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NATIONAL GEOGRAPHIC SOCIETY

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To carry out the purposes for which it was founded sixty-seven years ago, the National Geographic Society publishes the National Geographic Magazine monthly. All receipts are invested in The Magazine itself or expended directly to promote geographic knowledge.

Articles and photographs are desired. For material The Magazine uses, generous remuneration is made.

In addition to the editorial and photographic surveys constantly being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives.

The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus. By dating the ruins of vast aboriginal dwellings in that region, The Society's researches solved secrets that had puzzled historians for 300 years.

In Mexico, The Society and the Smithsonian Institution, January 16, 1940, discovered the oldest dated work of man in the Americas. This stone is engraved, in Mayan characters, November 4, 291 B. C. (Spinden Correlation). It antedates by 200 years anything else dated in America and reveals a great center of early American culture, previously unknown.

On November 11, 1935, the stratosphere flight of the world's largest balloon, *Explorer II*, sponsored by The Society and the U. S. Army Air Corps, reached a world-record altitude of 72,395 feet. Capts. Albert W. Stevens and Orvil A. Anderson took aloft a ton of scientific instruments and obtained results of extraordinary value.

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In 1948 The Society sent seven expeditions to study the sun's eclipse on a 5,150-mile arc from Burma to the Aleutians.

A Greek cargo ship sunk in the Mediterranean 2,300 years ago was found in 1952 and is being excavated by the National Geographic Society-Calypso Marine Archeological Expedition led by Capt. J.-Y. Cousteau of the French Navy.

The National Geographic Society and the Royal Ontario Museum in 1951 explored and measured newly found Chubb meteor crater, 11,500 feet in diameter, in northern Quebec.

The Society and individual members contributed $100,000 to help preserve for the American people the finest of California's mountains, the Giant Forest in Sequoia National Park.

One of the world's largest coalfields and mineral regions outside the polar regions was discovered in Alaska and Yukon by Bradford Washburn while exploring for The Society and the Harvard Institute of Exploration in 1938.

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Fortunately, the old-fashioned "medicine man" and his "sure cures" are on the way out. This is because nearly all of us now know the folly of relying on any treatment for arthritis other than those authoritatively approved.

This enlightened attitude is all to the good. For arthritis, if it is to be successfully controlled, must be precisely diagnosed and treated according to the needs of each *individual* patient.

Even though there are as yet no specific cures, much can be done for the more than five million people in our country whose cases have been diagnosed as arthritis, in one of its many forms.

For example, *osteoarthritis* or degenerative joint diseases . . . the type associated with aging . . . need not cause severe disability if diagnosed early and if the patient follows the doctor's advice. Indeed, this kind of arthritis usually responds well to treatment based on rest, weight control, mild exercise and avoidance of both mental and physical factors that may aggravate the disease.

Another common type of arthritis . . . *rheumatoid arthritis* . . . is a more serious disease because it involves not only the joints, but the entire body. Moreover, it is not associated solely with old age. Rather it affects people of all ages, most frequently young persons and adults in their prime.

Fortunately, certain hormone extracts and other medications have brought great benefits to many who have this type of arthritis. It is not yet known, however, how permanent the effects of these treatments will be.

The greatest good to be derived from any method of therapy for any type of arthritis depends not upon the doctor alone, but upon the patient as well. It is of the greatest importance for the patient to cooperate fully with the doctor, especially in regard to continuing treatment for as long as it may be required.

In fact, when rheumatoid arthritis is recognized early and treatment is carried out faithfully, well over 50 percent of those who have this condition can be spared serious disability and will obtain marked improvement.

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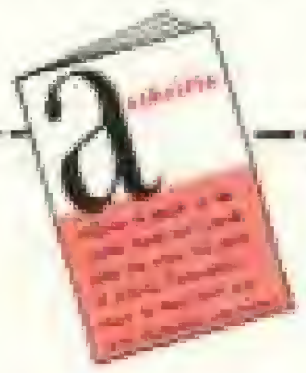

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VOL. CVIII, No. 5 WASHINGTON NOVEMBER, 1955

THE NATIONAL GEOGRAPHIC MAGAZINE

Beyond Everest

First Ascents of 23 Peaks and a Daring Rescue from a Crevasse Mark an Expedition Led by a Conqueror of Earth's Highest Mountain

By Sir Edmund Hillary, K.B.E.

THE mighty Himalayas exert a fascination on their devotees that is difficult to explain. It is not only the thrill of climbing to the summit of some lofty peak, or the excitement of exploring and mapping valleys and glaciers which men have never seen before, or even the pleasures of traveling through a countryside both beautiful and unspoiled.

There is more to it than that. Perhaps it is the lure of the ancient faiths that regard the Himalayas as the home of the gods and Everest as "Goddess Mother of the World." Or maybe it is just the simple urge of the spirit to flee from the animosities and complications of civilization and find peace and contentment in the thin, cold air where men cannot easily live. Be what it may, most of us who have been to the Himalayas want to return. I am no exception.

Unclimbed Peaks a Challenge

The year 1953 was an eventful one for me. John Hunt was leading an attack on the world's highest peak, and I was a member of his party. All previous attempts had failed, but this one was different. We seemed to have the right combination of efficient organization, good equipment, fit and well-acclimatized men, and, most of all, good luck.

In the end Tenzing and I stood on the summit—the culmination of an immense amount of effort and skill by 30 years of expeditions.*

But even from the summit of Everest my interest in other mountains did not fade. To the southeast I could see the great unclimbed bulk of Makalu, 27,790 feet, and I searched it for a possible route (page 596). Between Makalu and where I was standing lay an area of almost unknown country, a maze of mountains waiting to be explored and mapped and climbed (map, page 587).

Exciting Outlook for Explorers

Two years earlier, in 1951, the famous British mountaineer Eric Shipton and I had penetrated part of this region. Striking out to the east from the southern side of Everest, we had crossed a high, difficult pass and descended to the head of an enormous glacier, the Hongu. On the far side of it we could see another saddle, which we reached the next day.

It was an exciting view. To the east and south towered row after row of magnificent ice-clad peaks and extensive glaciers, all of them dominated by the massif of Makalu. Under the sheer western face of the mountain lay the Barun Glacier.

Shipton and I were among the first Europeans to look upon this glittering scene. Shortage of supplies made us turn back then, but I was determined some day to return and carry the exploration to the foot of Makalu.

My chance came in 1952 when I joined forces with Eric Shipton, Dr. Charles Evans of Great Britain, and George Lowe of New Zealand. Evans, a very experienced Hima-

*See "Triumph on Everest: I. Siege and Assault," by Brig. Sir John Hunt, C.B.E., D.S.O.; "II. The Conquest of the Summit," by Sir Edmund Hillary, K.B.E., National Geographic Magazine, July, 1954.

Kodachrome by Sir Edmund Hillary

Across the Mists, Makalu Presents an Icy Challenge to Men Seeking Its Summit

Exploring the Himalayas in 1954, Sir Edmund Hillary's party made 23 first ascents and reconnoitered 27,790-foot Makalu (right), world's fifth highest peak (page 596). Looking down into the wild Arun River, Colin Todd (left), Dr. Michael Ball, and their Sherpas stand amid charred stumps left by Nepalese foresters. Peak VI shines on the left. "This was one of our most dramatic views," says the author; "it made us feel small and helpless."

layan climber, later reached 28,700 feet on Everest and this year led an expedition which conquered Kanchenjunga, the world's third highest peak (page 583).

We crossed into the Hongu and then over the second pass to a 20,000-foot camp on an extensive snow field above the Barun Valley. The weather was kind to us; in two marvelous days we climbed three fine snow peaks of 21,100, 21,500, and 22,500 feet.

Most of the time, however, we couldn't keep our eyes off the dominant peak of the area—the loveliest I had ever seen. We called it Baruntse (*tse* means peak in Tibetan). It shot up 23,570 feet in an ice-fluted spire, much too formidable for our limited resources. It was, as Lowe commented, "worthy of an expedition."

We dropped down into the Barun Valley and followed its rough and broken glacier up to the head. But monsoon clouds, embracing all the peaks, let us see very little. A heavy fall of snow put an end to our plans; we retreated down the glacier to the constant roar of fresh avalanches.

Descending into the lower Barun, we saw this spectacular valley for the first time. The deep green of its forest contrasted beautifully with the blazing white ice of the jagged summits; innumerable waterfalls drifted hundreds of feet down the giant precipices. Crimson rhododendrons, great waxy magnolias, and all the other flowers of the Himalayas added their lovely colors to the scene (page 593).

Himalayas Lure Climbers Back

We emerged from the Barun over a 14,000-foot pass. Plunging 10,000 feet down to the humid heat of the jungle, we sweated our way back to India. Someday, I resolved, I would return to the Barun to enjoy its sparkling streams and gay flowers, to explore its many valleys and glaciers, and to climb some of its icy peaks.

The New Zealand Alpine Club had been planning a trip to the Himalayas for a number of years. Because I painted such a glowing account of the Barun, they decided to apply for permission to go there in 1954 and invited me to lead the expedition.

We decided to have a party of 10. Two members were from Great Britain—Evans and Dr. Michael Ball, who had an excellent Alpine record and was to be our expedition doctor.

The rest of our group came from New Zealand. George Lowe and I had spent the last three seasons in the Himalayas; the other six, who had never been there, were chosen for their outstanding records of hard packing trips and difficult ice climbs in the New Zealand Alps. Norman Hardie, William Beaven, and James McFarlane are engineers; Colin Todd and Brian Wilkins are scientists; and Geoffrey Harrow is a businessman.

Somehow managing to weather all the storms of finance and organization, the expedition gathered on March 28 at the railhead of Jogbani, on the Indian-Nepalese frontier.

It was good to step off the train for the last time. But, though our traveling was almost finished, our troubles were not. I looked around the platform for the customs officers, only to be told they had gone home for the night. This meant we couldn't unpack any of our gear until next day.

Rendezvous with the Sherpas

I think we must have set a record for the shortness of our stay in Jogbani. In one hectic morning we cleared all our gear through customs, presented our permit to enter Nepal to the appropriate officials, drew 35,000 rupees out of the local bank, made arrangements with the Indian Post Office to receive our mail runners, and hired two large General Motors Company trucks to move us.

The trucks, too, just about created a record—they were only two hours late; we were hardly ready when they arrived. Nevertheless, we loaded our four tons of equipment and food on board and thankfully left Jogbani behind. It took us four hours to cover the 30 miles of rough, rutted track to the village of Dharan Bazar, where the road ended. As we pitched our tents in a clearing among the foothills, we felt the expedition was really starting.

At Dharan Bazar we met our Sherpa porters (page 583). They had come to meet us from their homes in Namche Bazar and Darjeeling. It was great to see their friendly, smiling faces again. Our chief Sherpa was Sirdar Da Tensing, not the famous Sirdar Tenzing Norkey who climbed to the summit of Everest with me, yet a man of proven experience and loyalty who had also played a valuable role in the Everest assault.

Da Tensing had brought with him as fine a group of Sherpas as I have had on an expedition. Many were old friends: Dawa Thondup, Annullu, Pasang Dawa, Ang Dawa

582

↑ Mountaineers Rest in a Sunny Bivouac

Trekking 10 miles a day, the expedition ferried four tons of supplies ever higher into the Nepalese foothills. Here, at 3,500 feet, the men camp on a ledge above the Arun River. They pitch an awning as shelter from night showers and afternoon's hot sun.

← Hikes from camp toughen George Lowe (left) and Norman Hardie for backbreaking climbs ahead. Lowe, a New Zealand schoolteacher, supported the final push on Mount Everest in 1953. Engineer Hardie scaled Kanchenjunga, the world's third highest peak, in May, 1955.

Umbrellas serve as protection against rain and as weapons against venomous snakes.

Kodachromes by George Lowe (above) and William Beaver

583

♠ **Hillary Relaxes on a Springy Air Mattress**

When not climbing mountains, Sir Edmund runs a bee farm at Auckland, New Zealand. With Tenzing Norkey he stepped to the tip of Everest in 1953, winning a knighthood as his reward. He is pictured in Dharan Bazar camp (below).

♠ Bare-chested Dr. Charles Evans, who speaks Hindustani, drew the job of hiring porters. A surgeon, he climbed within 300 feet of Everest's summit, and led the British expedition that conquered 28,166-foot Kanchenjunga. Here the Sherpas choose their ice axes.

Photographs by Colin Todd (above) and James McFarlane

and Mingma had carried loads to 26,000 feet.

We signed on and equipped 15 of these men for load carrying at high altitudes. Fifteen others who had come along on the chance of a job we hired as carriers for the long march in.

Our two days at Dharan Bazar were busy ones. All our food and equipment had to be removed from packing cases, put into canvas kit bags, and made into bundles of 60 to 80 pounds each. Evans, our only competent speaker of Hindustani, worked at the difficult task of securing a hundred porters to carry our loads.

He finally obtained them through a coolie agent. This smooth gentleman demanded an advance payment of two rupees per porter for food—and then, as we found later, pocketed the lot himself. However, after we had issued most of the clothing to the sahibs and Sherpas, the camp rapidly assumed a festive spirit, with everyone proudly wearing new acquisitions.

On April 1 we moved off into the foothills. I had hoped for an early start, but many of our porters were late in arriving and some didn't come at all, precipitating a frantic rush to find extra men for the remaining few loads.

The last porters got away at midday, and what a strange hodgepodge they were! Their tough spindly legs, brief cotton skirts, and torn jackets made them look incredibly disreputable. Nevertheless, they kept going patiently up hill and down dale.

Women Act as Bearers

A splash of color was added by 30 to 40 women bearers. Many were mere girls, frail in appearance, but they carried their loads as well as the men. The younger ones were mostly very attractive, with fine features and smooth skins. They seemed fully capable of looking after themselves.

Our route led through steep, hilly country. We were usually wakened early by a cheerful Sherpa thrusting a cup of hot tea into our hands. Then, about 5:30, we would move off briskly into the cool of the morning, climbing the twisting tracks which crawl up the steep bush-clad hills or plunge abruptly down to some turbulent river. Wherever fertile soil had lodged there would be a few terraced fields and thatched huts with thin, scrawny cows grazing among the dry stalks.

Close to 8:30 we'd choose a pleasant stretch of grassy turf, pitch a canvas awning, and settle down to wait for breakfast. Our Sherpa cook, Ang Tseri, was an experienced campaigner who had cooked for numerous expeditions. We liked him immensely but were under no delusions that he would have qualified for a job at the Waldorf-Astoria. His eggs, fried in rancid fat, tasted very much as eggs fried in rancid fat taste the world over, but we were too hungry to care and devoured his food with enthusiasm.

Our three-course breakfast began with a large plate of porridge with sugar and milk; next came eggs purchased in the local villages; and finally a big mug of tea and chapatties, or biscuits, with butter and jam.

About 11:30 we would start again in the noonday heat and drag on for a few more hours, then choose some peaceful camp site beside a stream and settle down for an afternoon of resting, swimming, and reading.

Bamboo Bridge Nearly Collapses

Life was pleasant. We rarely covered more than 10 miles of the steep country in a day, but the constant climbing and descending soon hardened our muscles and prepared us for the more difficult work ahead.

Our route lay up the great valley of the Arun River, and we made gradual height over long wooded spurs high above the river on the east side. In the rather unsettled weather, the high hills were usually wreathed in clouds; but on rare occasions there'd be a break and we'd catch a glimpse of a towering ice wall or jagged rock summit across the valley (page 580).

On April 11 we dropped thousands of feet to the Arun River, just below the village of Num. The water here races in a wild torrent between steep bluffs. Slung high over it is a long suspension bridge of twisted bamboo and vines.

Mike Ball and I arrived at the bridge first. I had crossed it in 1952, but it looked in much worse condition now, and I doubted that we'd get our porters over safely.

When Da Tensing came up, the two of us eased out on the swaying bridge to examine it in detail. It was made of three long strands of twisted bamboo tied together with creepers from the bush. Our feet shuffled along one of the strands while we held on to the other two.

In places the supporting creepers had gone, and the bamboo ropes swung apart in a most

Khandhari Dozes in the Sun, Stones and Dust Pave Its Main Street

Stopping to buy food, the expedition gave Khandhari its liveliest time in years. Here the climbers broke out a Rugby football, and villagers swarmed about them, all eager to kick it.

Mysterious Tracks in the Snow Halt Evans and a Sherpa

Nepalese firmly believe in the *yeti*, or "abominable snowman," but no man has produced one in flesh or photograph. However, yeti tracks come to light not infrequently. To some explorers they suggest a bear or man-size langur monkey. Above, Dr. Evans photographs footprints in Chhoyang Valley. Below: Claw marks appear in place of toe prints

unpleasant fashion. I was relieved to get to the far side and determined to repair the bridge before allowing our bearers to cross.

Four of the local inhabitants met us, and, after an animated discussion in Nepali, Da Tensing informed us that they had offered to repair the bridge. The sum they asked was surprisingly modest, one I was happy to pay.

Disappearing into the bush, they returned with long pieces of vine and green bamboo, then swarmed over the bridge like monkeys, tying and twisting. In half an hour they had put it in reasonable shape.

It still took five hours of shouting and cajoling to persuade our porters to cross. Sweeping showers of rain had made the bamboo ropes very slippery, causing many of the bearers to balk; the Sherpas had to carry over many of their loads. I was tired and hoarse as I followed the last man over the bridge and climbed up the steep bluffs to our camp high above the river.

Two days later we reached the little Sherpa village of Sedua, perched on a hillside at 7,000 feet. From here a long ridge climbed in a series of great wooded humps toward a 14,000-foot pass leading to the Barun.

I could see heavy snow on the pass and realized we would have some difficulty crossing it. But for two days we urged our party on.

We pitched our second camp on the snow at 11,000 feet. Knowing our porters could go no farther in their light clothes, we gave them their wages, plus liberal baksheesh, and sent them back down into the safety of the forest.

To the southwest of us lay the enormous valleys of the Iswa and the Chhoyang, both unexplored. I sent off two parties to examine them. Evans and Harrow with six Sherpas

Cross-section of Himalayas compared with profile of Rocky Mountains

Formidable Defenses of the Himalayas Pose a Supreme Test to the Mountaineer

Everest's ascent in 1953 broke the spell guarding the giants of more than 27,000 feet. Italians in 1954 climbed K2, the second highest (not shown). Kanchenjunga, the third, and Makalu, the fifth, yielded in 1955, leaving only Lhotse unconquered. Lesser peaks of greater difficulty demand new methods, says the author.

and three weeks' supplies approached the Chhoyang from low down in its heavily bushed gorges.

After a hard time in the dense forest, they burst through into the open glacier of the upper Chhoyang. They explored and mapped this and crossed over a new pass, first into the Iswa and then into the Barun.

One of their most interesting experiences was the finding of tracks high up on a glacier. The Sherpas immediately identified these as the prints of the mysterious yeti and pointed out their similarity to a man's foot (opposite page). But Evans, although conceding the remarkable resemblance to human footprints, could clearly see claw marks. There were two parallel sets of tracks, one much smaller than the other; apparently there are not only

Nepalese Youth Carries a Deadly Gurkha Knife

This mountaineer sought a porter's job. His knife can manicure nails or lop off the head of a sacrificial buffalo.

↑ Arun Valley People Dress to Greet Western Visitors

Village headman's wife (left) wears the family savings account. Her turquoise-studded charm boxes contain Buddhist prayers. Mountain people call the rupees in her necklaces "company," for the East India Company which minted them many years ago.

↓ "This fierce and fiery old character is from the Tibetan border," says the author. "He deigned to carry a load for us a few days."

Kodachromes by Norman Hardie (left) and Charles Breer

large but also little "abominable snowmen."

The Iswa Valley was explored by Lowe, Todd, Beaven, and Hardie. They had considerable difficulty in entering this U-shaped trough. Formidable precipices and steep remnants of winter avalanche snow blocked their route. Eventually, however, they reached the floor of the valley and followed up beside the river, making their way through twisting creepers and dead tree trunks. After five days they turned a big corner in the valley and climbed up on the terminal moraine.

Dominating the scene to the north towered the massive 4-mile-long summit ridge of Chamlang, 24,012 feet. Its overhanging ice cliffs, fluted ridges, and appalling steepness made perfect subjects for photography, but nowhere along the whole impressive face could Lowe and his party see a chance for a climber to pick a reasonable route.

West of them the glacier rose in an icefall, and above this jutted an array of sharp peaks, all looking exceedingly steep and difficult. To the south they were hemmed in by the enormous rock precipices so characteristic of the Iswa.

A little overawed by their impressive surroundings, they pitched their tents at the foot of the glacier. In the next few days they set to work to explore and map the whole area.

They were suffering from some of the effects of altitude, varying from sharp headaches to disturbed stomachs, but they visited all the tributary glaciers, climbed several new passes of 20,000 feet, and reconnoitered some of the lofty peaks.

Cutting a Staircase in the Snow

On the tenth day their work was practically finished. Their diminishing food supplies called for an immediate retreat. Carrying heavy loads, they crossed over a new pass and dropped directly into the Barun Valley, where they rejoined the expedition.

Meanwhile I had been occupied in getting the main body of the expedition over into the Barun and up to base camp. My main problem was that of porterage: we had about 140 loads but only 38 porters capable of crossing a high snow pass. This meant constant relaying.

Dense forest and deep snow covered the ridge above our 11,000-foot camp. I made a way up it by cutting long lines of steps in the firm snow of the gullies. The porters trudged confidently up this steep staircase through the trees, maintaining a good pace.

The angle of the ridge eased off a little, but its edge became much sharper. It looked quite a mountaineering problem; at first the porters refused to tackle it. Only when assured that I had made a safe route did most of them consent to follow me.

Once again I swung my ice ax and cut hundreds of large steps along the more exposed portions of the ridge. The porters entered into the spirit and, despite the rather frightening drops below them, gallivanted along like a cheerful bunch of boys.

At 13,000 feet we found firewood on a ridge from which the snow had melted. I decided to use this site as a dump. Here we left our loads and raced back down to camp.

Camp on Narrow, 13,000-foot Ridge

We progressed so well with our relaying that on April 19 we were able to clear out the lower camp and move up to the 13,000-foot dump. On the narrow ridge we had great difficulty in finding sufficient room for our party of 40, but, by digging out numerous little shelves, we pitched all our tents and rigged up sufficient awnings and shelters.

In the evening I went for a short distance up the ridge. The weather had cleared; it was crisp and cold with the snow setting hard. The valleys below were stuffed with tumbled masses of cloud, only the odd sharp crest thrusting through. Filling the horizon to the east loomed the immense bulk of Kanchenjunga, glowing pink in the setting sun—an unforgettable sight.

Along the route ahead the ridge continued sharp and narrow for some distance, then petered out into a long, steep snow face. It could be a difficult problem for our inexperienced porters, and I resolved not to attempt to cross unless the weather was perfect. I stayed outside, watching the shadows of night racing across the valleys below, until the cold drove me back to my sleeping bag.

Morning dawned fine and chill. At an early hour Wilkins and I began sorting out loads for the porters. Six of our men had no footgear at all, so I decided to pay them off. They treated my suggestion with scorn and assured me that they had no fear of crossing the pass with bare feet. Too short of labor to argue, I accepted their reassurances.

We started when the warming rays of the sun struck our camp. Since the crest of the ridge was too jagged to follow, I cut a roomy

Porters Brave a Vine-and-bamboo Bridge Swaying Dizzily Above the Chhoyang

Hillary's carriers, fearless on trails, balked at Nepal's flimsy bridges. One span stopped a crew for five hours. Cables of twisted bamboo, for feet and hands, support this structure.

This Tropical Gorge Points the Way to Glaciers, Avalanches, and Crevasses

Members of the expedition journeyed to the head of Chhoyang Valley to explore 24,013-foot Chamlang but could find no climbing route up its sheer ice walls. Spring thaws will turn this stream into a torrent.

line of steps along the steep slopes on the left-hand side.

Wilkins watched the men carefully and gave any help that was needed. But his assistance was rarely called for; the men entered into the task with enthusiasm and crossed the steps with perfect balance. I was unnecessarily disturbed about our barefoot brigade; they negotiated the icy staircase with complete unconcern.

The long snow slope required almost continuous zigzags of steps. The sun was warming us up, and the porters followed along cheerfully. Three hours out from camp we reached the pass. With a growing feeling of excitement, I looked down again into the deep chasm of the Barun.

Wilkins and I glissaded down the long snow slopes, and our porters, glad to be on the downhill grade, came sliding and tumbling after. As we lost height, the river's roar came up to greet us, yet many hours passed before we made our way down the steep snow gullies which channeled through bush and emerged on the grassy flats of the valley floor. It was good to camp on turf again, with a crackling campfire and the now soft music of the river to lull us off to sleep.

Neighborly Climbers from California

Two days later we established our base camp on a mossy ledge at 15,500 feet, right under the towering cliffs of Makalu.

Ours wasn't the only party in the Barun. A quarter of a mile upstream stood the camp of the California Himalayan Expedition, whose objective was the summit of Makalu. They were tackling the fierce south ridge, and we could see them as little dots on the glacier leading up to the ridge.

We got to know well Dr. William Siri and his party and spent many happy hours with them. But the challenge they faced was an exceedingly formidable one. I wasn't particularly surprised when, after a long and gallant attempt, they were forced to admit defeat at about 23,000 feet.

Having established our base camp, I left the job of conducting the porters back for more loads to our sirdar, Da Tensing. I decided to go forward and explore the head of the Barun Glacier to solve some of the topographical problems in that area.

There were eight of us in the party—Wilkins, McFarlane, myself, and five Sherpas. We sorted out enough food for a week and the necessary tents and equipment for high-altitude living. It made a big pile of gear. We started off with the Sherpas carrying 50 to 60 pounds each and the sahibs 40.

For two days we labored over the tumbled moraine of the glacier, not enjoying a moment of it. We were not well acclimatized, and every footstep was an appalling effort. I watched Wilkins and McFarlane dragging themselves up behind me and wondered if they were thinking fondly of the easier altitudes of our New Zealand Alps.

Lack of Oxygen Slows Pace

The evening of April 24 we camped on a terrace on the east side of the Barun at a height of about 17,800 feet. We were heartily tired of lugging our packs up the glacier and looked forward instead to some climbing. Above the camp rose a fine peak of 20,370 feet which we intended to tackle, for we felt sure it would give us an excellent view of the west face of Makalu.

Next morning we started off for it. The first 1,500 feet was easy, merely scrambling over huge piles of shattered rock, but at that altitude our lungs fought for air and our pace was labored and slow.

Then the slope steepened. Above us loomed an unpleasant looking ridge with snow and ice clinging precariously to its tilting slabs. When Dawa Thondup caught up with us, I asked him if he wanted to go on.

"You no want me, sahib, I stay here!" was his reply, and, looking at the way ahead, I couldn't blame him.

Wilkins, McFarlane, and I roped up, however, and set off up the ridge. In our unacclimatized condition we found it hard, slow work, but we climbed cautiously upwards, hacking hundreds of steps and overcoming each problem as we met it. It was a relief when the angle of the ridge eased off and we were able to clamber up some simple rocks to emerge on the summit.

Page 593

Rhododendrons Light a Christmas Tree 10,000 Feet in the April Sky

Nature gave the "rose tree" spectacular beauty. Honey from the blossoms of some species is poisonous to man but not to bees. The hardy plant splashes color on forbidding mountainsides at heights up to 16,000 feet. In the Himalayas its hues range from blood red to pink and snow white. The largest species attain 60 feet. These two tangled trees blaze on a ridge above Nepal's Barun Valley.

 Kodachrome by William Siri

The view was superb! To the northwest stood Everest and Lhotse, looking remote and unattainable, with long plumes of snow trailing out from their summits. Towering high over us was the summit of Makalu—another 7,000 feet of grim rock and gleaming ice (page 596).

From our lofty perch we were able to solve many of the topographical puzzles on this west side of Makalu. We noticed especially that a glacier gave what appeared to be easy access to the foot of the steep slopes leading up to a high saddle on the north ridge of the mountain. I determined that if we had an opportunity we would examine this approach more closely.

Altitude Takes Its Toll

Carefully we climbed back down the ridge and then, with a new surge of energy, jumped rapidly from boulder to boulder back to camp. Next day we moved our camp to the head of the glacier at 19,000 feet.

On April 27 we woke to a fine morning. We wanted to climb something that would give us a comprehensive view of the Barun névé, the snow field at the glacier's upper end; so we picked the obvious lookout—a huge and uninteresting pile of rubble and snow a little to the north of us. McFarlane, Wilkins, and I set off for it.

The altitude was still taking its toll; we were climbing very slowly. I was pleased to note, however, that both of my companions were going a good deal better. McFarlane in particular was showing a marked improvement; his weakness and lethargy of the previous few days seemed to be vanishing. I felt that he might well prove to be a formidable climber at higher altitudes when he was better acclimatized—certainly he would be if determination had anything to do with it.

We reached the summit of our bump, 20,300 feet, and found it well up to our expectations. Lying beneath us were the vast snow fields of the Barun névé: McFarlane was full of regrets that he hadn't carried up a phototheodolite, the telescopic camera apparatus used by surveyors for map-making. After examining the area with care, I suggested we turn for camp.

McFarlane, however, had other ideas. His surveyor's blood was up, and he wanted to cross the névé and look over a dip in the main divide which we knew would give him a view of Tibet. Wilkins, fired by his enthusiasm, agreed to accompany him. I wanted to organize the camp for an immediate departure; so, after warning the other chaps not to be too late, I descended the ridge to the tents.

All afternoon I waited impatiently for their return, but there was no sign of them. As evening approached, I became very worried that they might have suffered some misfortune. Clouds were gathering and it was getting extremely cold. I crawled into my sleeping bag—the Sherpas had long been in theirs.

At 5:30 p.m., when I had almost decided to start a search, I heard a faint cry outside. Hastily I crawled to the door and poked my head out. A gruesome figure came staggering into camp: it was Wilkins, his face, hair, and clothes covered with dried blood.

"Where is Jim?"

"We fell down a crevasse. Jim's still there."

We helped Wilkins into the tent, although he assured us that he was practically unhurt, only very tired. The blood from a cut on his forehead was more unpleasant than dangerous.

I looked anxiously at the gathering dusk.

"We must find the crevasse before it grows too dark to spot it."

Our five Sherpas put on all their warmest clothing while I gathered ropes and sleeping bags. Then we started off up the glacier. Going like a madman, I soon drew away from the Sherpas. I scrambled fiercely over the loose moraine, searching frantically for signs of footprints on the snow in the center of the glacier. When I had almost given up hope, I dimly saw a set of tracks—Wilkins's path!

Relief Party Hunts Victim

Impatiently I waited for the Sherpas to arrive; then we roped up, and I led carefully off along the trail. In the darkness the glacier was a cold and frightening waste land. Suddenly I saw in the smooth expanse before me two holes, the one they had fallen into and the one Wilkins had clambered out of.

I crawled cautiously over to one of the holes and shone my torch down it. Cold, glistening walls of ice dropped down out of sight. I shouted and, to my immense relief, heard a faint reply. Jim was still alive!

We set to work to get him out. I lowered a long rope, but he couldn't catch hold of it. My torch couldn't penetrate the 60 feet of darkness to the bottom, and I didn't know what was happening down there. I decided that the only course was for me to be lowered. The Sherpas, cold and scared, tried to per-

suade me against it. However, since I persisted, they agreed to try.

I tied the ropes around me and then dropped, not without qualms, into the dark hole. Immediately I swung free, prevented by the overhanging lips of the crevasse from touching the walls.

Down I went for thirty, forty, fifty feet. Then I stopped, hanging there in mid-air. I yelled at the Sherpas to lower me farther, but nothing happened. They must have panicked. Even when I called for them to pull me up again, still nothing happened.

Suddenly, from only a short distance below, McFarlane's weak voice joined in with my cry of "Uppa! Uppa!" and I started rising in a series of jerks. I was almost to the top and could actually see the stars again, when I suddenly jammed under the overhanging edge where the rope had cut in. The Sherpas pulled like madmen, but I couldn't dislodge myself. Three of my ribs cracked under the strain of the rope.

Finally I persuaded them to ease off a little, then, with a superhuman effort, wriggled my arms free and was tugged over the top. It took quite a while to recover my breath.

In the end we had to leave McFarlane

Making a Raw Pudding, Sherpas Mix Flour with the Fresh Blood of a Sheep

Preserved foods sustained the New Zealanders at high altitudes; porters depended on ground barley. These men bought a sheep for a feast in Barun Valley. No Westerners cared to partake the blood dish.

George Lowe

Makalu's Pale Crown Glistens at Sunset Like the Candlelit Frosting on a Birthday Cake

Approaching by the formidable south ridge, a California team met defeat at 25,000 feet. Hillary's exploratory party on the northwest turned back at the same altitude. Tibet lies beyond the mountain.

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Kodachrome by George Lowe

French Alpinists in May, 1955, Planted the Tricolor on the "Armchair of the Gods"

The expedition, led by Jean Franco, ascended Makalu's north ridge (left). Eight climbers and one Sherpa, struggling in relays to 27,790 feet, found scarcely room for one man on the needlelike summit.

down there for the night. I lowered two warm sleeping bags for him. Meanwhile the Sherpas were shivering with cold and fearful of the dark and the wind. Clearly, they would have to get to warmth soon. I felt miserable leaving McFarlane 60 feet down there in the ice; I could only hope that the sleeping bags and his legendary strength and toughness would see him through. His fall would have killed a lesser man.

Our scramble down to camp in the dark was a freezing purgatory of sliding boulders and gasping lungs. My ribs were hurting abominably; all of us were at the end of our strength when we reached the tents.

Nevertheless, we returned to the crevasse at the first light of morning. Wilkins was greatly refreshed, so we lowered him into the hole by which he had made his escape.

After examining McFarlane, he reported that it would be impossible to move him out by that difficult route. His most depressing news was that McFarlane, obviously suffering from frostbitten hands and feet, had been too badly shaken and sore to crawl into the bags.

In the end we got him out by cutting away some of the overhanging edge of the crevasse, taking the risk that it might fall and engulf him. We pulled him nearly to the top, then I was able to get my hand on his waist loop and drag him to safety. Next we dressed him in warm clothes, put him into a sleeping bag, and lifted him onto a rough stretcher.

Carrying McFarlane to Safety

Our trip down to camp is one that Wilkins and I will never forget. Carrying a man at any time is a difficult business; at 20,000 feet it is arduous beyond belief (page 600). We rarely went more than 50 feet over the sliding boulders before we collapsed, gasping for breath. Through it all McFarlane remained cheerful as ever, saying that he would "rather be carried than walk down the glacier anyway!" By the time we reached camp, we had all had enough.

Wilkins stayed to look after McFarlane, while I took the strongest Sherpa and started off at once down the glacier for help. We camped the night on the ice where, too tired to eat, I sank immediately into a deep sleep.

Early next morning we reached base camp, and with great relief I handed over the task of rescue to George Lowe and our doctor, Michael Ball.

It took three days of hard work to carry McFarlane down to base. When we finally had him installed in reasonable comfort in his tent, Dr. Ball found the main injury to be frostbitten hands and feet. He worked unceasingly to bring as much of them as possible back to life (opposite page).

The remainder of the party had a much-needed rest; then we turned our thoughts to the next mountain problem. I had decided to examine the route onto the north ridge of unclimbed Makalu, the route that we had seen from our first 20,000-foot peak.

We started establishing a line of camps up the Barun and Makalu Glaciers: Camp I at 17,000 feet, Camp II at 19,200 feet, and then Camp III at 20,800 feet. Camp III stood at the foot of the slopes leading up to the Makalu Col, and from there a reconnaissance was carried out up the long snow slopes above (map, page 587).

Camps Reach 22,000 Feet

A camp site was found at 22,000 feet. Evans and Harrow left Camp IV early one morning and climbed up a very long, steep snow couloir in difficult conditions, finally reaching a height of 23,000 feet. They returned to report that the way ahead to the col at 24,310 feet appeared quite climbable.

This was good news, and I decided to press home the attack. Although suffering from my broken ribs, I resolved to take three other climbers and some Sherpas up to Camp IV. From there we would establish a camp higher up before thrusting towards the col, or pass, between the two peaks of Makalu. We would not attempt the ascent of either peak; our objective was to explore a route to the Makalu Col.

The plan proved a mistake. My injured ribs were apparently restricting the full use of my lungs, and I reached Camp IV with difficulty—only to collapse from lack of oxygen.

The expedition had to abandon its high hopes of reaching the Makalu Col and turn all its efforts to moving me down to more comfortable levels. This took three days of excessively hard work over the steep and rugged country. To make things worse, I must have been a very difficult patient, for I kept remarking with some sharpness that I was perfectly capable of walking.

Finally, in self-defense, Charles Evans let me try. After a few steps I was only too happy to collapse again onto the stretcher.

Hillary Types the Story of His Ordeal by Ice →

Three rib fractures suffered in an attempt to rescue Jim McFarlane (below) restricted Sir Edmund's breathing. Later, on Makalu, he collapsed from lack of oxygen at 27,000 feet. Three days on a jiggling stretcher took him to camp 5,000 feet lower.

↓ Dr. Ball Bandages a Frostbite Victim

Exploring a snow field, McFarlane dropped into a hidden crevasse and tumbled 60 feet. Though stunned, he called up cheerfully, "I don't feel too bad, but I'm a bit cold." Eighteen hours passed before rescuers fished him out.

Two days later McFarlane appears still dazed as he gets medical care. Frostbite cost him two fingers and all his toes.

Emirimmons by George Lowe

It was a relief to all of us when we reached Camp I where, at this comparatively modest altitude, I quickly started recovering (page 596).

It was now May 20. Not a great deal of time remained before the onset of the monsoon. We would have to make the most of it. Except for McFarlane and me, all were in excellent condition, well acclimatized and eager for more climbing.

Hardie, Ball, and Wilkins established a camp at the head of the Barun. In an amazingly short time they climbed six new peaks of more than 20,000 feet, the two highest being Pethangtse, 22,060, and Chago, 22,590. Hardie then went on with a few Sherpas and climbed even more peaks before making the first crossing over a high, difficult pass into the head of the Imja Valley.

Meanwhile a strong team composed of Lowe, Todd, Harrow, Beaven, and our best Sherpas set off to tackle one of our major objectives—23,570-foot Baruntse.

Particularly keen that this peak be climbed, I encouraged them to "climb it if you possibly can, and don't be put off by a few days of monsoon snow." My exhortation was unnecessary. Despite unpleasant weather, the men were determined to reach the summit.

