ATLAS MAP SUPPLEMENT: SPAIN AND PORTUGAL

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NATIONAL GEOGRAPHIC

THE CHANGING FACE OF OLD SPAIN BART McDOWELL, ALBERT MOLDVAY 291

LANDS OF THE BOLD CAPTAINS MAPPED ANEW 340

PITTSBURGH, PATTERN FOR PROGRESS WILLIAM J. GILL, CLYDE HARE 342

TREE SNAILS, GEMS OF THE EVERGLADES TREAT DAVIDSON 372

WONDROUS WORLD OF FISHES: A NEW GEOGRAPHIC BOOK 388

ISRAEL—LAND OF PROMISE JOHN SCOFIELD, B. ANTHONY STEWART 395

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COVER: Spanish flamenco dancer sends heels and skirts flying to fiery gypsy music (page 291).

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Wild ways of wildebeest studied under Society grant

CLOWN OF THE AFRICAN VELD, the gnu, or wildebeest, moves into the spotlight of scientific scrutiny. Cornell University zoologist Richard D. Estes, helped by a grant from your Society, follows the antelope's antics at Ngorongoro Crater, Tanzania. Often he sees bulls spar in ritual combat (above). But his observations also reveal that a male with his harem roams a specific territory and fiercely defends it from other bulls. Estes pioneers in studying comparative behavior of African ungulates—a hopeful step toward their conservation.

Other Society grants currently support scientific investigations of gem deposits in Southeast Asia, ice conditions on Isla Santa Inés, Chile, and the Ainu people of Japan. In next month's magazine, Edwin A. Link and Robert Sténuit will describe still another project undertaken with Geographic help: the longest deep dive experienced by man.

Let your friends share the fascinating adventures of men like Estes, Link, and Sténuit by nominating them for membership on the form below.

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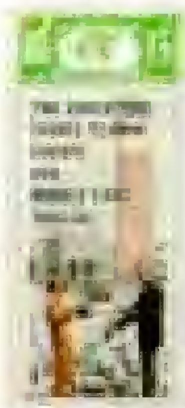

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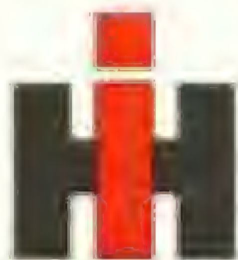

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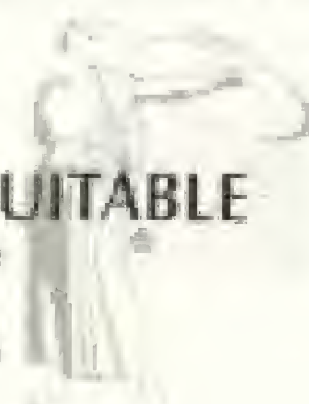

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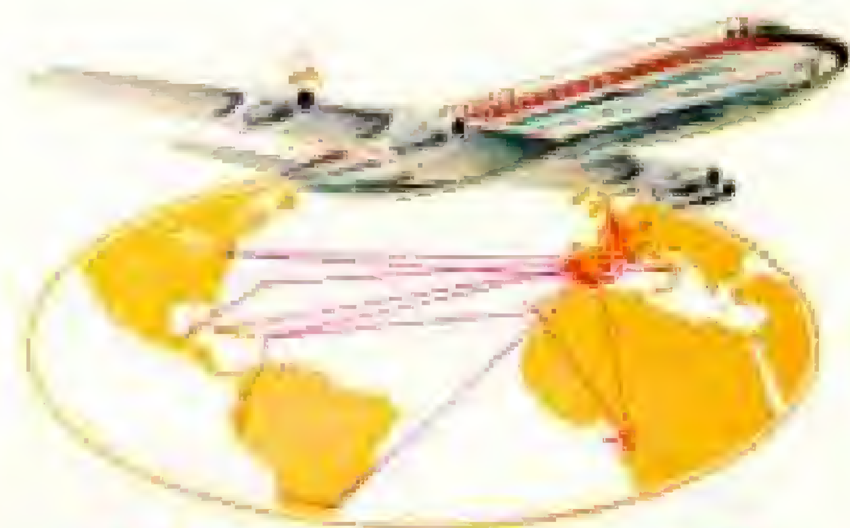

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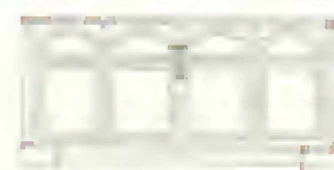

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There is no obligation. Just tell your Hammond Organ Dealer you want to try the Guaranteed Playtime Plan. Or mail us the coupon today and we will send you complete information.

