pulling them up and piling them into a mound. Around the emerging nest, they thus create an encircling moat, a characteristic "doughnut" that is easily identified from the air.

Jim King was one of the earliest wildlife pilots. In 1959 Jim and others found 1,124 trumpeter swans. With that one survey the world's known population of trumpeter swans was doubled. The results of the second survey, in 1968, defied everyone's expectations—except Jim's.

"I do a lot of gypsying around with the airplane, so I had a pretty good idea we'd find

even bigger numbers of swans," he told me. They found 2,847 trumpeters.

After that count the trumpeter swan came off the list of wildlife being considered for endangered status (the species had never been officially listed). And Jim began wondering where the 3,000 trumpeters spent the winter. He guessed the U. S. Pacific Northwest and British Columbia.

"Sure enough"—Jim grinned as he told me—"we put collars on some trumpeters, and they showed up in Washington State."

Subsequent surveys found more than twice as many trumpeters in Alaska. The 1980 total was 7,696, surprising even Jim.

Why are trumpeters enjoying such a grand success?

Jim King says he and his copilot, biologist Bruce Conant, "both kind of favor the theory of the warming climate." A study by the University of Washington reports that summer temperatures in interior Alaska have been nearly 4°F warmer this century than last. Swans have pioneered new habitat at higher elevations and at the northern limits of their range. As glaciers recede, trumpeter swans have occupied the vacated terrain.

"Small temperature differences could stretch the nesting season," Jim said, "allowing more time to bring off a brood."



Keeping watch over Alaska's flocks, a U. S. Fish and Wildlife Service Beaver planes across Bering Lake (above), near the Copper River Delta. Pilot Jim King was well clear of the birds in this view, foreshortened by the camera's lens.

Aerial observations and land-based computers aid the service in a statewide census every five years. Unable to fly during molt, a swan captured by airboat at Red Rock Lakes (below) will be banded for population monitoring.



One of Jim's concerns today is protecting trumpeters from human encroachments like mining, roads, and recreational cabins. A wary and reclusive bird while nesting, the trumpeter does not tolerate disturbances. Usually only one nesting pair will occupy even a large lake. On the fast-developing Kenai Peninsula south of Anchorage, swans have been displaced. "Since 1957," said Kenai National Wildlife Refuge biologist Ted Bailey, "human activity has forced trumpeters to move to more remote areas."

FAR TO THE SOUTH, our airboat slid around a bend and skimmed into the bay. Rees Madsen cut the throttle. I helped Terry McEneaney count: 50 trumpeter swans were gathered there. My companions, biologists at Red Rock Lakes National Wildlife Refuge in Montana, were banding and collaring molting swans in July at the foot of Lima Reservoir, just west of the refuge. At about 7,000 feet, the marshes of Red Rock Lakes mark the historical epicenter for efforts to save the swan; the refuge provides a major wintering and nesting ground for trumpeters in the lower 48.

Unable to talk above the roar of the airboat, Terry pointed out a swan, and we cut between our targeted bird and the reeds. Temporarily flightless because of molting, the swan struggled to escape. His wings flapped against the water like tattered sails. Terry leaned over, grabbed the bird by his big black feet, and swung him aboard.

The swan went immediately limp. I cradled him in my arms. He rested his looping neck on the pillow of his white breast. "Trumpeters remain surprisingly passive while being handled," Terry said. He sexed the swan—a cob (male). We weighed him—25 pounds—and put a collar on him.

"We've put collars on about a hundred swans now, although some lose them," Terry said. He's studying the birds' distribution and movements in the tri-state area of Montana, Idaho, and Wyoming.

The number of trumpeters in and around Red Rock Lakes has increased and now leveled off. The refuge swan population ranges from about 100 in the summer to 300 in the winter. The birds forage for vegetation in two ice-free, warm-spring ponds. For the

Circular homestead, carved from marshland, centers on an egg-laden nest near the mouth of Alaska's Copper River (right). Both sexes pluck construction material from surrounding vegetation, ringing the site with a moat. Swans also build atop muskrat houses, and nests are repeatedly rebuilt in successive seasons. The female, at lower left, leaves the nest to swim and forage. Known for skittishness at human intrusion while nesting, trumpeters favor isolated habitats like Minto Flats in central Alaska (below), where pink fireweed paints a 1,200-square-mile stretch of lakes, marsh, and shallow waterways.









Breaking free after incubating for more than a month, a nascent bird struggles to escape the shell, shown here life-size (above). With its pink foot clamped over its head and eye opened, the bird pecks away to rid itself of the shell, a tedious process that can take 24 hours. Only days old, a cygnet gains a better vantage point for a look at its world (left). Its parent stands guard in Kenai National

Wildlife Refuge. Hatchlings take to the water within 48 hours and are quickly coaxed away from the nest (below).

The first weeks of life are perilous. Some perish from predators and accidental trampling by parents. Others die from entanglement in vegetation and starvation. Cygnets feed mainly on snails, insects, shrimp, and other aquatic life. Becoming more vegetarian as they mature, they prefer tender aquatic plants.





Voracious appetites bring trumpeters flocking to the shore of Lonesome Lake to be fed by Trudy Turner (left), their cold-weather benefactor. Following a tradition begun by her father, Mrs. Turner distributes barley to the birds during winter months when vegetation is often inaccessible beneath the lake's frozen surface.

Only hours old, a cygnet surveys its surroundings from a lily pad in Alaska's Swan Creek (below). In a single summer it will grow to an astounding 15 to 20 pounds. Behold the majestic trumpeter, urged John James Audubon, "and you will feel, as I have felt, more happy and void of care than I can describe."



whole tri-state area, the population ranges from 400 in summer to 1,200 in winter.

The refuge has provided a place to study the life history of the species. Trumpeter swans pair off as early as two years of age. Legend insists that mated swans are faithful for life—as long as 30 years—but widowed swans are known to find new mates.

In both Red Rock Lakes and places in Alaska, swans get restless to return to nesting territories well before winter is over. At Red Rock pairs can be found on their frozen nesting sites in late winter, waiting for the ice to melt. They forage in the open-water areas. When conditions are severe, they may receive handouts of barley and other grain from refuge personnel.

Swans are invariably among the earliest waterfowl on the nesting grounds. Every day is crucial when trying to raise seven-ounce cygnets into 15- to 20-pound adolescents in one short summer.

Five eggs per nest are average, with hatching usually in late June. Young cygnets, unable to reach submerged food, are helped by the parents. The adults stir up the bottom with their bills and large webbed feet, causing vegetation and small invertebrates to rise near the surface. As their necks lengthen, the cygnets learn to dunk for vegetation. A trumpeter family spends the first winter together, a tie that usually lasts into the following spring.