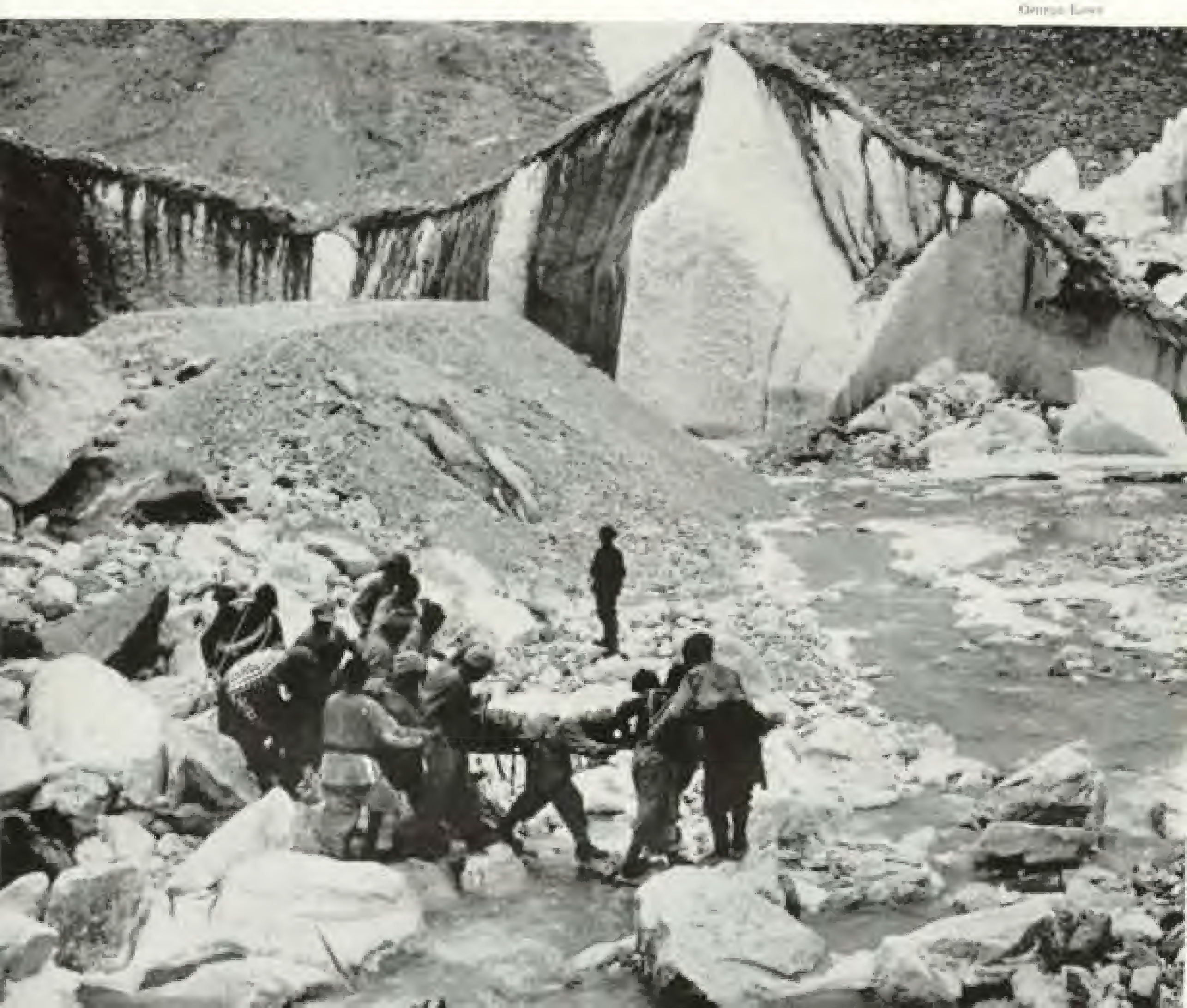
Attack on Baruntse

They established their first camp up a tributary glacier of the Barun at the foot of a 20,000-foot pass. All were in excellent spirits, and after an evening meal they lay in their bags exchanging songs with the Sherpas.

These Himalayan natives have their own ideas of music and sing in a high-pitched tone with little variation of note; it can, however, be very pleasant and soothing. They always regarded our deep-chested bellowing as a source of considerable amusement.

McFarlane's Litter Bearers Ford a Brook. Powdered Rock Stains Glacier Walls

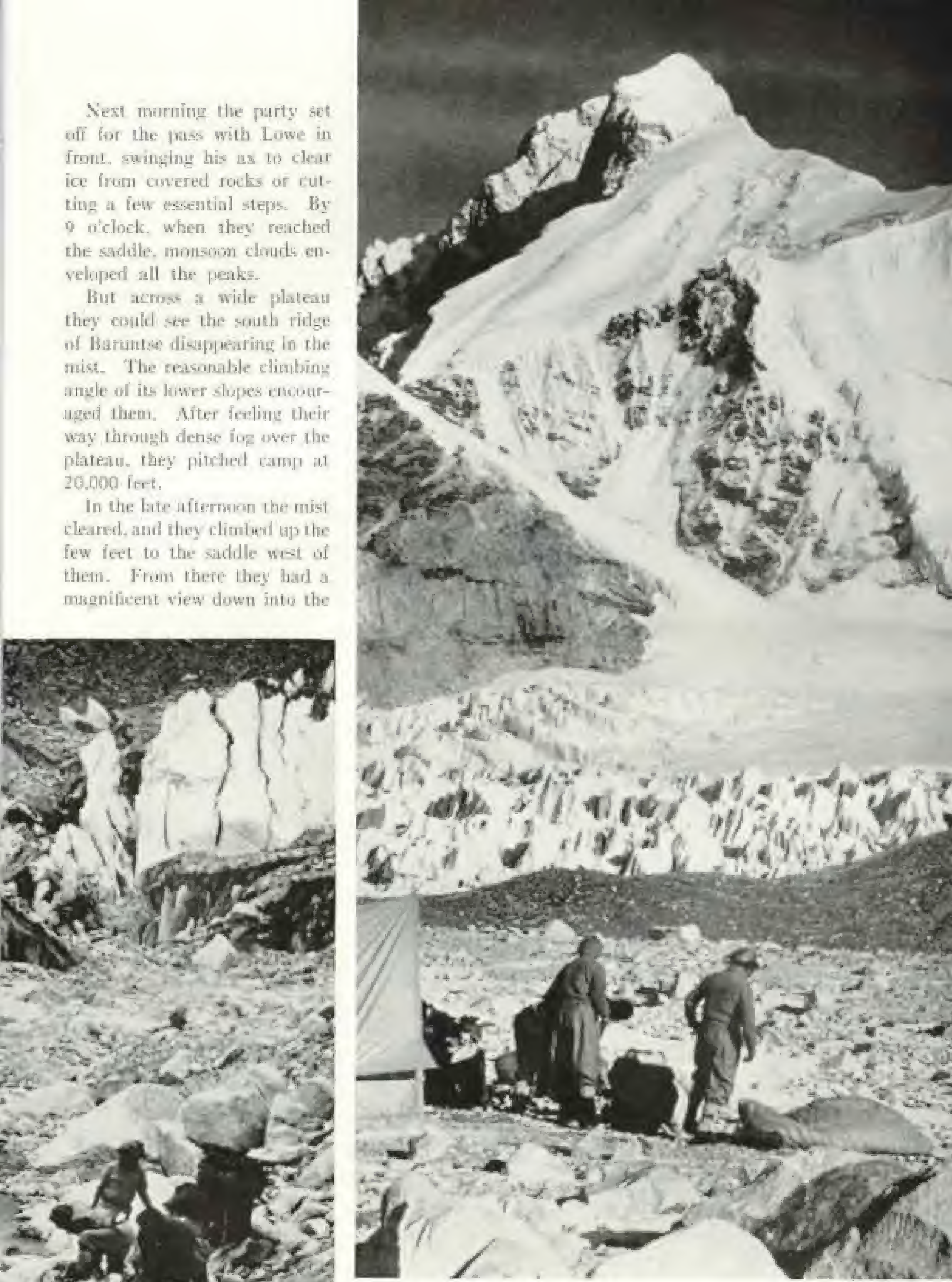
George Lowe



Next morning the party set off for the pass with Lowe in front, swinging his ax to clear ice from covered rocks or cutting a few essential steps. By 9 o'clock, when they reached the saddle, monsoon clouds enveloped all the peaks.

But across a wide plateau they could see the south ridge of Baruntse disappearing in the mist. The reasonable climbing angle of its lower slopes encouraged them. After feeling their way through dense fog over the plateau, they pitched camp at 20,000 feet.

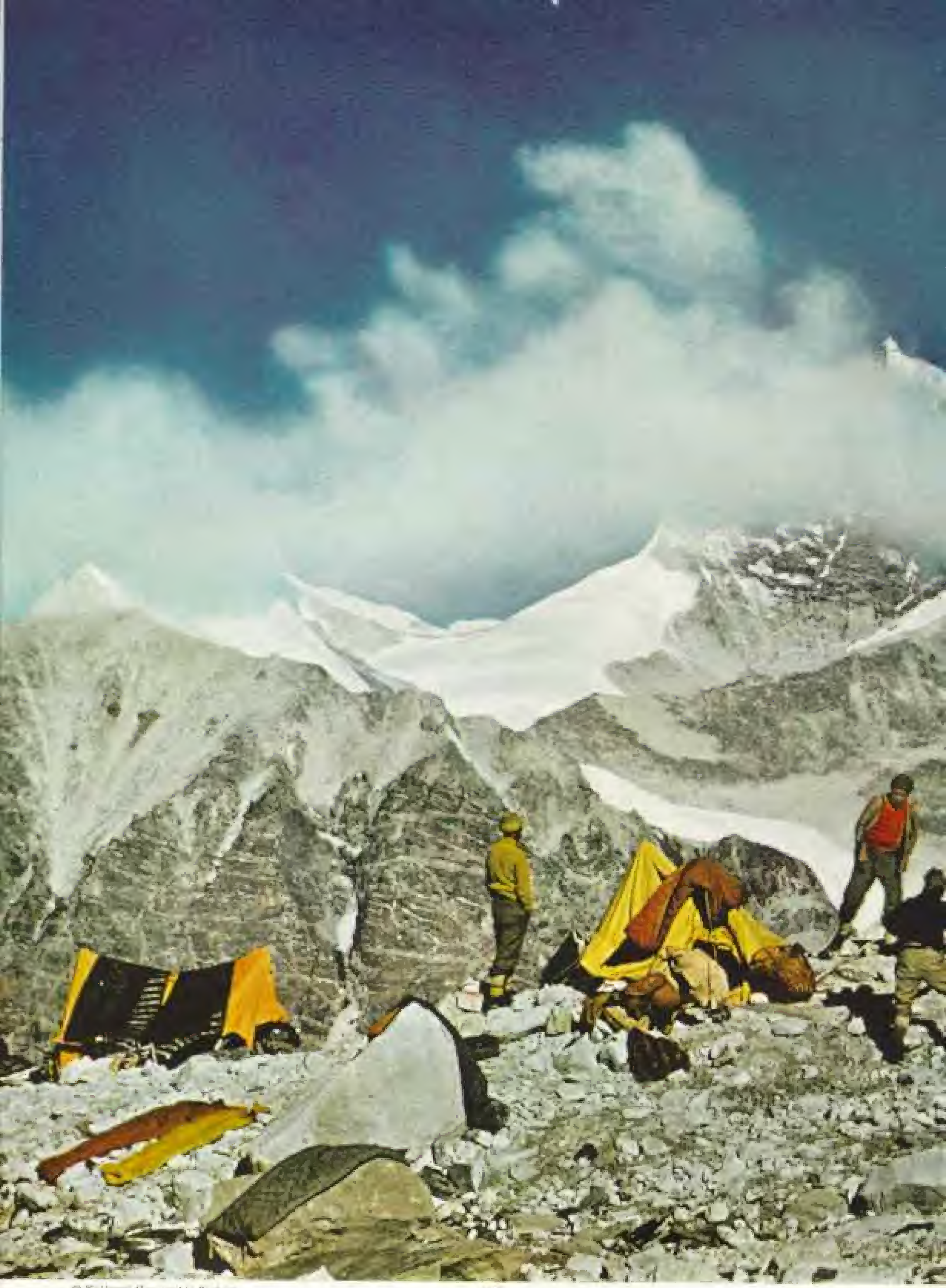
In the late afternoon the mist cleared, and they climbed up the few feet to the saddle west of them. From there they had a magnificent view down into the



601 George Lowe

Frozen Ramps Lead to Lhotse, Highest Unscaled Peak

A neighbor of Everest, Lhotse rises 27,890 feet; its Tibetan name means South Peak. Tent holds the injured McFarlane.



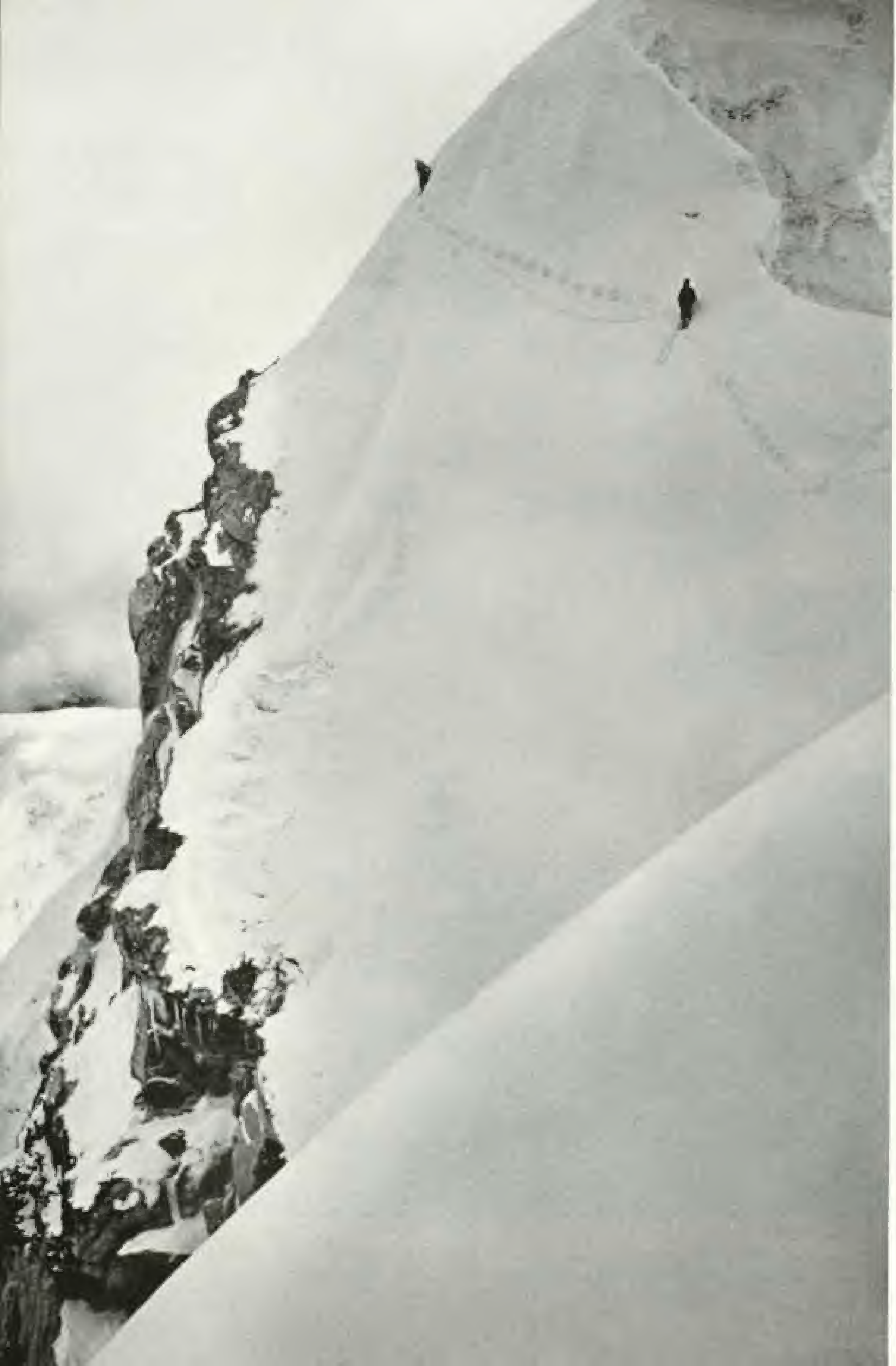
Ominous Monsoon Clouds Slither Across Saw-tooth Ridges into Hongu Valley

Blizzards block Himalayan climbers most of the year. Men venture in only when storms let up in late spring. These Sherpas, anticipating June's daily dose of snow, air bedding on the rubble left by a retreating glacier.

Kinderhume by George Lowe

The Sharp and Glittering Fang of Ama Dablam Holds Adventurers at Bay

"Ama Dablam seems unclimbable," says the author; "it is the most fantastically difficult peak any of us have seen." No one is known to have tested it. The 22,310-foot mountain dominates a wilderness south of Everest.



← Colin Todd's Ice Ax Cuts a String of Beads on Baruntse's Spire

"Stretching the limits of safety to the utmost, these men performed a feat of technical skill rarely equaled in the Himalayas," says the author.

Every foothold in the glassy surface had to be hacked out. One false step could have dropped the team thousands of feet.

← Geoffrey Harrow follows Todd's tracks.

→ Todd negotiates a corner close to Baruntse's 23,570-foot summit.

head of the Hongu Glacier, seen by Shipton and me in 1951. The Sherpas call this region "Panch Pokhari"—five lakes—and it is dominated by the upthrusting tower of Ama Dablam (page 603).

The party returned to camp to find the Sherpas taking a little exercise—kicking a Rugby football around against the mighty backdrop of Makalu—probably the highest game of football ever played (page 606).

That evening there was no singing, for the thought of the task ahead was a sobering one. Instead, the Sherpas monotonously intoned their prayers long into the night.

Next morning they established a camp at 21,800 feet on a saddle at the foot of Baruntse's south ridge. The mist was thick when they arrived. They cut a platform in the snow for their two tents. Three of the Sherpas then returned to the plateau camp, with Lowe belaying them on 200 feet of rope over the steepest portions. Annullu and Mingma, both outstanding climbers, stayed with the

♠ Everest, Dropping Guard, Unmasks Its Eastern Face in a Rare Show

Six miles distant and 7,000 feet above eye level, Everest's summit marks the top of the world. Minutes later swirling clouds curtained the panorama. Sherpa Urkien halts in wonder on the broad, smooth slope of Pethangtse (22,060 feet). Canvas overboot, a recent innovation, keeps his footwear dry.

♦ For Exercise After Climbing Mountains, This Sherpa Kicks a Football

In the thin, bitter air at 20,000 feet, lungs strain for oxygen and any move drains energy. New Zealanders saved their strength. But the porters, Rugby enthusiasts all, missed no chance to kick the party's football up and down Barun Glacier. Even so, the robust hillmen gasped for breath after any sudden maneuver.

sahibs. Hopes were high in the tents that night.

The following morning was windy and cold; it took the four sahibs a long time to get ready. At 6:30 a.m. they crawled out of the tent and tied on the two ropes. Lowe and Beaven led off up into the mist, while Todd and Harrow followed at some distance.

Their first problem was a deep crevasse spanned by a thin snow bridge, which they carefully crossed. Then they started up a long snow slope above.

Huge Snow Cornice Falls Away

The climbing was steep but not difficult, although at this altitude every step required a distinct effort and breathing was necessarily quick and hard, like that of a tired athlete at the end of a long run. Lowe plugged a trail steadily upward until he reached the edge of another great crevasse; from below, this had appeared to be the crux of the climb.

But the climbers were lucky—the crevasse was almost filled with snow; Beaven could cut steps into it, then hack a steep stair onto a little plateau above. He was leading, keeping well down from the crest of the ridge. Suddenly, without warning, there was a thundering "whoomp!" as an enormous cornice on his right broke off and went roaring down the mountainside. Lowe, with a lightning reaction, flung himself down the slope to the left, plunged his ice ax deeply into the snow, and put the rope around it.

Beaven was left swaying on a sharp crest of snow with a terrifying view of the 5,000-foot drop to the Barun Glacier. The 20 feet of ridge on his right had been a great cornice which had dropped away, leaving him only just in safety. Somewhat shocked by this close shave, Beaven cautiously descended to Lowe. Understandably, they spent a little time recovering their breath.

Meanwhile Todd and Harrow had caught up with them. They discussed the advisability of going on. The route ahead looked appallingly difficult, an apparently vertical wall of snow barring their way.

This wall, as Beaven's breath-taking adventure had shown, was corniced heavily on the right. On the left it ran out over a vertical rock face with no resting place, not even for the eye, until it reached the moraines of the Hongu Glacier, 4,000 feet lower down.

They seemed to have reached the end—the wall was too tough! Todd and Harrow weren't at all hopeful of negotiating it. But Beaven was more optimistic.

"It doesn't look so steep from closer up," he said. "Have a look at it."

So they started along slowly. Todd came to a small crevasse that cut across the ridge. It seemed snow-filled, and he prodded it with his ice ax. The snow fell away; through the hole he looked down on to the Barun Glacier. Hastily he withdrew and crossed elsewhere.

Then Todd set out across the wall. The snow was not well consolidated; holes large enough for both feet and cleared to hip level had to be made. With each blow of his ax the dislodged snow floated gracefully down for thousands of feet.

The climbers' only hope was that the wall would stick together long enough to take their weight. After two rope lengths Todd reached a corner and passed slowly round out of sight of Lowe and Beaven. Harrow followed him. To their consternation, the slope, far from easing, became steeper. It seemed once again that they must be stopped.

But they found the snow considerably firmer and safer. They cut their way on (pages 604 and 605).

Periodically, an almost vertical ice rib would bar their way. Getting by such obstacles took time. Three and a half hours after Todd and Harrow had separated from the other pair, all were still within shouting distance. Lowe and Beaven called out that they were returning to camp.

Todd and Harrow, however, were determined to continue. Mist swathed them as Todd cut steps doggedly along the terrific slope. Nowhere was there any easing of the exposure; nowhere could they rest safely. They just had to keep going or turn back.

On Baruntse's Lofty Summit

Now they were above 23,000 feet. Hail and snow were coming out of the mist. In places Harrow had to clear out steps that Todd had made only a rope length in front. Todd cut a last step, then saw an easy snow slope disappearing upward. It was the summit ridge.

His tremendous feat of step cutting left Todd weak and tired. But Harrow still had something in reserve. He went into the lead, breaking trail through 14 inches of powdery snow. They had 500 feet to go, and it took

Flooded Rice Terraces Form Gigantic Stairsteps on a Hillside in Subtropical Nepal

Water from melting glaciers irrigates rice in Bhote Kosi Valley. Farmers, who stir the mud with wooden plows, leave the sowing and reaping to wives. Shin-deep in silt, these women transplant seedlings.

Growing Crops Gave a Verdant Welcome to Explorers Marching Down from Eternal Snow

Hospitality and home-brewed rice beer awaited the Sherpas in the bamboo-roofed houses of Nepal. "We had difficulty getting past the villages," says the author. "Our porters got decidedly merry."

them a long time. Finally at 4:15 p.m. they climbed up onto a mist-shrouded summit.

Time, they knew, was vital if they were to get off the mountain alive. They spent a few precious moments eating a tin of sardines and some sweets. Then Harrow led off downward as fast as they could manage in the soft snow. They reached the wall—to find no steps visible. Snow and hail had filled them. Harrow worked gamely on, clearing out the steps, and they spread-eagled their way across from step to step. It was almost dark when, thankfully, they stepped off the great wall.

As darkness engulfed them, they called to the camp, still well below, and their shout was answered. They saw two flickering lights approach. Lowe and Mingma tied the two weary men in the middle of their rope, guiding them safely back over the last snow bridge and into the warmth and comfort of camp. Their boots were removed and hot drinks were thrust into their hands. For the first time in 14 hours they could relax and know they were safe.

Two days later Lowe and Beaven returned to the attack. After another long and arduous climb they, too, reached the summit of Baruntse. Here they were struck by a fierce snowstorm which made their descent an exhausting business. When their clothes became heavily encrusted with ice, their thoughts turned to the possibility of an emergency snow cave at 23,000 feet—only there wasn't anywhere to put a snow cave. They were exceedingly grateful to get off the wall as darkness fell, and to find two faithful Sherpas waiting to help them back to camp.

Limits of Safety Stretched

In their two climbs of Baruntse the party had been stretching the limits of safety to the utmost, but the feat of technical skill and sheer endurance that these men performed has rarely been equaled in the Himalayas.

Todd's effort—cutting steps for more than six hours along a slope of fearful steepness and exposure—would have been exceptional at Alpine levels, let alone in the thin, cold air of 23,000 feet. The four men and their Sherpas descended to lower levels with a justifiable feeling of satisfaction.

But their climbing wasn't finished. Although the monsoon with its continual mists and snow flurries seemed to be upon them, they determined to snatch a few more summits. Todd and Beaven climbed Nau Lekh (21,422 feet), while Evans and a Sherpa reached the summit of a 21,000-foot peak after a difficult and exposed climb. Finally, with some reluctance, they left the mountains behind, crossing various high passes to rendezvous in the Sherpa village of Khumjung.

In Khumjung Hardie rejoined them, and they enjoyed the generous hospitality of the Sherpas in their homes. Then began the long trek over the foothills to the civilized comforts of Katmandu.

McFarlane, Dr. Ball, Wilkins, and I went back the way we had come. Though we tried to give McFarlane as comfortable a trip as possible, he must have been miserable.

He had to be carried in a rough chair on the backs of porters, since his injured hands and feet left him quite helpless. Even so, I never heard him complain; he was, in fact, the most cheerful member of the party. What a relief to get him out to civilization!

And even though McFarlane has lost all his toes, and his hands will never be quite the same, he is getting fit and strong again. Such is his spirit that we expect to see him back soon in the mountains he loves.

23 Peaks Scaled for the First Time

We returned home feeling we had done much valuable work. We had explored and mapped large areas of previously unknown country. We had climbed 23 hitherto unscaled peaks, 19 of them over 20,000 feet in height.

Will we go back? I rather think so. For here are the world's loftiest peaks—thousands of them rising above 20,000 feet. To the mountaineer they stand as a terrific challenge, the supreme test. Besides demanding extreme technical skill, they present that most formidable of defenses—great altitude; nothing exerts a severer strain on the determination and endurance of the climber.

The ascent of Everest in 1953 stimulated immense interest in the Himalayas and seemed to break the spell which guarded the taller peaks. Now, among those above 27,000 feet, Lhotse alone is unconquered (page 601).

Although an increasing number of expeditions continues the attack each year, plenty of peaks remain untouched. And whatever these remoter mountains may lack in altitude they make up for in inaccessibility and heartbreaking terrain. Even tougher than the better known giants, they will demand new techniques before they submit to man.

Fresh Treasures from Egypt's Ancient Sands

Archeologists Add a Funerary Boat, Step Pyramid, and Temple to the Priceless Heritage of Relics of the Pharaohs

By Jefferson Caffery

Former United States Ambassador to Egypt

With Illustrations by National Geographic Photographer David S. Boyer

CRAWLING into a rock-cut chamber that shelters a wooden boat intact after 4,500 years is more the reward than the duty of an ambassador.

It was a dramatic moment for me when the first of forty-one 17-ton limestone blocks was raised and edged aside to reveal a remarkable boat, with papyrus-shaped bowsprit, which had lain undisturbed through four and a half millenniums at the foot of the Great Pyramid of Khufu (Cheops.)*

The chant of the workmen, "*Salli ala el-nobi*," filled the air. "Pray for the Prophet," they sang over and over as they tugged on chains of the block and tackle. I wondered whether the Arabic tune, pacing the diggers at their work, perhaps bore a resemblance to the song of the Pharaoh's workers who put the block there so many centuries ago.

The boat discovered at Giza last year is the largest of these ancient vessels ever found in a state of good preservation. Even the great masses of rope left in the burial pit looked as if someone might have carelessly coiled and dropped them there only a few years ago (pages 612, 616, and 617).

End to end with the uncovered vault, Egyptologists have located a second chamber. Here, they are fully confident, a second boat lies buried. Experience has proved that such funerary barks are likely to be found in pairs, or even in sets of three or more.

Boats Buried with Kings

Still a matter of debate among scholars is the proper designation of the knocked-down craft over whose crypt had trod thousands of visitors to the Great Pyramid. Experts have now cast doubt on its preliminary identification as a solar boat, of which ancient models appear on Egyptian tombs. Boats of this kind are believed to have been buried with the kings to carry them on their eternal voyagings through the sky in the company of the Sun-god.

When I left my post as Ambassador to France to go to Egypt in 1949, my first thought, apart from the business of state, was of the opportunity I would have to delve into ancient history. I soon found that it was to be my good fortune to witness many a chapter of archeological history in the making.

During my five years as Ambassador to Egypt I saw the persistent efforts of Egyptologists rewarded with many impressive finds. Archeologists regularly invited me to their digs, especially when they believed they were nearing "pay dirt."

Desert Sands Preserve Ancient Relics

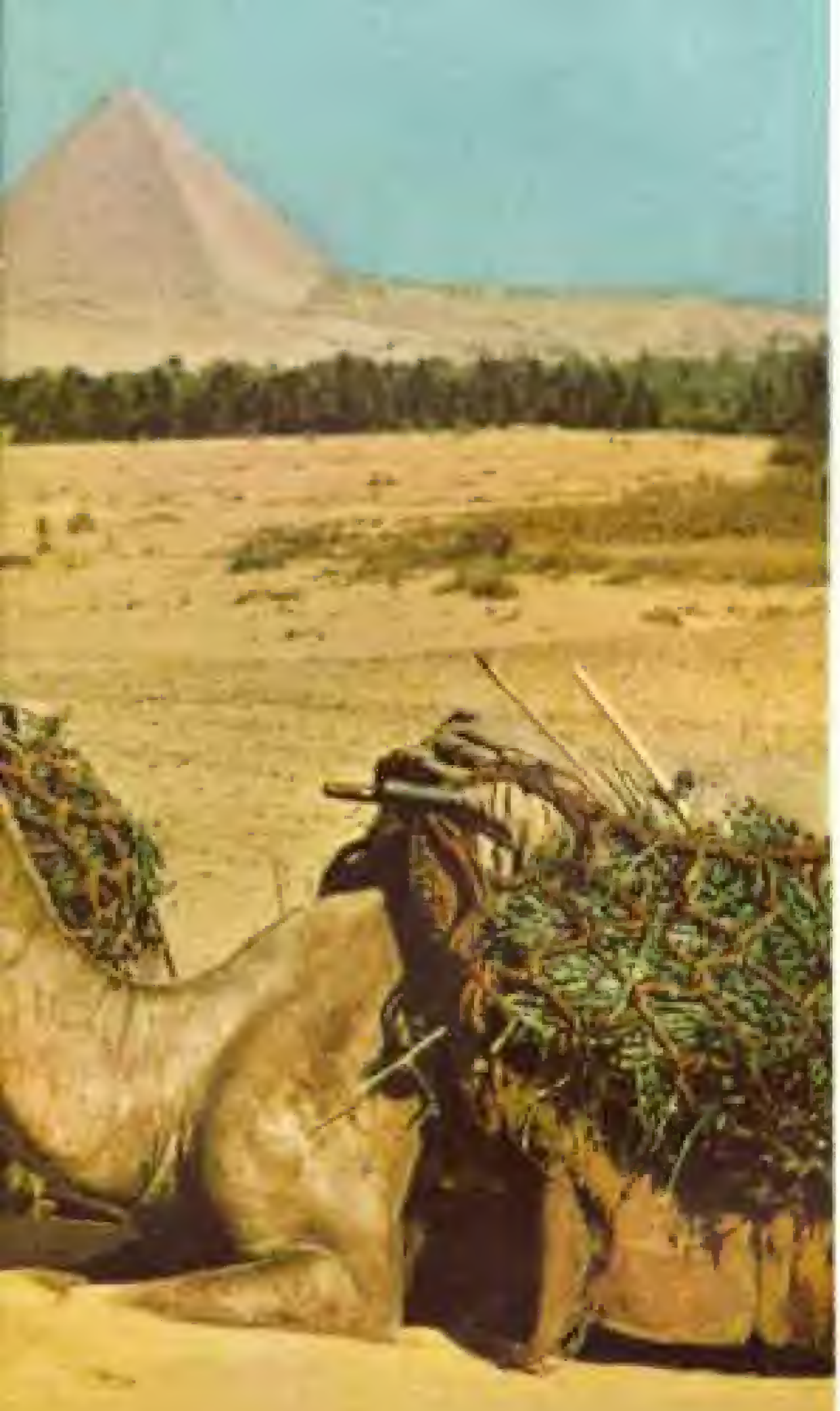
The most interesting of these successes—all three of which I followed closely—were the discovery of the famed boat at Giza, the excavation of the unfinished step pyramid at Saqqara, lost since ancient days, and the unearthing of the Valley Temple of Snefru at Dahshur, containing hundreds of valuable antiquities (map, page 621).

My original intention had been to retire from the Foreign Service after a year or two in Egypt. But from the standpoint of indulging my favorite pastime, I was glad that official duties kept me in Egypt much longer.

Here I found that the wonders of the past opened like a well-documented book before persistent inquiry and a willingness to travel, whether across the desert on horseback or crawling on hands and knees into ancient tombs. I know no more satisfying recreation, nor a more informative way to put together the pieces and puzzles of history.†

* See, in the National Geographic Magazine: "Kayaks Down the Nile," by John M. Goddard, May, 1955; and "Safari from Congo to Cairo," by Elsie May Bell Grosvenor, December, 1954.

† See "Daily Life in Ancient Egypt," by William C. Hayes, with paintings by H. M. Herget, National Geographic Magazine, October, 1941; also the 556-page color-illustrated book, *Everyday Life in Ancient Times: Highlights of the Beginnings of Western Civilization in Mesopotamia, Egypt, Greece, and Rome*, published by the National Geographic Society, Washington, D. C.; price, $5 postpaid in U.S.A. and possessions; $5.25 elsewhere. All remittances payable in U. S. funds.



← Egyptians Praying Toward Mecca Turn from the Pyramids of Their Forefathers

Egypt entered onto the stage of world history more than 5,000 years ago. Its ancient civilization endured for an incredible 3,000 years.

While yet young (about 2600 B.C.), the kingdom reared the largest single monument ever constructed, the Great Pyramid at Giza (right). This edifice was meant to be a burglarproof House of Eternity for the god-king, Khufu (Cheops).

With rollers but no powered machinery to aid them, the Egyptians quarried immense limestone blocks, dragged them to the 13-acre base, and mounted them as precisely as jewels. Herodotus, the Greek historian, estimated that gangs of 100,000 men toiled on the project.

Slowly a solid core of masonry rose around halls where the King would "live" after death. Finally, sheathed in dazzling white blocks, the Great Pyramid stood 480 feet high, glittering and majestic beyond dream.

Khufu's son, Khafre, built his pyramid next door. Another descendant, Menkaure, added the third (left).

Page 612, lower: A dismantled funerary boat of Khufu was discovered near his pyramid in 1954. Awaiting miraculous assembly, these pieces may have been reserved for the King's voyages across the sky with Re, the Sun-god. Here Hassan Zaki, of the Egyptian Department of Antiquities, colors a composite photograph (page 616).

⚜ Some 1,300 years after Khufu, King Tutankhamun went to his tomb with this painted boat (page 622). Egyptians believed that magic restored the mummified King to life, expanded his toy into a barge, and sped the craft along the celestial Nile. These Americans view the boat in the Egyptian Museum at Cairo.

Kodachromes by National Geographic Photographer David S. Boyer

Pursuing such a hobby is no less warming in human values than rewarding in archeological data. Egyptologists are among the world's friendliest people, and the password to their brotherhood is a little knowledge and a sincere desire to learn more about the heritage of splendid memorials to whose study they devoterdly dedicate their lives.

Just as friendly as the Egyptologists, and as eager to welcome visitors, are the men who shovel the sand and move it in baskets on their shoulders. These laborers are uneducated men, working in tatters or, more recently, in khaki suits, but they seem always ready to smile.

Diggers' Day Begins with Melody

Although official duties were exceptionally demanding, I looked forward each week to Saturday afternoon. Breaking away from international affairs whenever possible, I took week-end refuge at a desert dig.

The diggers sang impressively. Some of the words and tunes had been handed down through generations, for there are families whose sons, grandsons, and great-grandsons have been excavators.

In every gang one man has an exceptional voice. There is a song for every occasion, and when the occasion arises the leader puts aside his spade and strikes up the chant (opposite page). All others join in the chorus, with the crunch of the spade or the beat of the pick keeping time.

The diggers' day begins with a melody that asks God for happiness and good luck. The Arabic words mean that no one present should forget there is only one great Almighty, who feeds the fish in the depths of the sea and the worm under the stone, and that He never forgets to care for all beings He created.

When a visitor approaches, the pitch of the leader rises high in welcome, and all others answer: "Welcome to him who has come; coffee and tea for him who has come. Look at the handsome face of him who has come!"

If ladies are among the visitors, they monopolize the attention of the singers and inevitably are compared to the queens of ancient days.

Once some Foreign Service wives accompanied me to an excavation at Dahshur. Singing workmen welcomed them thus: "You beautiful, you sweet creation. Your hair is like the golden rays of the sun. Your eyes outshine the stars, your mouth is like Solomon's ring, and your teeth are more beautiful than the best of pearls. Your smile is indescribable because it comes from Heaven.

"When you walked in as though angels were carrying you, your silken clothes waved in the breeze, and you looked like the daughter of the moon. Your earrings and bracelets of gold, your necklaces of precious stones are beyond compare, and you rustle your beautiful ornaments as does the horse of a rich prince!"

As I recall, the ladies wore simple clothes and little jewelry. But tradition is stronger than fact, and they graciously accepted the compliments.

When important discoveries were made, the excitement affected all of us—the Egyptologist, the foreman, and the singing workers.

Never shall I forget the face of a man who could read no language and knew no history except by hearsay, when he sifted from the sand a beautiful alabaster vase. It had lain in a temple there for more than 4,000 years. Joyously he rushed to where my friend the archeologist and I were standing and said in Arabic: "The presence of the Ambassador enabled me to dig this up today, because it was destined for him to see me do it."

Indeed, destiny has been kind to me; I have seen many such treasures unearthed.

Boat's Timbers Weakened by Time

On May 26, 1954, the Giza boat was first revealed during a road-building operation near the Great Pyramid. From the day the stirring news broke I hoped that the preparations for uncovering the craft would move fast enough for me to explore it before leaving Egypt. My reward came in November.

First scrutiny of the boat revealed that the passage of 45 centuries had affected the wood, although it was still remarkably well preserved. Strict precautionary measures put in force by the Department of Antiquities of the Egyptian Government were amply justified.

For several months after the discovery, the Department experimented with pieces of wood extracted from the pit before the right combination of chemicals was found and made ready for use in preserving the relic. The Department's chemist went to Oslo and London to study the best methods for conditioning ancient wood. When the treatment was ready, the first ceiling block was lifted off the boat's limestone "slip," and the scientists went to work.

Raising His Arm Like a Choirmaster, a Foreman Leads Excavators in Song

Egyptians, first architects to work with stone, had been making full use of the material only a century when King Snefru erected this tomb about 3650 B.C. Midway through the job the chief planner discovered that the burial chambers would not support the structure designed. "Bending" the sides inward, he cut down the weight and created the Bent Pyramid at Dahshur, predecessor to the first true pyramid (page 648). These laborers, lightening work with a chant, improvise a story about the photographer. They uncover the Valley Temple, a gatehouse designed to aid Snefru's transit to eternity. Religious services for the King were held here for the next seven centuries.

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If this is indeed a solar boat, as some archeologists believe, it is ironical that it remained for so long in complete darkness after its ceremonial burial. In another ceremony in the presence of the youthful Minister of Education, Maj. Kamal El-din Hussein, and other Government officials, the boat came again into the light of a typically sunny Egyptian day.

At once we could see that the papyrus-shaped bowsprit had been detached from the hull in order to get the vessel into the 102-foot-long pit; it was leaning against the end of the solid rock enclosure.