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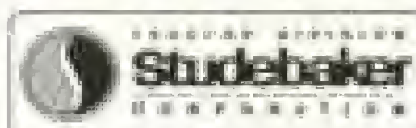
GRAVELY



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Two came to Britain...

how far did they get for $30?

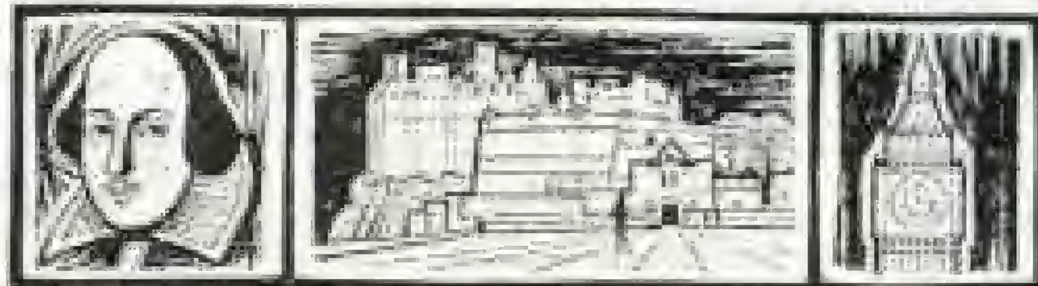
J.J. hired a car. Just for a couple of days. Cost $8.40 down, plus 10 cents a mile.

It was a very *small* car. Un-American. With strange shift gears and right-hand drive. And the English roads didn't help much, either! Narrow things, most of them—all meandering and quaint. His progress was solemn.

Still, he eventually made it to Stratford-upon-Avon. And back. A modest 220 miles all told. And his $30 was up!

T.T. spent his $30 before he left home.

He spent them with his travel agent . . . on ThriftRail Coupons. And when he got to Britain, he traded his ThriftRails for train tickets. That way, he saved a lot of money.



And *he* went to Stratford-upon-Avon (Shakespeare) and to Oxford (dreaming spires). The Lake District (Wordsworth land) and Perth (Scottish Highlands), Edinburgh (Scotland's capital) and York (cathedral country). And back to London again. All for $30!

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$30 worth of ThriftRail Coupons will buy *you* up to 1,000 miles of rail travel in Britain . . . a big saving on normal fares. ($45 books available, too.) But remember, you can only buy ThriftRails *in the States*. So have a chat with your travel agent about it. *Be seeing you!*

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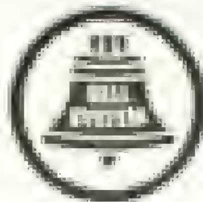

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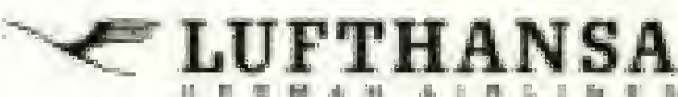

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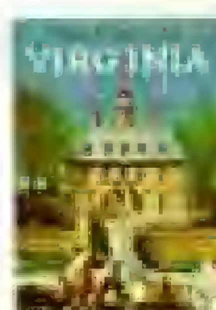

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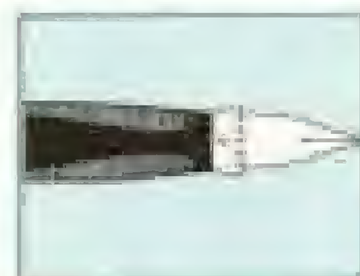

The beautifully sculptured grip nests his fingers in its curvatures. There is less pressure as he writes. His fingers do not tire; each letter flows easily and gracefully.

The point can be adjusted to the exact angle at which he writes—his hand stays relaxed. The angle is set by a dial as carefully calibrated as the lens on a $400 camera.

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Love Letters to Rambler

Malcolm Anderson

Chief Engineer of the Barbizon Plaza Hotel in New York City, Malcolm Anderson gives the "car-pool" performance story on the rugged Rambler:

"We all feel secure in our Rambler!"