SIX MONTHS LATER and 800 miles to the northwest, we camped on the January ice at the south end of Lonesome Lake in south-central British Columbia. We spent our first night on the lake right where the chartered ski-plane dropped us.

Next morning sun and swans burst upon us together. When they saw us, 350 trumpeters flew en masse toward us from the open water at the inlet of the lake. A vast concourse surrounded us, swans taking off and landing. The noise rose with the numbers. The trumpeters bugled in an overwhelming crescendo, unbelievably loud, like an orchestra of out-of-tune bagpipes.

The swans had mistaken us for Jack and Trudy Turner, their caretakers, and rushed upon us, eager for food. Presently Trudy and Jack appeared, walking out onto the

frozen lake. "They're not really tame," said Mrs. Turner, "they're just very hungry."

Wilderness homesteaders, Mrs. Turner and her father before her have been feeding barley to the Lonesome Lake trumpeters through all the winters since 1932. As we hiked to the grain shed on shore, Mrs. Turner condensed a lifetime among the swans into a single recollection: "The calls of the swans are one of my earliest memories, along with my mother's voice."

Mrs. Turner's father, Ralph Edwards, cleared and worked a family farm. In late October, flocks of trumpeter swans would begin to return in what Edwards described to his daughter as a "visitation of the angels." Some of the birds used to starve to death when ice locked the lake and they could not reach their natural food.

Edwards arranged with the Canadian Wildlife Service to provide funds to buy barley. His daughter took over feeding the swans in 1941. For 12 years she and her husband horse-packed the grain in to the lake, about 10,000 pounds of barley annually. Today the grain is flown in. Slowly, over the years, the flock grew. The high level was 512 swans in 1971.

The Lonesome Lake population at one time represented all the known trumpeter swans wintering between southeastern Alaska and the Columbia River. But Richard W. McKelvey, wildlife biologist for the Canadian Wildlife Service, told me that the big birds have recently increased so dramatically that some 6,000 Alaskan trumpeters now winter on or near the Pacific coast.

"We estimate 4,000 birds on the British Columbia coast," McKelvey said, "and more than a thousand inland, at places like Lonesome Lake. Washington State hosts most of the thousand remaining."

At Lonesome Lake I was delighted to find a cygnet wearing a blue collar, coded 40EA. This swan answered a nagging question: Where do the Lonesome Lake birds nest? This female cygnet had been collared on Minto Flats, near Fairbanks, Alaska.

Throughout their range, trumpeter swans face a number of hazards. The full extent of poaching is unknown, but several kills are documented. Trumpeters are vulnerable to poisoning when they swallow expended lead shot, mistaking it for grit. The

big swans can also blunder into power lines.

In some parts of the Skagit Valley of northwest Washington, the birds are caught in a critical conflict—swans versus development. Several hundred trumpeters winter on lakes, sloughs, and pastures of the valley. Standing beside Barney Lake one December day, I could see about 45 trumpeters grazing in a swale. Turning about, I saw hardly a quarter of a mile away a housing development—called, with some irony, I thought, the Trumpeter development.

According to Martha Jordan of the Trumpeter Swan Society, trumpeters are losing habitat as wetlands are drained and filled for real estate development and other activities. Martha was with me that morning as we glowered at the housing project. "Swan use of Barney Lake," Martha commented, "has declined sharply in the past four years. Guess why?"

Swans on one side of the lake, houses on the other—the image summons up the potential for conflict. Nevertheless, Martha Jordan can cite places in Washington where development has made room for swans. In the San Juan Islands, for example, a housing project for 30 families created a marsh that now supports 38 swans.

THE RESURGENCE of the trumpeter swan makes its admirers take heart. One morning at Lonesome Lake I had watched a fight break out on the ice. Defending his family from an intruding swan, a cob rushed in a screaming attack. Biting at the interloper's neck, knocking over bystanders, the enraged cob ended up pulling at the tail feathers of his retreating adversary.

The victorious swan returned to his mate and cygnets, swaggering across the ice on pigeon-toed feet. He and the pen (female), reunited, faced each other and began a triumph ceremony that looked to me like a square dance. They went aquiver, heads bobbing on long necks, wings extended and fluttering, tips down, as if wrapping themselves in white robes. The cygnets, eager to join in, tried with up-and-down movements of their heads to imitate their parents.

To me, it seemed a dance of celebration, not just for the triumph of this one family, but for the whole species. □

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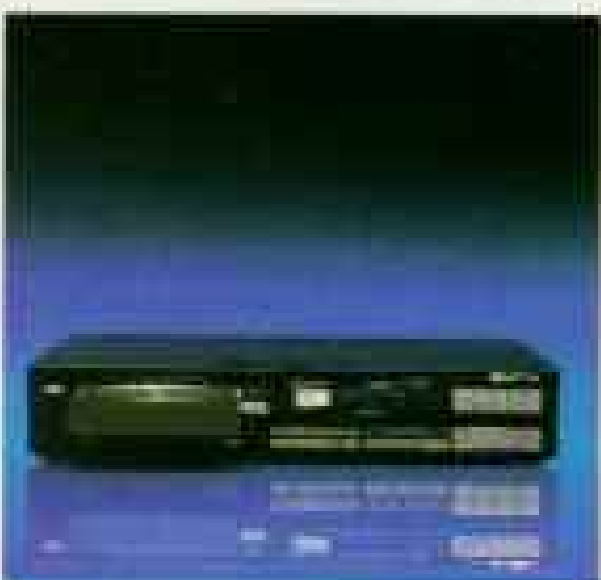
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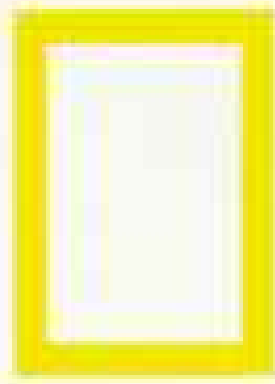


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Geographic education: good news and bad

“YOU HAVE INSULTED my fellow students and me a great deal.” I received that comment in a letter after the press reported remarks I made to the Economic Club of Detroit and the Association of American Geographers, stating the same concern I shared with Society members on this page in June: “Geographic ignorance: time for a turnaround.”

The correspondent who challenged me was Traci Hackler, a seventh-grader at Sapulpa Middle School in Sapulpa, Oklahoma. Others of her fellow students objected too, and one wrote, “We would like for you to come and *see for yourself* how much we know about geography!”

So I did.

When I walked into Larry Vandiver’s sixth-grade social studies class, the prominent maps, globe, and other teaching materials made it obvious at once that geography was not ignored in Sapulpa. Then I was introduced to an eager class of waving hands, and the first question was: “Do you take back all those things you said about us?”