Solar Boats Towed When Becalmed

The steering oar and matting remained apparently where the Pharaoh's men had placed them. Great masses of rope were much in evidence. As an archeologist friend explained, "This rope was to pull the boat in case it should become becalmed in the sky!"

When workers had removed enough ceiling blocks to enable us to see the condition of the vessel, we were surprised to find that it had been dismantled before it could be fitted into the pit. Then it had been carefully covered with fabric before the pit was sealed.

Supporters of a theory that the boat may have been used to transport funerary trappings to the site, and was then buried with all other such equipment, believe that the vessel's dismantled condition bears out this idea. Studies of the wood may yet throw light on this question.

A partial answer to whether or not the boat was ever in contact with water was provided by the discovery of white pigment on some of the craft's side pieces. The coloring proved to be calcium sulphate, or gypsum, which is easily soluble in water. Had the boat actually been used in the Nile, the white coating would in all probability have disappeared.

Near the center of the boat were found large and small poles that had supported a deck canopy to protect the royal voyager from the elements. Canopies appear in the draw-

King Khufu's Ghost Ship Sails into Light 4,500 Years After Burial at Giza

Early last year Kamal El-Mallakh, director of works at Giza, set out to clear a road near the Great Pyramid. Soon his men's shovels struck a pavement of massive limestone blocks. Mr. El-Mallakh chipped a hole through a stone. Out drifted the odor of incense and wood! Dim light revealed a pit stacked with lumber. The loose boards seemed to be parts of a large boat. Word soon swept the world that Egypt's mine of antiquities had yielded a rare 105-foot ship from the IVth Dynasty.

Authorities differ on the vessel's function. Some believe it transported the royal mummy to the pyramid. Others think it was designed to carry the dead king through the heavens (page 613).

← Zaki Nour, director of the excavation, brushes dust from a plank. Lower boards reveal finger-size holes intended, possibly, to receive the lashings seen at bottom of the pit. This mysterious tangle appears just as the ancient workmen left it. Possibly they disassembled the boat because it proved too long to fit the crypt.

↓ The author points with his cane to the bowsprit. This post is shaped like papyrus, a buoyant plant which primitive Egyptians tied in bundles to make crude raftlike skiffs. Bits of matting that drape the wood remain from the original cover.

Those around the pit are (from left): Dr. William Kelly Simpson, American Egyptologist; George V. Allen, United States Assistant Secretary of State; Salah Osman (standing), the engineer who removed the boat's stone roofing; Mr. Nour, Mr. Caffery, and Mr. El-Mallakh.

National Geographic Photographer David S. Boyer (opposite) and U. S. Information Service

Queen Hatshepsut, Egypt's Female Pharaoh, Built Her Temple Beneath 1,000-foot Cliffs

Often pictured in kingly kilt and beard, this strong-minded woman seized power as regent for her young nephew, Thutmose III. To achieve immortality, Hatshepsut built this immense three-terraced temple. Here the Queen placed countless inscriptions and images of herself in contact with the gods, hoping to leave for all time a record of her piety. Meanwhile, Thutmose hated the domineering aunt who frustrated his ambition. At last succeeding to the throne, the vengeful King sent his soldiers with swinging hammers to destroy her images.

Dawn's Celestial Fire Descends on a Shrine Where Ancients Worshiped the Sun as a God

Hatshepsut lined the entrance causeway with sphinxes, landscaped the lower court, and provided massive ramps for processions. Carvings behind the second-level pillars proclaim the god Amun her father by miraculous conception. Ruined top tier still holds a sun altar open to the sky. Priests on the terrace could look down a valley to the Nile's green bank, two miles distant. Monks in Christian times used the temple. Arabs called it Deir el Bahri, or North Monastery. Chapels in the cliff are hewn out of rock. Valley of the Tombs of the Kings lies over the cliff.

620 U. S. Information Service

Author Caffery Climbs to the Summit of King Khufu's Great Pyramid

Giza's pyramids survive among the Seven Wonders of the ancient world. Centuries whittled off the Great Pyramid's sheath of white stone and reduced its height by 30 feet. The carved initials of generations scar its peak. Khafre's monument (background) still wears its limestone casing near the summit (page 612).

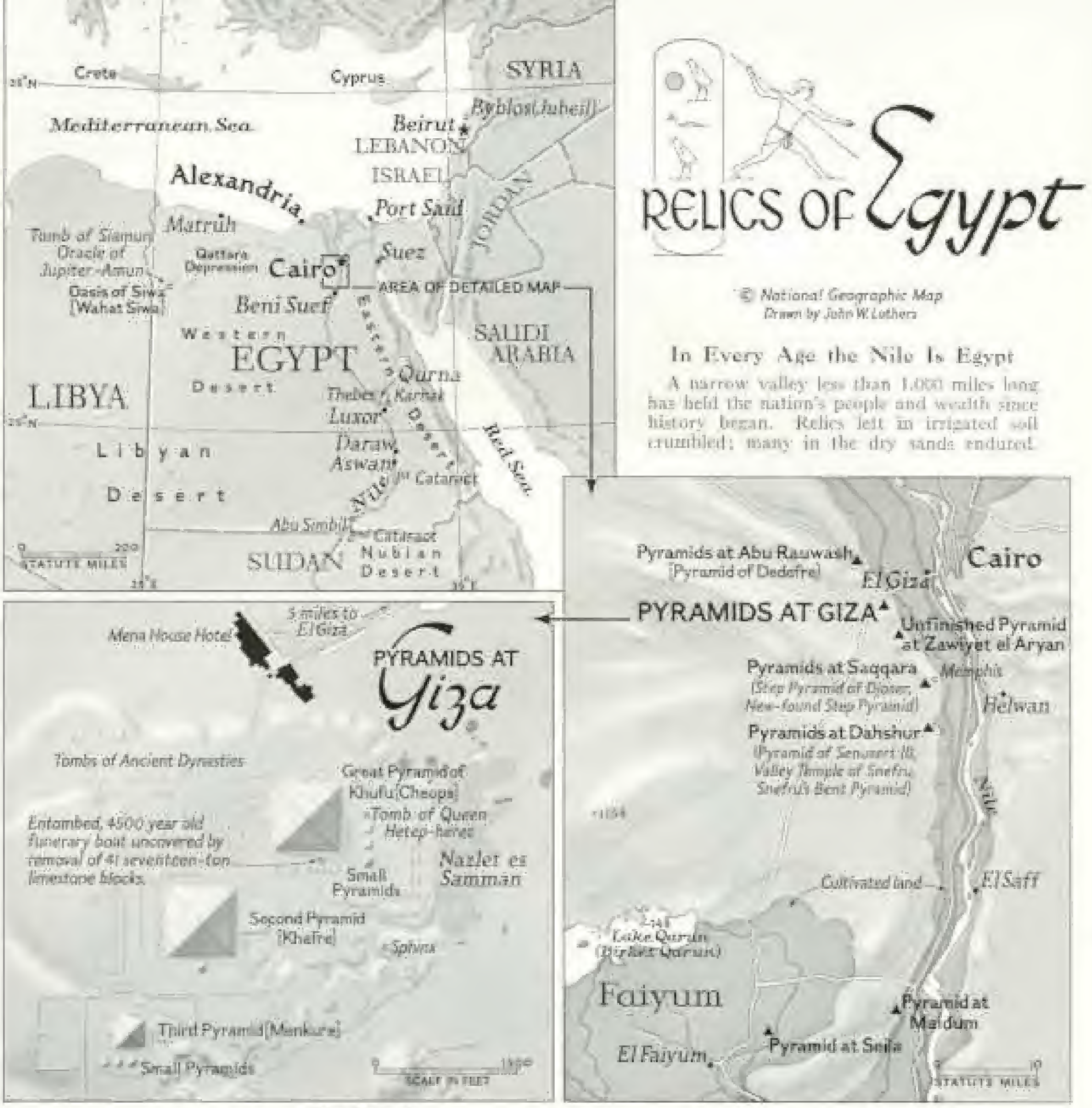
ings of ancient boats and in models. And a canopy with identically designed poles, though for a bed, was found in the tomb of Queen Hetep-heres, mother of Khufu, and is now in the Egyptian Museum of Cairo.

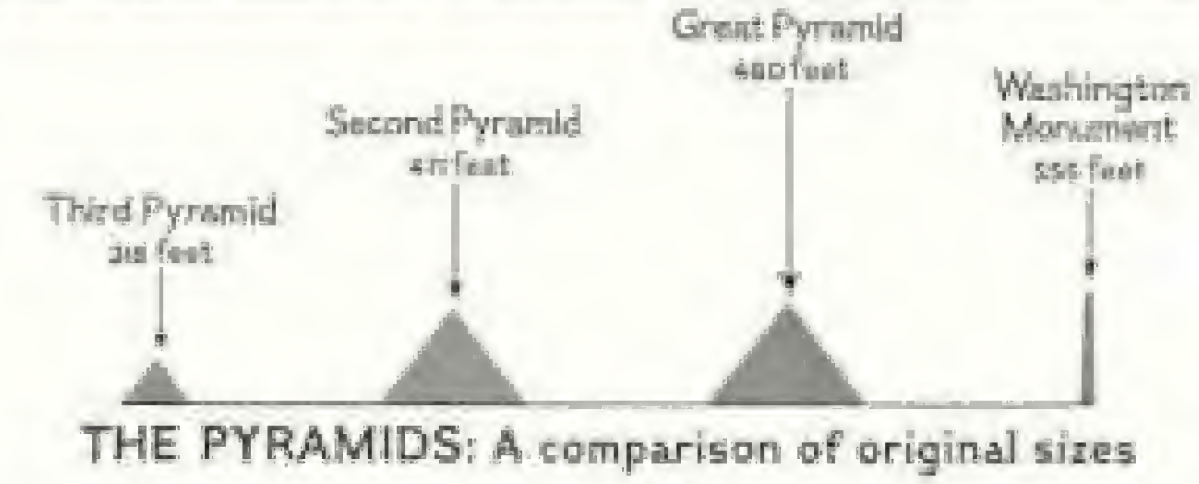
An important archeological discovery was the use of copper joints in the boat's construction. Their use, however, was limited, and most of the pieces of wood were put together with the customary wooden pegs.

It is believed from preliminary examination that cedar of Lebanon, acacia, sycamore, and pine are among the materials used. Wood of the *nabk*, or Christ's thorn tree, may also have been employed. Each kind was chosen for a particular part of the craft, depending upon its hardness and durability.

How many boats lay close to the pyramid of Khufu? Mention has been made of the companion boat that Egyptologists feel assured is hidden in a similar rock-cut vault adjacent to the first vessel found.

Three rock-cut boat chambers on the east side of the pyramid have long been known. Last year's discoveries added two more; probably others exist, perhaps on the west side.





THE PYRAMIDS: A comparison of original sizes

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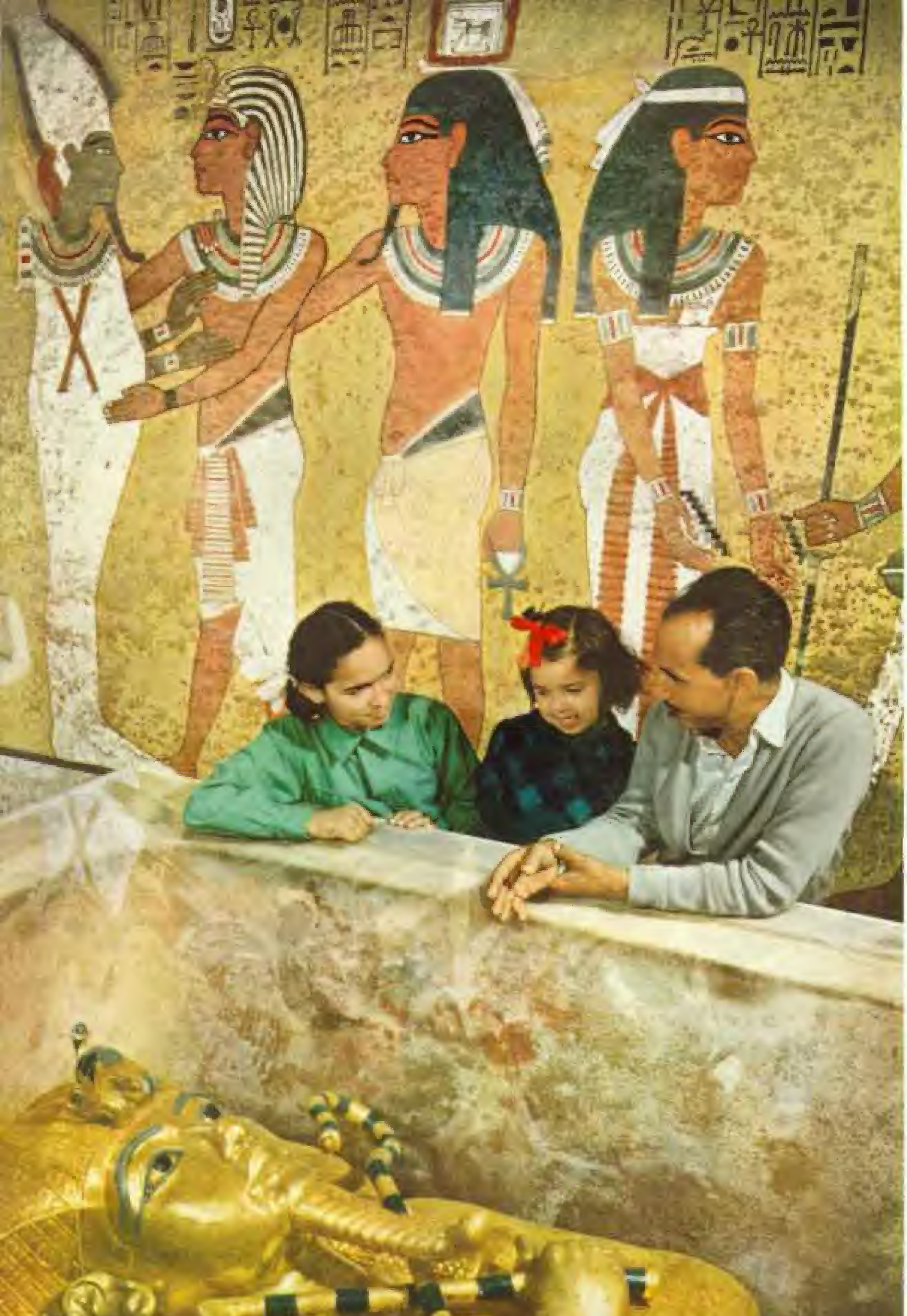
Five pits, and possibly a sixth, in which boats had been interred were found around the pyramid of Khafre, son of Khufu, whose burial monument stands only about 200 yards from his father's. If two of these were for the sky journeys, which are mentioned in the inscribed Pyramid Texts, then the three others possibly were used to transport the dead pharaoh on his final journey in this world or the next.

The Pyramid Texts shed much light on our understanding of Egyptian burial customs. Chanted at royal funerals, they were magical texts intended to facilitate the passage of the dead pharaoh.

To date, as I have said, Egyptologists are not agreed whether the boat at the base of Khufu's pyramid is truly a solar boat or whether it was put there for another magical or practical purpose.

Since the discovery some archeologists have even argued that the boat may have been used to ferry the mummy of Khufu to his burial monument and thus have become part of his funerary equipment.

If this boat, and the one the adjacent pit is confidently expected to yield, were indeed solar boats, their purpose was to provide vehicles for Khufu's excursions with the Sun-god, one boat for the day and another for



the night. The prow pointed westward, as with previously discovered barks thought to be solar boats. The remains of curtainlike matting, suspended before the prow of such craft, were found by the bowsprit in the pit.

Ancient Egyptians thought the sun traveled westward beyond the horizon and rose again the next morning from the east. Egyptologists agree that the people of the Nile 3,000 years before Christ believed that the Sun-god made that daily trip by boat.

What more natural means of transportation than a boat, for in those days almost all travel in Egypt was on the Nile. Ancient Egyptians feared eternal darkness, and when the Sun-god was traveling beyond the horizon they wanted to be with him. Thus the boats were prepared for the trip after death.

Such scenes are depicted on walls of the Tombs of the Kings at Thebes and on many papyri and sarcophagi. And we know from the Pyramid Texts how eager the kings were to stress their journeys with the sun by day and by night. Many epitaphs and poems honoring the dead kings contain lines like: "His Majesty, having passed life in happiness and years in contentment, went forth to heaven and joined the Sun."

Whatever the purpose of the boat at Giza, it is a find of the greatest value for the understanding of Egyptian shipbuilding.

The boat vaults at the base of Khufu's pyramid are by no means the oldest known. I have seen boat-shaped burial places around the mastabas at Helwan and Saqqara that date from the 1st Dynasty (circa 3100 B.C.). None of those I saw, however, contained preserved wood—only the crumbled remnants.

Many Americans have seen the Egyptian funerary boat in the Chicago Natural History Museum. This is one of six taken from beside the pyramid of Senusert III of the Middle Kingdom (circa 1860 B.C.) at Dahshur. Two other boats from that pyramid are in the Egyptian Museum, and another is in Pittsburgh at the Carnegie Institute.

Boat Burial Dated by Quarry Marks

One of the most interesting revelations at the boat site names the man who put it there.

As the excavation proceeded, many red quarry marks were discovered on the blocks that sealed the chamber. These had been inscribed by the gangs of workmen who had cut the stones. The great surprise was the cartouche found on at least eight of the blocks. It was the mark, not of Khufu, but of his son and successor, Dedefre.

It was the custom in ancient Egypt for a son to complete monuments begun by his father. However, far from completing his father's works, archeological evidence indicates that Dedefre suspended nearly all projects at Giza.

The stones bearing Dedefre's cartouche are almost the sole evidence of work here during his eight-year reign. These inscriptions suggest that Dedefre completed this monument in the fourth year of his reign.

Pharaohs Imported Lebanon Cedar

The probable use of cedar of Lebanon in the construction of the Giza boat brings up some interesting sidelights on ancient Egypt's commerce with Mediterranean neighbors.

Khufu's father, King Snefru, is recorded as having imported 40 shiploads of Lebanon cedar. Inside Snefru's Bent Pyramid at Dahshur, 4,600-year-old cedar beams, some a foot thick and 20 feet or more in length, are as solid today as other wood built into modern construction only a generation ago. It is possible that cedar was brought from Lebanon even before Snefru's time, for the Egyptians very early developed trade with other Mediterranean peoples.

From a later period, just about 3,000 years

Page 622

← King Tutankhamun's Mummy Rests Beneath His Golden Coffin Image

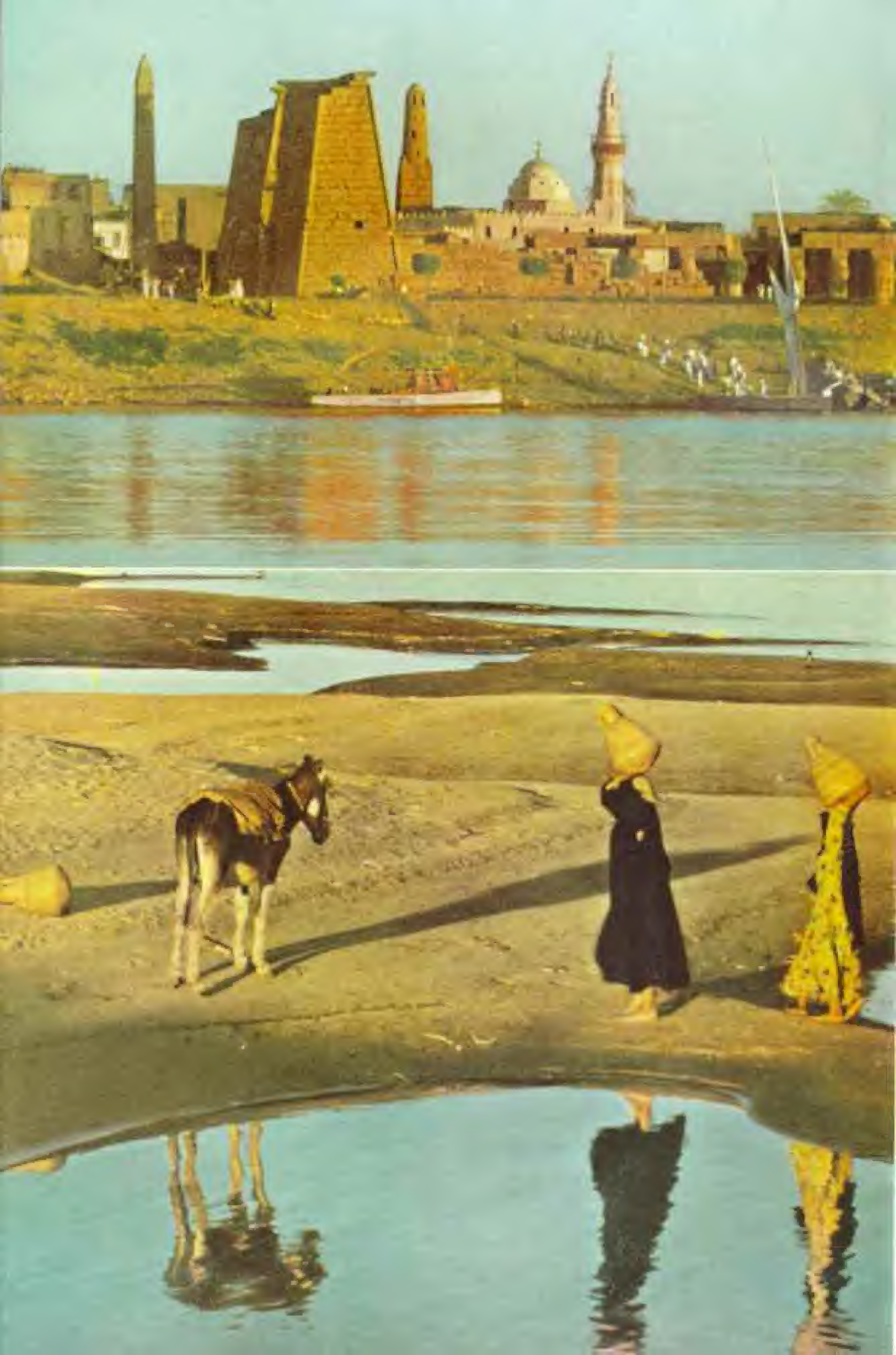
Happily preserved from grave robbers, the quartzite sarcophagus was discovered in 1925 in the Valley of the Tombs of the Kings at Thebes. The lifelike case is one of three, each successively larger, that fitted like nests.

As symbols of his rule, the King carries on his forehead the cobra goddess Uto of Lower Egypt and the vulture goddess Nekhbet of Upper Egypt. The striped linen cloth covering the head was worn only by pharaohs.

Crook and scourge, emblems of Osiris, god of the dead, rest in the hands of the image. Osiris himself appears on the wall in mummy wrappings, his usual costume. His skin is painted dark, color of the earth, to which he gave fertility.

Tutankhamun (second from left) greets the god. Hieroglyphics identify the two as "Osiris, First of the Westerners [the dead], the Great God" and "the Good God, Lord of Two Lands, Lord of Diadems, Tutankhamun, given life forever and ever."

The King's *ka*, or soul (center), carries the *ankh*, symbol of life. Bull overhead gives one of the King's titles, Mighty Bull. Nut, goddess of the sky and mother of Osiris, stands at right.



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Luxor Temple Has Endured 3,350 Years

Egypt ruled most of the known world when Amenhotep III dedicated the temple to the god Amun. Enlarging it, later kings advertised their glories.

Here Ramses II magnified his doubtful exploits in battle. Two mighty pylons on the left show the King smiting the Hittites, a "victory" from which he barely escaped alive. Ramses erected two granite obelisks. One still stands on the left; Paris has the other.

Ruins beside the huge columns at right show details of the festival of Southern Ipet, at which priests from Karnak floated the cult statue of Amun up the Nile to dwell at Luxor for 24 days.

Christians during the 4th century established a church in the temple. Private homes nestled among the columns as late as the last century. Today the dome and minaret of a mosque dominate the great Court of Ramses.

← Timeless Nile Presents an Age-old Scene

Egyptian women carry jars of water on heads. Qurna, their village, is built among tombs, many inhabited for centuries.

ago, the delightful odyssey of Wenamun, who journeyed to Lebanon for cedar, has been preserved on papyrus found by villagers in a pottery jar.

Wenamun, a functionary of the Temple of Amun at Karnak, was assigned the task of bringing cedar to Thebes for the periodic reconstruction of the god's ceremonial barge.

Sailing to Byblos (Jubeil), near the modern city of Beirut, Wenamun asked Zakar-Baal, the Prince of Byblos, for the needed cedar. Since Egypt by then had lost considerable prestige, the Prince refused to receive Wenamun and for 29 days repeated the order, "Get thee out of my harbor!"

But Wenamun had with him what would be considered today an "ace in the hole." It was an image of the god called "Amun of the Road," whose power threw one of Zakar-Baal's young nobles into a frenzy, during which the youth revealed to his fellow citizens that the revered god's likeness was in the city.

Next day the Prince sent for the Egyptian and reluctantly offered to cut the cedar. Wenamun declared that Amun-Re would bestow health and long life upon the Prince if the god's bidding were done.

Finally a fair deal was worked out: Wenamun offered gold, silver, and Egyptian linen, which were in high demand in Byblos. The Prince, for his part, sent 300 woodcutters and 300 oxen to fell the cedar and drag the logs to the port.

After recording further vicissitudes, the papyrus recounting Wenamun's adventures breaks off. It is known that he made his way back to the Nile, but there is no record that he successfully fulfilled his mission to deliver cedar to Egypt.

Aerial Photos Provide a Clue

While work on the boat excavation was still in progress, I received word of another sensational discovery.

At Saqqara, 10 miles south of Giza, the curator had noted a ground pattern on aerial photographs not very different from what he deduced the Djoser pyramid complex might have looked like if covered with sand. In the 1951-52 digging season the Egyptian Department of Antiquities decided to solve the mystery and called upon Mr. Zakaria Ghoneim to do the job.

Two weeks of excavating revealed a part of a great enclosure wall, not as well built as that around the courtyard of the Djoser pyramid, but resembling it. As the work proceeded, several mummies and monuments of later periods were found. Transferring his diggers to the middle of the enclosure, Ghoneim found a structure that appeared to be a step pyramid which had not been completed.

One day, when I was there, the workers found a shaft leading to the interior of the new ruin. This is the kind of discovery that shakes an archeologist with excitement. It is akin to a detective's discovery of a clue that will clinch the solution of a mystery.

Slowly the workmen penetrated the unfinished pyramid (page 640). This was the overture to enthralling discoveries at Saqqara spanning two years, during which I found satisfying relaxation there on frequent visits. A telephone call from Ghoneim usually meant that he had stumbled on something new, and I always took the first opportunity to go and see the find. Expectations were great.

(Continued on page 635)

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Anubis, Watchdog of the Dead, Guards → the Tomb of Queen Nefertari

Bride of Rameses II, Nefertari was buried in the Valley of the Tombs of the Queens near Luxor. Everlasting happiness was promised to her by magical formulas on the walls.

Here Isis, sister-wife of Osiris, extends her hands before the *shen*, symbol of eternity. Hieroglyphics proclaim "a recitation by the Great Isis . . . 'I have prepared for thee [the Queen] a place in the underworld.'"

The goddess Selket guards the shrine with the deadly sting of a scorpion worn in place of a crown. Golden stars spangle the blue roof.

Exposed to dampness after 32 centuries, the paintings may soon crumble. An artist preserves the scene.

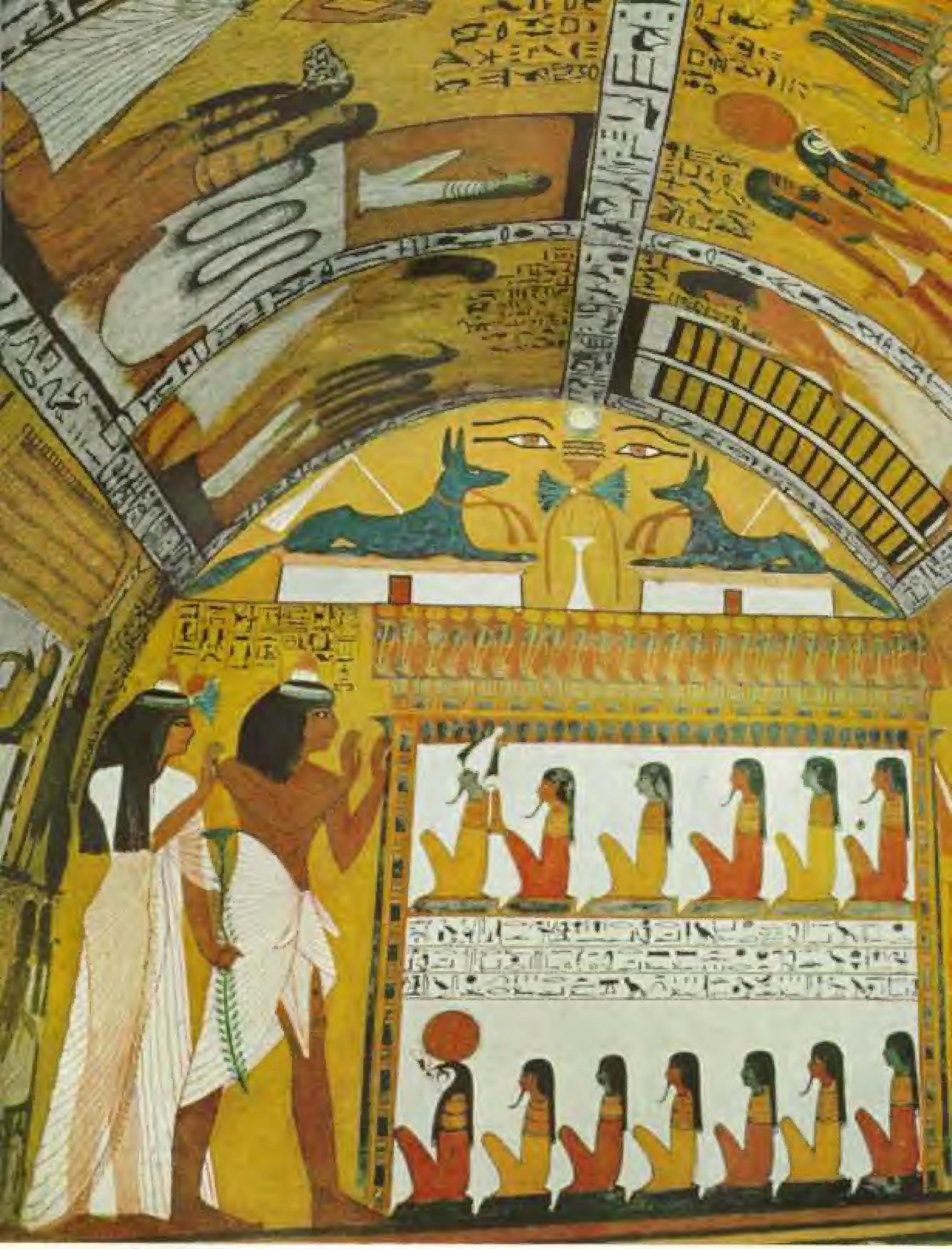
Rameses I Stands for Judgment Before the Throne of Osiris →

Here Osiris appears in green skin, sign of life's renewal in spring. He wears the *atef*, a crown bearing ostrich feathers, the badge of Maat, goddess of truth. A curl at the end of Osiris' beard indicates divinity. A manifestation of the child Horus, Osiris' son by Isis, stands at the god's knee.

Fully grown and falcon-headed, Horus introduces Rameses, who wears the royal headdress. As the mythical ancestor of the pharaohs, Horus displays Upper Egypt's white crown and Lower Egypt's red diadem. The deities Atum and Neith trail Rameses. On the far wall, four minor gods in mummy cloths represent the underworld.

A young Egyptian talking to two American girls perches on the Pharaoh's pink granite sarcophagus in the Valley of the Tombs of the Kings.

Kodachromes by National Geographic Photographer David S. Boyer



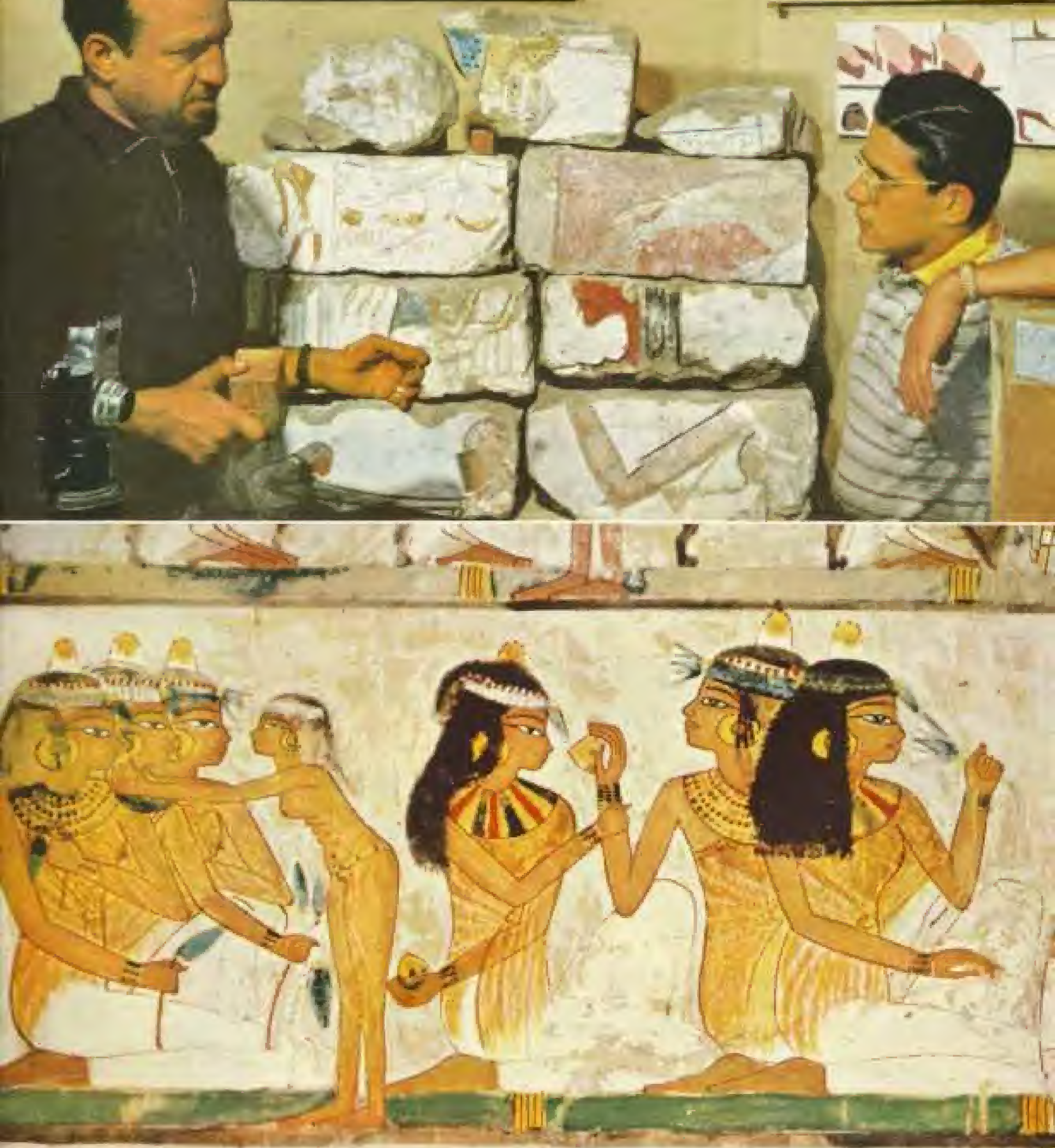
A Commoner and Wife (Left) Mingle with the Gods, Once the Right of Kings Alone

Sennedjem, a servant of the New Kingdom necropolis at Deir el Medina, watches squatting godlings play follow-the-leader behind crowned Osiris (upper panel) and falcon-headed Horus, who wears the Aten, or Sun Disk. In the panel overhead, sacred cobras balance solar circles on their heads. Above, twin jackals of Anubis sprawl on shrines, each faces an *eye*, a symbol of Horus. Vault at left spreads two panels showing Sennedjem adoring gods of the underworld and the ibislike Thoth, divinity of wisdom.

Reproduction by National Geographic Photographer David S. Boyer

German Archeology Student Takes Notes on Funeral Texts Written 31 Centuries Ago

In the large painting Osiris wears the striped atef, with the sun in its base. He is flanked by poles decked with animal skins, symbol of Emewet, a deity of the dead. Wine in bottle on table offers refreshment. To the left, Anubis in semihuman form embalms Sennedjem, just as he mummified his father, the benefactor Osiris, after the latter's murder by his jealous brother Seth. On the vaulted ceiling the mythical phoenix, symbol of resurrection, wears the atef for a sky ride on a solar boat with Horus and Atum.



631

Dancers of 1400 B.C. Double as Musicians

The pleasure-loving Egyptian made life gay with feast and drink, music and dance. He believed that the party would last forever if he pictured it on his tomb. These flute, lute, and harp players adorn the Theban grave of Nakht, an official in the reign of Thutmose IV. Cones of fragrant ointment worn atop wigs melt and scent the dancers' bodies. Wine jar and stylized clusters of grapes supply the banqueters. Bowls hold cosmetics and hair ribbons.

◀ Page 630: Another celebrated art work at the Nakht tomb shows guests in wide collars passing fruit and sniffing lotus blossoms. A young girl serves the party, and a blind harpist entertains.

Upper: These loose stones once walled the temple to Aten at Karnak. King Akhenaten, sometimes called the world's first monotheist, built the shrine to establish the worship of the Sun Disk. Narrow panel at right shows Egyptians bowing to Akhenaten; after his death they branded him a heretic and destroyed his temple. Bearded Dr. Mohammed Hammad, Director of Works at Karnak, here discusses restoration of the temple with Aly Ahmed Fakhry, an Egyptology student.

Feluccn Taxis Ply the Mighty Nile...

When in days beyond memory the rains of northern Africa began to fail, hunters settled along the riverine jungle of the Nile. There they remained, caught in the vise of desert waste, to wrest a living from a narrow ribbon of black loam.

Egyptians observed that each July the Nile rose from its bed in surging tide and swept the land. Receding, it left a treasure of fertilizing mud. Before history began, the farmer learned to irrigate. Three crops a year were possible.

In the months before the flood the earth lay scorched, panting and half dead. When the Nile did rise again, it was like a rebirth. From this

←Pigeons work for Egyptian landowners. This bird supplies guano for a vegetable garden.