We six Rambler car-pool commuters live together (comfortably) for between 15 and 16 thousand miles a year. Our jointly owned Rambler "reliable" is so economical that in the last six months alone our "treasurer" has accumulated a surplus of $580.00 in the kitty after paying all expenses—gas, oil, maintenance, parking, bridge tolls. With 48,000 miles on the car, we toyed with the idea of trading but decided to stay with what we have—but unanimously voted that if we were to buy, it would have to be a Rambler. Incidentally among the six of us, we own a total of five Ramblers!

Meet the 1965 version of Mr. Anderson's car-pool "reliable" at your Rambler dealer today. It's the Classic 770 4-Door Sedan—Spectacular in looks and ride—Sensible in economy of operation. One of the Sensible Spectaculars for '65.

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March, 1965

NATIONAL GEOGRAPHIC

The Changing Face of Old Spain

MY WIFE MARTHA calls it "the time you were a war correspondent in the Crusades."

So it seemed that day in the Spanish town of Alcoy. The plaza roared with hundreds of troops—a roiling sea of helmets and turbans. Scimitars clashed with battle-axes. Explosions of black powder deafened us and thickened the air. And over the noise, Al Moldvay moaned, "There must be a better spot for photographs."

We were covering a lively celebration, the Fiesta of Moors and Christians. In Alcoy each year, townsfolk re-enact the Spanish Crusades that freed their ancestors from Moorish rule seven centuries ago. But we were viewing the mock battle from the street level, choking with the powder smoke, dodging wild sword thrusts, and squirming through the throngs of reveling Spaniards.

"Couldn't we get up on the castle wall?" Al asked a festival official.

"No one is permitted on the wall without a costume," the official replied. "Modern clothing would spoil the illusion. But wait"—he rapidly conferred with an aide at the door of

By BART McDOWELL

National Geographic Senior Staff

Illustrations by National Geographic photographer ALBERT MOLDVAY

EKTACHROME (BELOW) AND KODACHROMES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER ALBERT MOLDVAY © N.G.S.

"O Spain ... one half of thy face—fiesta; and the other misery ...." So wrote novelist Pérez Galdós of his 19th-century homeland, a nation long inured to a cruel geography, a climate of extremes, and a history of conflict. Today the misery fades as irrigation turns barren lands to green and new industry spurs the economy. But Spain's fiestas remain, spicing life with gaiety and drama. Seville's *Feria*, or fair (above), pulses with the tempo of stomping feet, clapping hands, and passionate flamenco rhythms.

Tiled arc of the Plaza de España in Seville sees a quieter moment of relaxation—the late afternoon *paseo*, or stroll, beside arcades fronting government offices. Built for the Spanish-American Exhibition of 1929, the plaza blends Moorish and Renaissance architectural styles.

His eyes intent, matador Antonio Campos watches the action in the Madrid bullring as he awaits his turn. Because of his daredeviltry, bullfight aficionados have dubbed him "El Imposible."

the castle. "Yes, it is all arranged. You can wear these costumes."

Two Crusaders obligingly doffed their finery for us. And minutes later we emerged on the castle wall overlooking the battlefield plaza, Al in a red-plumed helmet and a cape to hide his camera, I in a suit of mail.

"Typical of Spanish courtesy," Martha said when I rejoined her. "Where else would total strangers give you the armor off their backs?"

The Alcoy fiesta was indeed typical of our Spanish travels. We found Spain noisy, colorful, dramatic, hospitable—and disarming.

Every Spanish celebration has its own special flavor and mood. At the Fair of Seville or at the grape festival in Jerez de la Frontera, spirits are as sunny as Andalusia; there are the ripples of ruffled skirts, the stutters of castanets, and the hoofbeats of Andalusian horses prancing with the pride of their Arabian blood. Most of all, there is laughter.

But if some festivals represent high noon, others seem dark as midnight. Holy Week in Toledo—or even in worldly Madrid—brings the solemn hush of a penance. Processions move as to a dirge, the devout carrying forests of crosses, their feet manacled and bare (page 331). The crowded street falls as quiet as a confessional.

Still again, the exception: In Zaragoza, on the Day of the Virgen del Pilar, we watched and listened as the image of the Virgin was carried around a great plaza on a silver litter. I expected reverent silence but was startled—

and strangely moved—by the full-throated roar of 10,000 onlookers. Nor did the cheering faithful stop at that; from their purses and pockets they pulled white handkerchiefs and waved them—a flashing field of white—in the traditional accolade given triumphant matadors.