And why, they wanted to know, did I think that geography wasn’t being taught in American schools? I said that part of the problem was competition for their time. Math, English, science, and other subjects all had claims on it.

Then I told them that they had a good teacher interested in geography, as were their principal and superintendent. “You are lucky to be in such a situation, because there are so many classes in so many schools where geography is not taught at all, or very little. And,” I said, “that concerns me because students will need a knowledge of geography all their lives. Many of the decisions you make as you grow older, many of the professions you may go into, require such knowledge.”

We went on to other matters, talked about the Great Barrier Reef (above right), and I found they were learning not just places and facts but even such concepts as the relation

between literacy rates and life expectancy.

Shortly after I returned from Sapulpa Middle School, feeling better about the state of geography in our schools, mail began to pour in from Society members responding to my June column. Letter after letter agreed that geography in our schools is, overall, in dismal shape. I’d rather have been wrong.



NATIONAL GEOGRAPHIC PHOTOGRAPHER JOSEPH H. BALLEW

I heard from teachers, professors, a school-board member, parents, grandparents, and the simply concerned. Many offered excellent suggestions as to how to improve the teaching of geography, or how parents can supplement their children’s education at home, or how games, puzzles, and hobbies can spark a child’s interest.

As I was leaving the middle school, that insistent voice shot one last question. “Well, do you take it back yet?” I take it back for Sapulpa. One day I hope I can take it all back. Meantime, we have a lot of work to do.

Silvestro Brosens

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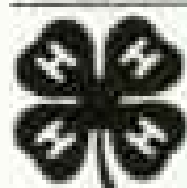
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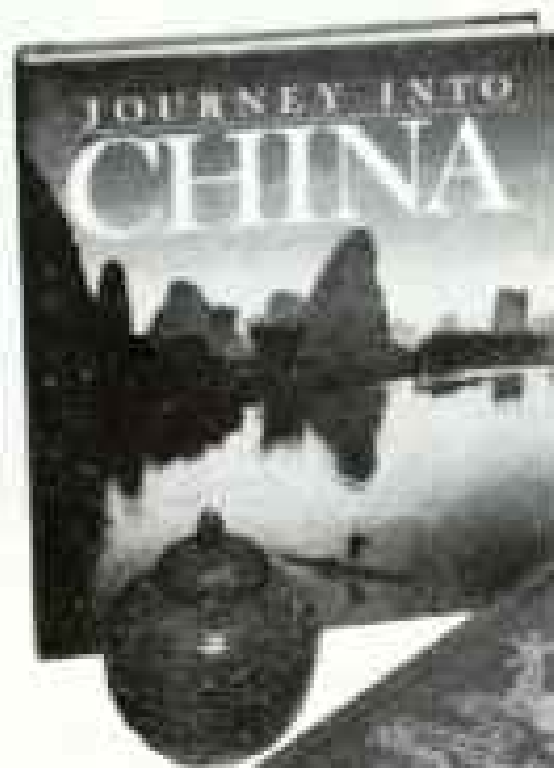
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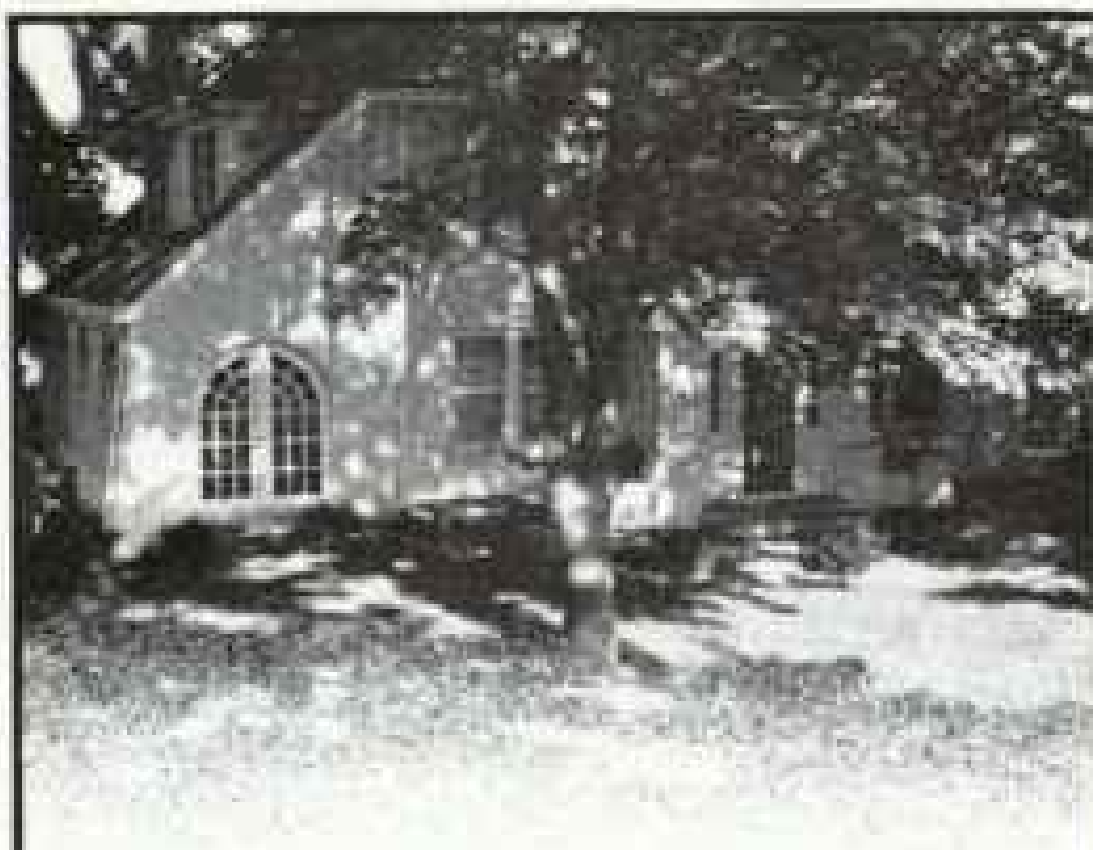


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Members Forum

Afghan Frontier

Sometimes I have wondered which is the most remarkable photograph I have seen in 30 years of NATIONAL GEOGRAPHIC. Now I know: that of the Afghan refugee on the front cover of the June 1985 issue—magic.

Filippo Valli
Berkeley Heights, New Jersey

On your June cover is the most compellingly beautiful young girl I have ever seen! Do you know more about her?