633

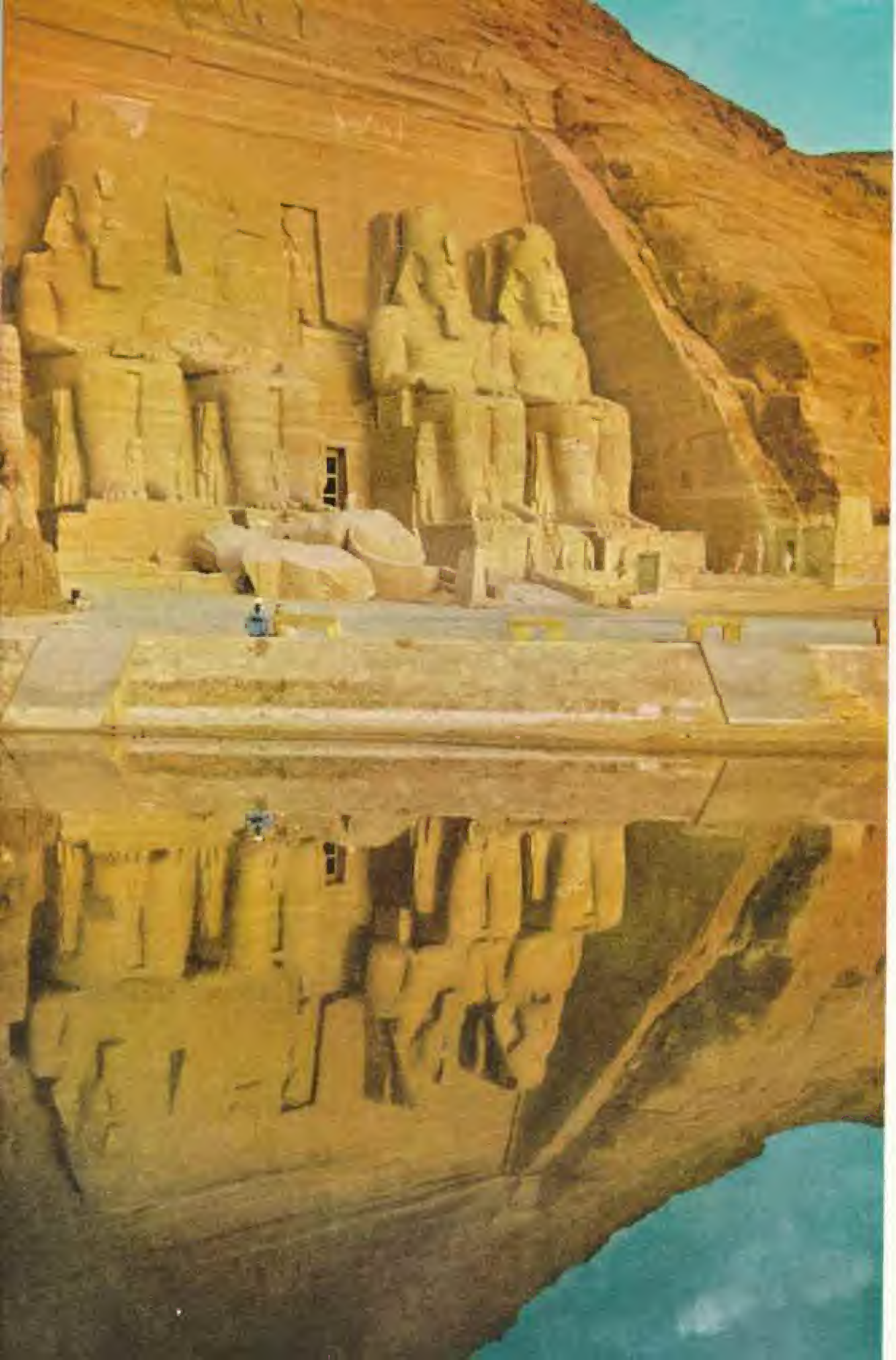
...Giver of Land and Life to Egypt

yearly miracle the Egyptian took hope that there would be resurrection for him, too. And he thanked his gods, especially Isis, whose tears for the dead Osiris caused the river to swell. Annual ceremonies by the priests reminded the river to do its duty.

Today a more scientific solution, the dam at Aswan, ensures the land of continuing water.

These boatmen row from Luxor toward Qurna on a day too calm for sails. A companion vessel furls its canvas. Automobiles wait on the sandspit to transport visitors to Queen Hatshepsut's temple of Deir el Bahri and to the Valley of the Kings.

→ A Luxor farmer shinnies down a palm with a wild pigeon, caught in a wicker trap.



Finally the diggers reached the sarcophagus, a beautiful, unusually large one made of alabaster. Unlike most royal coffins, which have lids on top, this one had been sealed from one end (page 642). The sarcophagus reposed in a deep chamber, which had been carved out of solid rock, and the pyramid had been superimposed on the rock.

As I descended into the chamber for the first time, the discovery stood forth as a rare achievement, although the marred condition of the shaft indicated that thieves must already have pilfered the tomb centuries earlier.

It was my private belief that, since the pyramid obviously had been entered, perhaps shortly after the death of the king, the grave robbers would not have left the beautiful sarcophagus untouched. Fragments of late papyri in the shaft showed that the pyramid might have been re-used as a burial ground.

The great day for the opening came—and the sarcophagus was indeed found empty. The question arose: Why was it sealed as if it had never been disturbed? Is there any hope of finding a real burial somewhere else among the vaults beneath that pyramid?

Archeology gives a possible answer, for this is not the first time sealed but empty royal sarcophagi have been found. The best-known example occurred at the unfinished pyramid at Zawiyet el Aryan, where the Department of Antiquities at the beginning of the century found a granite coffin sealed but vacant.

Some Egyptologists think that the sarcophagus which Ghoneim uncovered may have been intended for the *ka*, or soul, and that the real burial may yet be found under the pyramid. To this theory, too, Egyptology lends credence, for there are examples of kings who had more than one pyramid or more than one tomb. All concerned are awaiting the final answer and conclusive identification of the occupant of the pyramid. Most archeologists believe that the owner was a previously unknown monarch of the IIId Dynasty, Sekhemkhet, perhaps the grandson of Djoser.

The Step Pyramid of Djoser (circa 2740 B.C.) undoubtedly was the first attempt of the ancient Egyptians to make a royal tomb in the shape of a pyramid. It took them about a hundred years to perfect the form.

Step Pyramid Sets Style

During that period several pyramids were built after the pattern of Djoser's, all of them stepped in shape. Architects as well as archeologists are eager for completion of the excavation of the newly discovered Saqqara pyramid to understand the progress it reveals in construction of these monuments.

Ghoneim has found numerous galleries, or niches, along the passages of the pyramid. In them some very worthwhile ancient objects, including vases and jewelry, have been obtained.

Comparison of the interior of this pyramid with that of Djoser suggests that we can expect to find many other passages and galleries. No one knows what valuables may come to light. We must leave the last word to the basket and the spade.

When I heard about the great discoveries of Dr. Ahmed Fakhry in the area of Dahshur, where the pyramids of the father of Khufu stand, I hurried one afternoon to the site. Unfortunately I arrived too late. The day's work was over; the excavator and his staff had left. Only guards remained on the scene.

I observed the diggings with no difficulty. But when a companion wanted to take a photograph, one of the guards protested. The Egyptian Government in those days insisted on providing me with an armed escort on all my expeditions. The protest of the excavation guard did not disturb me, but one of the police officers detailed to me immediately intervened on behalf of my photographer friend.

The guard's manner became more vehement. He protested by swinging his cane in the face of the policeman and told him:

Page 634

← Nile's Mirror Doubles the Grandeur of the Colossi of Rameses at Abu Simbil

To hew a temple out of solid rock, ancient masons journeyed beyond the First Cataract into the Nubian wilderness. They smoothed the face of a cliff into a pylon, the traditional entrance to an Egyptian temple, and sculptured four 65-foot figures of their king, Rameses II (page 630). Lesser members of the royal family, both adults and children, were represented as pygmies at the feet of a giant. Each colossus wore the double crown of Egypt; none now preserves it entire.

Sculptured falcons, sacred to Horus, perch on the terrace. The god himself, bearing the solar disk, stands above the temple door. This entrance throws the sun's first rays 160 feet back into the sanctuary, as it was designed to do 33 centuries ago.

Originally the temple stood high above the Nile. Water, backed up by the Aswan Dam, draws near today. If more dams are built, Rameses' monument may be flooded.

Lateen Sails, a Trademark of the Arabs, Send Feluccas Skimming Across the Nile

Ancient Egyptians used the upper Nile as a passageway to the Sudan, source of ivory and gold. Each evening the children on right pen goats in the brush corral. Date palms and other trees line the banks.

Barren, Eroded Mesas of the Nubian Desert Crowd the River's Green Shores

Broad waters near Abu Simbil show the effect of Aswan Dam 180 miles downstream. Riverside villages and ancient temples have been flooded since 1912. Sand blown in from the desert forms the beach.

"The orders of Dr. Fakhry, who is my boss, are that nobody will take photographs. You can use force if you like, but to take pictures or to enter the temple must be done over my dead body."

When this was translated to me, I saluted the man who carried out his orders, even when surrounded by police officers, and left.

Two days later Dr. Fakhry called at the chancery and invited me to go with him to see the temple. Our friendship ripened from that day. I cannot recall how many Saturday afternoons thereafter I spent with him at Dahshur, and on each occasion something new had been brought to the surface.

Dig Casts Light on Ancient Genius

The excavations at Dahshur proved to be of immense importance. Why? Here was an exciting exploration into the great IVth Dynasty, 2650-2500 B.C., when Egyptians were capitalizing on the artistic innovations of Imhotep, a "universal man" of his period, physician and sage, architect and practitioner of priestly magic.

The work at Dahshur put together some of the puzzles of that era to make a more comprehensible story.

It was Imhotep who built for his king, Djoser, the Step Pyramid at Saqqara. Before that time the kings of Egypt built their royal tombs as mastabas—large rectangular buildings of mud brick. Young Imhotep decided to build of stone. His choice resulted in the amazing monuments of the IIId Dynasty and set the pattern for construction in Egypt for centuries thereafter.

Imhotep built a stone mastaba and kept adding successively smaller mastabas, one on top of another, until the step pyramid was perfected. The genius of the man went far beyond this structure, however, for he built many monuments new to Egyptian architecture around Djoser's pyramid complex.

Imhotep's talents far outran his times. Doubtless he fully deserved the honors bestowed upon him by the Egyptians, who later deified him. Even the Greeks revered Imhotep: they recognized in him the attributes of their own god of medicine and healing, Asklepios.

The fact that Djoser was aware of Imhotep's brilliance, and encouraged him by providing men and materials, suggests the stature of Djoser. For a hundred years Egypt lived under the inspired influence of these two, and their traditions persisted long after.

Then Egypt came again to a turning point. Another great and able man founded a new royal house, opening the door on the glittering IVth Dynasty. He was Snefru, and with his reign we find the first attempt to build a real pyramid from the start, with straight lines from the four corners to the top.

At that time Egypt's capital, Memphis, extended for miles along the Nile Valley, and the whole western plateau was its necropolis. Snefru decided to build his monuments at a place about five miles south of the step pyramids at Saqqara, in the area we know as Dahshur.

Two stone pyramids dominate the landscape, one of them of most peculiar outline. This is the famous Bent Pyramid, so called because the lines of construction from the four corners slant partway up at an angle of 54° and then angle at 43° to the top (page 615). About a mile to the north stands the first true pyramid, also built by Snefru (page 648). Farther away three brick pyramids, once covered with limestone, are spaced at the edge of the cultivated valley.

The site was known to contain monuments and tombs preserving the work of kings, and in 1894-95 the Department of Antiquities worked in the brick pyramid area. Here excavators found some of the most beautiful jewelry of ancient Egypt yet discovered. These precious objects, which belonged to princesses who lived some 3,800 years ago, today adorn several cases in the Egyptian Museum in Cairo and have become famous the world over.

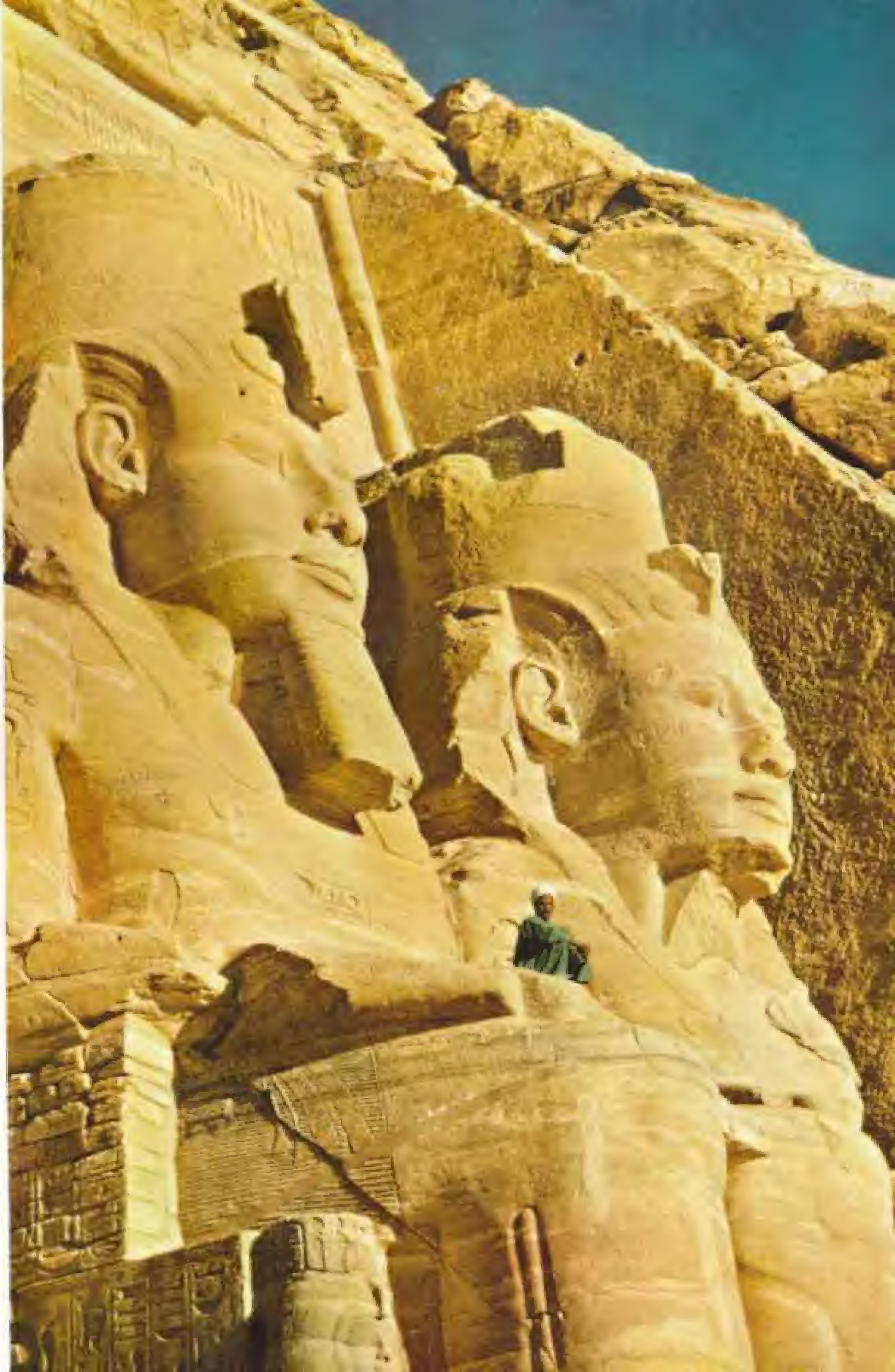
Page 630

Rameses' Great Stone Faces Stare into Eternity →

For centuries the colossi lay half buried beneath sand drifts; they were rediscovered in 1512 and cleared several times. Today a wall on top of the cliff holds back the Libyan Desert.

Seti II built the stonework (left) to support his ancestor's arm. Modern concrete patches the cracks. But little has been done to restore Pharaoh's beard (right), part of his arm, and the peaks of his crowns (page 634).

Rameses II carved his name in cartouches on each chest and right arm. Greek mercenaries of 590 B.C. added their signatures, subsequent visitors did the same. The guard on the royal hand stands by to prevent further desecration.



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Rolling Back the Desert, Diggers Open the Newly Discovered Step Pyramid at Saqqara

Built block on block so that the sides rose in giant stairs, the step pyramids preceded the Bent Pyramid (second from right) and true pyramid (right). This burial monument is believed to have belonged to King Sekhemkhet. It was found in 1937 by Zakaria Ghoneim of the Egyptian Department of Antiquities. His excavations yielded gold jewelry, alabaster dishes, ivory tablet, tweezers, and ritual sarcophagus (pages 636, 642).

In 1924 the famous archeologist Gustave Jéquier tried for a short time to excavate around the Bent Pyramid, but the work was left unfinished. He investigated the causeway and established the existence of some surrounding walls. Jéquier also noted several slight elevations which, he felt, might conceal the remains of buildings.

In 1945 the Department of Antiquities began a new study of the area, confining its work to the interior of the Bent Pyramid (page 644). This effort had an important result: discovery of Snefru's name on some stone blocks, establishing the pyramid as his. It also threw new light on why the pyramid was "bent."

Apparently the builders planned too steep an angle at first. Partway through the undertaking the chief architect discovered that the interior would not support the weight of so high a true pyramid and changed the slope of the sides to give a lower silhouette.

My friend Ahmed Fakhry began his investigations in a different direction. His plan was to work outside the pyramid, searching for the various temples which he was sure must have existed.

In 1951 he excavated to the east of the Bent Pyramid and found near it a funerary temple. Altars were still standing in the shrine. Charcoal remained in a vase on one altar. It was perhaps left behind by the last priest as he burned incense in the name of the ancient gods for the soul of the pharaoh.

The sands of the desert considerately buried the altars, preserving traces of colors painted on them, to be revealed after the passage of centuries by a descendant of the ancient Egyptians who still probes untiringly into the history of his ancestors.

When I asked Dr. Fakhry how he decided where to dig, he replied: "Well, Mr. Ambassador, in determining the point to excavate, it's about nine-tenths luck and one-tenth knowledge of the customs of the ancient peoples."

I don't know what part luck played in the outcome. But I do know that Dr. Fakhry is modest about his knowledge. And he knew, of course, that the pyramid temple invariably was built at the foot of such a monument's eastern slope.

Anyway, he assembled his crew one day and told his foremen that he was about to dig for a valley temple. He pointed to a spot where the workers were to start.

Remarkable Find by Dr. Fakhry

"It may take two weeks, a month, or maybe more before we find anything," the Egyptologist told his assistant, "and some people believe there is nothing to find. But if we don't dig, we shall never know."

That was at 7 a.m. In one hour and twenty minutes the top of a stone wall was exposed. When the workers stopped for breakfast, Dr. Fakhry sat on top of the wall reading inscriptions on stone fragments and finding it difficult to believe the evidence of his own eyes.

Since that memorable day excavators have uncovered hundreds of blocks, large and small, with inscriptions and reliefs; statues and stelæ, stone vases, and other priceless antiquities of incredible variety. Some inscribed walls of the temple remained just as their builders left them.

No boy with a new toy was ever happier than Ahmed Fakhry. He confided to me that he had never hoped for so rich a find. As a result of the orderly survey he had made before digging, it was his conclusion that there would be no walls standing and that the temple would contain no reliefs.

"Why?" I asked.

"This was based on my previous excavations near the pyramid, high on the plateau, more than half a mile away. I found that stonecutters dating from Roman times to only a hundred years ago had helped themselves to stones from the area of the pyramid itself. I felt they would not have done so unless they had already exhausted the much more accessible supply near the valley."

Especially vividly do I remember the day when Dr. Fakhry sent word of uncovering the first statue of Snefru still retaining its color, and with a crown on its head. I went to Dahshur immediately.

Dr. Fakhry happily led me to his find. I offered my heartiest congratulations and informed him that his discovery happened to fall on my birthday, whereupon it was decided to have a party at the end of the workday in honor of both occasions.

The Dahshur excavations were important not only for the temples and wealth of antiquities unearthed, but also for the discovery that the Egyptians in that early period decorated their temple walls with reliefs not surpassed for quality even in later eras (page 645). Thus they recorded ceremonies and festivals which were handed down even into Roman times. Such was the force of tradition in the Nile Valley, a force strongly felt even to this day.

The Bent Pyramid has always intrigued me. Obviously it was one of man's first efforts to achieve the true pyramid. A short distance to the north the first perfect pyramid was later completed (page 648).

From their Dahshur experience architects learned the most suitable angle for the outer slopes of pyramids: about 51°. The outgrowth of this pioneering can be seen in one of the wonders of the world, the Great Pyramid of Giza, built for Snefru's son, Khufu.

Some 70 Pyramids Along Nile

The sons of Snefru were no idle princes. Most of those whose names have come down to us were active in the administration of the country. Brothers and nephews of Khufu, the most famous being Hemiunu, built Khufu's Great Pyramid at Giza. The tomb of Hemiunu lies west of the Great Pyramid.

In all, more than 70 pyramids have been located along the Nile. They extend for 50 miles from Abu Rauwash in the north to Maidum in the south, with a few in the Faiyum Province to the west. Many are heaps of ruins. Some have not been excavated or even carefully examined.

One of the latter which I should like to see excavated is the pyramid at Seila, in Faiyum. I remember the hot day in mid-

King Sekhemkhet's Sarcophagus Slides Open After 4,600 Years

Digging into the step pyramid at Saqqara, Mr. Zakaria Ghoneim (left) brought to light this alabaster coffin in a chamber carved from the living rock. On its top he found desiccated leaves of a shrub associated with the ancient Sed ceremonies.

During the Sed festival the King dressed in archaic costume, retired to dramatically designed galleries, and sat on splendid thrones while participating in ceremonies connected with Osiris. Later he pictured these rites on temple walls.

This is the only Egyptian sarcophagus known to open at the end; others were sealed at the top. Mr. Ghoneim discovered no trace of the King's mummy, but he hopes to find it in another chamber.

◆ Alabaster wine jar, vases, and bowl belonged to King Djoser. Some 30,000 stone vessels like these were buried with him.

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Photographer Lloyd K. Town

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Within the Bent Pyramid: Looking from Floor to Ceiling of the Lower Chamber

King Snefru's ritual-minded architects built two entrances and two burial vaults. This room, cluttered with modern scaffolding, appears to have been the false tomb. The presumed sepulcher lies at the end of a labyrinth of passages guarded with pitfalls intended to drop any unwary intruder to his death. Notwithstanding, thieves found a way in. The first scientific examination (1839) revealed no treasury (pages 615, 658).

Cut in Stone for Eternity to Read: King Snefru's Trust Fund

To ensure their memory, Egyptian monarchs bequeathed rich estates for support of temples and priests. These enterprises, exempted from many obligations, deprived succeeding pharaohs of revenues and helped to undermine the national economy. Dr. Ahmed Fakhry, excavator of the Valley Temple of the Bent Pyramid, translates this endowment as the author listens. Each graven figure represents a plantation.

summer when I went to inspect it. For more than three miles my friends and I walked in the sand until, finally, horses and donkeys were brought to help us move faster.

I circled the monument many times, wondering who built it, why that desert spot was chosen, and what antiquities might lie beneath it. Because it resembles the step pyramids, I believe that it must be dated in the IIId Dynasty.

But where are the tombs of the court officials, which almost always are found around the pyramid complex? Answers must await investigation by experts, who will enjoy, I am sure, the same tingle of challenge I felt in visiting that remote and desolate site, where only the top of the pyramid peeks above the desert sand.

Another puzzling structure that particularly attracted me and that cries out for further study is the pyramid at Maidum. What remains of this proud monument, southernmost pyramid of the Memphite necropolis, has the appearance of a tower standing in the desert.

Although it was built as a step pyramid, the terraced sides of the Maidum monument were filled in with masonry, giving it the appearance of a real pyramid. Many of the original stones have been removed. The interior is very simple.

The identity of its builder is uncertain, but future research may reveal his name. Once it was thought likely to be one of the two pyramids of Snefru. After the excavations at Dahshur located Snefru's two pyramids there, that theory of ownership was abandoned. It is reasonable to believe that the monument was built prior to Snefru's succession to the throne.

A belief that I entertain, with the cautious support of Dr. Fakhry, whose Dahshur discoveries made him all the more interested in Maidum, is that the construction may have been started by King Hu (called Huni in some texts), but was completed by Snefru.

Daraw Market in Southern Egypt Auctions Camels Fresh from Sudan Grasslands

No Egyptian tomb inscription mentions camels, but Genesis (12: 16) records a pharaoh's gift of the animals to Abraham. Arabs, who invaded Egypt A.D. 640, popularized the beast. These buyers inspect hoofs and teeth.

Although much has been accomplished at Maidum in the past, more work will be necessary to be sure of its builder's name.

My long-standing interest in Alexander the Great led me to one of Egypt's most interesting sites. I had closely studied the career of the Greek conqueror and had visited many of the relics of his empire in Egypt. Frequently, when Dr. Fakhry and I were discussing that era, he suggested that we make a trip to the Oasis of Siwa (Wahat Siwa).

This oasis, famous as the seat of the oracle of Jupiter-Amun, lies about 170 miles south of Matruh on the Mediterranean coast (page 650). On the flight from Cairo to Matruh Dr. Fakhry and I discussed the great conqueror, who took time to travel deep into the Western Desert of Egypt to consult this oracle.

Alexander was a pupil of Aristotle, and one of the best educated men of his age. He respected alike the history of the ancient East and the wisdom of Egypt. Of the oracles scattered about the then-civilized world, that of Amun had a reputation as one of the most reliable.

From Matruh we took the desert road to Siwa, traveling in eight hours the distance that Alexander the Great perhaps took as many days to cover. We stopped to inspect ancient cisterns, built even before the Greeks conquered Egypt and still in use by the Bedouin. Although it was summer, we did not suffer from the heat.

Secret Passage Solves a Mystery

The *maamour*, or police official, of the oasis and members of his staff were awaiting us a few miles outside Siwa. After a profuse welcome, he took us to the Government rest house and provided the warm and lavish hospitality traditional in that part of the world.

Our first goal, of course, was the site of the ancient oracle. There my friend Dr. Fakhry was at home again among his favorite monuments. He first visited Siwa in 1938, when he cleared parts of the temple.

We inspected the sanctuary and the secret passage which was used by the priests when they spoke the words worshipers took to be utterances of the gods. The temple was constructed with a great wall paralleling an inner chamber.

But visitors were unaware of the passage between the walls. It led to three niches and, near the ceiling, to two small entrances to crypts. The stone between these niches and the inner chamber of the temple was thin enough for priests stationed in the corridor to hear the voices within the temple, although none of the worshipers could know they were so near at hand.

When a priest thus hidden spoke, his words must have sounded as if coming from afar, and all inside the temple, except the priests in the know, must have believed it was the voice of the god.

Communicating with the Oracle

Petitioners at the oracle of Amun received answers to their pleas in one of three ways:

First, while the god's image was borne around the temple in a boat, questions were asked. A slight movement of the boat indicated a reply, which was then interpreted by a priest.

Second, the petitioner wrote down two questions, each of which required a simple yes or no answer. A typical pair: "Is Seti guilty of theft?" "Is Seti innocent?" Possessed by the spirit of the god, a priest picked the "right" answer.

Third was the direct pronouncement of the god, emanating from a priest in one of the secret crypts.

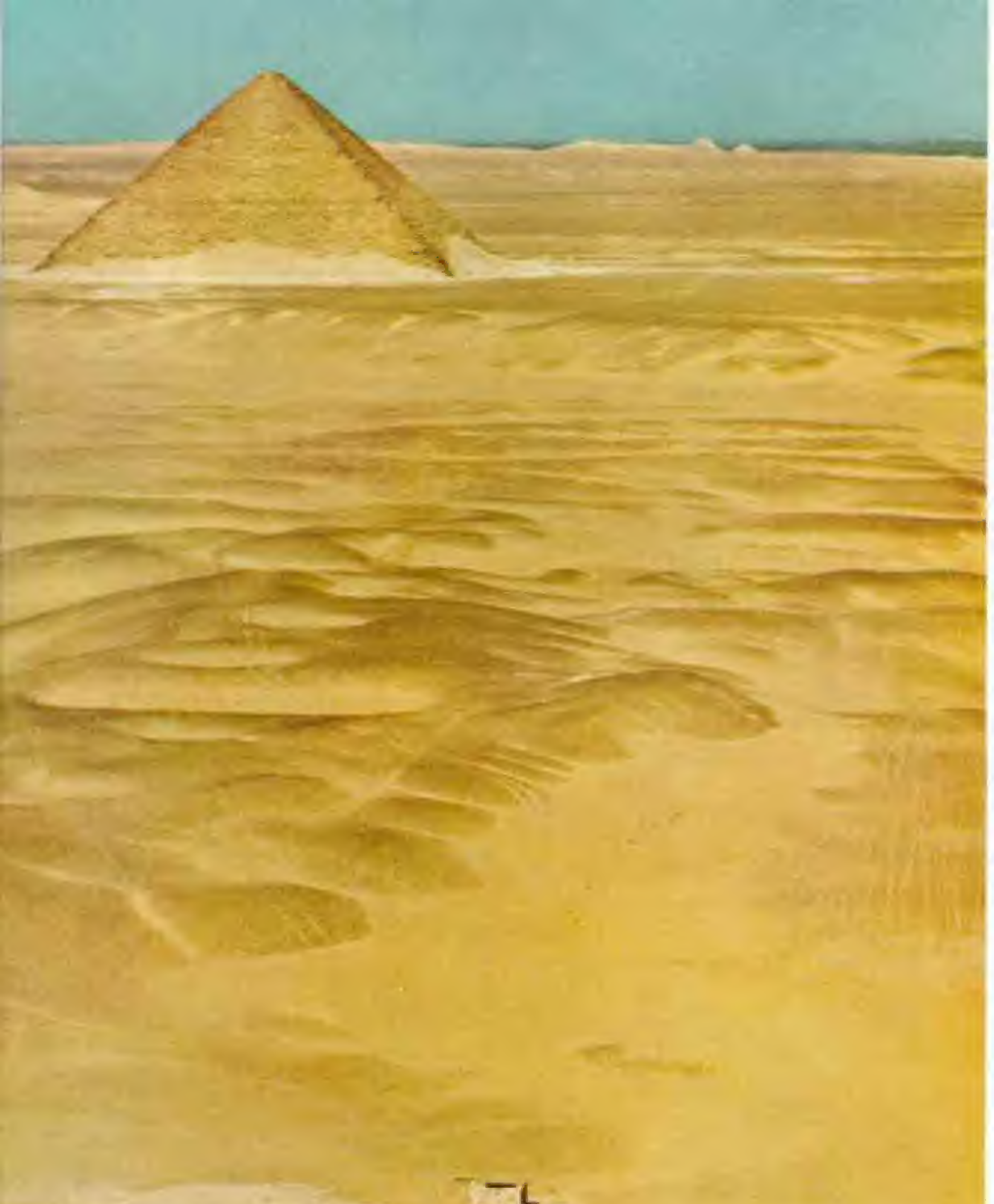
We saw the spot where Alexander must have stood, watching the procession of the oracle. The priests carried the boat of the god on their shoulders, preceded and followed by girls dancing, singing, and playing musical instruments. The procession circled inside the temple until at last the high priest gave the sign that the heart of the god was satisfied.

Alexander spoke privately with the god Amun, a priest being intermediary. Afterwards the King's followers asked Alexander many questions. The Macedonian replied that he had heard nothing which did not please his heart. He declined, however, to divulge the news he had received from the oracle.

Alexander later wrote to his mother, Olympias, that he had received secret instructions from the oracle and would inform her when next he saw her. But the son never saw his mother again, and the secret of Amun's words went with the conqueror to his grave.

We stayed two days in the Oasis of Siwa, seeing most of its monuments, including a painted tomb that I consider the finest work of art yet found in the Western Desert.

This tomb belonged to a certain Siamun,



✦ Jeep Trails Weave Sand Patterns Beneath the First True Pyramid

Learning from the Bent Pyramid experiment, King Sneferu's architects achieved the Northern Pyramid at Dahshur. This 325-foot tomb immediately preceded the monuments at Giza (above). Brick house in foreground serves workmen excavating the Valley Temple of Sneferu's Bent Pyramid (page 615). Dump trucks (left) will run on steel rails lying near by. Nile Valley shows green on the horizon.

✦ Khufre Carved His Image in Stone Beneath His Pyramid at Giza

The Sphinx was 1,200 years old when a young prince sleeping beside it dreamed that the statue told him, "Uncover me when you are king." Later, becoming Thutmose IV, the dreamer did clear away the sands. A tablet on the monument records the incident. In this view, a temple stone hides the Sphinx's lion body.

✦With this sign, figurine salesmen at Thebes give traveler's fair warning they are buying imitations.

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A. F. Kuykendall

Oracle of Amun Spoke to Alexander the Great from the Oasis of Siwa

In 331 B.C., before invading Persia, Alexander longed to know his future. To consult the Siwa oracle, according to a contemporary historian, the emperor journeyed across the Libyan Desert, following two ravens sent as guides by the god Amun. Speaking through his priests, the oracle imparted secrets that the Macedonian never revealed (page 647). Rags of Siwa dates lie in the courtyard of the acropolis.

and its examination was completed by Dr. Fakhry in January, 1941. Regrettably some of the walls are disfigured, apparently by soldiers during World War II, who removed chunks of plaster as souvenirs.

The sheiks of Siwa invited me to dinner in one of their beautiful gardens. For the occasion they cut palm trees for a shelter, latticed with fronds and interspersed with fruit and flowers.

Great platters of whole roasted lambs and dozens of tasty dishes were set before us. It was an unforgettable experience—dining in the garden by lantern light among those hospitable, conservative people who are proud of traditions passed down to them through many generations.

As I left Egypt, archeologists again were probing selected spots around the world's most massive historical monuments. From our own country, the University of Pennsylvania had a party in the field. The winter digging season brought out a larger force of singing sandmovers than I had seen for years.

If there were diggers and funds enough, the Memphite necropolis alone would yield the answers to hundreds of questions which puzzle Egyptologists and might, perhaps, alter history already written.

The green valley and the sprawling delta doubtless contain thousands of buried monuments. Many recent finds of value have resulted from the digging of an irrigation canal, or from a farmer's decision to level a knoll in his field.

Again, a patient cultivator of the rich Nile soil, noting luxuriant growth everywhere on his patch save in one spot, where stone nears the surface, digs to remove the stone—and unearths another archeological clue to the wondrous past.

I left Cairo with the thought that what has been done, in terms of what may be done in the future, amounts only to spade pricks on the shimmering surface of ancient Egypt's splendor.

Wealth and Wonder of Northern State Trees

Pines, Oaks, and Maples—Species That Housed American Colonists—Are Favored Arboreal Symbols of the Cooler Tier of States

By William A. Dayton

United States Forest Service

With Paintings by National Geographic Artist Walter A. Weber

LAST spring the little town of Brier Hill, in northern New York, witnessed a forceful affirmation of man's age-old comradeship with trees.

Twenty aroused citizens, backed by the authority of a World War I machine gun (not loaded), gathered to defend an old elm tree. The State's Department of Public Works had ordered the blight-stricken landmark cut down as a hazard.

The cordon of vigilant townspeople held off the State's axmen while a tree surgeon examined the elm and reported that it might be saved. Removal of the tree was postponed—and the minutemen of Brier Hill disbanded.

As it turned out, the diseased tree had to be felled. But the incident dramatized the long-standing bond between man and trees of which George Pope Morris wrote:

> Woodman, spare that tree!
> Touch not a single bough!
> In youth it sheltered me,
> And I'll protect it now.

State Trees, a Tribute of Affection

Since New York set the fashion in 1889, 42 of the 48 States have chosen popular and typical trees as their arboreal emblems.

In this issue the National Geographic Magazine presents the State trees of the northern United States, from Maine and Delaware to Washington and Oregon. Paintings by staff artist Walter A. Weber portray the 17 trees picked by 22 States. One species, sugar maple, is the choice of four States. Four picked pines, and three named the stately American elm as their favorite.

All 17 trees are deeply rooted in the history, tradition, and economies of their States, as well as in their soil.

State legislatures have officially blessed many of the selections; in some instances, trees were picked by forestry groups, garden and women's clubs, or students. In 1907, for instance, 43,586 Illinois school children cast ballots expressing a decisive preference for the stalwart bur oak (page 676).

Several States have supported their choices with the reasons that prompted recognition. A fair example is Pennsylvania's Act No. 233:

> Whereas, the hemlock . . is still today, as it was of old, the tree most typical of the forests of Pennsylvania; and
>
> Whereas, the hemlock yielded to our pioneers the wood from which they wrought their cabin homes; and
>
> Whereas, the hemlock gave its bark to found a mighty industry; and
>
> Whereas, the hemlock everywhere lends kindly shelter and sure haven to the wild things of forests; and
>
> Whereas, the lighted hemlock at Christmastime dazzles the bright eyes of the child with an ungessed hope, and bears to the aged, in its leaves of evergreen, a sign and symbol of faith in immortality; now therefore, Section 1. Be it enacted, &c., That the hemlock tree (*Tsuga canadensis* Linnaeus) be adopted as the State tree of Pennsylvania.

Major timber trees, a liberal endowment of our land, are almost all represented on the list of State trees. In the northern tier of States we find, in addition to Pennsylvania's hemlock, the eastern and western white pines of Maine and Idaho, Oregon's Douglas fir, Montana's ponderosa pine, the red pine of Minnesota, and Washington's western hemlock. The list includes a variety of valuable

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Editor's Note

This article is the first of two presenting, in text and paintings, the State trees of the United States. The second article, describing southern State trees, will appear in a forthcoming issue of the National Geographic Magazine. The trees of Connecticut and Indiana (white oak and tulip tree, respectively) will be portrayed in the article on southern State trees, since they are symbols of States in that group also.

The State tree features will enlarge The Magazine's survey of the plant kingdom, important aspects of which have been presented in the articles: "American Wild Flower Odyssey," May, 1953; "How Fruit Came to America," September, 1951; "Our Vegetable Travelers," August, 1949, and "The World in Your Garden," July, 1947.

William A. Dayton is outstandingly qualified to write about trees. He served for years as Chief of the Division of Dendrology and Range Forage Investigations of the U. S. Forest Service and its principal taxonomist. Walter A. Weber is renowned for his paintings of wildlife, which have enriched the pages of The Magazine for 16 years.

hardwoods, such as oak, maple, and birch.

Long before ancient man populated the New World, many of the trees we know flourished here. The maples, with only trifling modifications, have been around for 60,000,000 years. Ice Age man hunted grotesque beasts among oaks, elms, poplars, and pines.

Trees profoundly affected North America's more recent history. Arctic explorer Vilhjalmur Stefansson once remarked that Eric the Red was America's first real-estate promoter, giving Greenland its name to beguile the natives of his practically treeless Iceland.

What's more, some pundits who delve into the runic mysteries of Icelandic sagas tell us that Eric's doughty sons, Leif and Thorvald, and other Norse mariners sailed to northeastern America largely to seek wood.

Here giant trees grew in fantastic numbers. Before the coming of the white man, forests clothed 822,000,000 acres, or two-fifths of the United States' present area.

Eastern white pine alone (page 656), growing in what seemed to be limitless abundance, served Americans as their principal timber source for three centuries. This tree literally built the American Colonies.

Pines Reserved for Royalty

England, as mother country, took care to secure ample masts and spars for her navy. The royal charter of 1691, granted by William and Mary to the Province of Massachusetts Bay, reserved to Their Majesties all white pine trees with a diameter of at least two feet, except those on premises privately owned. Such trees were blazed later with the King's "broad arrow" brand. Similar reservations were made by Queen Anne, George I, and George II. Restrictions on pine cutting enraged the colonists and helped create the climate that nurtured rebellion.