Geography Shapes Spanish Character

So it is that Spanish spectacles are as varied as Spain itself. A law student in Madrid tried to explain this variety for us. "All Spain is the result of our"—he groped for the word—"our *passionate* geography."

At that time Martha and I dismissed the statement as so much Spanish rhetoric. We thought our young friend was referring to the voluptuous coasts, the garden fragrance, the castles, the sheer sensual beauty of the land. But after traveling thousands of miles through Spain, we understood this strange choice of words: Passion can also wear a crown of thorns. And so does Spain.

It is one thing to read that, next to Switzerland, Spain has the highest average altitude in Europe (see supplement map, **Spain and Portugal**, distributed to members with this issue). It is another to drive through mountain passes where—for thousands of years—armies have been halted in blood. More than once we recalled the words of the Duke of Wellington: "With small armies you do no good here, and with large ones you starve to death."

In few countries does history live more vividly. Spain's mountains have discouraged change; isolated villagers cling to the ways of their fathers. Yet its vast coastlines have invited invasion from Celtic times onward. This timeless contradiction helps shape and conserve the national character.*

Traveling Spain, the visitor gets personally involved in geography. For us, the splashing fountains of the Alhambra echoed Spain's Moslem epoch. For us, Roman Spain would always be the aqueduct in Segovia, straddling streets, striding the countryside—truly triumphal arches in Europe's driest land.

Rainfall was more than a statistic when we celebrated a happy harvest with some countryfolk ... or when we walked on earth so cracked with drought it crunched underfoot. And once I listened as a grieving father told how a flood had drowned his little son.

Yet, in their long struggle with geography, Spaniards now seem to be winning. An employee of the new steel mill at Avilés, in Asturias, explained this economic progress in

*See "Speaking of Spain," by Luis Marden, NATIONAL GEOGRAPHIC, April, 1950.

Acrobats build towers, flag-bedecked fishing boats parade, and all Palamós smiles in honor of Our Lady of Carmen, patroness of seafarers. Her image rides on the fishing boat at center.

Palamós and other villages along the Costa Brava, or Wild Coast, share their festivals with a host of visitors, who come from abroad to make the 100-mile shoreline a playground. But for the fishing fleet working in Mediterranean waters, the Fiesta del Carmen is as much a prayer as a party—a prayer for full nets, safe landfalls, and the beneficent succor of the Virgin herself.

terms of his *almadreñas*, the wooden shoes of the rainy north (pages 330-31).

"I wore them as a boy," said Teófilo Rodriguez, "because Avilés was only a country village then. Very muddy. You have seen our almadreñas? Each shoe has three legs like a milk stool—to lift you above the mud. Well, the mud is gone. To build the mill, an estuary was filled. Now we have more jobs. And money. And paved streets. My children do not wear wooden shoes."

That steel mill has also helped boost Spanish steel production to nearly four times its 1940 level (page 320). A similar success marks other industries. Overall, the national income has doubled in the last generation.

The living standard has also jumped. And for the first time since the Spanish Civil War, the national treasury stores a surplus of gold bullion. Many economists predict that Spain is beginning an economic take-off similar to Italy's after World War II.

Outsiders share in the credit: the European investors, the tourists, the United States AID mission. But the overwhelming credit belongs to the Spanish people themselves.

Let me admit at once that I am prejudiced. I have admired things Spanish since I spent my own boyhood in Mexico.* Yet perhaps for this very reason, I brought certain reservations with me to Spain. Many of my Mexican friends still take a rebellious view of their mother country. I expected a stiff and stuffy people, riven by classes of the prideful rich and the depressed poor. Martha shared these feelings. And so we came to Spain as somewhat suspicious friends of the family.

But almost instantly, Spaniards surprised, delighted, and charmed us. There was less poverty than we expected—except in parts of green Galicia and the western dust bowl of Extremadura.

And for all their formality, Spaniards seemed to us the least stuffy people in Europe. Cab drivers chat easily with grandees, the gravest face in Spain has its share of laugh wrinkles. We also found that Spaniards are perhaps the most courteous people in the Western World.

Barcelona Makes Noise and Money

Martha and I began our Spanish travels at a traditional starting point: the great port of Barcelona. Spain boasts two cities of more than a million—Madrid and Barcelona. But Barcelonans boast only of Barcelona.

"We Catalans are the only hard-working people in Spain," they are pleased to admit.