Robin Hamblin-Fuller
Ottawa, Ontario

Many have asked about this girl. Photographer Steve McCurry knows only that she was about 13 years old and lived in the section for widows and orphans in the Nasir Bagh refugee camp.

I just returned from a trip to Peshawar, Pakistan, to find the June 1985 issue of NATIONAL GEOGRAPHIC. The article depicted conditions exactly as I found them in the refugee camps and hospitals. The photos certainly left me with the distinct impression you people can go anywhere and get marvelous pictures, even under the most difficult and hazardous conditions.

John D. Hess
El Centro, California

Mexican Border

Regarding "Life on the Line" (June 1985), why not reinstitute the program of a quarter of a century ago in which workers were hired in Mexico, given medical and skill tests, taken to the U. S. to work, then after a few months returned home. Most of these people don't want to live permanently in the U. S.; their homes and their families are in Mexico. They just want to work hard to get some money.

Eric Williams
Monterrey, Mexico

The braceros program you refer to actually ran from 1942 until Congress terminated it in 1964.

I found your story biased as it relates to the problem of illegal immigration. I have been in charge of the Houston District Anti-Smuggling Unit for five years and have never met a smuggler who wanted his activity to be legalized. Most smugglers have no compunction about using violence or the threat of violence to extort fees from family members and/or friends. In the past 20 months

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my office has seized approximately 30 firearms (including two submachine guns) from alien smugglers, and it is my firm belief that the only rules the vast majority of these people follow are ones that are made up as they go along.

Charles R. Griggs
Houston, Texas

Great Salt Lake

I was pleased to see "No Way to Run a Desert" (June 1985), an article that hit close to home. I commute to Salt Lake City every day, passing several miles of the Great Salt Lake. There have been times when I've wondered how long it would be before we'd have to travel a different

route. I've waited in long lines while construction crews worked to raise Interstate 80, and it's been a long time since I've seen solid land on either side of the highway for several miles. The peak runoff days are over for this year. We can only hope that from now on the lake will subside or remain within its new boundaries.

Lisa Royle
Tooele, Utah

Bob Marshall

As head of the Wilderness Society, founded by Robert Marshall 50 years ago, I read with interest the excellent piece on the Bob Marshall Wilderness (May 1985). Marshall died at 39, but he remains an inspiration—one of the first explorers



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to view wilderness not as something to be conquered but to be embraced.

William A. Turnage
Washington, D. C.

If Bob Marshall had walked through the valley shown in the photograph on page 672 and thought it was Monture Creek as your caption suggested, he would have been lost. The area in your picture is the Danaher Meadows.

Carl Davaz
Missoula, Montana

Our caption writer and several reviewers were indeed over the hill that separates the two basins.

The Atom

The reference to "phosphorus-coated TV screen" (May 1985) should read "phosphor." The fluorescing chemicals inside the cathode-ray tube are not elemental phosphorus.

Alfred R. Matthews
Decatur, Alabama

Phosphor is the correct term.

While reading the Koran recently, I was struck by verse 30 in the chapter "The Prophets," which states as follows: "Are the disbelievers unaware that the heavens and earth were one solid mass which we tore asunder, and that we made every living thing of water?"

As far as I know, this seems to be the earliest



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reference to the big-bang theory of the creation of the universe. This was roughly 1,350 years ago.

Khawaja N. Anwar
Gainesville, Texas

The Nile

Robert Caputo states (May 1985) that Lake Nasser "holds 133 million acre-feet—the equivalent of *two years of Nile water*." With the foldout map Farouk El-Baz writes that the reservoir "stores nearly 170 billion cubic meters of water, enough to satisfy Egypt's needs for *about three years*." I would appreciate clarification of what appears to be a 33 percent discrepancy.

Ben Yuri Biersach
Honolulu, Hawaii

Both statements are correct. The average annual flow at Aswan is 84 billion cubic meters. Two average years would fill the reservoir, which can hold 133 million acre-feet or nearly 170 billion cubic meters. Egypt and Sudan have an agreement that guarantees 55 million cubic meters of water to Egypt annually. Thus a full Lake Nasser can supply Egypt's needs for about three years.

The IV Dynasty pharaoh who built the largest pyramid at Giza wrote his name as Khufu, so why do you call him Cheops?

Alan Blair
Jülich, West Germany

Our style is to use the Greek versions of pharaohs' names, as they are more familiar to most of our readers.

Vietnam Memorial

Thanks for the wonderful article about the Vietnam Memorial (May 1985). I was disappointed because the article did not mention that the American Legion and its Ladies Auxiliary contributed more than one million dollars for its construction.

Robert Powell
Chicago, Illinois

Editor's Column

I would like to add to your count of those in favor of the metric system (June 1985)! This should make at least $29 + 1 = 30$.

Walter Selig
Lafayette, California

We have received many letters from readers who wish to be added to the pro-metric count.

Keep thinking metric!

Patrick Carpenter
Edina, Minnesota

Perhaps those who mindlessly protest the metric system should be invited to go back to Roman numerals to balance their checkbooks.

G. C. MacDonald
Shalimar, Florida

President's Page

Don't be disheartened! Yesterday at separate times I asked my children, ages 10 and 12, to answer the four geography questions mentioned in your June 1985 President's Page. Neither knew that Manila was in the Philippines, but both knew the five Great Lakes, knew that the Amazon was in Brazil, and easily named three African countries south of the Sahara.

Martha W. Fullerton
Huron, South Dakota

My studies are in the field of meteorology, in which a great deal of geographic knowledge is necessary. Just the other day a classmate suggested that Canada was one of the 50 states.

Dean L. Iovino
Rahway, New Jersey

To reverse a trend in education, one must first convince the educators. During anti-apartheid demonstrations at Cornell University, I met a faculty member who not only misidentified the country of South Africa on a map, but also couldn't tell where the great Kimberley diamond mines were or what had become of that other (former) bastion of inequality, Rhodesia.

William Mayers
Newfield, New York

What is so upsetting about the majority not knowing where the Amazon River is? What earthly good does it do a physician, attorney, or clergyman to know this? If college students don't know where the Amazon is, it's my hope that they are learning, instead, to solve problems, to be risk takers, and to apply the knowledge of their given specialty. It's counterproductive to clutter the mind with unnecessary information.

Jane West
El Cajon, California

While I was attending a lecture for Army Reserve officers, the instructor challenged our geographic knowledge by handing out a blank map of Central America and instructing us to fill in the areas with the correct countries and capitals, if possible. Most of us were embarrassed at our inability to achieve a passing score. This was inexcusable for future military leaders.