America's saga of lumbering began beneath the eastern white pine, but Paul Bunyan's ghost strides today among the West's sky-scraping conifers. At the turn of the 20th century lumbermen foresaw the end of white pine giants, shouldered their axes, and moved west. The Douglas fir (page 685) then towered as the world's foremost timber tree.

From Indians early settlers inherited respect, affection, and useful knowledge of America's trees. Indians brewed medicine from bark and leaves. They perpetuated an imaginative tree lore. New Mexico's Pueblo tribesmen believed that man, created in the deep underworld, reached the light by planting and climbing a mighty pine tree that broke through the earth's surface.

Indians taught the early colonists to obtain syrup from the sugar maple's sweetish sap. And the cry "Sap's running!" still quickens young hearts and old when spring thaws snow in the northern woods (page 662).

Trees, surviving for generations in solemn dignity, often give living persons their most tangible link with the past. Visitors to Mount Vernon, Virginia, stroll among hollies and hemlocks planted by George Washington.

Dying Man Writes Will on Birch Bark

Since earliest times trees have been coupled with human drama. In a Massachusetts forest a starving soldier of the French and Indian War found strength to write this message on a piece of birch bark: "My beloved wife, Dorcas, I must die—remember me—my love to Zuriah when she is old enough. I send you two silver spoons, taken from our enemy, as a token of my love, and my duty to my country and king."

Writing a last will and testament on birch bark is, perhaps, unique. But our beneficent trees seem to have limitless possibilities of serving man. Besides providing lumber for general construction, furniture, utility poles, paper pulp, and other such obvious purposes, trees more subtly meet countless needs in our daily lives.*

Chemistry transforms cellulose, the fibrous material that composes the bulk of wood, into thousands of uses. About 67 percent of commercial rayon has a wood base. Modern plastics and synthetic resin glues are cellulose derivatives. Chemists are even trying to find uses for wasted lignin, the cement that binds wood cells together.

Unfortunately our lucrative forests have numerous foes. All things considered, fire probably wreaks the worst havoc. In 1947 some 200,000 blazes swept an area about the size of Indiana. The loss in timber, dwellings, and other structures amounted to more than $55,000,000. This doesn't account for damages hard to calculate in dollars—watershed destruction, soil and wildlife depletion, and wreckage of recreation grounds.

The ravenous appetites of insects cost some $160,000,000 a year. Fungi also rank among

* See "Versatile Wood Waits on Man," by Andrew H. Brown, National Geographic Magazine, July, 1951.

653 National Geographic Photographer William W. Campbell, III

Maryland Boy Scouts Earn Forestry Merit Badges by Identifying Leaves

the direst tree despoilers. The American elm has been hard hit by the Dutch elm and phloem necrosis diseases despite all efforts to check their spread. White pine blister rust has threatened the five-needle pines, and millions of dollars are being spent to eradicate the host plants, currant and gooseberry.

American forests contain nearly two trillion board feet of saw timber, 85 percent of it softwood. The appraised value of all our forest products in 1953 soared to a staggering total, $26,300,000,000.

By comparison, however, only a portion of our virgin woodland remains. Trees cover about three-fourths of the original acreage, but one-fourth of this never will produce good saw timber. Federal, State, and private agencies are educating men to protect the woods against fire, insects, and disease, and to follow proper cutting and planting methods.

With the help of forest rangers throughout the United States, artist Weber found superb specimens of State trees to illustrate this series. He traveled week after week, sketching the trees in their true settings.

Searching for western white pine, Mr. Weber located a virgin stand in the Lochsa River Valley of Idaho's Panhandle. The eastern white pine painted by Mr. Weber lifts its crown skyward near Mount Katahdin, Maine's loftiest peak. His buckeye tree stands in Oxford, Ohio; the festive holly near Dover, Delaware.

Deer Watch Artist at Work

In Wyoming the artist chose a particularly graceful cluster of balsam poplars on Cottonwood Creek below the majestic Tetons. Scarcely moving for hours, he became so much a part of the quiet landscape that three deer came without fear to drink near his easel. He quickly sketched them into his picture (page 688).

As tree symbols, the States have chosen characteristic species beloved in the region. All the trees depicted here are native American plants, few have attained marked success outside the Western Hemisphere.

One notable exception is the northern red oak (page 663), which is being planted increasingly in England. Sturdy *Quercus rubra* apparently grows better on poor soil and in a smoke-laden atmosphere than England's native species, and some of these Americans now stand in Sherwood Forest, storied haunt of Robin Hood.

Red Maple Favors Swamps and Pond Shores

(State Tree of Rhode Island)

THE happily named red maple wears something red all year round.

Winter buds, early flowers, and unfolding leaves, even seeds, glow red as if flushed with joy to be alive. Reddish spring twigs increase in brilliance as the season progresses. And throughout the summer the leafstalks and veins retain a crimson tint.

The tree's autumn foliage, though sometimes orange or yellow, usually turns scarlet or the color of claret. Artist Walter Weber chose this arresting stage to show Rhode Island's favorite tree in a favored position close to water.

Red maple (*Acer rubrum*) is the most widespread of a dozen maple species native to North America. Some "splitters"—dendrologists prone to make fine distinctions between species—add several others.

A medium-size to large tree, it has an average height of from 60 to 80 feet; sometimes it attains 120 feet. The crown is moderately narrow with steeply angled branches. When mature and out in the open, however, the crown may be broad and round. With age the bark may split into elongated scales, but typically is thin, smooth, gray, and not unlike beech bark.

The tree grows biggest along the lower Ohio River and most abundantly along the lower Mississippi. Though it occurs in dry places, it prefers moist or wet soils, beside streams, in swamps, in dense woods floored with damp humus, and similar sites. Habitat accounts for its common names, swamp maple and water maple.

Abounds from Canada to Gulf

Red maple appears widely in eastern North America, from southern Newfoundland and the Maritime Provinces of Canada westward to Lake of the Woods on the Ontario-Manitoba boundary. Southward it reaches through much of Minnesota and Wisconsin to Michigan, Indiana, southern Missouri, easternmost Oklahoma, and Texas. In Florida it extends well southward along the peninsula.

A friendly type, red maple thrives in the company of black and white ash, shellbark hickory, swamp white oak, and tupelo (black gum). The tree characteristically is erect, fast-growing, and easy to transplant: excellent for shade along street borders and on lawns, especially where there is sufficient moisture.

Mixed with silver maple, box elder, and other maples, the wood sells in lumber markets under the name of "soft maple." It contains more sapwood and demands more water than the sugar maple (page 662), which is heavier, harder, and stronger. The light-brown heartwood may be tinged with red. It polishes well.

Cabinetmakers Use Red Maple

Before mahogany became generally available, red maple was perhaps the most desirable wood for the making of colonial furniture.

It is still used for furniture, cabinetwork, interior finish, box stock, veneers, clothes hangers and clothespins, gunstocks, and woodenware. Among hardwoods it ranks next in value to sugar maple for charcoal and for distillation in production of wood acetate.

In Quebec the tree is now and then tapped for sap to make syrup and sugar. The yield is approximately half that of the sugar maple. But even after years of tapping, red maple can provide good saw logs and other wood products.

Men who know and deal in wood refer to its specific gravity. Why? Because it is a measure of wood density, and that quality is of particular importance in determining the worth of wood for given purposes. The specific gravity of red maple is around 0.46. This means that the wood has a slightly better than average density, which makes it suitable for furniture, boxes, and crates, but not for flooring or decking.

If you want to find the specific gravity of any wood, divide the weight of a block by that of an equal volume of distilled water at its greatest density (4° centigrade, or 39.2° Fahrenheit).

Page 683

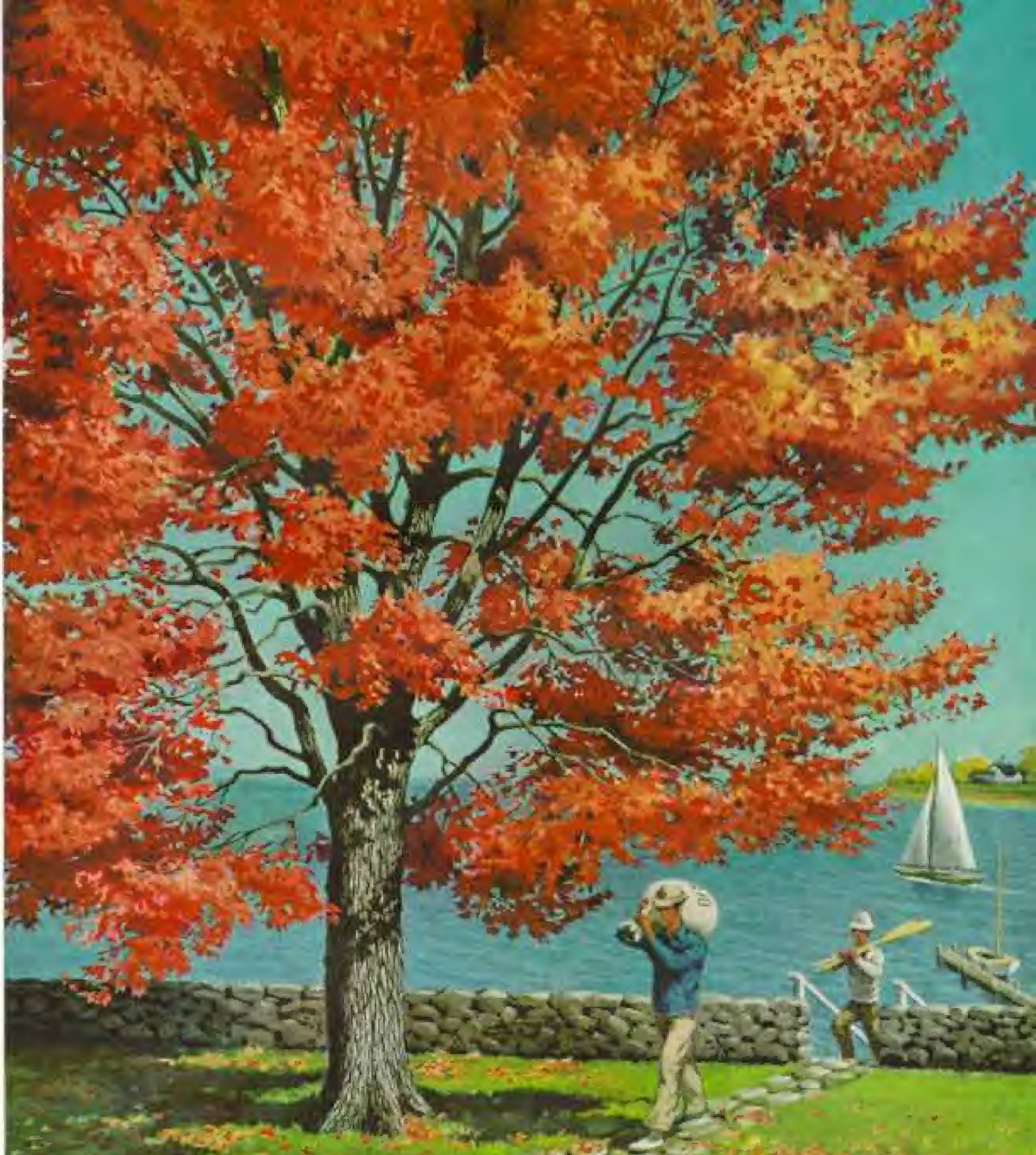
Red Maple Gave the Colonists Wood → for Spinning Wheels and Windsor Chairs

Five-petaled flowers are borne on relatively long stalks (pedicels) and massed in few-flowered clusters on last year's twigs. Male and female flowers may occur on the same tree, though growing separately.

Seed wings droop in pairs from slim stems.

Leaves, relatively small among eastern maples, measure 1½ to 4 inches long (rarely longer). They are three-to-five-lobed and heart-shaped at the base. The familiar maple-leaf pattern is sharply toothed.

Painting by National Geographic Artist Walter A. Weber


WALTER A. NEELD

White Pine, Largest Eastern Conifer

(State Tree of Maine)

FOR 300 years Americans framed their homes, mills, and churches and fitted out ships with lumber provided by stands of white pine that grew thick and clean from Maine to Minnesota.

The eastern white pine (*Pinus strobus*) made Maine the "Pine Tree State" long before officially becoming its arboreal symbol. Though dominant here, the species ranges southward throughout the Appalachian Mountains to northern Georgia. Surprisingly it appears again in southern Mexico.

Pine Flies on Flag

This handsome and useful tree figured on a 17th-century Massachusetts coin and on that Colony's flag, which flew from colonial ships early in the American Revolution.

The white pine is the largest of the American conifers growing east of the Rocky Mountains. At maturity it stands from 90 to 150 feet high, occasionally attaining 200 feet.

Conifers are the cone-bearing trees, which include in addition to true pines, the spruces, firs, hemlocks, redwoods, and larches. The conifers, which characteristically have needle-like leaves and are mostly evergreens, contrast with the deciduous, or leaf-shedding, trees, such as the maples, oaks, beeches, elms, and poplars.

Pinus strobus is the original white pine; the only reason for prefixing "eastern" is to keep it distinct from its important relative, western white pine (*P. monticola*), which is the State tree of Idaho (page 680).

White pine sometimes grows in pure stands, but is more often found with deciduous (hardwood) trees such as maple, birch, and beech, or, depending on locality, with soft-woods such as red, jack, and shortleaf pines.

Up to the beginning of this century, eastern white pine furnished the best known and most highly prized quality timber in North America. The soft, light wood, even-grained and easy to work, was pure gold to the lumber trade. Because of its conformation and color, the tree also has long been popular as an ornamental.

Enemies Take Heavy Toll

The decimations of Paul Bunyan and his colleagues, losses to fire, hurricanes, and disease have by now reduced the original stand, estimated at three-fourths of a trillion board feet, to about 15 billion. Since 1909 white pine blister rust has been a widespread and powerful enemy.

A board foot, the standard unit of timber measurement in the United States, is one foot by one foot by one inch.

Eastern White Pines Masted the Yankee Clipper Ships

Matchmakers, as well as British and American shipbuilders, depended for years on this tree. The species may live 350 to 400 years. Young trees are remarkably tolerant of shade.

←Slender blue-green needles, 3 to 5 inches long, grow in clusters of five. They are soft, except for minutely saw-toothed edges. Leaves remain on the tree two or three years.

Pendulous cones, 4 to 8 inches long, are narrow and cylindric, often curved, with thin, flattened, resin-bearing scales.

Ridged, dark-reddish bark may grow two inches thick.

Painting by National Geographic Artist Walter A. Weber

American Elm, Emblem of Dignity and Grace

(State Tree of Massachusetts, Nebraska, and North Dakota)

BALANCED beauty of American elms bordering a street suggests the architectural perfection of an Old World cathedral. The arching boughs of this ornamental tree grace numerous New England and Midwest towns, and a mature, free-standing specimen enhances any landscape.

French botanist François André Michaux observed in his book on North American forests that the elm (*Ulmus americana*) is "... the most magnificent vegetable of the temperate zone."

History Was Made Under Elms

William Penn came to terms with the Indians beneath a huge American elm. Under the Washington Elm, which stood at Cambridge, Massachusetts until 1923, George Washington traditionally took command of the Continental Army. New England later developed the custom of planting clusters of 13 elms to commemorate the original Colonies.

The American elm is the largest and handsomest of the six elms native to the United States—a third of the world's known elms. Most important of our timber elms, *Ulmus americana* occurs in this country in stands estimated between three and five billion board feet; about half of the commercial lumber comes from Wisconsin and Michigan.

The tree quite commonly attains an age of 200 years or more and a height of at least 100 feet, with an average breast-high diameter of four to six feet. Much larger specimens have been recorded, however.

American elm prefers moist, rich lands along stream borders, and fertile slopes of gentle hills. For such a big tree the root system seems surprisingly shallow.

The species ranges from southern Canada to central Florida, growing nearly everywhere in the eastern States except the high Appalachians. Westward it extends across the Dakotas to Montana and appears in Nebraska, Kansas, Oklahoma, and Texas.

The wood is hard, heavy, cross-grained, and difficult to split. It is strong and bends well, but has a tendency to warp and twist. The specific gravity ranges from 0.51 to 0.75.

Elm provides the finest American wood for staves; it is also suitable for boatbuilding, sporting goods, trunks, furniture, and kitchen cabinets. England imports substantial shipments of the lumber.

Insects and Disease Plague Elms

As a living thing the American elm best serves the community; on street or lawn it makes a superb shade tree. But, tragically, the species is especially subject to insect and other injuries. Dutch elm and phloem necrosis diseases have done devastating damage to elm-shaded avenues and parks.

The American elm does not resist drought as stubbornly as the Chinese elm, but stands up well in windbreaks on the Great Plains.

Many a New England Town Owes Its Charm to Stately Elms

←American elm's leaves measure 2½ to 6 inches in length. They turn yellow in autumn and drop off earlier than those of most other elms.

Flowers precede the leaves in spring. Small clusters dangle from slender, drooping stalks. The green fruit, dry and somewhat flattened, is about half an inch long. Grouse, bobwhites, rabbits, and opossums relish it.

Egg-shaped buds may be either blunt or sharp, but do not taper at the tip. An elm stump readily sends out new sprouts.

Bark is gray and scaly.

The Birch Is Known by Its Bark

(State Tree of New Hampshire)

SCHOOLBOYS of the stern past knew the birch for its bite as well as its bark. To them "that sour tree of knowledge" meant the rod a master did not spare.

But to New England's wooded landscape the gleaming white trunk of paper birch lends a markedly bright note. Naturally and officially New Hampshire chose the species in 1947 as State tree, applying the vernacular name of "white birch." This loose term by no means pins the tree down to New Hampshire or even to New England, for white-barked birches grow elsewhere in North America, Europe, and Asia, including Siberia.

"Give me of your bark, O Birch-Tree . . . I a light canoe will build me," wrote Longfellow in *The Song of Hiawatha*. American Indians also used the water-resistant bark for wigwams and utensils.

Girdling for Bark Dooms the Tree

Thoughtless collectors of birch bark today often cause the death of beautiful trees. Cutting through the inner bark seriously injures a birch; girdling it is fatal.

Paper birch (*Betula papyrifera*) has the widest distribution of any North American species of birch. This tree ranges from Labrador and the Hudson Bay area to Alaska, British Columbia, Washington, northeastern Oregon, northern Idaho, and western Montana. It grows in scattered stations in Wyoming, Colorado, the Dakotas, Iowa, and Illinois, spreads well over Minnesota, Wisconsin, Michigan, the larger part of New York and New England, and, via the mountains, reaches south to western North Carolina.

The tree occurs in rich, moist woods and along gentle stream banks, yet stunted specimens may fight for life on rocky, wind-whipped summits. The best stands frequently occur on cutover or burned areas where trunks develop eight-inch diameters in 30 years. Young trees need plenty of light.

Paper birch grows largest near the Canadian border, reaching an average height between 60 and 70 feet, with a breast-high diameter of two or three feet.

The wood is light, hard, tough, close-grained and uniform in texture. Along with yellow and sweet (or "black") species, the paper birch is the most commercially important of our native birches.

Easy-working qualities, hardness, color, and figure make birch a favorite for furniture. Lumber dealers commonly name it according to color, regardless of species; hence we hear of black, gray, red, white, and yellow birch.

The wood, especially that of paper birch, regularly goes into thread spools, dowels, wooden handles, shoe lasts and pegs, even toothpicks. Also used for sashes, boxes, and crates, it is equally suitable for toys, paper-roll cores, and fuel. It makes pulp, too.

Birches and Sugar Maples Blaze Gold and Red after Autumn's First Frost →

✦ White, paperlike bark, on which generations of children have scribbled messages, is the birch's most conspicuous feature. It peels off as neatly as adhesive tape. Sheets separate freely into onionskin layers.

Oval leaves, 1½ to 4 inches long, are sharp-tipped or tapered and usually doubly saw-toothed.

Young light-green twigs, slightly hairy and beset with orange spots, turn reddish the first winter. They remain shiny 4 or 5 years, until mature bark appears. Flowers and fruit usually appear in drooping catkins.

Sugar Maple's Flowers Appear in Spring; U-shaped Seed Wings Drop in the Fall

The bark of young sugar maples is smooth and silvery gray. On mature specimens, like the one above, it becomes darker, scaly, and more furrowed. Glossy twigs are reddish brown or buff.

Sugar maples are mostly one-sexed, but both male and female flowers may be borne on the same tree. Long-stalked, greenish-yellow flowers pop out in umbrella-shaped clusters.

Leaves, growing opposite in pairs, are 4 or 5 inches broad, usually 5-lobed and heart-shaped at the base. Normally they are irregularly toothed, dark green above, paler beneath. Seed wings grow up to 1¼ inches.

Sugar Maple, Sweetest Tree That Grows

(State Tree of Vermont, New York, West Virginia, and Wisconsin)

(Painting on Page 661, with Birches)

THE sugar maple won selection by four States on account of four virtues; the tree is a source of syrup and sugar, a handsome shader, a highly valued timber, and, as firewood, burns cheerily and fragrantly.

Chief glory of the northern woods in autumn, the sugar maple's foliage turns a brilliant red, rich orange, or clear yellow; its vivid color comes from the altered proportions of visible pigments in the leaf. With the onset of autumn, the green chlorophyll fades. Then other pigments show off: xanthophyll, which gives yellow to the leaf, and carotin with its carrot hue. Still others, anthocyans, account for the intense reds and purples in the fall foliage.

A Real, Live "Candy Tree"

Sugar maple (*Acer saccharum*) gets both Latin and common names from its sweetish sap, source of maple syrup and sugar. Each year the maple syrup industry brings millions of dollars to Vermont, New York, Wisconsin, and other northern States.

An average tree will yield 15 to 20 gallons of sap in a good season, which boils down to somewhat more than a quart of syrup.*

Sugar maple tends to become a large tree; it often towers 80 or 90 feet. Recorded specimens have even reached heights of 120 to 150 feet, with breast-high diameters of four or five feet.

The species has a very wide distribution; it occurs in 30 States in the eastern half of the Nation from Maine to Georgia, besides ranging as far west as the Dakotas and north into Canada. In some of these areas it is also called hard maple and rock maple.

It is prized as a shade and ornamental tree, but does not take readily to city streets.

Most Rewarding of Our Maples

Sugar maple prospers best in moist but well-drained uplands, typically at an altitude of 3,000 feet in the Appalachians. It grows quite slowly above a shallow and wide-spreading root system. In the North it sometimes appears in pure stands, but frequently associates with red and white spruce, balsam fir, basswood, and beech, oak, black cherry, hickory, red maple, and yellow birch.

Economically, sugar maple is the most valuable of our dozen native tree maples and fortunately the most abundant. The estimated commercial stand in the United States is about 33 billion board feet, a good third of it in the States around the Great Lakes, with Michigan

* See "Sugar Weather in the Green Mountains," by Stephen Greene, NATIONAL GEOGRAPHIC MAGAZINE, April, 1954.

leading. In fact, approximately three-fourths of the maple stand in the Lake States and New England is sugar maple. In bulk of production it ranks third among hardwoods of the United States.

This hard, heavy wood has a specific gravity of about 0.69; it is strong, straight-grained, tough, works well, does not warp or splinter, and cracks little on seasoning.

Used for Bowling Alleys, Dance Floors

Sugar maple develops true heartwood slowly. Its whitish wood provides fine flooring material, takes an excellent polish, and is markedly abrasion-resistant. These qualities make it most acceptable for bowling alleys and ballroom floors. And sugar maple is best of all native woods for shoe lasts.

The chief uses of sugar maple, in order of volume consumed, probably are boxes and crates, flooring, furniture, boot and shoe findings, handles, woodenware and novelties, shuttles, spools, bobbins, looms, and miscellaneous sporting goods. Bowling pins and balls, billiard cues, croquet mallets and balls are usually made of sugar maple. Bird's-eye and curly maple grains enhance sugar maple as a veneer wood. The timber is much used in millwork, for sashes, doors, and kindred fittings. Only hickory surpasses it as a fuel.

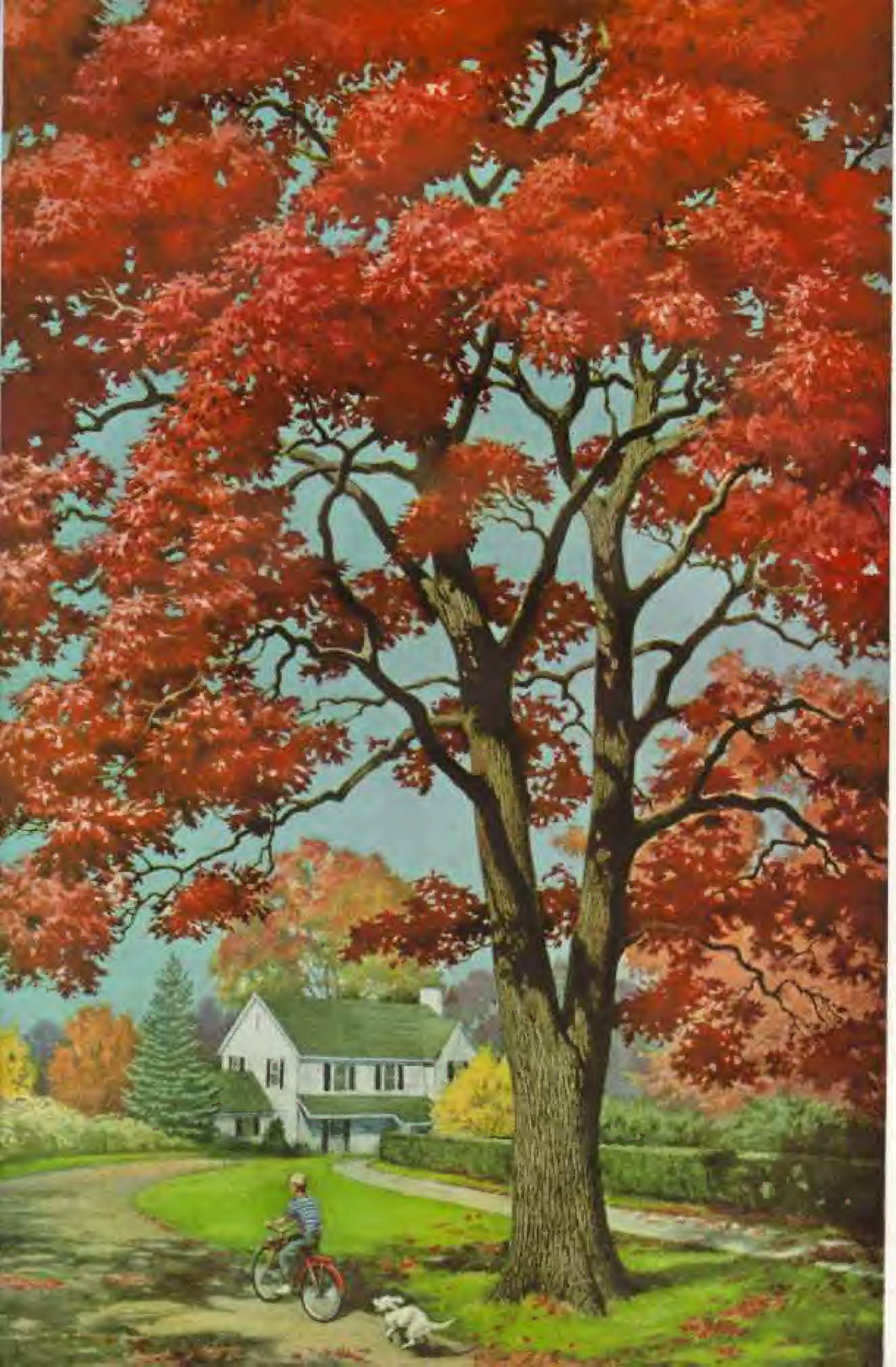
Sugar maple is a variable species, and a number of varieties and forms of it have been identified and named.

For many years sugar maple was called *Acer saccharinum*, the name now used for the silver maple.

Maple Sap Starts Flowing While Snow Still Blankets Vermont's Green Mountains

Maples yield sweetish sap, but only the sugar maple and the black maple are important producers. Several thousand Vermont farm families engage in sugaring each spring.

663 National Geographic Photographer Robert F. Sisson



Northern Red Oak Is a Monumental Asset

(State Tree of New Jersey)

ON the grounds of the National Academy of Sciences in Washington, D. C., stand six northern red oaks planted in memory of six nature lovers. The trees honor ornithologist John James Audubon, authors Ralph Waldo Emerson, Henry David Thoreau, Walt Whitman, and naturalists John Burroughs and John Muir.

Decorative as well as commemorative, northern red oak shades streets and ornaments lawns and rural landscapes. The species (*Quercus rubra*, syn. *Q. borealis*) is among the fastest-growing native oaks. Annually, when young, it may add a foot or more in height and an inch-wide tree ring.

The reddish-brown wood is heavy, hard, stiff, strong, shock-resistant, and smooth-finishing. It is difficult to dry, however, and has a tendency to shrink and split.

Its hard qualities make red oak most valuable for flooring; it resists abrasion, stays in place, takes handsomely to polish, and keeps a good appearance. The timber is used for general construction, manufacture of window sashes, and household furniture; it goes into boats, railroad ties, posts, and poles; also shores up mines and tunnels.

Northern red oak reaches an average height of around 70 feet, with a breast-high diameter of two or three feet. But heights up to 150 feet have been recorded.

Quercus rubra ranks among the relatively few oaks which have an extensive range in Canada. It is found from Cape Breton Island, Nova Scotia, and Prince Edward Island (where it is the only native oak), through New Brunswick, southwestern Quebec and westward across southern Ontario, almost as far as Lake of the Woods.

In the United States northern red oak rambles south into Alabama, west to Mississippi, Louisiana, Arkansas, and Oklahoma, north through Kansas, Nebraska, Iowa, and Minnesota. In 1950 New Jersey officially named it the State tree.

It thrives in areas which have an annual rainfall between 30 and 55 inches; it likes neither very wet nor very dry sites. Seldom occurring in pure stands, it mixes with other deciduous trees, particularly oaks and hickories, maples and poplars.

Estimates put the red oak stand in the United States at 83,700,000,000 board feet; somewhat more than half is northern red oak.

Introduced into England and France during the first half of the 18th century, the northern red oak has become the best known and most successful of North American oaks in Europe. There are notable plantations of it in Germany, Belgium, and France.

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← Given Growing Room, Northern Red Oak Develops a Round, Leafy Crown

→ Leaves, wedge-shaped at the base, measure 4 to 8½ inches in length and have 7 to 11 lobes. Appearing in late spring, they turn deep red or orange in autumn and hang on until late fall or winter.

Flowers show in springtime with the unfolding leaves. Long hairy staminate catkins pollinate the less conspicuous pistillate blooms. The latter develop into single acorns or pairs. They require two years to mature. Pistillate flower shown here (left of acorns) appears slightly larger than life size.

Short-stalked acorns grow up to an inch in length. A tight-fitting cap, closely beset with minute hairy scales, covers one-third of the egg-shaped nut.

Dark-gray to reddish-brown bark of mature trees is ½ to 1½ inches thick.

Holly Wears Evergreen Leaves and Gay Red Berries

(State Tree of Delaware)

BEDECKED with scarlet berries, American holly provides a festive foil to winter's stark and snowy landscape. Crisp, spiky leaves seem to suit the frosty scene in which Walter Weber has painted this well-loved evergreen (*Ilex opaca*).

But American holly stays dressed up all year round. Its broad leaves are in decided contrast to the needlelike ones of most of the other native evergreens.

Mature holly trees average between 40 and 50 feet in height; they may reach up to 100 feet, with breast-high diameters of four feet. They have numerous, fairly short but spreading, horizontal or drooping branches. Some boughs bend low, almost touching the ground. The tree tapers to a dense crown.

Thousands Gather It for Wreaths

American holly grows slowly in the forest because it must compete with taller species for sunlight and moisture. In eastern plantations where it is raised commercially, the best trees average a height of about 10 feet in 12 to 20 years.

The chief economic use of American holly is as an ornamental, either for live planting or for Christmas decorations. An estimated 10,000 persons are seasonally employed on the Eastern Shore of Maryland alone, gathering cuttings for the wreaths, sprigs, and sprays which we have come to associate with yuletide.

Not to be confused with English holly, widely cultivated in the Pacific Northwest, American holly ranges from the coast of Massachusetts to midway along the Florida peninsula. Westward it extends through West Virginia, Kentucky, and Missouri to eastern Texas and southeastern Oklahoma.

Holly is tolerant of shade and will abide varied, even poor, soil conditions. It thrives in rich, deep, moist earth, yet can live in the rather sterile and acid sandy coastal plains, which it sometimes shares with pines.

New England holly is scrubby, but in the lower Mississippi Valley and Gulf States, particularly Texas, Louisiana, and southern Arkansas, it reaches big-tree stature. A "lone wolf," it scorns anything so gregarious as pure stands. Merchantable trees are scarce.

Light-colored and of uniform texture, American holly somewhat resembles boxwood. It is hard, but rather weak and brittle; it tools well. The heartwood has a typical ivory hue, making it distinct among our woods. Occasionally it shows a bluish tint or stain. With an average specific gravity of 0.58, holly weighs about 36 pounds per cubic foot.

From Piano Keys to Pullman Cars

The wood is quite suitable for the manufacture of scientific instruments like rules and scales; it is also used for inlay work, Pullman-car finish, piano keys, backs of brushes, and toy boats.

Exact statistics for the annual holly cut in the United States are hard to obtain—too many portable sawmills scattered around in the woods. What's more, unreported timber frequently goes straight to woodworking plants. Someone somehow managed to log in the 1943 holly lumber cut at 126,000 board feet.

To maintain a continuous crop of holly, man must devise less ruthless methods of harvesting it, especially during the Christmastime massacre. Today the widely scattered stand contains some 5,000,000 board feet.

Quail, wild turkey, and other birds relish the fruit or berry, as do deer. The seeds—about 31,000 to the pound—are difficult to germinate, but birds helpfully distribute them through the forest. Leathery leaves discourage insects, and their prickles turn away leaf-hungry animals.

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← **"Christmas!" Says the Holly. Green Boughs Wear Cakelike Frosting**

Thick evergreen leaves, alternately spaced, remain on the branches about three years. They are elliptic, oval, or elliptic lance-shaped in outline, and about 1½ to 4 inches long. Dull green above the yellowish green below, the leaves have spiny, wavy margins. Even when fresh the leaves are flammable, and fire swiftly strips and kills the tree.

The fruit is a small, round, berrylike drupe, usually solitary, with about four ribbed nutlets, or "seeds."

Twigs are slender, somewhat drooping, and dusted the first year with fine reddish hairs.

The sexes usually are distinct. Male and female flowers are borne on separate trees, only occasionally on the same individual.

Flowers are small and four-petaled, borne in the leaf axils or scattered along the twigs.

Holly's light-gray bark is thin and smooth and in older trees becomes slightly roughened and dotted with excrescences. It is peculiarly susceptible to injuries, from which the tree does not readily recover.

Paintings by National Geographic Artist Walter A. Weber

Harmless Eastern Hemlock Inherits a Lethal Name

(State Tree of Pennsylvania)

THE misnamed American tree, unlike the Old World hemlock whose juices killed Socrates, is poisonous to neither man nor beast. Its feathery foliage, however, reminded our first settlers of the hemlock plant they had known in England.

At first lumbermen ignored eastern hemlock (*Tsuga canadensis*), because this conifer's wood warps and splits and contains numerous knots hard as rocks. They even found it undesirable for firewood—too apt to spurt showers of sparks.

Valued for Timber, Pulp, and Tannin

But today the tree Longfellow made memorable with "This is the forest primeval, the murmuring pines and the hemlocks" is valued timber; furthermore, it takes a place of honor as Pennsylvania's State tree (page 651). Among the varied destinations of the wood are prefabricated houses, paneling, and furniture. It also supplies pulp for newsprint and wrapping paper.

Its inner bark contains from 10 to 13 percent tannin. Imported and other native tannins have lessened United States dependence upon hemlock; nevertheless, it provides Canada's chief material for tanning leather.

Eastern hemlock, with a preference for moist and shady sites, is a medium-size tree 60 to 70 feet high; occasionally it climbs to 100 feet or more. Trunk diameter measures two to four feet. This evergreen is one of the most satisfactory for home planting.

In the mountains of western North Carolina and eastern Tennessee live the giants of the species. One Tennessee specimen has a height of 98 feet, a circumference of about 20, and a spread of 69.

The estimated stand of eastern hemlock in the United States comes close to 14 billion board feet. Nearly two-thirds of it grows in the northeastern States; yet Michigan now leads in production of eastern hemlock timber, pulpwood, and tanbark.

The bole of a typical eastern hemlock tapers gradually upward. From it extend long, slender, horizontal, or drooping branches which sometimes sweep down to the ground. The dark-brown or cinnamon-colored bark on old trees may be three inches thick, deeply furrowed into rounded ridges, and usually covered with close scales.

Not strong, the wood is medium soft, stiff, and brittle. It tends to splinter and is coarse-grained, but looks well when stained and waxed or polished.

Japanese Name for American Tree

In 1847 the Austrian botanist Stephan Ladislaus Endlicher attached the Japanese term *Tsuga* to hemlock for a sectional name. Later, *Tsuga* became its generic indicator. Therefore our native eastern hemlock has a Japanese generic name and for a common name a complete misnomer!

A pity our forefathers didn't keep the Iroquois Indian term *onenta*, meaning "greens on the stick." In Longfellow's words:

> Green not alone in summer time,
> But in the winter's frost and rime ...

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← **Eastern Hemlock: a Source of Newsprint**

→ Shiny dark-green leaves about a half-inch long resemble the teeth of a comb. Curved and polished upper surfaces throw back glistening reflections of the sky's light. Undersides have a dull chalky appearance. Needles fall in their third year.

Fruiting cones are delicate and dainty. They are egg-shaped, ½ to ¾ of an inch long, slender-stalked, drooping, and solitary. When ripe, they change from yellow green to purplish or brown.

Pioneers Found a Friend in Sturdy Buckeye

(State Tree of Ohio)

TAMING the wilderness beyond the Alleghenies, ax-swinging settlers found a fine tree they dubbed the Ohio buckeye because its shiny brown nut with a white spot resembles the eye of a buck, or stag. Scientists later called the species *Aesculus glabra*.

Ohio has affectionately adopted the tree, whose homely name, sharp as the echoed crack of a rifle, now designates the Buckeye State. From earliest pioneer days the tree has been associated with Ohio, which was admitted to the Union in 1803, only 15 years after its first permanent white settlement.

Transplanted Early in Europe

The buckeye soon found its way from North America to Germany. Botanist Karl Ludwig Willdenow (1765-1812) studied a specimen in the Berlin Botanic Garden and published the accepted scientific name, *Aesculus glabra* Willd., in 1809.

Ohio buckeye is a medium-size to rather small tree, with many resemblances to the horse chestnut introduced from Europe.

Its native range reaches from southwestern Pennsylvania through West Virginia, Kentucky, and Tennessee to northern Alabama and northeastern Mississippi.

Skipping the lower Mississippi Valley, the tree grows from northeastern Texas through eastern Oklahoma and Kansas and the six southeasternmost counties of Nebraska to southern Iowa, Illinois, Indiana, and Ohio.

Typical buckeye habitat is the rich moist soils of stream banks and bottom lands. The trees are more picturesque than graceful. The branches at first tend to curve downward, the lowest often reaching quite close to the ground, as if their weight were greater than their strength; then almost at the last moment they sweep upward. The stout, reddish-brown twigs follow a similar pattern.