Actually, that is Catalan exaggeration. Barcelona must share industrial honors with Madrid and with a strip along the factory-dotted Cantabrian coast on the Bay of Biscay; together, these three areas account for more than half the industrial output of Spain.

"At least," said my wife, "Barcelona leads in the production of noise."

So it may. Certainly it clangs with industrial percussion. Textile shuttles pulse. Trains chug to the noisy dock area with loads of steel, ceramics, wine, and chemicals.

*See "Mexico in Motion," by Bart McDowell, NATIONAL GEOGRAPHIC, October, 1961.

Medieval walls and tower of Tossa de Mar on the Costa Brava bespeak a time of terror when Barbary pirates hid out in secluded coves by day and attacked by night. The crenelated fortifications prevailed: invaders never captured them.

Roman ruins atop the hill at right recall the more leisurely existence of earlier times; pines and cork trees grow amid the remains of mosaic floors, hot-air heating system, and swimming-pool bath.

Behind the 12th-century tower lies old Tossa, astride a rocky neck of land. Modern hotels and villas border a nearby beach.

Swedish vacationers splash ashore at Sitges, a resort south of Barcelona. This year Spain expects 15,000,000 visitors, equal to half the population of the country.

Ancient Phoenician sailors knew this coast. About 600 B.C. the Greeks came, bearing gifts of grapevine and olive root—and every bustling Barcelonan knows what that means today to the port's export business.

"Next to France and Italy, we Spanish are the greatest Mediterranean wine producers," a local businessman told me. "And our olive trees—they grow in 37 of our 50 provinces—produce one-third of all the world's olive oil."

Success has not spoiled Barcelona. From early morning—when the flower market begins to bloom along the leafy Ramblas—until the last waterfront restaurant has stopped serving seafood late at night, Barcelona exerts a special Mediterranean charm.

Narrow, crooked streets of the Gothic quarter are polished by the footsteps of 50 generations. Here one Sunday, as vesper bells echoed through alleyways, we wound to the Plaza de San Jaime, facing the 14th-century city hall. In the twilight, 200 teen-agers had

Barcelona "Fatherland of all valiant men . . . a city unique by reason of its situation and its beauty," wrote Miguel de Cervantes of Spain's biggest port and second largest city. Sprawled beneath the slopes of distant Tibidabo, the onetime Roman colony rivaled Genoa and Venice as a trading center during the Middle Ages. Here in 1493 Isabella and Ferdinand welcomed Columbus home from the New World, and today a bronze Admiral of the Ocean Sea overlooks the harbor from atop a 175-foot column. Full-scale model of the *Santa Maria*, his flagship, lies moored at lower right. Green ribbon through the old city marks the tree-lined Ramblas.

Inspectors check a line of new SEAT 600's, first low-cost Spanish-made cars, at the factory in Barcelona. The city's many industries have created the largest middle class in Spain. Operating under a license from Fiat of Italy, the SEAT company employs 9,000 workers who turn out 250 automobiles a day in two models, the 600 and the larger 1400. Spain, with little automotive manufacturing a decade ago, today produces more than 77,000 cars, 50,000 trucks, and 13,000 tractors a year.

joined hands in great circles. A band played bright, brassy music in two-four time. Daintily, the dancers pointed the toes of their soft shoes; then the whole group lightly leaped in unison (next page).

"The dance is our famous *sardana*," said a civil guard. He nodded toward a ring of preschool children—toddlers, really—leaping irregularly like a school of mullet. "We start them young, for the sardana is the secret of Catalan success. To dance it, one must count

the steps very carefully. That's good training for business."

In a Barcelona-built SEAT sedan (preceding page) Martha and I drove northward to the steep Pyrenees—that 10,000-foot wall that keeps Spain Spanish—and then dipped down to the Costa Brava. Some call this touristic magnet the Spanish Riviera, and it has the cliffs, cypresses, and crowded hotels to prove it. The Costa Brava is a major attraction for the 13,000,000 tourists who came to Spain last year—making tourism the nation's greatest earner of foreign exchange, nearly a billion dollars a year.

By day we watched the beaches disappear beneath beach towels and bathers from England, Germany, and France. We saw scarcely a grain of sand and heard no word of Spanish until late afternoon, when the crowds went indoors to anoint their sunburns. Then a second population emerged: short, strong old men wearing black berets and sashes. They came out of their whitewashed houses to tinker with the gasoline lamps of beached boats and haul wheelbarrows full of rocks.