Peter J. Sigona, Jr.
Groves, Texas

.....
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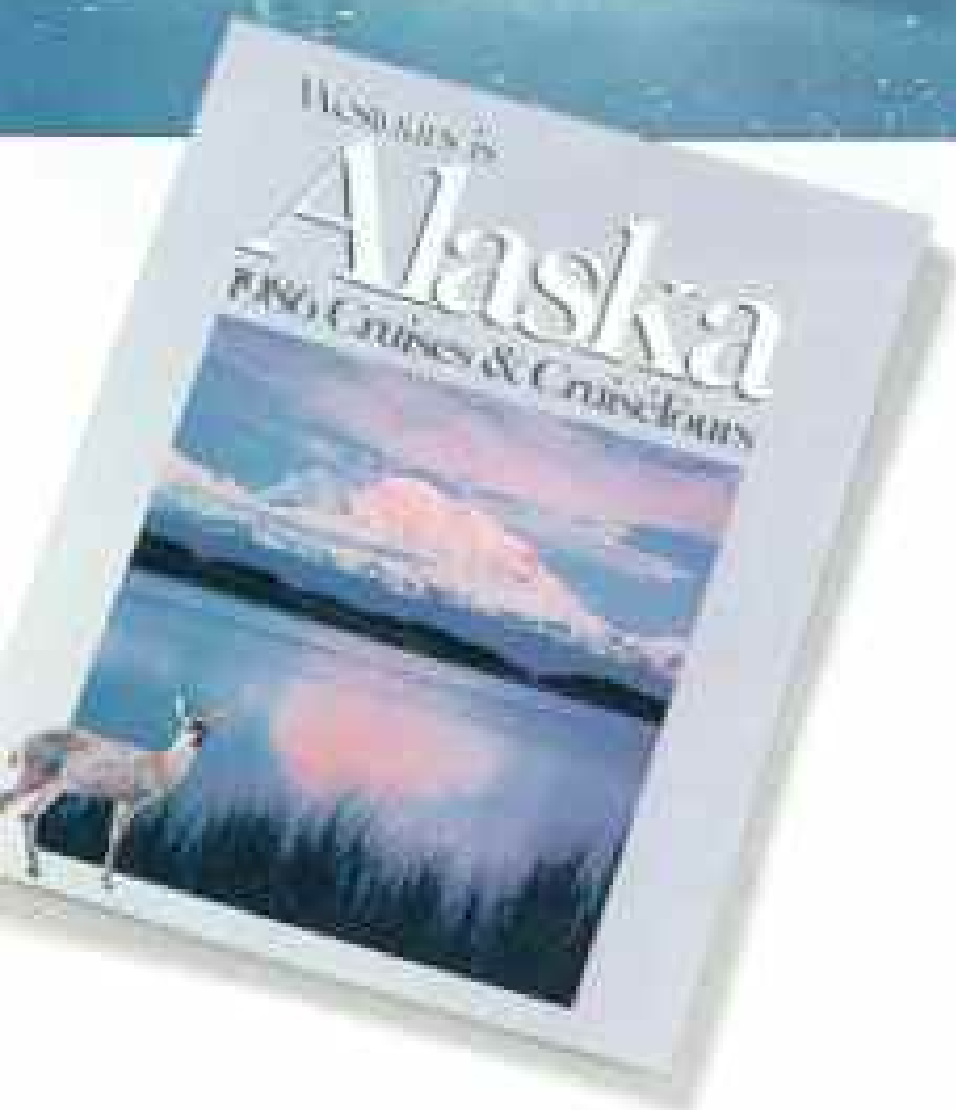
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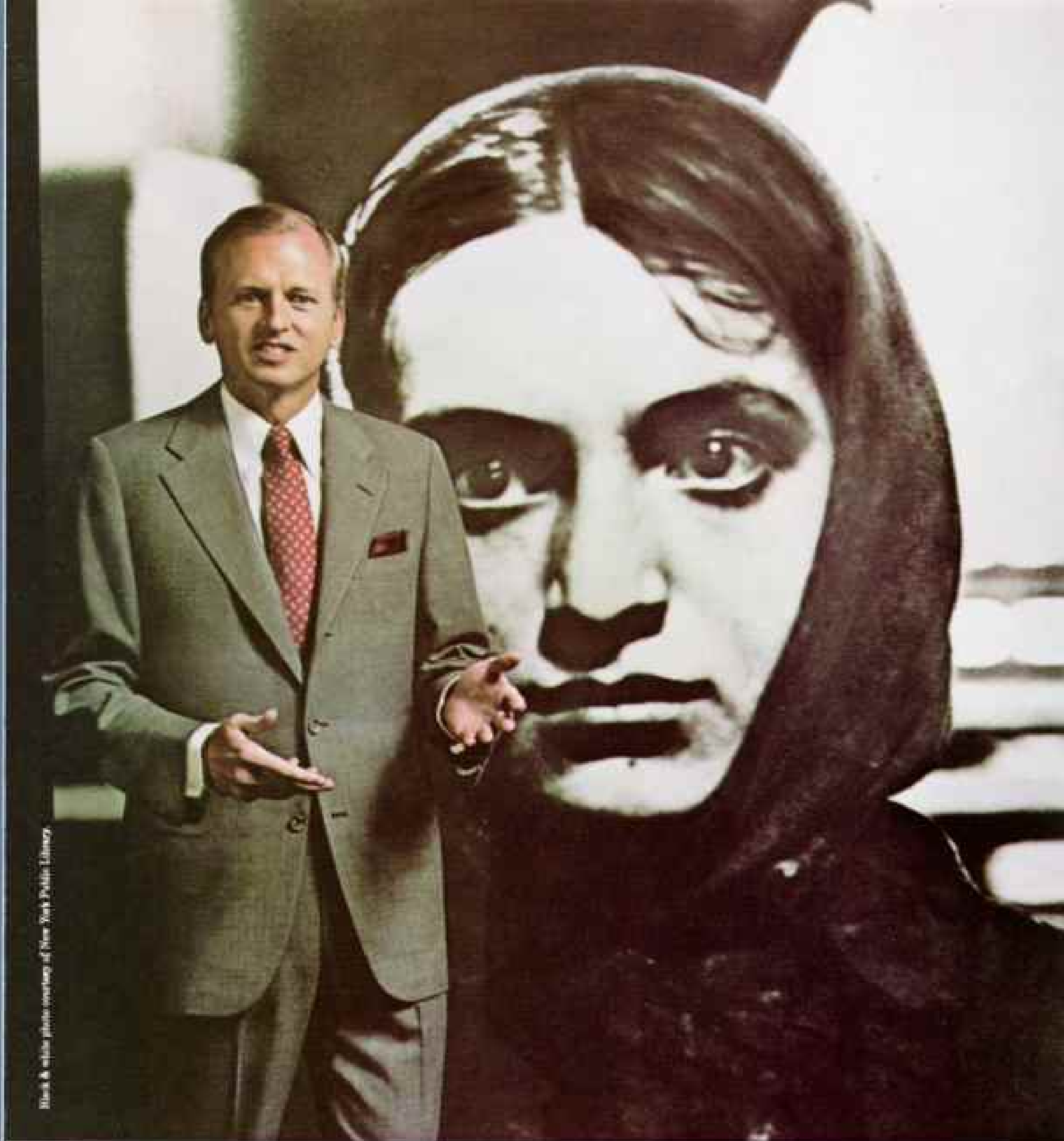
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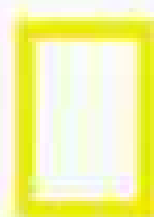
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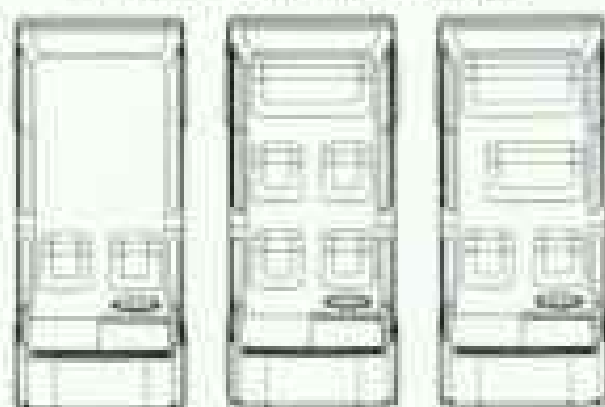
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Photographed by Andrew Laurie *Galapagos Marine Iguana: Genus: Amblyrhynchus*
Species: cristatus Adult size: Total length, 57 – 135cm (marine iguanas vary in size among the islands)
Adult weight: 1 – 12kg Habitat: Lava reefs and shorelines on the Galapagos Islands
Surviving number: Unknown