The "champion" Ohio buckeye listed by the American Forestry Association stands in Elyria, Ohio, with a height of 90 feet, a 60-foot spread, and a breast-high circumference of 8 feet 1 inch. Such measurements are by no means common; more normally the buckeye stands only about half as high. The tree grows most abundantly in the Tennessee River Valley.

Buckeye wood is light (with a specific gravity of about 0.33), straight-grained, soft, weak, whitish or grayish, and odorless. Chief use of the wood is for furniture, boxes and crates, caskets, signs, trunks and valises, and toys.

Before the general use of light metals, buckeye was in demand, because of its lightness and ease of turning, for artificial limbs. Its lack of odor and light color make it suitable for food containers. During pioneer times it was shredded into fibers for plaiting homemade summer hats.

Indians Boiled Nuts for Food

Early settlers concocted a medicinal extract of the bark, but it is not a recognized drug. The nuts, or seeds, contain toxic glucosides, which act as severe irritants to the nervous system; livestock has been poisoned by eating either the nuts or the tree's foliage. After repeated boiling, however, these glucosides break down into harmless substances. Nuts so treated were a food source for American Indians.

In contrast with its relative, the Old World horse chestnut (*Aesculus hippocastanum*), which has shiny and resinous buds, the winter buds of Ohio buckeye are smooth and pale brown outside with reddish scales inside. This typical smoothness of buds and leaves, too, suggested *glabra* (smooth, or hairless) for the specific name.

But there's nothing smooth about the spiky, nut-housing capsules which eventually fall to earth. You have been warned: don't go barefoot under the buckeye tree.

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← Settlers Fashioned Pails and Cradles from the Versatile Buckeye

The gray or ashy bark on older buckeye trees may thicken to three-fourths of an inch. Rather soft and corklike when young, the bark later grows rough, deeply grooved, and scaly. When bruised it emits a disagreeable odor, giving rise to such local names as "fetid buckeye" and "stinking buckeye."

Buckeye buds (not shown) are among the first to open in the spring; they quickly grow to a length of about two inches. Even when dormant the immature leaves can be readily detected within the buds. Full-grown leaves, in pairs, are parted into five rather narrow, finely toothed leaflets.

Following the leaves, the pale greenish-yellow flowers appear in April or early May, bursting forth in terminal panicles about four to six inches long.

Buckeye's lustrous seeds, or nuts, are favorite souvenirs of small boys. A prickly capsule holding the fruit splits open at maturity.

A Tree Is an Amazing Mechanism

LIVING familiarly with trees, we accept their benign and useful presence. We are quick to profit from their value as storehouses of lumber and pulp, and of such useful products as fruits and nuts, oils, waxes, rubber, and drugs.

Yet few of us suspect the fantastic whirl of activity that catches up every deciduous and evergreen tree in fulfillment of its place in our planet's living pattern.

Man has skin, organs, bones, muscles, and a nervous system upon which his life and usefulness depend. A tree employs roots, trunk, bark, and leaves to do its work on earth.

Each Leaf an Efficient Laboratory

Leaves are, in effect, the lungs of a tree, though their manner of breathing is peculiar to the plant world. The underside of each leaf is pitted with thousands of porelike stomata, or infinitesimal openings. Through these stomata leaves inhale and exhale oxygen and carbon dioxide.

But leaves emit generous amounts of water vapor and vastly more oxygen than carbon dioxide, which, in fact, is released only as a waste product. Thus the breathing of trees purifies and tempers, even renews, the air around us.

In a sense, a tree performs magic. It seems to manufacture something out of nothing.

Leaves soak up energy directly from the sun and convert water and air, plus chemicals and minerals from the soil, into a great body that may weigh 1,000 tons and tower 300 feet into the sky.

Miracle of Photosynthesis

The tree accomplishes this feat by the remarkable process of photosynthesis, which man with all his ingenuity has not yet managed to imitate.

Bundles of specially organized leaf cells called chloroplasts produce chlorophyll, the familiar green substance of all growing plants. Chlorophyll, in turn, picks out just the rays of sunlight it needs to transform water and air into the substance of branches, trunks, and roots.

Specifically, the leaf rearranges carbon, oxygen, and hydrogen into a variety of carbohydrates, usually sucrose, one of the basic foods of all living things.

The leaf then converts the sugar into starch, which is stored in leaves, seeds, and roots. Since the tree cannot digest starch, the leaf with incredible virtuosity changes the starch back into sugar as the tree demands food.

This process of photosynthesis, to which we owe our green and habitable world, is most active during the two or three hours on either side of noon, and ends when night falls.

Photosynthesis creates the world's food supply. All plants and animals feed upon the organic substances which leaves and grasses convert from unassimilable elements into digestible material. Falling to the ground, leaves and twigs decay and combine with the soil's nitrogen to create the humus which fertilizes the forest floor.

Only a fraction of a tree's constructive energy—between one and two percent—is devoted to self-perpetuation, the making of seeds. Seeds themselves vary widely in size. For instance, it takes 300,000 hemlock seeds to make a pound, while certain tropical coconuts may weigh 40 pounds apiece!

The wood of a tree is compactly stored in trunk and branches. And it is this wood, of course, for which mankind's appetite seems insatiable.

Stump Tells Life Story

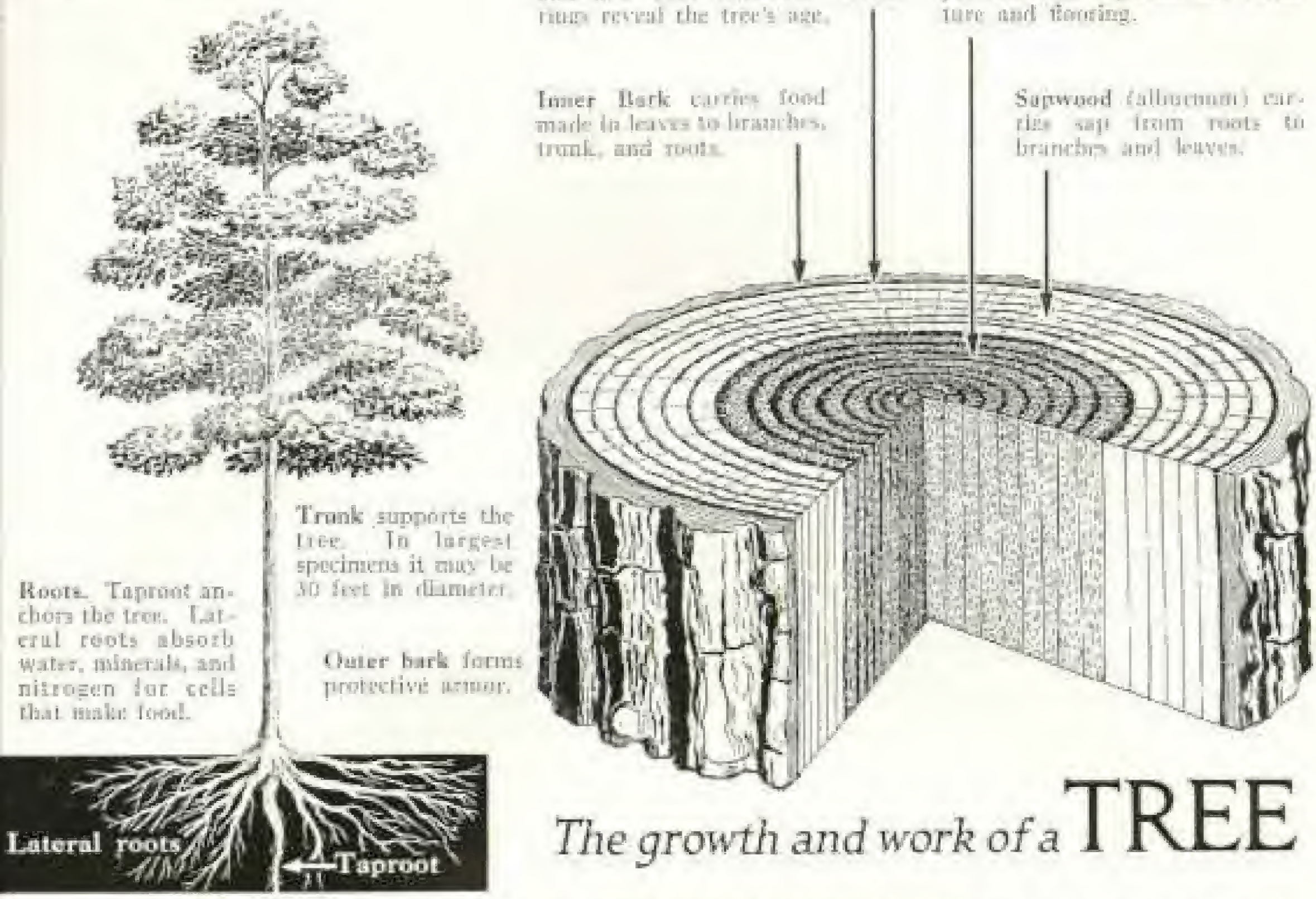
A boy, jumping upon the sweetly redolent stump of a new-cut tree, may know only that its concentric markings are annual rings that show the tree's span of life. Yet this cross section can teach far more.

Much of a tree trunk's substance is dead. The lifeless core or heartwood (duramen), the major storehouse of timber and pulp, strengthens and supports the tree.

The living outer portion of the trunk contains the pipelines for a circulatory system as amazing as man's. Sap is the tree's blood; it flows up to the leaves through minute channels in the sapwood, the part of the trunk just outside the heartwood. No veins are necessary, as in man, to carry the life fluid back to revitalizing organs, for the phloem, or inner bark, conducts carbohydrates and other food elements made in the leaves down to the branches, trunk, and roots.

Because of this replenishing up-and-down flow of nourishment, the tree continues to grow till death. Some botanists believe trees die only from such causes as disease and injury. Giant sequoias survive as earth's oldest and largest living things.

Growth in the trunk occurs in the cambium layer alone, that narrow section between sapwood and inner bark. Peel bark from a tree



The growth and work of a TREE

Leaves produce sugar by photosynthesis, oxygen being a by-product. Millions of microscopic chemical laboratories (chloroplasts) trap radiant energy from the sun, carbon dioxide from the air, and water from the soil. A tree's oxygen renews the air we breathe. Sugar is used as a direct source of energy for the tree or transformed into starch, proteins, and other products, including wood, resin, gums, oils, waxes, and alkaloids.

Drawn by Robert E. Burton

and you'll find the moist, sticky cambium film. Its cells are constantly splitting, making new sapwood on the inside, bark on the outside.

The inner bark continuously converts to outer bark, assuming patterns which identify the different trees: rough as an oak, smooth as a beech, or shaggy as a cedar.

Roots Drink Tons of Water

The tree stands on its roots and through them draws in the tons of water required to satisfy the urgent thirst of its growing months. Conifers, elms, and birches generally reveal a flat and shallow root structure; most of the hardwoods, such as walnut, hickory, oak, and beech, thrust taproots straight down.

Roots divide again and again, the fine rootlets splitting into a maze of hairlike terminal strands that push out in the ceaseless search for water—and for oxygen, without which they perish. Roots grow best where they have to work to find enough to drink.

The cumulative pressure of growing roots can split granite or move boulders. And the tree takes more than water from the soil; for its roots absorb nutritious minerals in solution and may get nitrogen from bacteria.

The tree's waterworks handle a remarkable volume. A scientist once calculated that to build one ton of wood a tree has to soak up approximately 1,000 tons of water.

Moisture pours into the atmosphere from a tree in an invisible fountain of vapor. Almost every tree throws off large quantities of surplus water.

Cohesion (or water tension), osmosis, and the transpiration pull of leaves are the principal forces by which a giant tree pumps up hundreds of gallons of water a day from the ground. A mature date palm in a desert may seem exempt from the tree's common thirst for water. Yet it may need as much as 200 gallons a day in the hottest months to maintain maximum vigor and yield.

A tree is indeed an amazing mechanism. And, despite the dendrologist's knowledge, it remains a mysterious thing—as mysterious as any living work of nature.

Red Pine Pays Its Way

(State Tree of Minnesota)

BACK in the days when wood put to sea, shipwrights found that some of the timber best suited for masts, spars, and decking came from red pine forests. Wooden vessels eventually went out of style, but not the popularity of this tree, one of the most profitable in the United States.

Lately it has been under renewed pressure, trying to meet the growing demand for summer log cabins. Outdoor-conscious Minnesota, with its "10,000 lakes" and 250,000 acres of red pine, picked the tree to represent the State.

Red pine is an honest name, inside and out, because that is the color of the tree's bark and heartwood. Yet many persons, including lumbermen and authors, persist with the misnomer "Norway pine," a term as misleading as the scientific name, *Pinus resinosa*. The tree has no Scandinavian background, nor is the wood unusually resinous.

Practical for Poles

Red pine wood, moderately soft, light, and close-grained, makes better structural material than eastern white pine (pages 656 and 657) because it is stronger and heavier. Creosote easily penetrates the yellowish sapwood, making the tree practical for poles and piling.

But the chief value of the species lies in lumber for floors and general millwork. Less importantly it goes into wrapping paper and paperboard. Distillation of stumps yields resin and turpentine.

Mature red pines average about 70 to 80 feet tall, with breast-high diameter of two or three feet; occasionally a tree will grow to a height of 120 feet. Young trees develop thick, spreading, down-to-earth branches with tufted dark-green, lustrous foliage; often they are planted for ornament. Older forest trees have a long, clean bole and high horizontal limbs.

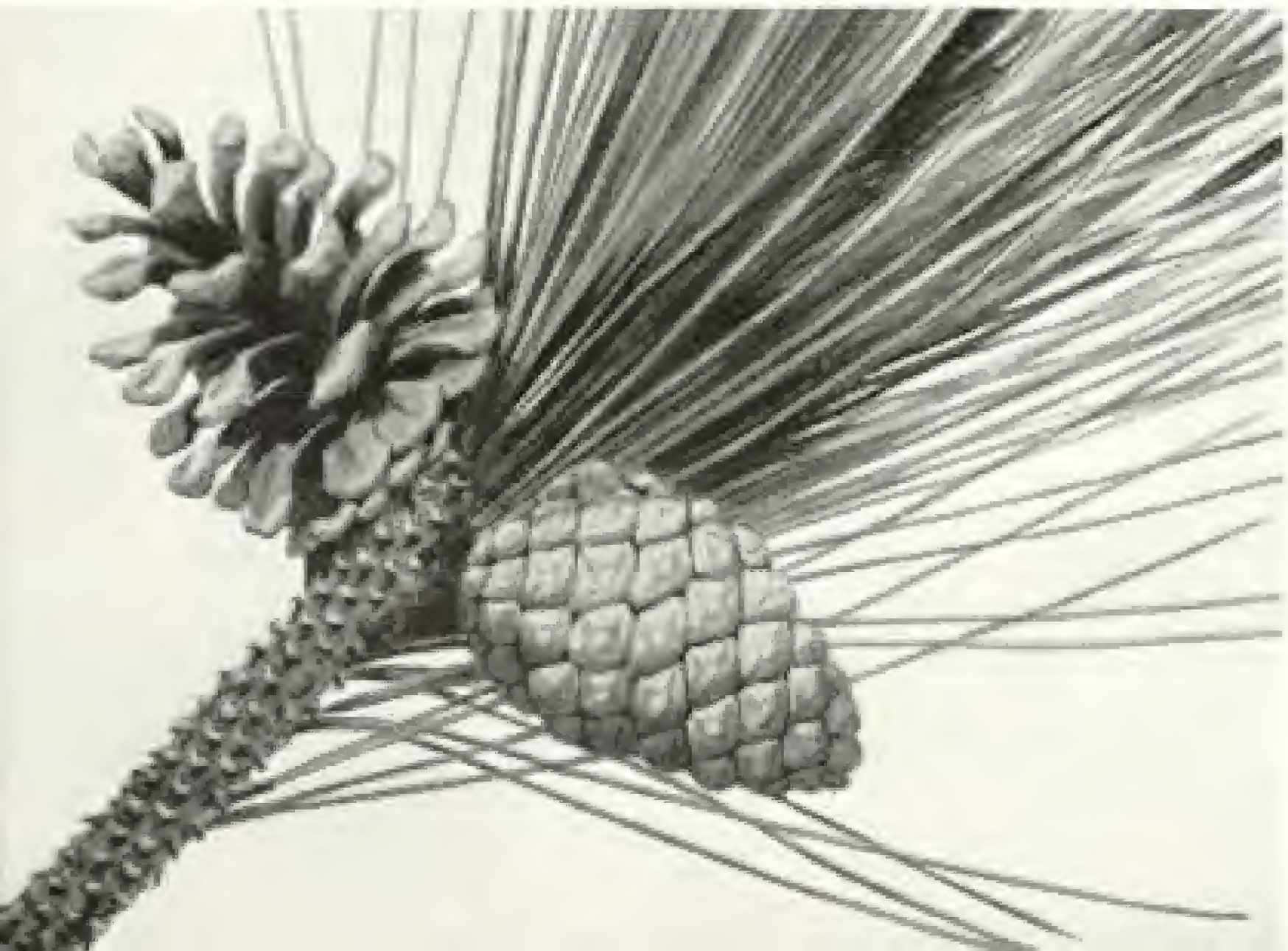
Sociable Pine Seeks Company

The tree prefers loamy sand or gravel, but occurs on dry, rocky ridges and in a variety of other sites; it will live among dry barrens and in areas too poor for white pine and most hardwoods. It is a sociable tree, frequently found in the company of other pines, several species of oaks, paper birch, and aspens.

Red pine often begins life humbly beneath the branches of jack pines, but comes out on top as that shorter-lived species quits growing. The rather fast-growing tree does its best to rise above, or somehow escape, shade.

Latest available figures place the United States stand of saw-timber-size red pine at 2,900,000,000 board feet; most of this is in the Northeast, the rest in Minnesota, Michigan, and Wisconsin. Red pine transplants well and is much used for reforestation within its natural range.

Compared with other species, red pine has few insect and fungus enemies. But the red pine sawfly may strip it of leaves; bark beetles, budworms, and European pine-shoot moths cause damage, and the red pine cone beetle breeds in the cones.

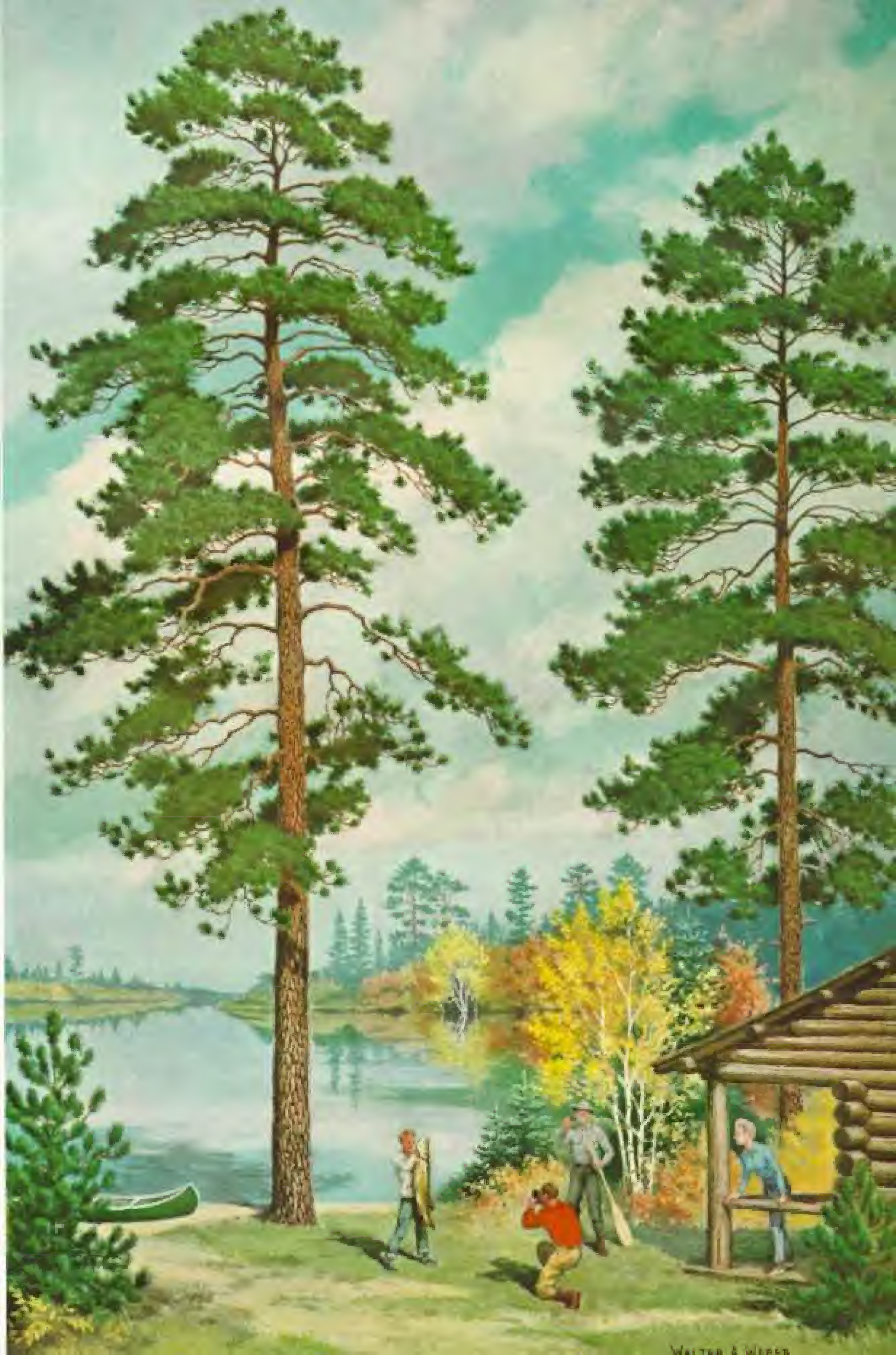


Red Pines Frame a Northern Lake →

←New twigs are orange colored, later they turn reddish brown. Dark-green needles are slender, soft, and flexible. Growing in pairs, they measure 5 or 6 inches and remain on the tree 4 or 5 years.

The almost stalkless cones, borne at right angles to the branches, are 2 inches long. They ripen and shed their seeds in early autumn. Slightly concave scales have no prickles. Their color changes from green to shiny light brown at maturity.

Paintings by National Geographic Artist Walter A. Weber


WALTER A. WEBER

Bristly Acorn Named the Mighty Bur Oak

(State Tree of Illinois)

MASSIVE trunk and heavy limbs make the bur oak impressive in city or prominent on prairie. Shaggy-brimmed, scaly elfin caps of the acorns suggested the common name of this midwestern favorite, scientifically known as *Quercus macrocarpa*.

Toward the end of the 18th century a French botanical explorer, André Michaux, probably discovered and certainly described the State tree adopted by French-named and French-settled Illinois. Michaux referred to it as the oak with the big fruit.

Later his son, Dr. François A. Michaux, visited what is now the bluegrass region of Kentucky and Tennessee, where his father presumably discovered the bur oak. Here the younger Michaux reported that beech, hickory, and the oak *à gros glands* (with large acorns) formed the main body of the forests.

The bur oak is one of the most widely ranging of United States oaks; it occurs farther north and west than any other native eastern oak. Bur and Oregon white, or Garry oak, are the only oaks found in western Canada.

The distribution pattern of the bur oak is triangular, the angles penetrating New England, Manitoba, and Texas.

Normally, bur oak is a big tree, one of the largest of all oaks. The appearance of a gnarled veteran, though less graceful than the related white oak, is often patriarchal: the crown is composed of large, spreading branches that writhe in all directions. At the northern and western extension of its geographical range, however, it becomes a stunted tree.

Acorns Largest in United States

The tree's scientific name, *macrocarpa* (literally "long-fruited"), like the vernacular names bur oak and mossycup oak, refers to the acorns, which average the largest among United States oaks.

Bur oak grows best in rich bottom lands, but may occupy a wide variety of sites. The so-called "champion" tree lives in Big Oak Tree State Park, Missouri; this specimen is 145 feet high, 17 feet 6 inches in circumference at 4½ feet above the ground, and has a crown spread of 101 feet.

The lower valley of the Wabash River is reputed to be the ideal site for the species. From there heights of 170 feet and breast-high diameters of six or seven feet have been reported.

One frequently finds bur oak among red and blue ash, American elm, silver maple, black walnut, and hickories. On prairies and grasslands it may occur in pure stands. Because of the tree's aversion to shade, it forms open groves, examples of the "oak openings" referred to by James Fenimore Cooper and others who wrote of the American frontier.

Timber Similar to White Oak

Bur oak wood is heavy, hard, strong, and durable. Used mostly in general construction and for railroad ties, it is also sold in the lumber market as "white oak," serving satisfactorily the same purposes as that species. True white oak timber is commonly held to be somewhat superior, but it is almost impossible to differentiate between the two. Bur oak wood is in demand for quartersawed oak furniture because of its handsome grain, due largely to conspicuous medullary rays. A cross section of a tree shows these rays radiating from the center.

Often planted for shelter belts, bur oak is sometimes grown as an ornamental. It is tolerant of smoke, dust, and gas, and fairly free from insect and fungus pests.

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Spreading Crown and Writhing Branches → Make Bur Oak a Popular Shade Tree

Acorns vary from ¾ to 2 inches in length. A bristly prolongation of the cup scales covers half or more of the nut.

Twigs at first are orange colored. In the second and third years they become corky winged, as in sweet gum and elm. This corkiness disappears as the tree matures.

Leaves, clustered near the twig ends, are yellow green when unfolding, turning yellowish or brownish in the fall. When mature they average 6 to 12 inches in length, perhaps the largest leaves of any United States oak.

Fan-shaped in outline, with the broader end forward, the leaves are mostly wedgelike at the base. Ordinarily they carry about three pairs of lower lobes, with rounded sinuses; these sometimes almost cut the leaf in two.

Mature leaves are thick, firm, and dark green. Usually hairless and shiny above, they are pale green, silvery, or whitish beneath. They tend to drop off in the fall instead of clinging to the tree through the winter, as do the leaves of many of our oaks.

Rough, furrowed, and scaly bark varies from light to dark brown. It is moderately fire resistant.

Black Hills Spruce Aims Skyward Like an Arrowhead

(State Tree of South Dakota)

ABOUT as big as Connecticut and Rhode Island combined, the Black Hills country remains so isolated that its flora and fauna vary strikingly from relations elsewhere. Not surprisingly, then, Black Hills spruce (*Picea glauca* var. *densata*) differs from the typical white spruce of eastern North America; the western variety is a hardy, slower-growing, more compact tree with denser, brighter-green foliage.

The natural range of Black Hills spruce, one of many variants of the white spruce species, is apparently confined to this out-of-the-way region of western South Dakota—a fact which helps explain why botanists did not pay much attention to the tree until 1933.

French explorers in 1743 were the first white men to visit the Black Hills. Later the area echoed the gunplay of Calamity Jane, Deadwood Dick, and Wild Bill Hickok.

Here Gen. George Armstrong Custer battled with the Sioux Indians. And this was the setting for the second great American gold rush, its prize the fabulously productive Homestake Mine at Lead.

Black Hills spruce is locally called white spruce. But the typical white spruce, also known as Canada spruce and eastern spruce, thrives far more widely through northern latitudes. It grows from Labrador to Alaska, in northeastern Minnesota, northern Wisconsin and Michigan, across New York, Vermont, Maine, and the Canadian Maritime Provinces.

Straining the limits of tree growth on the North American Continent, white spruce extends far northward with black spruce, larch, and balsam poplar. And it joins other conifers to spread a vast forest blanket over Quebec and northern Maine.

White spruce does best in moist, sandy, or gravelly loam beside streams, ponds, and lakes. Normally a medium-size tree, it reaches maximum dimensions on the eastern slopes of the Canadian Rockies: 150 feet tall, three or four feet in diameter. Its estimated stand in the United States amounts to about two billion board feet. In Canada, where it is a leading commercial tree species, the stand is far more extensive. Interior Alaska depends mostly upon this wood for construction and fuel.

The nearly white or yellowish-brown wood is soft, resin-free, straight-grained, easy to work. Though low in nail-holding properties, it glues nicely and retains paint moderately well. It receives preservatives reluctantly.

Where lightness and stiffness are requisites, as in canoe paddles, it is a favorite. And because of its resilience and resonance, white spruce wood is in demand for musical instruments and particularly for piano sounding boards.

Mills use white spruce for making doors, sashes, kitchen cabinets, and ladder steps. In mining and irrigation country it forms flumes and sluice boxes. The wood sometimes goes into barrels and boats, but much more regularly into boxes and crates.

But white spruce is most valued for pulpwood, especially for newsprint, enormous quantities of which flow duty free into the United States from Canada and end up as our daily papers. Last year Canada supplied 80 percent of the newsprint used in the Nation.

Black Hills Spruce Raises an Evergreen Pyramid Against the South Dakota Sky →

← Bark on young trunks and branches is orange brown and relatively smooth. At maturity it becomes scaly and turns gray or reddish brown.

Pointed needles, less than an inch in length, grow singly from all sides of the twig. When crushed they give off a skunklike odor.

Somewhat egg-shaped cones are 1 to 1½ inches in length.

Paintings by National Geographic Artist Walter A. Weber


WALTER A WEBER

Western White Pine, Monarch of an Unspoiled Land

(State Tree of Idaho)

MISTS rise from a stream racing beneath tall pine spires in a clean mountain world.

The scene: a remote valley of the Rocky Mountains in the "pipestem" of northern Idaho.

The tree: western white pine (*Pinus monticola*), one of the most valued conifers of the West, cherished for its beauty in parks and sought by the lumberman for its white, straight-grained, flaw-free wood.

David Douglas, the celebrated Scottish plant explorer whose name is commemorated in the Douglas fir (page 685), discovered this pine. As to where and when, there is some controversy. Some say 1825, others 1831. Evidently he made his discovery in what is now the State of Washington.

Douglas sent seeds of the tree to Great Britain. Not until the 1850's, however, did western white pine become widely cultivated there. Actually the tree likes Scotland and Ireland better than England.

Fares Better Than Eastern White Pine

Western white pine is the transcontinental counterpart and today a grander version of eastern white pine (page 656). As would be expected, the western tree has managed to remain wilder and less molested by axmen than the eastern. In fact, since most of our big eastern white pines have been lumbered, we tend to think of the western species as naturally having the more impressive dimensions. Its heavier needles give the latter tree a denser crown.

Southern British Columbia, including Vancouver Island, is the northern limit of western white pine's range. Southward it spreads through western and northeastern Washington, northern Idaho, and northwest Montana to western Oregon and northern California, to the middle Sierra Nevada, and to isolated stations on the San Bernardino and San Jacinto Mountains. It does not cross the Continental Divide.

In British Columbia and Washington it grows from near sea level up to 3,500 and 6,000 feet, respectively. The higher locations are in the interior. In Oregon it is found between 3,000 and 6,000 feet in the north and from 5,000 to 7,500 feet in the south.

At its southernmost limit in California western white pine climbs to 11,000 feet.

This is a long-lived tree, adding up a ripe old age of from 200 to 500 years. It may reach a height of 170 feet and a breast-high diameter of five feet. The largest known living specimen flourishes near the town of Elk River, Idaho. This tree soars to 219 feet, with a breast-high circumference of 21 feet 3 inches.

Typically, western white pine grows in dense but not pure stands. Its arboreal companions in the North are western hemlock and Douglas fir, grand and Pacific silver firs. In California it commonly associates with Douglas fir, lodgepole pine, red and Shasta firs.

Endures Hot and Cold Extremes

When young the tree is tolerant of shade, but it becomes rather intolerant with increasing years. It grows on a variety of sites but reaches its best proportions in deep porous soils.

Western white pine gets along on 15 inches of annual precipitation in Montana and Idaho, yet does very well, too, in the Puget Sound area with 60 inches or more. It grows in areas where temperatures vary from —26° to +98° F.

In the open the student can readily recognize western white pine from the tree's habit of sending out a few more or less horizontal branches beyond the rest. In the more typical dense stand the tree has a narrow, conical crown with numerous short, rather drooping branches. The bole eventually becomes branch-free for half to more than two-thirds of its length from the ground.

White pine blister rust finds a ready victim in western white pine; this fungus kills the tree by girdling its trunk and limbs.

Pine squirrels and certain birds, such as the white-headed woodpecker and Steller's jay, destroy the cones in their greed for the seeds.

Major Stands in Idaho

More than 17 billion board feet of western white pine still stand in the United States, according to estimates. Idaho, with 12 billion board feet, claims the preponderance.

The most important timber in northern Idaho is western white pine. The State leads in lumber production of this tree, locally known as Idaho white pine.

Matchsticks May Be the Fare of This Giant Western White Pine

Building contractors seek the western white pine for doors, window sashes, and other millwork. The wood is easy to work, has excellent gluing and paint-holding qualities, and nails well. Lower grades go into boxes.

Odorless and light in weight, the wood is the Nation's leading source of matchsticks. About half the cut goes into matches, the rest into some 35 other lines of wood products.

Slender Cones Help Identify the Tree

Trees seldom bear fertile cones before reaching 40 years.

Drooping cones measure 4 to 12 inches. Longer and slimmer than the eastern white pine's cones, they give the western evergreen its nickname, "finger-cone pine." Greenish or purplish at first, they turn yellowish green during their second summer of growth.

Ripe cones unfold in September or October. Two red-brown seeds pop from beneath each full-grown scale. Borne away by wind, the seeds keep their vitality several years.

On young trees the bark is silvery or grayish, rather thin, and smooth. On old trees it cracks into small, thick scales, brownish or purplish gray.

Young twigs are downy, with fine reddish hairs. Needlelike leaves, five in a bundle (a characteristic of the "soft" pines), are 1½ to 3 inches long. They are thicker and stiffer than those of the eastern white pine.

Paintings by National Geographic Artist Walter A. Weber

Mt. St. Helens Reigns Above Half a Million Acres of Douglas Fir

Dense stands of Douglas fir crown the mountain slopes of Oregon and Washington (page 685). The species contributes 60 percent of the trees in this forest, the St. Helens tree farm in southwestern Washington. St. Helens is one of 12 huge tracts operated by Weyerhaeuser Timber Company.

Tree farms are an innovation in the lumber industry. For generations wasteful loggers turned virgin forests into deserts of ghostly stumps. Denuded land eroded and choked rivers with silt. Wildlife, deprived of cover, perished. The modern lumberman practices conservation. Guarding his soil, he sows and harvests his trees, just as the farmer grows crops.

Douglas fir, unlike many other timber trees, does not encourage selective, or individual, cutting. Its seedlings, refusing the shade of older and larger trees, sink roots in open clearings and mature as a crop, like wheat. Lumbermen harvest large stands, leaving islands of live timber to reseed the bare ground.

A new stand reaches marketable age in 80 to 100 years. If fire wipes out the young crop, the lumberman transplants seedlings grown in nurseries. He cuts additional blocks of mature firs after the young trees become established.

These cleared patches were cut over a five-year period. First, the loggers removed lesser trees for poles and pulp, then they felled the majestic firs with power saws and dragged the logs to a "landing" with tractor or block-and-tackle. Ten-foot-wide trucks transported the logs to rail cars, and locomotives hauled them 35 miles to Weyerhaeuser's plant in Longview. There three sawmills turn out some 1,250,000 board feet daily.

This striking aerial photograph shows the loggers' road network. Paths gouged by tractors scar the stump-dotted slopes. The average tree here towers 200 feet and contains 5,000 board feet.

Volcanic Mount St. Helens, its peak hidden by clouds, rises 9,671 feet in the Cascade Range. The last major eruption in 1842 buried an entire forest.

Douglas Fir, World's Leading Lumber Source

(State Tree of Oregon)

HERE is a superb example of wealth and wonder in one tree. Douglas fir, most important single lumber species in the United States, accounts for a fourth of the country's standing saw timber. This giant is the dominant evergreen of the Northwest and highly important, too, in western British Columbia.

The scientific name of the Douglas fir (*Pseudotsuga menziesii*, syn. *P. taxifolia*) honors Archibald Menzies (1754-1842), the first man to collect plants on the Pacific coast. Its popular name commemorates another Scot, David Douglas (1799-1834), the greatest of early western plant explorers, who met an untimely death when only 35 years old.

Sometimes called Douglas spruce, Oregon pine, and red fir, Douglas fir is perhaps the most valuable softwood in the world. It ranges naturally over well-watered slopes and valleys from southwestern British Columbia through western Washington and Oregon to central California. Also found in Utah, Nevada, and Rocky Mountain areas, it occurs as far south as Mexico.

The United States stand contains an estimated 493 billion board feet. Washington and Oregon have about 77 percent of this figure, and the largest trees hug the coastal region between the Cascades and the Pacific.

Mature trees lift their thick, pyramidal crowns to heights of 100 to 200 feet and more; diameters of three to six feet are common. The largest, in Olympic National Park, Washington, is 53 feet, 4 inches around.

Douglas fir is ideal construction timber. Combining strength, stiffness, and generous dimensions, it provides beams up to 2x2x60 feet. The wood meets a variety of needs: millwork, flooring, furniture, ships and boats, piling, railroad ties, and cooperage. Lesser amounts go into fiberboard, paper pulp, and wood distillation. Narrow-ringed, slow-growth logs are in demand for veneer.

Difficult to work by hand, the wood machines smoothly and glues satisfactorily; it retains paint poorly, however, and because of its density (specific gravity 0.45 to 0.68) does not readily receive preservatives.

Douglas fir is one of the West's chief Christmas tree species and is a resinously redolent ornamental. The handsome tree is popular in Europe for landscaping or lumber.

← Of American Trees, Only California's Sequoias Surpass Douglas Fir in Size and Majesty

↓ Soft, flattened needles, about ¾ to 1¼ inches in length, are spirally arranged around the branches, but often spread into two opposite rows. Bright-red staminate flowers (left) appear in early spring on the undersurface of the previous year's growth. Reddish pistillate flowers (center) grow on the ends of the branches. Hairy cup scales at the base of the pineapplelike flower open like petals as the flower matures.

Pendulous cones, 2 to 4½ inches in length, ripen in autumn. Conspicuous three-pointed bracts, resembling snake tongues, protrude from the thin, rounded scales.

Painting by National Geographic Artist Walter A. Weber

Ponderosa Pine, a Buttress of the Lumber Industry

(State Tree of Montana)

STRAIGHT, strong trunks, sheathed with large bark plates that glow cinnamon red in the sun, identify the massive ponderosa pine (*Pinus ponderosa*). Familiar to motorists and holidaymakers, it grows in every State from the western edge of the Great Plains to the Pacific and in parts of southwestern Canada, even Mexico.

Dry and parklike groves of ponderosa pine, floored with needles, grass, manzanita, and mountain mahogany, delight the hiker in the high and arid plateaus and foothills of the West.

On the Fourth of July, 1876, in a small Arizona settlement, lumberjacks stripped the branches from a lofty ponderosa pine to run up the American flag with rawhide strings. The tall flagpole became such a well-known landmark that it named the place Flagstaff.

Supreme Court Defends Tree's Name

Ponderosa pine is perhaps the only American tree whose name has been reviewed by the United States Supreme Court. In 1934 the Court ruled against selling lumber of this species as "California white pine."