"Sinkers," an old fellow said, "to weight our nets. We are going out to catch sardines."

This man was but one of 105,000 Spaniards who engage in fishing and earn 1 percent of the national product. With government loans, deep-sea fishermen are today modernizing fleets that already harvest the open seas from Newfoundland to the Gulf of Guinea. Yet the small-scale local fisherman continues to follow "the work of St. Peter," as one of them remarked.

Civil War Still Affects Birth Rate

We turned inland from the beach, skirting the Pyrenees foothills, and wound westward through the verdant wine country of Catalonia. Our purpose was to follow a loose schedule on a great looping route—to skim the Mediterranean coast to the Strait of Gibraltar, then head inland and north.

Near a village we saw a rural school that plasterers and painters were refurbishing. We stopped to meet Señor Imat, the stocky schoolmaster, and his wife.

"Are you adding more space?" I asked.

"No," said the schoolmaster. "We have fewer children now than last year."

In an era of world population explosions, this condition seems strange. Yet we had stumbled upon an important population fact for the whole country: For seven decades the birth rate has declined, and during the Civil War of 1936-39 even fewer children were born. Now the number of young adults from 25 to 30—productive child-bearing ages—is limited. Demographers believe that until 1980

Crosses of carnations carpet a street in Sitges during the Feast of Corpus Christi. Villagers painstakingly place the petals in original designs to glorify the Holy Eucharist, borne aloft in an evening procession. Afterward, the fiesta's first celebrants swirl over the crushed blossoms.

Round and round go the rings in the graceful *sardana*, an age-old dance that some scholars believe derives from sun-worshiping rites of ancient Greek colonists in Catalonia. "Young men and women linked by their hands," as Homer wrote of such dancers, celebrate the daily triumph of the sun over darkness. They dance beneath the stars in Barcelona's Plaza de San Jaime. Coats and shoes pile up in the centers.

Black Virgin of Montserrat, patroness of Catalonia, extends her golden orb to a pilgrim, who offers a kiss in hope of blessing.

Sacred Citadel of Montserrat Nests in a Mist-clouded Crown of Pinnacles

While Spain lay under the heel of the Moors, pious Christians retreated to the craggy heights of Montserrat to venerate the Virgin Mary, whose presence, they believed, dwelt in the holy mountain.

Near one of the lofty hermitages, a Benedictine monastery rose in the 11th century; it flourished with reports of miracles worked by the Virgin. Her presence took visible form, Spaniards say, in the 12th-century Romanesque carving of darkened wood (above). As the fame of the Black Virgin spread throughout the world, the devout in multitudes climbed the steep road to the shrine.

In 1522 a wounded soldier limped up the mountain, seeking solace from the Madonna. Ignatius Loyola placed his sword on the altar, knelt in vigil through the night, then rose to renounce the world and dedicate his life to her service. He founded the Society of Jesus and became a saint.

Today Benedictine monks maintain a 200,000-volume library and a printing shop, established in 1499. At vespers, choirboys of the Escolania, among the oldest conservatories in Europe, sing the "Salve Regina," a prayer that Columbus heard every evening on his voyage to the New World.

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Awaiting a verdict, petitioners at Valencia's Tribunal of the Waters attend open-air court in the provincial capital. Strict rules govern the flow of water from the Río Turia through a network of canals, and farmers who violate them receive fines or lose their water rights. The Moors established the court in 960.

the Spanish birth rate will show no appreciable gain. Meanwhile, longer lives add nearly 1 percent a year to the population.

Martha volunteered to drive through Catalonia "so you can relax and absorb the scenery." I absorbed a countryside of green hills and vineyards, but I could not relax. Not that Martha is a bad driver; alarmingly, she was the best driver on the road that day. Prosperous workers from all over Europe are learning to drive their first cars during Spanish holidays. Blinded by towering camping gear, whipped about uncertainly by their trailers, they give Spanish roads a baleful zest. And Spanish trucks—their freight more than tripled since 1950—offer other bulky challenges.

Roman Road Leads to Valencia

South of Barcelona, the seaside scenery began to resemble "California with castles," as Martha put it. Angular, craggy fortresses seemed a natural part of these hills.

Tarragona, with its Roman walls and amphitheater, is a history book with hotels. Its statue of Caesar Augustus seems at home, as was the emperor himself when he sojourned here. Rome unified and governed Spain during six centuries and exerted a profound influence. Modern highways still follow the routes of Roman conquest and the 10,000 miles of imperial road—as we did now.