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Home to a unique diversity of animals, the Galapagos is one of the world's greatest natural wonders. According to his own account, it was here that Darwin began formulating his evolutionary theories. Recently, the Galapagos was brought to the forefront of the news by a wildfire on the main island. Raging for weeks, the fire imperiled the animals, many of which, like the marine iguana, are threatened species.

Nothing could bring the marine iguana back should it vanish completely. And while photography can record it for posterity, more importantly photography can help save it and the rest of wildlife.

As with other species endemic to the Galapagos, the marine iguana's existence is extremely vulnerable and can be easily disrupted by factors caused by nature or man. Through photography, both as a scientific tool and a means of communication, a better understanding can be achieved of the deli-

cate ecological balance of the lifeforms that have survived on the Galapagos throughout the ages.

And understanding is perhaps the single most important factor in saving the marine iguana and all of wildlife.



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On Assignment

WEIGHING HIS EVERY WORD, *S. Jeffrey K. Wilkerson* (below, at right) turned a tense encounter with Guatemalan guerrillas into a civil exchange for this month's article on the Usumacinta River—part of the developing frontier between Mexico and Guatemala. After three hours of hostile questions and political harangues, the ecologist and archaeologist persuaded the rebels, who had never seen journalists in this obscure region, to have their picture taken after concealing their identities with bandannas. "I have no doubt," he said, "that they would have shot us if they had felt we were compromising their interests."

A veteran investigator of Mexico's pre-Columbian cultures, Wilkerson reported on the Totonacs and Huastecs in Veracruz for the August 1980 *GEOGRAPHIC* and followed the route of Cortés in the October 1984 magazine. In this issue he turns to the river that nurtured the flowering of Maya civilization. Threatened by impending dams, many of the region's ruins have never been properly documented. At one site, Mexican team members built a temporary tower to give photographer *David Hiser* (right) a good view of eroded Maya rock carvings.



BY S. JEFFREY K. WILKERSON (ABOVE); DAVID HISER



02

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THREE SECOND PRIZES: A Trip For Two to the 1987 Sugar Bowl, Cotton Bowl or Orange Bowl (4 days, 3 nights at the Sheraton New Orleans, or the Sheraton Dallas, or the Sheraton Americas, and airfare on American and \$500 spending money).

500 THIRD PRIZES: Official NFL footballs.

Any licensed driver can enter. No purchase necessary. Odds of winning determined by the number of entrants. All prizes will be awarded. Sweepstakes entry forms available throughout the Amoco marketing area at participating retailers and Amoco dealers. Drawing on or about Jan. 16, 1986. Winners will be notified directly.

Your Car Knows



38¢ a Mile.



HOLLAND AMERICA CRUISES CARIBBEAN & MEXICO

It doesn't take a lot of money to go a long way on a Holland America cruise. Consider all you get.

For 7 or 14 days aboard the Noordam, the Nieuw Amsterdam or the Rotterdam, you'll have magnificent accommodations and gourmet cuisine. Onboard activities ranging from tennis and golf to a casino and a theatre. Plus Holland America's exclusive Ocean

Liner Service™, and the expert attention of our experienced Dutch officers and world-renowned crew every mile of the way.

And those miles lead to some of the most exotic ports of call in the world. Places like St. Thomas, Montego Bay and Grand Cayman in the Caribbean. Puerto Vallarta, Zihuatanejo/Ixtapa, and Acapulco along the Mexican Riviera.

Our 7- and 14-day cruises include free air* from most major gateways. And on Holland America ships, unlike any other luxury cruise, *no tipping is required.*

So on your next trip, remember, you can have it all on a Holland America cruise. For 38¢ a mile, it's the most luxurious vacation value on land or sea.

See your travel agent today.



*Does not include Christmas cruises to the Caribbean. Ships' registry: Netherlands Antilles.