The valuable tree is the most widely distributed commercial species of the West. Its vernacular names are many, including bull pine, western yellow pine, and yellow pine.

Ranging in height from 80 to 200 feet, the tree has a deep taproot as well as an extensive system of lateral roots. It grows in varied sites, from sands to clays and gravels or in volcanic ash. It frequents both dry and moist slopes, canyons and ridgetops, requiring normally about 18 inches of rain a year.

The species has many variations. In eastern Nevada, Utah, and in the Rocky Mountain area generally there is a type sometimes known as "Rocky Mountain ponderosa pine." On the Coconino Plateau in northern Arizona ponderosa forms the most extensive pure pine forest in this country, if not in the world.

A Major Timber Resource

The total commercial stand of ponderosa pine in the United States is estimated at a very substantial 186 billion board feet. It ranks third among United States lumber species, providing three to four billion board feet annually. Actually, as a single species, it ranks second only to Douglas fir, for southern yellow pine, nominally in second place, is a complex of six distinct species.

Ponderosa rates high as construction lumber, mine timber, and piling. It is popular for boxes and crates, and for millwork—doors, sashes, and flooring. As it does not easily split, it takes nails and screws readily. Slabs and other waste make good fuel.

Specific gravity ranges from 0.39 to 0.60. Light in weight, the wood is strong, somewhat coarse-textured, but often even-grained.

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← **Tall and Massive Ponderosa Pines Enrich and Beautify the West**

→ Botanically, this tree belongs to the cluster-pine section of the hard-pine subgenus. It has persistent leaf sheaths, jointed seed wings, and relatively hard wood.

Stout leaves average 5 to 7 inches in length and grow typically in bunches of three.

Cones, often clustered, start out erect and greenish to purplish in hue. Later they become horizontal or downbent and reddish brown. Oblong or ovoid in shape, the cones are about 3 to 6 inches long, their scales thickening at the end and bearing a slender prickle.

When a cone drops off, it often leaves part of the base attached to the branch.

Freshly broken twigs release an odor like that of orange peel.

Buds (not shown) are brown.

WALTER A. WEBB

Balsam Poplar Soaks Its Roots in Water

(State Tree of Wyoming)

POPLARS grow fast: some shoot up 20 feet in six years. And they have the happy habit of quickly taking root on burnt-over land. Thus young poplars provide nursery shade for slower growing tree species that ultimately form the main body of a hardwood forest.

Balsam poplar (*Populus balsamifera*, syn. *P. tacamahaca*) grows naturally on the open prairie, usually close to a watercourse where it can keep its roots wet. And, as Walter Weber's painting shows, the species thrives among rugged snow-clad mountains.

These poplars shade city streets and ranchers' homesteads. Decorative in town or country, they look their best in autumn; then the leaves, like thin gold coins, shimmer with startling brilliance against blue sky.

Used for Windbreaks on Prairie

Primarily a tree of boreal or arctic America, balsam poplar may reach a height of 100 feet in its rather short life; breast-high diameter of such a tall tree may measure as much as six feet. Typically it has a long, straight bole, somewhat similar to a conifer's, with small branches and narrow, oblong crown. This poplar is one of the most used of all tree species for windbreaks and shelter belts in the prairie and plains States.

Balsam poplar, a member of the willow family, is sometimes confused with the eastern cottonwood (*Populus deltoides*). Moreover, the name poplar has been misapplied to the tulip tree, the so-called "yellow poplar" or "tulip poplar", a relative of magnolia, thus increasing the problem of nomenclature.

From Labrador and Newfoundland, the Maritime Provinces and Quebec, the species spreads westward across Canada through Yukon and fans out over most of Alaska except the extreme north.

Southward the tree bypasses Washington, barely touches Oregon, and rarely appears in Idaho. It clings to the Rocky Mountains from western Montana to north-central Colorado at altitudes between 6,000 and 12,000 feet.

Balsam poplar crops up again in the Black Hills of South Dakota and in the northwest corner of Nebraska. It breaks out in eastern North Dakota, northern Minnesota, Wisconsin, and Michigan, also in New York, Vermont, New Hampshire, and Maine.

The estimated United States stand of balsam poplar, concentrated chiefly in the States around the Great Lakes and in the northeastern part of the Nation, is 500 million board feet. The average annual cut takes 13 million board feet. The Canadian stand is substantially larger.

Light-colored or grayish, balsam poplar wood is straight-grained, of uniform texture, soft and weak. Like other cottonwoods, it goes into furniture, boxes, crates, lard and butter pails, matches, and excelsior.

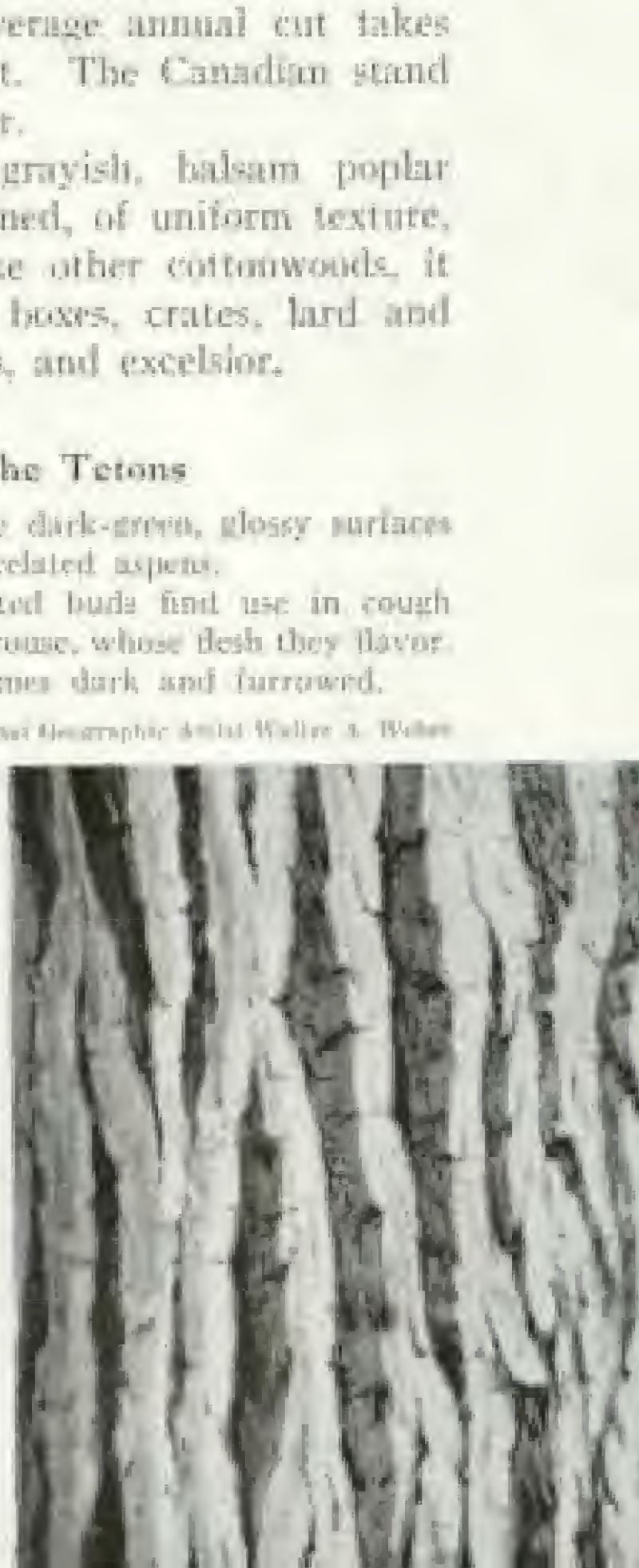
← **Balsam Poplar's Golden Foliage Shimmers Against the Tetons**

✦ Oval, tapering leaves are aromatic. They measure 3 to 6 inches and have dark-green, glossy surfaces and paler veined undersides. Rounded leafstalks distinguish the species from related aspens.

Drooping flowers precede the leaves. Balsam poplar's fragrant, gum-coated buds find use in cough syrups and other medicines. They provide winter food for ptarmigan and other grouse, whose flesh they flavor.

Young bark is smooth and greenish to reddish brown. Mature bark becomes dark and furrowed.

Painting for National Geographic Artist Walter A. Weber



WALTER A. WEBER

Western Hemlock Relishes Copious Snow and Rain

(State Tree of Washington)

ALMOST anywhere in the wet Northwest the western hemlock will put down its roots. The species (*Tsuga heterophylla*) abounds from windy Pacific beaches up to mile-high mountain levels—in fact, wherever annual rainfall totals 60 to 100 inches.

Perhaps this tree is loveliest in winter when its myriad tiny needles cast dense blue shadow patterns on the snow. But at any season down-sweeping branches give the tall conifer a graceful silhouette. The slender, lashlike leader at the tiptop characteristically droops like a buggy whip standing in its holder.

Capt. George Vancouver, English navigator-explorer, and his crew may have been the first white men to see western hemlock. They came upon it in 1792 in the Puget Sound area, an appropriate discovery site, since the species today is the State tree of Washington.

Largest of 10 Hemlock Species

Western hemlock is most abundant and attains maximum size in Washington, Oregon, and western British Columbia. Of the 10 known species of this North American and Asiatic genus, it is the largest. Olympic National Park in Washington claims a specimen which stands 125 feet high with a circumference of 27 feet 2 inches. But in British Columbia western hemlocks not uncommonly grow up to 160 feet.

An adaptable conifer, western hemlock does best in deep, damp, porous earth, yet can subsist on poor, shallow soils if sufficiently moist.

Ordinarily it mingles with other conifers. In Alaska, however, it sometimes occurs in pure stands. For instance, nearly three-fourths of the timber in the heavily wooded Tongass National Forest is western hemlock—58 billion board feet of it.

Estimates put 63 billion board feet of this species in Alaska, and about twice as much in the States. Almost all the Nation's commercial production is confined to Washington and Oregon, with Washington on top.

Once Scorned as Lumber

The wood is fairly uniform in texture and straight-grained. Rather easy to work, it doesn't splinter as easily as eastern hemlock; it glues well and has average nail-holding capacity.

Like its eastern counterpart, western hemlock was once scorned as lumber. Now it is becoming popular for a variety of uses, which include flooring, sashes, doors, and other millwork, furniture, railroad ties, and piling.

Today three times more of its wood goes into pulp, chiefly for newsprint, than into lumber. The principal pulpwood source in the Pacific Northwest is western hemlock.

The bark's tannin content averages 12 to 22 percent; however, competition from quebracho, a tree of tropical America, and other tanning agents has thus far limited its role in the leather industry.

← Snow Mantles a Mile-high Forest of Western Hemlock in Washington's Cascades

↓ Western hemlock bark is dark russet brown and vertically furrowed. On mature trees it may be more than an inch thick. The slender, somewhat hairy twigs are pale yellowish or brownish at first, later reddish brown. Small ovoid buds (enlarged 1½ times) are bright chestnut brown. Needles measure about ½ to one inch in length and emit the characteristic hemlock odor. They are narrow, flattened, and blunt-tipped; glossy green and somewhat grooved above. Their undersides carry two whitish bands of stomata.

Cones are about the same length as the needles; their oval scales hide narrow-winged seeds.

Paintings by National Geographic Artist Walter A. Weber

S.S. *America* Reminds Cadet-midshipmen That One of Them May Become Her Skipper

First-year men, marked with a "P" for plebe, wait on tables at the United States Merchant Marine Academy.

Kings Point: Maker of Mariners

The Young U. S. Merchant Marine Academy Combines Theory, Sea Experience, and Tradition in Preparing Ships' Officers

By Nathaniel T. Kenney

National Geographic Magazine Staff

With Illustrations by National Geographic Photographer Volkmar Wentzel

THE young man ducked from under the radarscope hood, glanced hopelessly at the inky-black glass of the window, then turned to the group clustered in semidarkness behind the ship's wheel.

"Surfaced submarine bearing three-four-eight, sir," he reported. "Range three-zero-two-zero yards. Course three-five-nine, speed eight knots."

In the brief calm that followed I could hear dit-dahs of international code chirping in the radio shack behind the bulkhead.

"What? A sub?" roared Lt. Alfred Fiore, dropping his dividers on the chart.

Lt. Comdr. Arthur Fraser seized the lanyard that hung above the compass. There was a blinding flash of light.

No torpedo exploded beneath us, however. We were merely attending an electronic-navigation class of the United States Merchant Marine Academy at Kings Point, N. Y. Commander Fraser, instructor, did indeed grab a lanyard: it raised a shade, and sunshine struck suddenly through an ordinary window in Bowditch Hall (page 700).

Classroom Sails Safely on

After "navigating" this classroom through a make-believe war zone, a dozen cadet-midshipmen turned from shining rows of gyroscopic compasses, radar and loran receivers, fathometers, and direction finders to look out the window. Beyond the green tree-studded campus lay the western end of Long Island Sound.

"All right, Mr. Baldwin, we'll check your solution," said instructor Al Fiore to the cadet at the radar. "That's your suriaced submarine," and he indicated a deep-laden oil barge chuffing past City Island's complex of yacht yards.

"That's not bad. A sub would give almost the same radar return she does. But the course you figured would bring her on the Stepping Stone rocks!"

"Wait," said Commander Fraser. "I looked under the blind. She really was heading this way, dodging those plebes out there learning to handle lifeboats."

"In which case, I will overlook Mr. Baldwin's grin of triumph," said Fiore, trying not to smile himself. "Class dismissed."

Academy a War Baby

Here, hard by busy Long Island Sound, within sight of the towers of New York City, Uncle Sam schools hundreds of youths who will sail the merchant ships of tomorrow.

Kings Point, the 12-year-old U. S. Merchant Marine Academy, is a youngster compared to West Point and Annapolis, or even to the Coast Guard Academy.* Of the Nation's service schools, only the Air Academy, born last year, is newer. Yet there is no lack of regimental spirit and dedication among Kings Pointers.

As visiting Annapolis midshipmen and West Point cadets remarked to me: "They have a wonderful spirit. We don't understand how they get it without the long-established traditions we have."

The answer is that Kings Point, until it can put more years in its wake, simply makes do with one of the most glorious of all American traditions—the United States Merchant Marine. Not the history of the school but that of the calling it serves binds Kings Pointers in the brotherhood of the sea.

"Welcome Aboard!"

I came to the 65-acre campus on Long Island's north shore early in September. A college year was beginning. Plebes (freshmen) still wandered uncertainly about in blue dungarees; Academy tailors would fit them out in trim khakis and snappy blues.

*See, in the National Geographic Magazine, "Under Canvas in the Atomic Age," by Alan Villiers, July, 1955; "The Making of a West Pointer," by Howell Walker, May, 1932; "West Point and the Gray-Clad Corps," by Lt. Col. Herman Beukema, June, 1936; and "Annapolis, Cradle of the Navy," by Lt. Arthur A. Ageton, June, 1936.

Merchant Marine Academy at Kings Point Educates Officers Beside Salt Water

Wiley Hall, the former Chrysler mansion, stands in front of the 172-foot unguyed steel flagpole, reputedly the country's tallest. Stack at left discharges smoke from a Liberty-ship boiler plant that heats the entire Academy.

Cadet-midshipmen in Dinghies Train for College Races on Breezy Long Island Sound

The museum ship *Emery Rice*, a onetime U.S. Navy gunboat, ties up in Harbor Basin, an artificial harbor. Formerly she took cadets on cruises; today she rests in dignified retirement. A housing above her deck contains maritime relics.

Petty Officer Harry Odell, in the Navy-like uniform of the United States Maritime Service, logged me in at Vickery Gate, bidding me a cheery "Welcome aboard!"

"In 1938," recalled Lt. Everett Northrop, assistant librarian, to whom I applied for an initial lesson in Kings Point history, "the Maritime Commission established a merchant marine cadet-training program.

"At first our cadets trained only aboard merchant ships. Then we added shore training at temporary bases.

"When we were handed the staggering job of training officers to man the increasing American World War II fleet of cargo vessels and transports, the Government quickly realized that we needed a permanent institution.

"One of your own Society's trustees, Vice Admiral Emory S. Land, was chairman of the Maritime Commission during the Academy's building days. Admiral Land gave wholehearted support to the project, and we honor him as one of our founding fathers.

"He retains his enthusiasm for the Academy. Each year he gives the Admiral Land Medal and Award to the Kings Point graduate with the best record in naval architecture."

Former Mansion Now Nerve Center

For $100,000 the Federal Government bought the million-dollar estate of the late Walter P. Chrysler at Kings Point, on the edge of Great Neck, a 19-mile drive from New York. Here the United States Merchant Marine Academy came into being. The late President Franklin D. Roosevelt hailed its dedication on September 30, 1943.

The campus was later enlarged by the purchase of adjoining properties, but the Chrysler place with its gardens, terraced lawns, and Italianate mansion, now used as administration building, remains its hub (page 705).

In 1950 the Maritime Administration, a part of the Department of Commerce, assumed the training responsibilities of the Maritime Commission. Academy staff titles denote Maritime Service rank, not Navy, although most of the teachers also hold commissions in the Naval Reserve.

One finds it hard to believe that almost everything here was built and equipped in the space of a few hectic war years.

"Among our early leaders must have been some first-rate supply officers," smiled a member of the faculty.

"For example, the fine furniture you saw in the Delano Hall cadet-midshipman lounge showed up here, along with a French-built motor lifeboat, soon after the liner *Normandie* burned at her pier in New York."

Most remarkable acquisition was the entire engine room of a Liberty ship. It stands two and a half decks high in Fulton Hall. While heating the whole campus, it teaches students how to make a steamship go.

Engine cadets man the pulsating plant around the clock. They make actual repairs. Though they have been known to lose eyebrows to burner flarebacks, the fuel-oil smoke from the tall stack is usually the light-brown haze that means good firing.

Hobby Is Homemade Steamboat

One day I saw the cadet officer of the watch listening round-eyed to a phone.

"The physical training chief, Comdr. James Lieberg, is getting after him for too little hot water in the gym showers," grinned Capt. Lauren McCready, engineering department head, whose hobby is cruising in his own little homemade steamboat (page 702).

"A prime lesson for 'Mr. Gadget,' as they call engineering cadets. Now he knows what the 'Old Man'—the captain of the ship—will say if later in life he lets steam drop in the middle of the Pacific."

Cadets and instructors working together built a complex, compact planetarium. Here a switch brings the Southern Cross into the concave plywood "sky" or sets the low midsummer sun to circling the Arctic Ocean. From their chairs students can see the stars over the Indian Ocean and the Bay of Biscay.

Each State is assigned a Kings Point cadet quota. Applicants must prove high-school educations or the equivalent, take competitive examinations held annually in the major cities, and pass the rigid Navy physical examination for officer candidate.

Kings Pointers are Navy as well as Merchant Marine cadets. They graduate with three diplomas: commission as Naval Reserve ensign, bachelor of science degree from their fully accredited alma mater, and license as third mate or third assistant engineer.

All cadets take the usual college sciences such as chemistry, mathematics, and physics. Teaching only these and the sea specialties, Kings Point would turn out mechanically qualified officers.

"But the Merchant Marine officer should be well educated and able to act as an am-

↑ Model Lifeboat and Air Blower Teach the Rudiments of Sailing

When the order comes, "Abandon ship," sail can save lives; hence cadets learn to handle boats under canvas. These boys find how to trim sail in a stream of air blown by the baffle box behind the instructor.

↓ A Class in Marlinespike Seamanship Learns the Art of Rope Splicing

Plebes wear the "freshman's" regulation haircut. Two of them employ a wooden fid to part the strands of a large hawser, used in docking and towing. Sailors' standard knots are demonstrated on the bulkhead.

bassador of our American way of life everywhere in the world," said Rear Adm. Gordon McLintock, Academy superintendent.

The Admiral went to sea as a cadet at 16, soon after graduating from prep school, third in his class. When he received an unlimited master's license at 22, he became one of the youngest United States shipmasters.

Two years later he had a sea command, and for 12 more years he took ships to the far corners of the earth. Adelphi College, of Garden City, New York, recently awarded him a Doctor of Laws degree in recognition of his achievements.

"I want every Kings Pointer to have a good background in the liberal arts and humanities," the Admiral continued. "I want them to represent their Nation and their profession with distinction at sea and ashore, as did American shipmasters of old.

Choice of Foreign Languages

"Therefore, we have a Department of History and Languages, known on campus as the 'Longhair Department.' It doesn't try to produce poets and artists, but it does help make Merchant Marine officers cultured gentlemen, and this is as it should be."

In the Longhair Department each cadet has his choice of learning French or Spanish or Russian. He studies the story of Western man, investigates the place of his country in history, and looks at the great cultures that are the Western heritage.

I attended one of Lt. Victor Lugowski's lectures on ancient classics. He used color slides. They showed Homer's Mediterranean lands as seen today from a ship, and they made the lecture come alive for fascinated cadets who would one day see those places too.

A Seaman's Holiday

Later I learned that Lugowski made the slides himself during summer leaves. Like many of his Academy colleagues, he sails at every opportunity, feeling that in this way he best keeps in touch with latest developments in the marine profession.

Most of the teachers, especially of technical and professional subjects, are Merchant Marine officers as well as college graduates. In more than one of their offices I saw university degrees hanging on the wall beside master's or chief engineer's tickets for any ocean, any tonnage, or any horsepower.

With a world of complex learning to impart, Kings Point sets a dizzy academic pace.

Cranes Hoist Cargo Aboard a Model Ship

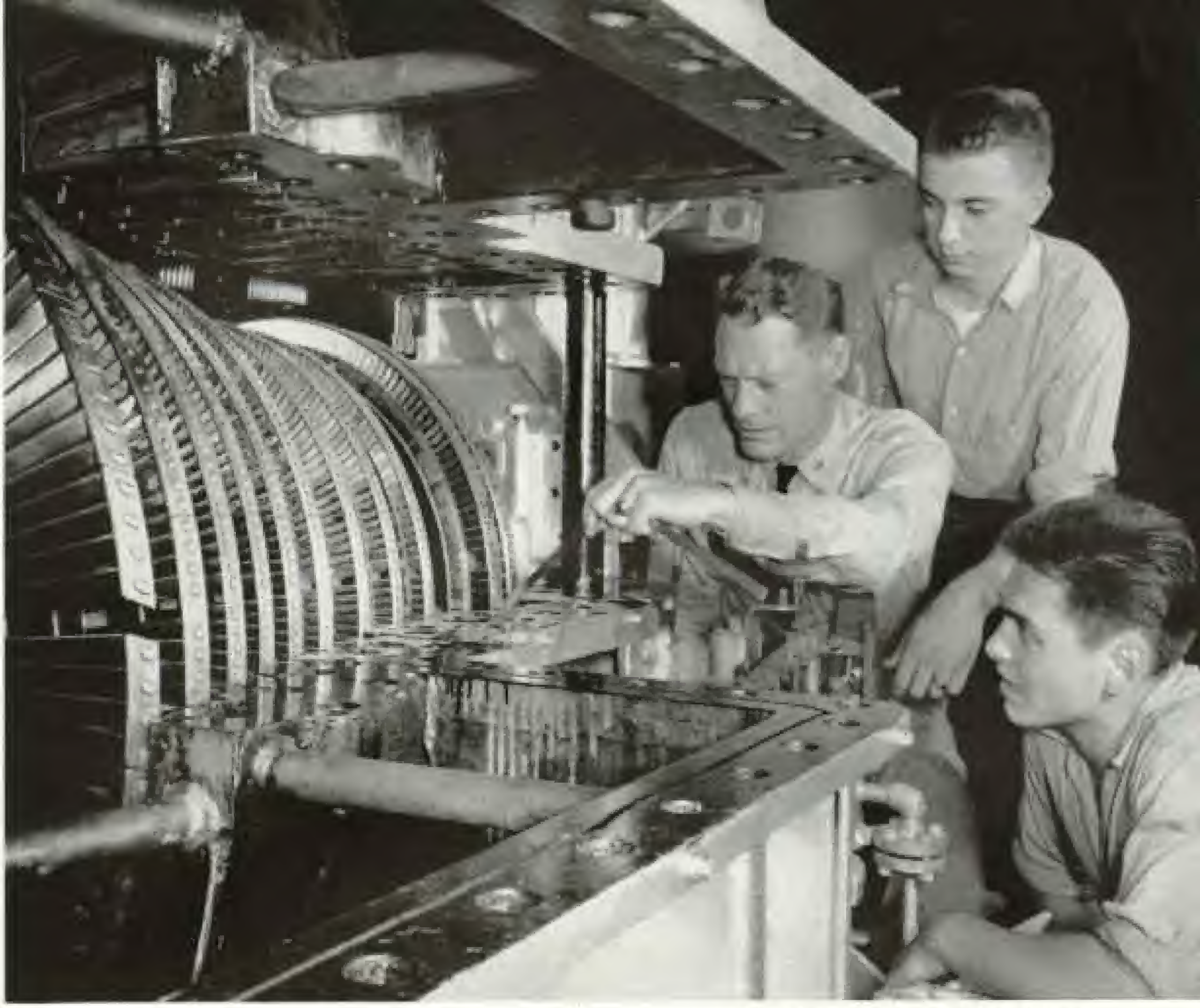
Rear Adm. Gordon McLintock (in cap), superintendent of the Academy, watches nautical-science students practice the standard cargo system used on most freighters and passenger ships today.

Lt. Comdr. Owen E. Thompson (right) and the cadet beside him operate controls on the far side of the mast table. "Airplane sling" lowers barrels into the hold. Loaded net at left is part of a second cargo gear not visible in the picture. Many modern vessels use two sets of gear; they can serve the same hatch simultaneously.

Virtually all loading is now done by machine. Cables, spooled on drums, are driven by electric winches.

Three shoulder stripes identify the cadet-midshipmen as first classmen (seniors). They graduate as deck officers, becoming third mates.

National Geographic Photographer Robert F. Sisson



699 National Geographic Photographer Robert F. Sisson

Naval Vessel's Turboelectric Unit Propels the "Ship" in an Engineering Laboratory

This full-size turbine, originally built for a naval destroyer escort, is specially mounted to aid instruction. The turbine powers a vessel's propellers. High-velocity steam directed from nozzles spins the turbine's blades. Close clearances between blading and nozzles are imperative, otherwise larger volumes of steam rotate with blading, increasing turbulence and friction. Lt. Comdr. Sidney O. Carlson shows these cadet-midshipmen how to check clearances with a feeler gauge, which can determine tolerances of 1/10000 inch.

School keeps for 11 months each year, and fewer than two-thirds of an average plebe class answers the roll on graduation day.

The highly regimented campus life follows the West Point and Annapolis pattern. The student body as a whole is the Regiment of Cadet Midshipmen and is divided into battalions and companies.

Campus buildings bear the names of those who in days past made the Stars and Stripes respected in every sea: Nathaniel Bowditch, father of United States navigation; Capt. Samuel Samuels, master of the sailing packet *Dreadnought*; Nathaniel Brown Palmer, Yankee sealer and discoverer of Antarctica; Robert Fulton, steamboat genius; cadet-midshipman Edwin J. O'Hara, who died in World War II, fighting a four-inch deck gun as his merchant ship went down; and many others.

The Academy hospital is named after Mary A. Patten, a resourceful woman who once commanded a clipper. In 1856 she brought the three-skysail-yarder *Neptune's Car* safely in after her husband, the captain, fell ill.

Cadets reverently salute the handsome War Memorial monument bearing the names of 212 Kings Point cadets and graduates who died in World War II.

To savor barracks life, I spent a night with cadet-midshipman Wayne L. Berry, a tall, serious first classman and petty officer regarded by colleagues and faculty as a better-than-average cadet in all respects.

As a cadet petty officer, Berry had a room to himself on the fourth deck of Jones Hall, but it contained standard equipment for two:

♠ **Cadets in Winter Blues Probe the Sky for Its Secrets**

Students on the roof of Bowditch Hall operate sextant (left), weather balloons, and a lifeboat's yellow radio set. Span glass covers two of the radar scanners.

♠ **Binocular at a Window Checks Ships Seen on the Radarscope**

To identify "blips" observed on the screen, students in Bowditch Hall merely look out over Long Island Sound. The scope is hooded to shut out light.

two beds, two chairs, one table, one lamp, four lockers, two washbasins. Berry's rifle stood upright at the head of his bed, and his framed cadet commission hung on a white-painted wall. Otherwise the room was bare as a monastery cell.

I arrived, toothbrush in pocket, at 1855 hours—five minutes before 7 p.m. A bell rang for evening study period at 1900. I took rough notes from time to time, and some of them are as follows:

Berry buries nose in thermodynamics textbook. Kenney ditto, in a magazine. Other first classmen drop by (they're allowed to visit), and they must be studying thermodynamics too, because they use words like "entropy," "enthalpy," and "Carnot cycle."

2130 hrs. Bell rings. Berry shuts book, puts small radio (only authorized room luxury) on table. Kenney relaxes on bunk.

A Visitor Breaks a Rule

Berry: "If you were a plebe, I could fix your wagon for that. Class II offense. *Bunk sitting or lying on between reveille and tattoo. Ten demerits.*"

Kenney: "Well. May I smoke?"

Berry: "Watch the ashes, though. White-glove inspection tomorrow. They even test tops of window ledges for dust."

2131. Cadets, agog over unusual civilian visitation, jam into room. Bull session. Talk fast and furious; 24 minutes before tattoo.

In this session I steered the conversation away from regimen, searching for what there was to leaven the rigid life.

I heard about dances beside the Chrysler swimming pool, with Japanese lanterns and a June moon and girls in shimmering dresses. For decor at the last one there had been a cadet-built whale in the pool.

The whale really spouted, too, with the aid of a condemned fire hose. When I inquired if anyone ever jitterbugged into the pool, my friends chorused a shocked "No!"

The room rocked with glee at my asking why Lt. (jg) Edward MacCrisken, instructor in ship's medicine, immobilized with heavy lead weights the locked cabinet that houses Little Joe, classroom demonstration skeleton.

"We spread a rumor we were going to steal Little Joe and run him up the flagpole!" one of the visitors whooped.

The flagpole is 172 feet high, the tallest ungayed steel mast in the United States, so the Academy claims (page 694).

"You know why it's so high?" chortled a cadet.

I confessed I didn't.

"So none of us on week-end leave in New York can argue we couldn't see a recall signal!"

Berry and his friends told me they somehow found time to get out student publications, fill the ranks of a successful intercollegiate debate team, attend camera and astronomy club meetings, go spearfishing with the campus Trident Club. Athletics, varsity or intramural, are compulsory. Saturday night movies cost a dime.

A cadet may take his girl sailing on the sound in an Academy boat, sing in the Glee Club, play in the band, or try out for the honor of "ramkeeper." The latter holds Neptune III, the Kings Point mascot, during football games.

Lt. Comdr. Ralph Harpole, Protestant chaplain, told me on a later occasion that the cadets were deeply religious, like seafarers everywhere. Active Protestant, Catholic, and Jewish groups thrive on campus.

Our session in Berry's room ended with tattoo at 9:55 p.m. Five minutes later the bugle blew taps over the loud-speaker system. Within seconds every room light was off and every cadet in bed.

Berry, I judge, was asleep at 10:01 p.m. Around midnight I fell into fitful sleep on a very hard bed.

On routine duties, cadets came and went quietly during the night. They had fire watches and regular watches in the boiler room, in the main administration building, or in the battalion offices.

Wayward Plebe Takes a Brace

At 6 a.m. a bugle brought all hands tumbling to the deck in instantaneous, tumultuous awakening. At 6:30 a plebe took up station beneath a clock in the passageway, standing at a rigid "brace"—exaggerated attention—and calling off the minutes before mess muster.

"Sir, *five* minutes to mess muster... *four* minutes to mess muster...."

My roommate popped out of his room precisely at reveille. It was his duty to see that all doors on his deck were open and all hands up and about. Then I found out that the clock-watching plebe was paying the penalty for breaking some part of the semi-official fourth-classman's code which is called

Students Practice Ship Loading with Bogus Cargo

Reid Pier used to serve wealthy Long Islanders commuting to Manhattan Island by ferry; today it holds hoisting equipment for loading an imaginary freighter. This ship's hold is only a deep concrete pit. In lieu of real cargo, a life raft swings aboard. Steam piped down from the Academy's boiler room powers the winch at right.

Building at left houses the Petty Officers' Club. Its members, who hold rank in the U.S. Maritime Service, are attached to the Academy.

City Island, a yacht-repair center, lies in the background.

Little Effie Toots a Shrill, Steamy Whistle

Capt. Lauren S. McCready, head of the Academy's engineering department, has a hobby: she is *Little Effie*, a onetime whaleboat that he converted into a coal burner. When he takes a crew for a spin, he selects at least one hefty stoker for her hand-fired boiler. Here Captain McCready, hand on the tiller, steers *Effie* into Hague Basin (page 694). The mainland looms in the distance.

S.S. Miss Calculation: a Triumph of Errors

Page 705: The listing model in this tank contains built-in faults designed to illustrate problems of cargo and ballast. With scarcely any effort on the part of her crew, she shows what poorly stowed cargo can do to a ship.

A 100-pound weight at the end of the tackle sets the crazy hull reeling drunkenly. Her handlers occasionally wear bathing trunks.

Stowage and ballast are very important items in a deck officer's training.

Miss Calculation berths in a laboratory full of cutaway ship models and other teaching aids, many of them given by shipping lines.

Explanations by National Geographic Photographer Volkmar Wentzel


100 LBS

"class system," or less officially, "class rates."

This code insists that plebes walk in single file, even when there are only two of them. Plebes "square" corners, meaning they change course abruptly, 90 degrees at a change, as on the parade ground. They must also follow starboard edges of walks and corridors, a requirement that provides them miles of healthy extra footsteps per year.

"Sophomores" Roam the Seas

The various cadet classes and ranks are distinguished from each other by a baffling insignia system involving shoulderboard and sleeve stripes. I made an important discovery while trying to learn the system.

"Why," I asked Lt. Comdr. Luis Bejarano, librarian, "doesn't the third class, the sophomore class, have insignia?"

"They do—one stripe," Bejarano replied, "but the third class is scattered over the oceans. Second college year is sea year; the world is the third classman's campus.

"Our system is unique. We don't send our cadets out on mass training cruises. They go as individuals helping work American merchant ships on regular runs. The largest cadet group in any one ship consists of six in the liner *United States*.

"An ordinary cargo or passenger-cargo vessel will carry one deck and one engine cadet. We've had cadets who sailed three times around the world in their sea year. Most have logged 50,000 miles or more."

Steamship lines like the cadet system, cheerfully paying the trainees. They know they are not only obtaining the services of a junior officer, but, more important, helping to train a body of men from which they will later hire their ships' officers.

The Academy keeps a special representative, currently Comdr. Sherman Reed, in New York. Commander Reed's job is to find ships for "sophomores," then keep track of them on their peregrinations, which he does with a boxful of cards on his desk.

Meeting the *African Moon*

The day I talked to him, he had 260 cadets at sea or in foreign ports. All were on regularly scheduled runs—the United States today has comparatively little tramp shipping—and so Commander Reed knew pretty well when each cadet would get back to New York.

When a cadet is due in, Commander Reed or some other Academy officer meets him to find out how he is getting along. On a day when Comdr. Clifford Sandberg, assistant head of the engineering department, drew the meeting duty, I went with him to a Brooklyn pier where the S. S. *African Moon*, Farrell Lines, was unloading baled hides and frozen lobster tails from Cape Town.

She carried two cadets, who shared a stateroom on the officers' deck and ate with the officers. The deck cadet was ashore, but the ship's chief engineer quickly produced his engine cadet, Nick Starace. Even in greasy dungarees, he was well poised.

"This was a wide-eyed plebe last year?" I asked incredulously as Starace went off to fetch his sea project.

"They mature fast at sea," nodded Sandberg. "It's a wonderful system."

The commander studied Starace's sea project carefully and marked a high grade on the bulky notebook. I leafed through it later and gathered that the youth had described and sketched the refrigeration machinery with which the *Moon* kept her lobster tails frozen.

Learning Ports and Products

Each cadet works on some sort of sea project in his hours off watch. A popular one with deck cadets is a study of the various products shipped out of ports visited. They bring back samples in labeled bottles. Starace said with a smile that his topside colleague had failed to collect either an elephant tusk or a diamond this voyage.

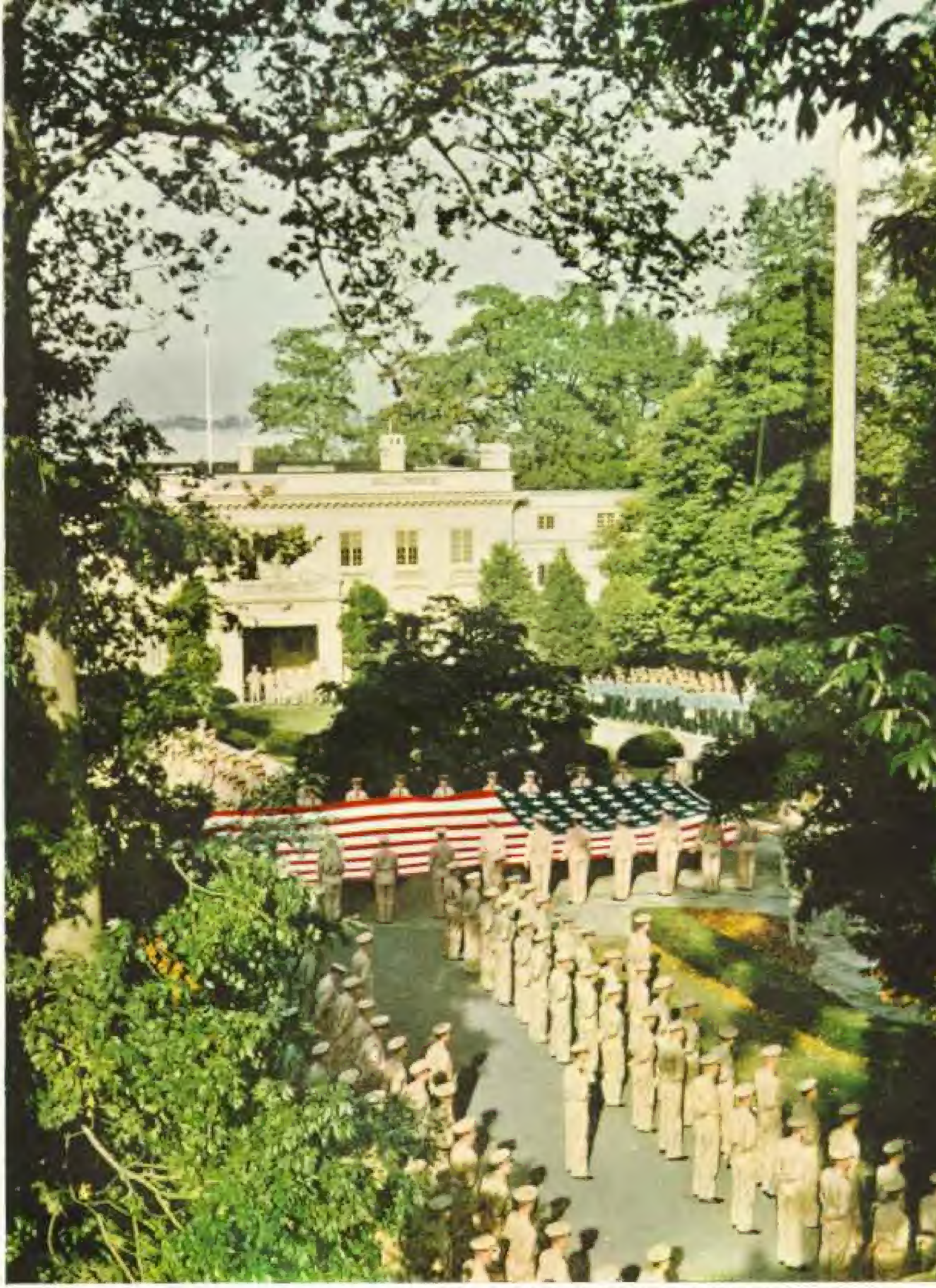
"Mr. Starace, the Chief likes you and wants you to sign on for another trip," said Commander Sandberg.