At the fishing village of Ampolla, we eased toward the broad flood plain of the Ebro.

Lush coastal fields showed what work and water could do. It also revealed a cross section of Spanish agriculture: In the marshes by the sea stood soggy fields of irrigated rice. From drier roots grew long-staple cotton. Next came groves of glossy orange trees, as neatly rowed as a formal garden. Vineyards clung to steeper slopes. On the nearly perpendicular hills above, shepherds tended grazing herds.

With all its industrial growth, Spain remains an agricultural country. And here statistics seem to lie: Agriculture accounts for only 26 percent of the national product, and 60 percent of the workers labor elsewhere than on the land. Yet most Spanish factories still produce for the domestic market—and farmers are the largest group of customers. In the banks, farmers deposit the savings that manufacturers borrow.

At Valencia new suburbs spread wide and flat onto the crop-carpeted plain. But old bridges on the Rio Turia spanned centuries as well as water. A mellow archway loomed on the riverbank, a remnant of the old wall and city gate. From that point streets grew snug, and the city fitted its still-popular name: Valencia del Cid, or Valencia of the Cid, honoring the 11th-century knight who fought the Moors and became the ideal of Spanish chivalry.

We saw this opulent sea-scented city with Vicente Giner Boira, scholar, lawyer, loyal son of Valencia, and "your *enthusiastic* member of the National Geographic Society."

"Careful of the low archway," warned Señor Giner. "This is the old city wall stormed by the Cid nine centuries ago." We stood in a private patio where clothes dried on a line; broomweed bristled on top of the thick ten-foot wall. "Christians lived on this side of the city, and so the Cid stormed this wall hoping for inside help."

We joined Señor Giner for a drive. "*Aquí.* The Cid died here—where you see the vacant lot. Soon we shall raise a plaque saying here is the Cid's death place."

On a Thursday morning, I met Señor Giner at the Valencia Cathedral door to see a Moorish legal relic still alive and working, the Tribunal of the Waters (opposite).

"A court unchanged in its details since A.D. 960," said Señor Giner. "See those chairs?" He pointed to eight black thronelike seats beside the Gothic portal. "For the judges—each elected by farmers in a canal district."

A crowd was gathering, a mixed group of sunburned farmers and camera-bearing tourists. Across the street the jurists were putting on their black robes.

"This court may be even older than a thousand years," said Señor Giner. "In other forms it might have existed in Roman times. We feel sure that Hannibal used a water dispute to set off the Second Punic War—just north of here, at Sagunto." Thus Spain became a battleground in the long struggle between Rome and Carthage.

The crowd was now blocking traffic in the narrow street; everyone stirred as the judges filed to their seats.

"Now I must leave you," said Señor Giner. "I am also the administrator of the tribunal." He dissolved into the judicial crowd.

The court case was a simple one: A farmer charged his neighbor with flooding a field and damaging the crop. The neighbor had his say. Then the judges put their heads together. The charge, they announced, was valid, and a fine would be levied later.

Provincial pottery and tiles brighten a model kitchen in Valencia's National Ceramics Museum. Girls in silk and lace demonstrate the preparation of *paella*, Valencia's most popular dish. Water drawn from the indoor well will steam rice, chicken, and seafood.