In October on Nickelodeon Cable TV: National Geographic

EACH SUNDAY'S PROGRAMMING IS REPEATED THE FOLLOWING SATURDAY FROM 8 TO 11 P.M. (EDT)

EXPLORER



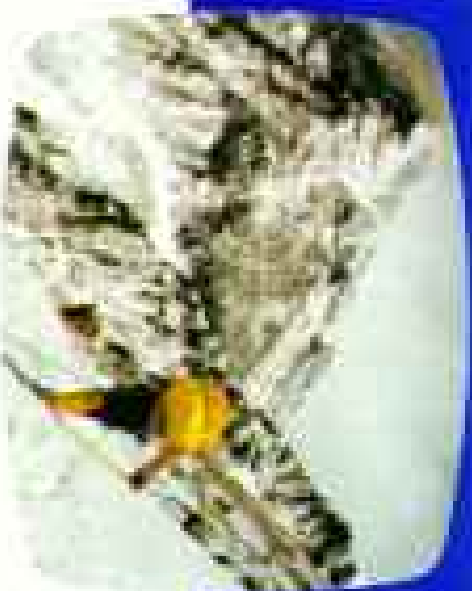
Sunday, October 6

- **5:00 CAMEL MAN**
Beard blowing in the wind, Noel Fullerton streaks across Australia's desert pursuing his favorite creature, the wild dromedary.
- **5:15 STRANDED**
Why do certain species of whales swim in droves onto shore, there to die tragically?
- **6:30 THE HIGHLY EXALTED**
Vestiges of the past, cowboys on a northern Nevada cattle ranch tell colorful tales of life on the range.
- **7:15 GALLIC POET**
Majestic Scottish landscapes frame Sorley MacLellan as he movingly evokes his life and reads from his works.
- **7:45 HOLY STONE**
Travel to Pietrasanta, Italy, where artisans shape the precious marble hewn from Carrara's hillsides.



Sunday, October 13

- **5:00 ARCHAEOLOGICAL DETECTIVES**
Searchers for the past uncover ancient Roman ruins on the island of Cyprus.
- **5:15 THE SKY'S THE LIMIT**
Float far from the madding crowd as Geographic cameras capture the joys of ballooning.
- **6:05 FALL LINE**
Hold your breath as daredevil skier Steve Shea descends a near-vertical slope in Wyoming's Teton.
- **6:15 TREE OF LIFE**
A giant fig tree in the tropical forests of Belize hosts myriad creatures large and small.
- **7:15 MAN OF WHEAT**
A teacher-turned-farmer recounts 40 years of hardship and satisfaction.
- **7:45 SHOOTING AFRICA**
Join a spectacular wildlife photo safari in Kenya's Masai Mara Reserve.



Sunday, October 20

- **5:00 THE SHEEP OF NEPAL**
The future of these mountain dwellers is uncertain as Western ways encroach on their traditional life-style.
- **5:15 IN PURSUIT OF THE BOAR**
The noble wild pig eludes mounted hunters in France.
- **5:45 FILMING THE IMPOSSIBLE**
Travel the world with Britain's most adventurous cameraman.
- **6:45 AMATEUR NATURALIST**
Explore tidal pools on Jersey and climb the shore cliffs of the Shetland Islands with Gerald and Lee Durrell.
- **7:15 HERCULEANUM**
Victims of Vesuvius, buried Herculaneans see the light of day after 2,000 years.
- **7:45 CANYON CARVER**
Meet decay carver Tan Brunet as he turns trees into birds.



Sunday, October 27

- **5:00 WHALE ROUNDUP**
Eskimos on Canada's Churchill River capture beluga whales for East Coast aquariums.
- **5:15 YUKON PASSAGE**
Four intrepid adventurers retrace the path of Klondike gold seekers in this National Geographic Special.
- **6:00 RETURN OF THE BALD EAGLE**
Massachusetts once again shelters bald eagles, thanks largely to one man's efforts.
- **6:30 LANZAROTE: LAND OF PARCHED EARTH**
Discover the rugged beauty of this volcanic Canary Island.
- **7:00 THROUGHOURED**
Get to know the handsome aristocrat of race horses.
- **7:45 KODOI DRUMMERS OF JAPAN**
Exhilarating performances by some very different drummers.

SEE EXPLORER

on Sundays:

5 p.m. Eastern
4 p.m. Central
3 p.m. Mountain
5 p.m. Pacific

and Saturdays:

8 p.m. Eastern
7 p.m. Central
6 p.m. Mountain
8 p.m. Pacific

NOTE: Some Pacific time zone subscribers receive **EXPLORER** 2 p.m. Sunday and 5 p.m. Saturday. Consult local listings or call your cable operator for confirmation.

**THIS PAGE
TEARS OUT**



Nickelodeon, America's most respected cable network for children, is now for adults, too! We've enriched our programming with the prestigious National Geographic EXPLORER series. And thanks to the new Nick at Nite, Nickelodeon brings you quality television 24 hours a day. To get Nickelodeon, call your local cable company.

October on Nickelodeon!

EASTERN TIME	MONDAY THROUGH FRIDAY	SATURDAY	SUNDAY
7:00-7:30 AM	Black Beauty ★	7:00-9:00 AM	Pinwheel ★
7:30-8:00	Lassie	9:00-9:30	Out of Control Powerhouse
8:00-8:30	Belle & Sebastian/The Little Prince	9:30-10:00	Mr. Wizard's World
8:30-9:00	Today's Special	10:00-10:30	Lassie
9:00-2:00 PM	Pinwheel ★	10:30-11:00	The Little Prince
2:00-2:30	Today's Special	11:00-11:30	Nick Rocks Belle & Sebastian
2:30-3:00	Belle & Sebastian/The Little Prince	11:30-12:00	Dangermouse
3:00-3:30	Black Beauty	12:00-12:30 PM	You Can't Do That On Television
3:30-4:00	Lassie	12:30-1:00	Dangermouse Nick Rocks
4:00-4:30	You Can't Do That On Television	1:00-1:30	Belle & Sebastian
4:30-5:30	Turkey Television	1:30-2:00	Lassie
5:30-6:00	Dennis the Menace	2:00-4:00	Special Delivery
6:00-6:30	MON-WED: Mr. Wizard's World / THU-FRI: Out of Control	4:00-5:00	Standby... Lights! Camera! Action!
6:30-7:00	Nick Rocks	5:00-6:00	Livewire
7:00-7:30	You Can't Do That On Television	6:00-6:30	Out of Control
7:30-8:00	Dangermouse	6:30-7:00	Nick Rocks
		7:00-7:30	YCDTOTV
		7:30-8:00	Dangermouse



Nick at Nite™

	MONDAY THROUGH FRIDAY	SATURDAY	SUNDAY
8:00-8:30	Dennis the Menace	8:00-8:30	Dennis the Menace
8:30-9:00	The Donna Reed Show	8:30-9:00	Donna Reed
9:00-11:00	Nick at Nite Movie	9:00-11:00	Movie
11:00-12:00	Turkey Television	11:00-12:00	Turkey Television
12:00-1:00 AM	Route 66	12:00-1:00 AM	Route 66
1:00-1:30	Dennis the Menace	1:00-1:30	Dennis the Menace
1:30-2:00	The Donna Reed Show	1:30-2:00	Donna Reed
2:00-4:00	Nick at Nite Movie	2:00-4:00	Movie
4:00-5:00	Turkey Television	4:00-5:00	Turkey Television
5:00-6:00	Route 66	5:00-6:00	Route 66
6:00-6:30	Dangermouse★	6:00-6:30	Dangermouse★
6:30-7:00	Nick Rocks	6:30-7:00	Nick Rocks

Schedule is subject to change without notice.