But Starace said that although he liked the *Moon* and everybody in her, he wanted a tanker next, for experience.

"I'll ask Commander Reed to set it up," Sandberg said. "I take it you have no special problems to discuss?"

"No, sir, not today," replied Starace. "Yesterday I was teed off because the Chief had me type his spares inventory, but today it occurs to me that what I learned that way might come in handy in your classroom next year!"

Later, Starace and I stood alone on deck watching the busy tugs scurrying about their affairs and the quarreling gulls wheeling above the masts. He told me of whales spouting in the windy South Atlantic, of raising lonely St. Helena in the dawn, and



Color transparency by National Geographic Photographer Volkmar Wentzel

Starting Their Day. Cadets in Summer Khakis Fall In for Morning Colors

Two dozen men hold the nylon flag preparatory to raising it. Wiley Hall (background) is the Academy's administrative headquarters, where VIP's are piped aboard. A laboratory class at right wears blue dungarees.

Plebes Stand at Brace. "Let's See More Chins, Mister," Says the Upperclassman

After a full day in school, these beginners were routed out in full uniform and lined up in the dormitory hall to learn student discipline. As a privilege of his lofty status, the upperclassman appeared in bathrobe. Brace is a position of exaggerated attention here, just as it is at the other service academies.

of the white mists blanketing Table Mountain behind Cape Town. He had had an education, all right.

I looked into some of Commander Bejarano's files on Academy graduates. Most, of course, had become ships' officers—masters, chief engineers, lesser grades.

More than two-thirds of the officers in the superliner *United States* are graduates of the U. S. Merchant Marine Academy, and so are the captains of several Farrell Lines vessels. A Kings Pointer is chief engineer of one of Esso's largest tankers. Many serve in the Navy under their reserve commissions.

Kings Pointer Doubles as Doctor

Others have become oceanographers, hydrographers, shipping executives, marine-insurance experts, marine-supply men, officials of stevedoring firms, port captains, regular Navy and Coast Guard officers, stationary engineers, and instructors.

One Kings Point grad directs the Hayden Planetarium in New York. Another, mate in *Meredith Victory* during an epic refugee run made by that ship in 1951, delivered several Korean babies with only his school course in ship's medicine to guide him.

Still another operates a copra plantation on Tahiti. More directly than many, he can attribute his paradisiacal life in the South Seas to the Academy. Calling at Papeete during his sea year, he fell in love with a French girl and went back after graduation to marry her.

Not all Kings Point alumni, of course, end up in such odd anchorages. But certainly the Academy's graduates shove off for the great wide world with well-founded optimism in their hearts. Words of one of their football songs well sum up the faith with which they face the voyage of life:

> Heave ho! my lads, heave ho!
> Let the seas roll high or low
> We can cross any ocean, sail any river,
> Give us the goods and we'll deliver.

Twentieth Anniversary of the Epoch-making Stratosphere Flight by *Explorer II*

THE date: Armistice Day, November 11, 1935. Grouped around radios, millions of Americans listened to the laconic conversation of two men suspended in a metal ball more than 13 miles above the earth.

Capt. Albert W. Stevens and Capt. Orvil A. Anderson had ridden the *Explorer II* stratosphere balloon to a new world's record altitude of 72,395 feet. Their flight, sponsored by the National Geographic Society and the U. S. Army Air Corps, was launched from a cliff-encircled depression—the Stratobowl—in South Dakota's Black Hills near Rapid City. After 8 hours and 13 minutes aloft, the flyers brought their instrument-laden gondola safely to rest near White Lake, South Dakota, 230 miles from the launching site.*

Flight's Value Grew with the Years

November, 1955, marks the 20th anniversary of that epoch-making flight. The data it yielded opened broad new avenues of investigation. Yet in 1935 not even *Explorer II*'s sponsors could gauge the richness of their legacy to the aeronautical sciences.

That fact was often stressed by General of the Air Force H. H. Arnold, a trustee of The Society until his death in 1950. He stated that the stratosphere expedition "bore fruit in World War II far in advance of what was imagined to be the results at the time."

The Army Air Forces' wartime commander referred in particular to lessons learned from the use of strong magnesium alloy for the hull of the nine-foot spherical gondola, the success of the gondola's advanced pressurized cabin, its two-way radio communication with the distant earth, and items of personal equipment, such as electrically heated flying suits.

"Many other items of equipment and methods were improved which later played important parts in giving American airmen superiority in the skies of Berlin and Tokyo," the General added.

Explorer II carried 64 scientific instruments aloft. They provided much of the information on which scientists based stratosphere research in the intervening years.

Dr. Hugh L. Dryden, director of the National Advisory Committee for Aeronautics and a life trustee of The Society, summarizes the expedition's sky soundings as follows:

"About a ton of scientific apparatus produced new data on the direction of travel, number, and energy of cosmic rays; the distribution of ozone in the upper atmosphere; the spectra and brightness of sun and sky; the chemical composition, electrical conductivity, and living spore content of the air above 70,000 feet, and radio transmission from very high altitude."

Dr. Dryden also cites the unique color photographs made of earth and sky. But perhaps the most significant accomplishment, he points out, was the "convincing demonstration that man could protect himself from the environment of the stratosphere, from air so thin that the fan for rotating the balloon was ineffective, and from severe cold of 80° Fahrenheit below zero."

The U. S. Air Force's Bell X-1A now holds the unofficial record for man's farthest aloft—90,000 feet, or approximately 17 miles. But the rocket-powered plane stayed that high only a few seconds. Stevens and Anderson were above 70,000 feet for one hour and 40 minutes, an achievement yet unequaled.

A New Explorer Challenges the Old

Explorer II still holds the altitude record for a manned balloon. But she may lose that distinction soon to a namesake, *Explorer III* of the U. S. Air Force. Two young parachutists, Capt. Edward G. Sperry and 1st Lt. Henry P. Nielsen, plan to take this balloon 90,000 feet or higher and jump. Their purpose: research in survival problems of flyers forced to eject from tomorrow's planes.†

Captain Stevens, commander of the *Explorer II*, held the retired Army rank of lieutenant colonel at his death in 1949. Captain Anderson, the pilot, became a major general in the Air Force, retiring in 1950.

Today, in retrospect across two decades, aviation recognizes their flight as vital to research that followed, research that now promises unmanned earth satellites and, eventually, voyages by man into space.

* For full accounts of the *Explorer II* flight, see, in the NATIONAL GEOGRAPHIC MAGAZINE: "Man's Farthest Aloft," January, 1936, and "Scientific Results of the World-Record Stratosphere Flight," May, 1936, both by Capt. Albert W. Stevens. See also "National Geographic Society-U. S. Army Air Corps Stratosphere Flight of 1935 in Balloon *Explorer II*" (Contributed Technical Papers, Stratosphere Series, No. 7), published in 1936 by National Geographic Society, Washington, D. C.

† See "Aviation Medicine on the Threshold of Space," by Allan C. Fisher, Jr., NATIONAL GEOGRAPHIC MAGAZINE, August, 1955.

Immigrants Still Flock to Liberty's Land

By
ALBERT W. ATWOOD

"THERE she is!"

We rushed from the cramped cabin of the Coast Guard cutter, more than a score of us—Public Health and Immigration inspectors, Customs officers, a few news reporters, photographers, and myself.

The liner loomed high above us, cliff-sided and colossal, yet undeniably beautiful in the fog. A home to 1,300 passengers and crew, the splendid vessel seemed vibrant with life and purpose.

Many from Mediterranean

I wanted to board a liner from Mediterranean ports because so much present-day immigration comes from Italy and Greece, or from Germany via the Mediterranean. The Italian Line's *Andrea Doria* had brought several hundred immigrants to New York Harbor; it was part of my assignment to come face to face with these typical newcomers as they were admitted, or refused entry, to the Promised Land.

It was not my purpose to cope with the pros and cons of the "immigration problem." Rather I sought to witness and report the arrival of just a part of one day's contribution to the greatest and longest-continued migration in the history of mankind.

True, the scale of immigration is reduced from what it once was. But it is still a ceaseless stream, an intensely colorful and human saga of joy and sorrow. Im-

migration is one of the oldest and at the same time one of the ever-fresh themes of American history.*

It was not difficult to board the ship with the ocean as smooth as it was on that mild spring day. Four strong young sailors fairly lifted us up the short steel ladder. In earlier years, when a rope ladder was used, it was easy to miss one's step in a rough sea.

Because of dense fog, our cutter had spent hours searching for the incoming liners expected that day. Eager to get to work after the long morning of frustration, we hurried up to the saloons where inspection of the passengers and crew began.

Officers of the United States Public Health Service are first to greet anyone who tries to

* See, in the National Geographic Magazine, "Our Foreign-born Citizens," February, 1917, and "Foreign-born of the United States," September, 1914.

"We're Here at Last!" An 8-year Dream Ends for a European Refugee Family

Thanks to the Refugee Relief Act of 1953, a new life opens for Romanian-born Eduard Zimmer, his wife, and three sons. Mr. Zimmer applied for a United States visa in 1947. Forced to wait until 1955, he became No. 30,000 to be admitted under the act. His sponsor in California guaranteed job and housing.

Opposite: Zimmer and 9-year-old son, Albert, marvel at New York Harbor and the Empire State Building from the *General W. C. Langfitt*, refugee ship that carried them from Germany.

↓ Mrs. Zimmer and sons precede Father down the gangplank. To follow the Zimmer family from Germany to the United States, see pages 712, 713, 715, and 721.

National Geographic Photographer Robert F. Sisson

enter the country. I took my stand, therefore, beside the senior surgeon, Dr. Henry M. Friedman, medical officer in charge of boardings. In nearly 50 years of service Dr. Friedman has inspected more than a million incoming passengers and crew members (p. 710).

Out on deck huddled masses of immigrants. Admitted by guards through a narrow door, they were first examined by one of Dr. Friedman's assistants. Then the newcomers walked about 40 feet toward the doctor. It was a tragic few yards for some, as Dr. Friedman's practiced eye caught a physical or mental defect.

"That badly crippled young man I just passed can hardly walk," Dr. Friedman said, "but he's a skilled watchmaker and will do all right. That old man over there whom I've set aside has a bad heart and has lost an eye and a leg. Still, if Immigration thinks his children will not let him become a public charge, he can come in."

Dramas Have Happy Endings

Inspection must be extraordinarily swift and yet as sure as skill and experience can make it. Any unnecessary delay in di-charging passengers means a loss in time and money to both the steamship companies and the passengers.

At first glance, the inspection of a lengthy ship's roster of passengers may seem a hopelessly confused and impossible undertaking. But the work gets done; each Immigration inspector may have up to 100 persons to examine, if the list is a large one. His job is first to determine nationality. For those not American citizens, their right to enter must be determined.

Each inspector has before him several hundred pages of regulations, and some 50 different classifications of persons who can or cannot enter. Each person must be checked also against a "lookout" list of applicants who need to be more closely questioned.

I was delighted to see how many happy endings there were. Here was a father, somewhat feeble, but a clean-cut farmer type, with six fine-looking children, the oldest in his twenties. None spoke English. The mother, already a citizen, was living in California, and father and children were joining her.

"I'll make you a bet," said the inspector as he passed them. "Within a few years that man will own an auto and also a farm!"

I joined Edward Ferro, supervisory immigrant inspector and "commodore" of the inspection crew. A steward handed him a tele-

gram. Three children had been admitted a few minutes earlier. Now came a wire from the uncle with whom they were to live, refusing to accept them.

The three children, frightened and unable to speak English, were brought back from the pier—a girl of 17 soon to become a mother, a strong-looking boy of 16, and a girl of 11.

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U. S. Navy, Official

Happy Refugees Line the Rail of a Transport Entering New York Harbor

Then, fortunately, a Travelers Aid Society worker appeared, explaining that another uncle, living in a different town, was on the pier and ready to take the children.

"Bring him on," ordered Ferro.

The uncle, a substantial-appearing man, came in. He explained that he had a house for the children and would take them despite the girl's condition. Since he had never seen them before, Inspector Ferro made the introductions. Then the children fell on the strange uncle's neck, kissed him eagerly, and, happy now, trooped off the ship after the Travelers Aid worker.

A few days later, Edward J. Shaughnessy, the director of the New York District Immigration Service, and I made an early-morning trip to New York's International Airport, frequently called Idlewild. Although most European immigrants still come by surface vessel, a steadily increasing number now arrive by plane.

Nineteen international airlines brought some 536,000 passengers to Idlewild in 1954, nearly half of them aliens.

"We get all kinds, from the poorest immigrants to some of the world's wealthiest and most famous," said John H. Adams, supervisory immigrant inspector at the airport.

As I sat beside the examining inspector, the first plane crew filed past. Then came a handsome Turkish Government official, here

Last Step Before Getting Visas Is a Solemn Oath →

Having met conditions for resettlement in the United States, Eduard Zimmer and family swear that all their statements are true. Michael A. Falzone, U. S. vice consul, administers the oath in Bremen, Germany.

Preparing to leave for his new home, Albert Zimmer submits to inoculation at an emigrant assembly center near Bremen. Brothers Adolph, 13 years old, and Robert, 15, await their turn. Like other immigrants, all candidates for resettlement under the Refugee Relief Act must take medical examinations.

to buy farm equipment. He was followed by a stolid, heavy-set Yugoslav farm woman.

Next in line came a woman from Macedonia, who was quickly admitted under the Immigration and Nationality Act (the McCarran-Walter Act) of 1952. This act replaced or codified all previous immigration and nationality laws. It carried forward (with slight changes from earlier legislation) the quota system based proportionately on the number of persons of each nationality living in the United States in 1920. The 1952 act removed all racial bars to immigration.

It also exempted alien husbands or wives of U. S. citizens from quotas. For example, because the husband of the woman from Macedonia was a citizen (he owns a restaurant in Ohio), he could petition for a nonquota immigrant visa for his alien wife.

Under the Displaced Persons Act of 1948 about 340,000 of the homeless were admitted. The current Refugee Relief Act of 1953 authorizes the immigration of 209,000 refugees, close relatives of United States citizens, and orphans outside of normal quotas.

The United States took the leadership in establishment of ICEM, the Intergovernmental Committee for European Migration, which is supported by 26 nations. So far, the Committee has moved nearly 400,000 of Europe's excess population to Australia, Canada, the United States, Argentina, Brazil, Venezuela, and other countries.

Naval Transport Reserved for Refugees

The Committee now operates a United States naval transport, the *General W. C. Langfitt*, to carry immigrants on a full-time basis (pages 708, 709, 711, and 715). But it also depends heavily on airlift.

Many of the "compassionate" cases go by air. These are infants, the aged, infirm, and women soon to become mothers. Special categories, such as a group of Basque shepherders needed for work on western ranches, and 20 Italian war orphans for adoption, have come by chartered plane. Flexible in its routine, a plane can pick up groups in widely scattered places (page 718).

On a steamship there is time for a person

who may have contracted a disease to come down with it. Not so likely on a plane. Thus, in the "hold" rooms at Idlewild, incoming passengers are closely questioned by a Quarantine officer of the Public Health Service to learn if they have visited parts of the world known to be suffering from epidemics.

From the Public Health hold rooms passengers in general go directly into the Immigration waiting rooms. From there they are guided, in orderly flow, into nine inspection rooms, and from them into the Customs waiting room. American citizens are examined separately, since their inspection takes less time.

Whether present-day immigrants come by air or surface ship, their lot is rendered much easier by the voluntary agencies, such as Travelers Aid, National Catholic Welfare Conference, National Lutheran Council, United HIAS (Hebrew Immigrant Aid Society) Service, and Church World Service.

In earlier days, unwary immigrants were sometimes exploited. A very green one gave a "runner" $97 to buy him a ticket for Kansas City and start him on his journey.

The runner pocketed the money, put the victim aboard the Third Avenue Elevated (fare at the time: 5¢), and told him to ask the conductor to let him off at Kansas City.

Voluntary Agencies Guide Strangers

Today the vigilance of authorities and the activities of voluntary agencies help to prevent such exploitation.

When an ICEM chartered aircraft brings a group of refugees and other migrants into Idlewild, representatives of the voluntary agencies meet them and complete their travel arrangements; then they accompany them to the "well" near the stationmaster's office at Pennsylvania Station, whence they are sent off to all parts of the country.

Welfare officials also comfort the confused and bewildered, take the place of relatives who cannot get to New York, and telegraph relatives for money for those who lack it. They fill in forms, prepare documents and petitions, and sit in on exclusion and other hearings.

One welfare worker told me his office handles 100 cases a day, acting as first friend of the foreign-born new arrival.

The most striking single fact I discovered about present-day immigrants is the improvement they reveal in living conditions and educational standards in their homelands.

"When I came over from Italy in 1910," a veteran news photographer told me, "95 percent of my fellow immigrants couldn't read. Today the proportions are reversed. Now and then an old lady comes who can't read, but the young people have had educational advantages unknown half a century ago."

Millions of Europeans were driven from their homes by the Hitler regime in Germany, by the upheavals of World War II, and the spread of communism. Among those who have been welcomed to this country are a high percentage of professionals, technicians, artists, craftsmen, and other well-qualified people, many of them prominent and successful in their native lands.

From Politician to Night Watchman

Not all have found financial success here, though many have. As I crossed the campus of an American college one evening in company with its president, he nodded to a poorly dressed man in middle life.

"He was in the Cabinet of a country now behind the Iron Curtain," the educator told me. "He's our night watchman and is working to put his son through college."

We find them everywhere—former lawyers, judges, diplomats, artists, theater managers, professors, and army and navy officers—happy to accept jobs as doormen, dishwashers, and elevator operators.

"I am proud to be a laborer in the United States," said a former European statesman who was discovered sorting clothes in a Chicago laundry.

One young man, who had fought the Communist regime as a guerrilla, had to work as a street cleaner in an Illinois city before he could find a position in Washington, D. C., as a translator.

But many finally hit upon work in line with their training—teaching in universities, as specialists in the Library of Congress and other Federal agencies, or as translators in the Department of State.

Some immigrants risk their lives to get to the United States. Newspapers tell of escapes from concentration camps and from behind the Iron Curtain, of perilous border crossings, of encounters with vicious dogs, land mines, and electrically charged barbed wire.

Two Albanian brothers, now in this country, seized a Communist motorboat. The captain and some soldiers on board were persuaded to drink heavily drugged wine.

"It tastes like perfume," complained the captain.

"That's because it's wedding wine," was the explanation. As soon as captain and soldiers became unconscious, the brothers disarmed them and steered the boat into a non-Communist port.

Immigration has been increasingly regulated since World War I, both as to numbers and as to quality. A dual system of screening lessens the chance of rejection and heartbreak.

Large numbers are weeded out abroad. Every would-be emigrant must secure a visa from an American consul. He is given a medical examination. He must provide documents, including police and prison record, military record, and birth certificate. He is registered and fingerprinted.

Emigration, which often involves the sale of a farm and homestead, is a serious business. The visa system prevents impulsive or spur-of-the-moment action. Best of all, refusal of a visa, if such action proves necessary, prevents an expensive and useless trip. When a visa is granted, there is reasonable assurance of admission.

Auf Wiedersehen!

Relatives wave from the quay at Bremerhaven, Germany, as the refugee ship *General W. C. Langfitt* sails for New York.

The 26-nation Intergovernmental Committee for European Migration chartered the *Langfitt*, a U. S. Navy transport.

ICEM, aiming to bring 131,750 migrants from overpopulated Europe to less crowded lands by the end of this year, also chartered airliners and booked space on ships.

A United States Doctor Studies the Chest X-ray of an Incoming Swiss Physician

Dr. Henry M. Friedman (right), senior surgeon of the U. S. Public Health Service at New York, is responsible for medical clearance of most ship passengers entering the port. In a 50-year career he has boarded thousands of vessels and examined more than a million persons (page 710). Here, aboard the French Line's *Liberté*, he meets Dr. Paul Cottier, an exchange student from Bern.

United States consuls in foreign countries are responsible for enforcing the numerical limitations, and for observing preference classifications as well as other provisions of law.

Spotting an Immigrant Not Easy

"The first thing to remember about immigration," James E. Duffy, a New York ship news reporter, told me, "is that an immigrant now looks like anyone else."

Although not true of all immigrants, this statement does apply to many. It is not easy for an immigrant to gain admittance nowadays without some form of sponsorship, some assurance of a job and a home. Such arrangements, naturally, are most readily made by relatives already living in this country.

To their overseas kin American relatives write: "You come dressed right. I wouldn't want to be on the dock and meet you wearing a shawl."

The present immigration law, through special preference classes and nonquota (free from numerical limitations) provisions, greatly favors family reunion. This means that very large numbers of parents, children, wives, and even brothers and sisters of present United States citizens are constantly being admitted.

Adoption of orphans from war-torn countries, both European and Asiatic, and the admission of war brides, have been made easier by special legislation since the close of World War II. The total number in these groups is about 200,000. Although most war brides arrived soon after the close of the war, others are still coming.

From colonial times down to this moment, Europeans have emigrated to what is now the United States for a variety of reasons: to escape political and religious persecution; as victims of wars, revolutions, and famine; pressure of population; and other causes.

But mostly they come to better their lot.

"If my grandparents hadn't come over as

immigrants," the wife of a university professor told me, "I wouldn't be using a washing machine. I would be pounding my family's clothes on stones in a mountain brook in Italy. My cousins still do."

Free land, undeveloped resources, and a pressing need for unskilled labor beckoned for many decades. The first wave of immigration from Ireland, in the 1840's, was set in motion by repeated potato crop failures. Waves of Germans followed.

Million a Year Before World War I

But the really precipitous rise in immigration did not make itself felt until after 1900; the average was more than 1,000,000 a year between 1905 and 1914.

Emigration in such vast numbers was impossible until modern transportation became available. The popular idea that Europeans swarmed ashore here before the American Revolution is in error. Actually, in the first one and a half centuries of settlement, only an estimated 80,000 could endure the long, expensive, and dangerous voyage. Not more than 250,000 came between the close of the Revolution and 1820, and about 750,000 between 1820 and 1840.

In early days there were no sailing schedules. Ships were pitifully small—300 or 400 tons at most—and the voyage took two months. Seventeen vessels between Liverpool and Quebec were wrecked in 1830 alone.

Food and water were often unsafe for human consumption. Sanitary conditions in the ill-ventilated steerage were appalling; disease was rampant. An average of 10 percent of immigrants died on the voyage.

Building of railroads in Europe made it easier for emigrants to reach seaports. And when transatlantic steamships began their schedules, the trip was drastically shortened.

By the 1890's steamship companies were providing bedding and table utensils. Running water, washrooms, and medical attention, too, were introduced. But even as late as 40 or 50 years ago conditions still were rather primitive. A New York newspaper-

Confusions of a Strange Land Beset Immigrants Waiting for Baggage Tags

Ellis Island Museum

National Geographic Photographer Robert F. Sisson

Helping Hands Greet Immigrants Leaving a Chartered Airliner from Europe

Mrs. Ruth Tropin, of the Intergovernmental Committee for European Migration, dispenses identifying buttons at New York's International Airport. Badges bear initials of voluntary agencies that help refugees find homes.

man, who came over 45 years ago, told me:

"They divided us into units of seven, with one as the leader. The company gave me the food for seven and also tin dishes, forks, spoons, and cups. We had to sit on the floor to eat, and wash the dishes in cold salt water. It took 23 days. On my last trip from Rome by air, I came over in 23 hours."

Since World War II, international travel by sea and air has had a phenomenal increase, averaging a 10-percent rise each year. Temporary visitors account for much of it.

Thousands of exchange students from Europe and Asia have flocked to our shores, as well as newspaper and radio men, technicians, artisans, businessmen, and specialists. I ran into a group of visiting Egyptian policemen and another of Turkish railway men.

The boom in overseas travel has also greatly increased the number of United States citizens seeking re-entry after trips abroad. These, too, are a responsibility of the Immigration and Naturalization Service.

The Public Health and Immigration Services are charged by law with the "primary" inspection of everyone, alien and citizen, who enters the United States —2,000,000,000 persons since 1928, and more than 118,000,000 in 1954 alone.

Most of these, 97 percent, in fact, are "border crossers," U. S. citizens and resident aliens returning from Canada and Mexico, and Canadian and Mexican citizens visiting temporarily in this country on business or pleasure. In the vast majority of cases this traffic is entirely legal.

But it is necessary each year to deport a substantial number of persons who have entered illegally; over the past five years the average has exceeded 17,000 a year.

These include the thousands who try to enter without inspection, or without proper documents, or by false statements. Among them are numbered those who do not comply with admission conditions, who are violators of narcotics laws, criminals, or subversives. They include immoral classes, mental and physical defectives, and those likely to become public charges.

Until recently, large numbers were detained, pending determination of admissibility, in immigrant detention stations in Boston, Seattle, San Francisco, San Pedro, Honolulu, and above all at Ellis Island in New York Harbor.

Brothers, Long Parted, Meet with a Kiss and a Handshake

Such reunions are common at Idlewild, where chartered planes arrive almost daily with migrants ready to take up a new life.

After passing Health, Immigration, and Customs examinations, newcomers may complete their journeys with relatives or sponsors or be entrained by voluntary agencies.

National Geographic Photographer
Robert F. Sisson

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Immigration, Old Style: Romanians of 1906 Arrive in Shepherd Garb

In the National Geographic Magazine for May, 1907, appeared this photograph of a family in native costume—seven of 1,018,363 Europeans admitted in 1906. They were not identified. Does any reader recognize them and know how they and their descendants have fitted into the fabric of American life?

Ellis Island was by far the best known. From its establishment in 1892 until it was closed in 1954, it processed 20,000,000 immigrants, sometimes as many as 5,000 a day.

But now the great majority of pending exclusion and deportation cases are released immediately under conditional bond or parole or supervision.

Stowaways Cause Headaches

In huge offices at 70 Columbus Avenue, the real business of the New York Immigration District is carried on. Through the Information Center as many as 3,500 persons have passed in a single day. In other rooms people apply for extension of stay in the country, petition for citizenship, appeal unfavorable rulings, and file applications for sponsorship of intending immigrants. In individual chambers hearings are held, scores at a time.

One of the minor, but annoying, problems of the Immigration Service is the stowaway. Several hundred are detected each year, on board ship or ashore later. Few come by air, although one was found in a cargo of tomatoes and another in a planeload of race horses, both at Miami.

Now and then the Immigration and Naturalization Service must deal with refugees, a number from Baltic countries, who arrive in small sailing boats without visas or documents of any kind. Most have been admitted, either through discretionary permission of the Attorney General or by private legislation.

A more serious problem is to detect alien crewmen who desert their ships or otherwise overstay the time allowed them in port. More than a million alien seamen annually enter United States ports, and, on the average, about 2,000 jump ship each year.

Wide World

Immigration, New Style: Romanians, Too, but Dressed Like Everyone Else

To escape Russian troops advancing into the Balkans in 1940, the Zimmer family fled to Austria and Germany. The Lutheran World Federation aided their passage to the United States last July. American relatives often write immigrants to "dress right" if they want to be met at the pier (page 716).

"Wetbacks." Mexicans who illegally enter the United States, many of them by wading or swimming the Rio Grande, have received much publicity in recent years. In a single local inland district, many hundreds of miles from the Mexican border, 700 aliens were apprehended in a five-month period.

One ingenious man had himself sewed in a sack and stacked in a boxcar full of bags of potatoes! Between 1,500 and 1,800 smugglers and transporters of aliens are caught in a single year.

The Immigration Service also supervises admission of nearly 200,000 temporary workers, under bond, from Mexico and Canada.

An immigrant who is admitted has three choices open to him. He can return to his homeland or visit abroad. He can remain in this country all his life as an alien. Or he can become a citizen.

Immigrants, both aliens and citizens, have contributed magnificently to the richness and diversity of United States civilization. These contributions have been made not only by famous individuals, their names familiar as engineers, artists, writers, men of affairs, scientists, actors, and athletes. Humbler folk, too, have done much of the hard work that has built our Nation.

Immigrants Fight for Adopted Land

In the Revolution, the Civil War, and both World Wars the foreign born have done their full share, and more.

Their valuable contribution is the more noteworthy because emigration itself entails a terrific emotional strain. Leaving his home and job behind, the immigrant must learn a wholly new language and new customs. He may feel walled off, at first, from full par-

tication in the life of the United States.

Today adult education for citizenship is reaching enormous numbers of immigrants. In the country's public school system some 3,000 classes were held for them last year. The principal subjects taught are the English language and American history and government.

To observe such an adult citizenship school in operation, I spent a day with James T. Gallahorn, Jr., the administrative principal of the Americanization School in Washington, D. C.

The day of my visit, 1,486 students from 79 countries were registered. The oldest was just under 80 years; the majority were from 30 to 39. The largest group were Germans, but I talked with men and women from Afghanistan, Argentina, Chile, China, France, Greece, the Netherlands, Hungary, Iran, Japan, Pakistan, Peru, and Lithuania.

From the very first day, only English is spoken. Each student has a booklet with illustrations of simple objects, like tables and chairs. The teacher points to the picture of a table, says "table," and makes the students repeat the word until they all unmistakably know it.

There are no grades, marks, or final examinations. A student may register at any time and attend as regularly as opportunity allows.

Graduates of these schools do not necessarily apply for citizenship. The immigrant is perfectly free to remain an alien, if he so desires. But the purpose of citizenship education is implicit in its name, and it is highly successful in attaining its purpose.

In the United States, naturalization—the legal act by which a foreigner secures the rights and privileges of a citizen—is primarily

2,659 New Citizens Swear Allegiance at a Mass Ceremony in Chicago

In 1934 a huge backlog of naturalization petitions confronted Federal authorities throughout the United States. Patriotic organizations helped solve the problem—and also dramatized the value of citizenship—by arranging programs for November 11 (formerly Armistice Day but now officially Veterans Day).

With right hands upraised in Chicago's Medinah Temple, these foreign born renounce ties with their native lands. For the occasion, Federal District Judge Win G. Knoch (at desk, right) convenes his court outside its regular quarters for the first time.

United Press

a judicial process carried out by some 1,300 courts. Since 1907 about 7,000,000 foreigners have been naturalized.

Last year, to catch up on the huge backlog of naturalization applications, brought about by recent changes in the law, but especially to dramatize and emphasize the value of citizenship to the foreign born, many naturalization ceremonies were scheduled on November 11, Veterans Day.

In larger centers of population, however, courts naturalize at least once a month. The would-be citizen must file a petition and undergo a preliminary hearing before a Naturalization examiner. The final hearing is the court ceremony which confers citizenship.

Hearings last from 15 minutes to an hour and a half. Questions are put not only to the petitioner but to two witnesses for him.

Only 1.7 percent of all petitions for naturalization were denied in 1954. With the citizenship education of these days, it is rare that the number denied exceeds 2 percent.

Any native American who has failed to attend a well-conducted court naturalization ceremony has missed an inspiring experience.

On November 11, 1954, more than 50,000 persons were naturalized at one time, a big share of them in ceremonies at the Hollywood Bowl in Los Angeles, Chicago's Medinah Temple, the Polo Grounds in New York City, and Ebbets Field in Brooklyn.

Never before in history, perhaps, did one nation acquire so many new citizens at one time by peaceful, voluntary, and individual act.

But let us attend a regular courtroom ceremony. The petitioners are there very early, filling the room to overflowing, dressed in their best, attentive, silent, serious to the point of solemnity.

The judge takes his seat, and a color guard brings in the flag to the accompaniment of stirring martial music. Next, the judge and local civic and patriotic leaders make short inspirational addresses. The Immigration examiner makes his report to the judge, usually recommending that most of the petitions be granted.

Then the judge requires that those who have titles of nobility renounce them. All take the oath of allegiance, and the judge grants the petitions.

American citizenship has taken on a deeper meaning during and since World War II. Some 300,000 foreign born did their stint in the armed services during that conflict. One hundred and forty-three thousand of them were naturalized in the United States and in other parts of the world. For the first time, American citizenship was granted on foreign soil to members of our armed forces serving outside the United States.

Much of this emergency naturalization was done administratively and not judicially, by

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Pinches of Earth Symbolize the Blending of Many Peoples into One

Under leadership of Maj. Gen. U. S. Grant, 3rd, USA (Ret.), National Unity Day ceremonies in New York last June spotlighted a forthcoming campaign to raise $5,000,000 for an American Museum of Immigration at the base of the Statue of Liberty. Bits of soil from 54 lands and all U. S. States and Territories were mixed and scattered from the statue's torch. This Spanish-American boy adds Spain's contribution.

officers of the Immigration and Naturalization Service and their representatives. The late Dr. Henry B. Hazard, assistant commissioner for its Research and Education Division, covered six continents and traveled nearly 100,000 miles naturalizing. He worked:

1. On a ship during a raging gale in the Atlantic.

2. In a blizzard in Iceland.

3. On Navy combat vessels.

4. In desert heat up to 120° and more in Iran and Egypt.

5. In the humid, insect-ridden jungles of the Solomon Islands and New Guinea.

In his official report Dr. Hazard quoted an account of a ceremony held by a vice consul close to the wintry battle line in Belgium:

"One evening an officer and a soldier came in.... It was snowing and raining and a cold wind was blowing. They had been many hours on the way and had only found us with difficulty. The soldier was very tired, almost exhausted.... I read the oath to him by candlelight. I took his hand to congratulate him, and he broke down, completely.

"'I am sorry, Sir, I apologize. I just couldn't help it. This has been a great day for me, and I waited so long for it—thought I never would get to be an American up here. Now at last I am a citizen, and those other guys will never be able to call me a foreigner again.'"

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the sun for warmth, like the rainbow for beauty, like forever
for strength, like snow for softness. When I grow up my
fleece is going to be part of one . . . that's what I hope . . .
If I lean against you, you can imagine from the one
warm spot how it would be to have a St. Marys Blanket
around you tonight. And when you are warm, tell me
where scarecrows come from . . . and where do they go?

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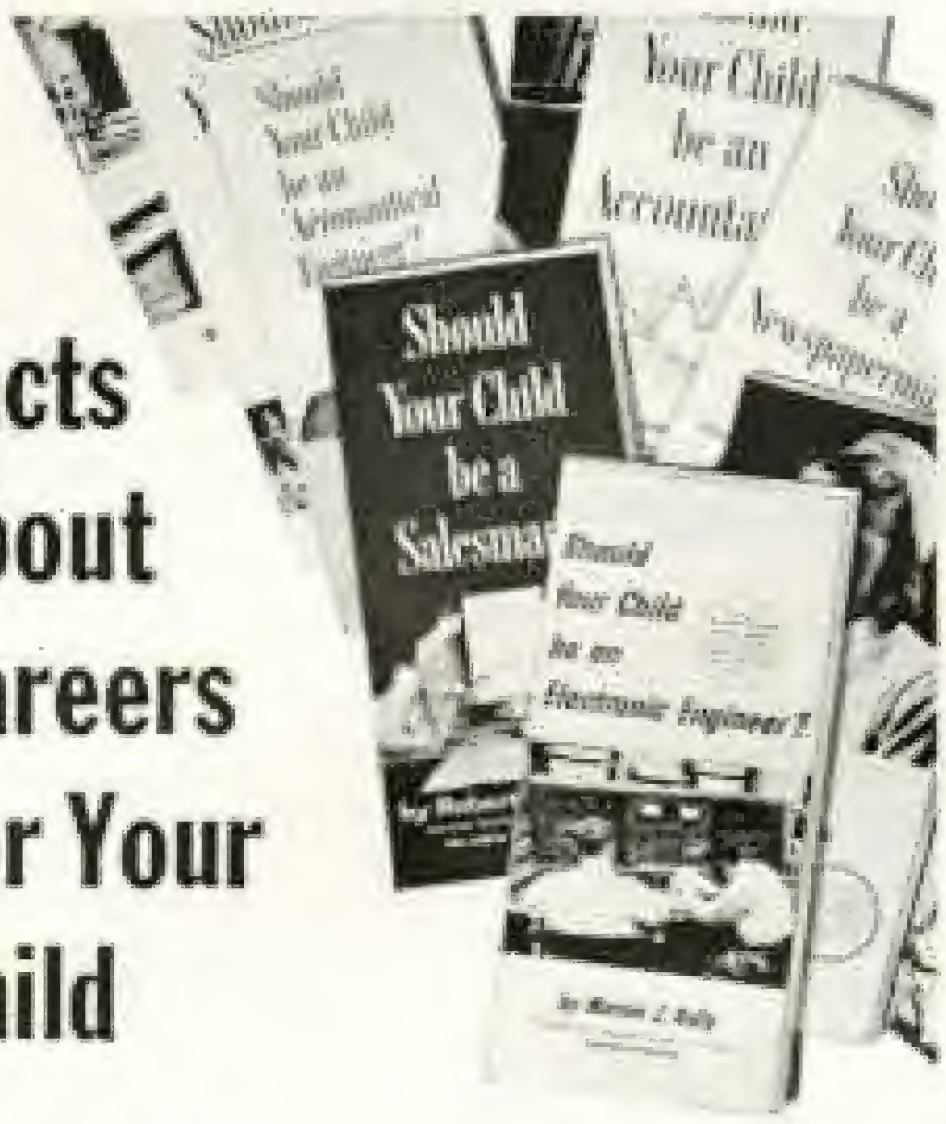

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11-46

ICY GOING FOR SUPPLIES *for air-raid warning line. Ship is being freed by icebreaker.*

"WANIGANS" ON THE WAY. *They're pre-assembled buildings, carried on tractor-drawn sledges.*

TO THE FAR NORTH BY AIR, *as well as by land and sea, go supplies, materials and personnel.*

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New Radar Warning Line will scan Arctic skies

Distant Early Warning Line for defense now being built by Bell Telephone System

Far up in the frozen north—clear across the top of North America—there's a new air-raid warning line under construction.

It is being built by Bell System research, manufacturing and operating specialists at the request of the United States and Canadian governments.

It is a vital and challenging task. Much of the electronic equipment has had to be specially developed. All of the equipment, materials, food, fuel and personnel have to be transported thousands of miles by land, sea and air to the trackless wastes of the Arctic. Years of work are being crammed into months of time.

The design and development of equipment for the warning line is the work of Bell Telephone Laboratories, the Lincoln Laboratory at M.I.T. and Canadian scientists.

Western Electric, the Bell System's manufacturing and supply unit, did the planning, engineering and construction of a preliminary pilot project. It is now doing the same over-all job for the new extended line from Alaska across northern Canada, in close cooperation with defense forces and other governmental departments.

The Bell System's ability to meet emergencies of this kind when called upon by the Government is made possible by its research, manufacturing and operating units working together as a team.

The DEW line is one of many projects in which this teamwork is helping in defense.

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