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★ Watch Bill Cosby on "Picture Pages" after "The Adventures of Black Beauty" and during "Pinwheel" (weekdays at approximately 9:55 am and 12:55 pm and weekends at approximately 7:55 am and 8:55 am) and every day after the 6:00 am showing of "Dangermouse."



“Nuclear-generated electricity has become one of the basic props supporting the entire national economy.”

Dr. Lynn E. Weaver
Dean, School of Engineering
Auburn University

Is there a connection between nuclear energy and economic growth? Some little-known facts show how America's nuclear power plants benefit the economy.

In the next two years, more than 15 new nuclear plants are due to join the 94 already generating electricity in this country—for refrigerators, streetlights, assembly lines, computers, subways, and a thousand other elements of modern American life.

Nuclear saves money and fuel

Despite the high price tags on some of the new plants, the average cost of generating U.S. nuclear electricity is still under a nickel per kilowatt-hour.

That's economical energy. Nuclear power saved American consumers over \$2 billion in 1984 alone, compared to what the electricity would have cost coming from coal- and oil-fired plants.

What's more, using nuclear fuel cuts energy imports and

takes some of the pressure off our shrinking domestic reserves of oil and natural gas.

An electrifying economy

The U.S. Gross National Product is a basic measure of economic activity. Since 1973 the GNP has grown by 31%, which closely parallels the 33% growth in the nation's electricity demand.

But over the same period the direct burning of fuels for *non-*

electric energy has actually gone down, as the economy converts to using more electrical energy.

What many people don't realize is that most of America's new electricity is coming from coal and nuclear power. Electricity growth in 1984 was 58% coal and 24% nuclear, according to the Federal Energy Information Administration.

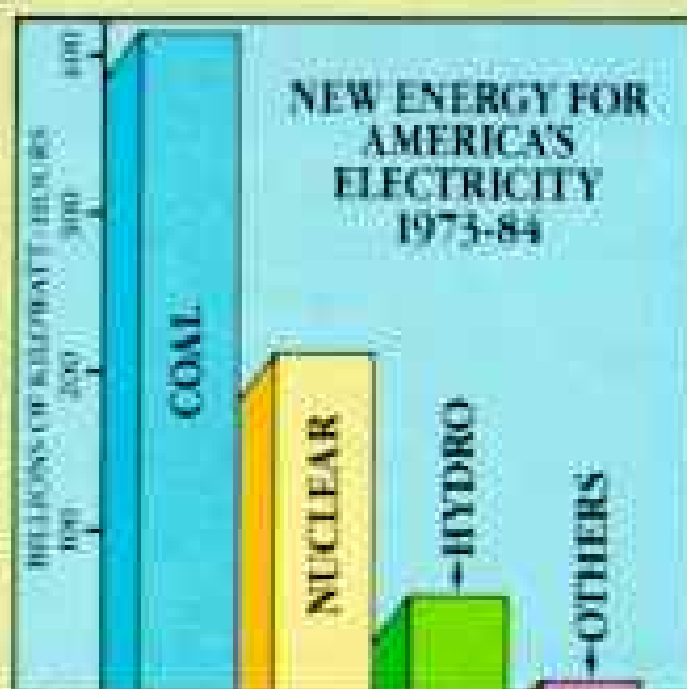
The key to energy independence

The growing supply of electricity from U.S. coal and nuclear also reduces our dependence on *imported* energy. Greater use of domestic electricity sources means fewer U.S. dollars sent abroad.

Nuclear power and coal can meet the country's growing electrical needs *and* help reduce our dependence on foreign oil.

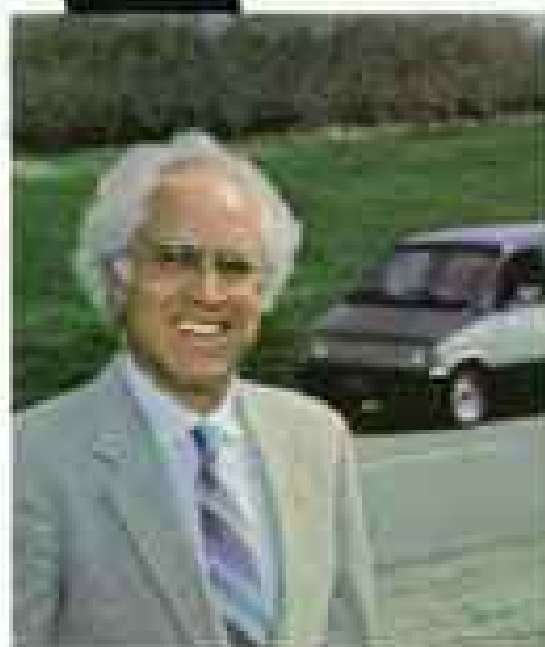
For a free booklet on this subject, write the U.S. Committee for Energy Awareness, P.O. Box 1537 (K14), Ridgely, MD 21681. Please allow 4-6 weeks for delivery.

Information about energy
America can count on
U.S. COMMITTEE FOR ENERGY AWARENESS



Coal and nuclear energy have provided over 90% of all the new electricity added to our energy supply since 1973. This has enabled utilities to reduce their consumption of more costly oil and natural gas. Source: Energy Information Administration/U.S. Dept. of Energy.

AEROEN



"Air flow management does more than help Aerostar and Merkur get better mileage, also contributes to better handling!"

*Larry Socha
Manager,
Exterior and Aerodynamics
Design Engineering*



Complete air flow management helps make Aerostar's fuel economy ratings better than the many 1985 compact sedans.

Ford Aerostar is one of the newest examples of the commitment to quality at Ford Motor Company; demonstrating leadership in applying aerodynamic principles to automotive design.

A swept back front end, spoilers, flush glass and door handles are all quality refinements that help Aerostar slip through the air with a whisper.



*26 EPA estimated city mileage / 31 EPA estimated city mileage

Get it together—Buckle up!

ENGINEERING

Merkur's biplane rear
spoilers not only contribute
to a solid road feel but also
reduce the air
resistance behind the
car for greater
dynamic efficiency.



Merkur uses a small scoop
to take only as much air as
the engine needs for cooling
and let the rest flow over the
car smoothly to exert

"down force" on Merkur's
biplane rear spoilers.
Result: The feel of solid,
in-touch-with-the-road,
quality.



Ford • Lincoln • Mercury • Merkur
Ford Trucks • Ford Tractors

**Quality
is Job 1.**