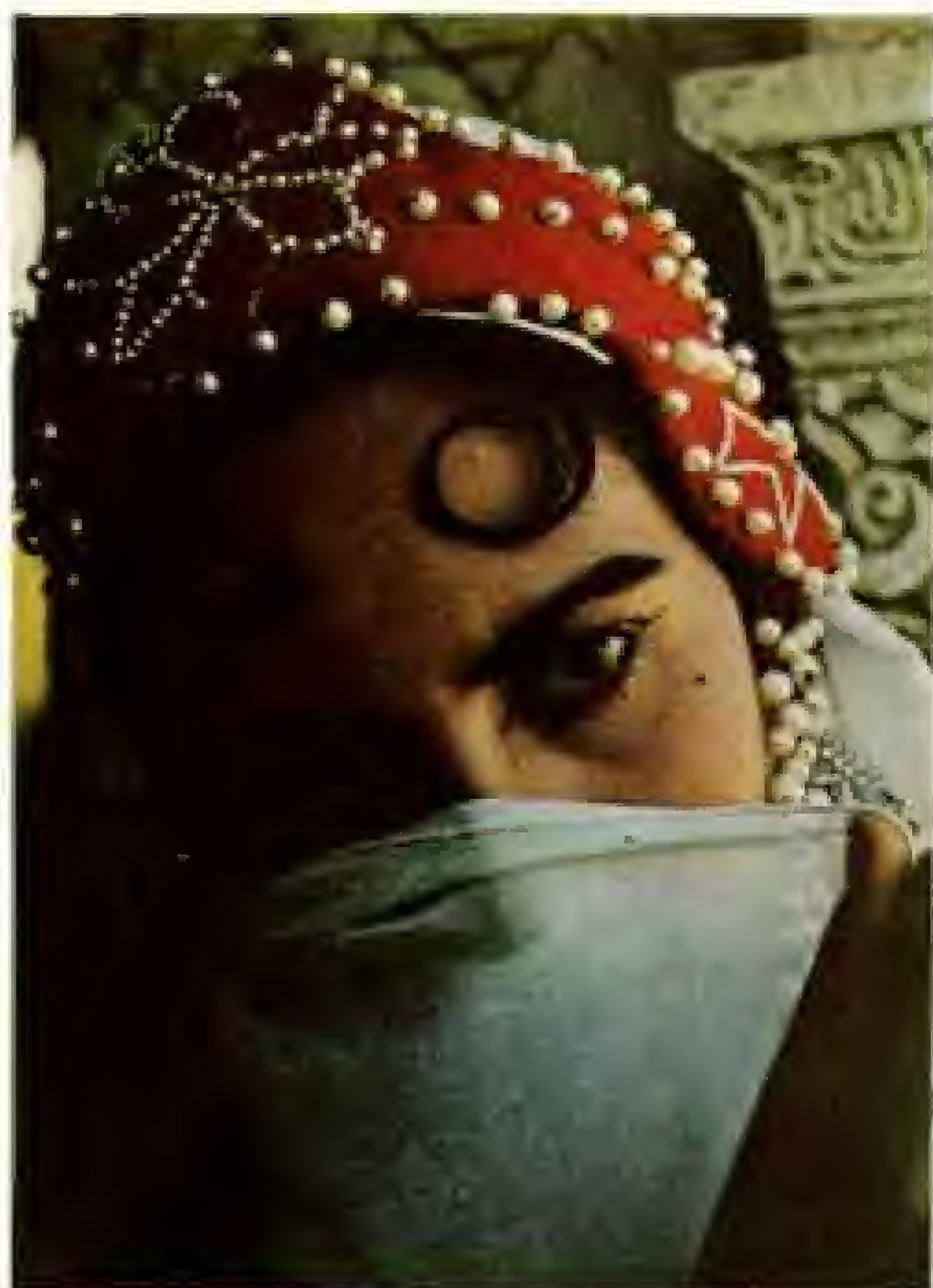
KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Though tourists watch the proceedings, the farmers scarcely notice them. Every Thursday for as long as they can remember—or their fathers, or their fathers' fathers—this court has ruled on water disputes. There is no appeal from its decisions. And though there is no other court quite like it, the Water Tribunal is typical of a thousand other traditions of local government. Local *fueros*, or rights, exist in almost every cranny of Spain.

"I still don't understand this Water Tribunal," a woman near me remarked in English. A tourist, she was speaking to her local guide. "Why do they meet at the cathedral? Are they talking about holy water?"

"In a sense, yes," said the guide gravely. "In a dry land, all water is holy."

Given the grace of water, Valencian farmers work earthly miracles. Their orchards produce a quarter of all the oranges grown around the Mediterranean. A bountiful rice harvest was in full progress as we left the city; on Lake Albufera we stopped to watch the threshing. Sails, shaped like those of Arab dhows, glided



Alhambra: a palace befitting paradise. The Moors, who conquered Spain in the eighth century, believed the fertile plain of Granada rivaled the heaven described in the Koran and so established a grand city there. On a hill called Sabika, Moslem artisans created the splendor of the Alhambra—a marvel of marble columns, lacework arches, and stucco tracery.

The Alhambra's Court of the Lions (opposite) sequestered beauties of the harem; the dark-eyed enchantress above is a haunting reminder of those days. "Sabika is the crown on Granada's brow," wrote Islamic poet Ibn Zamrak, "... and the Alhambra ... is the central ruby of its crown."

through the fields. They propelled *barquetes*, boats that ply the irrigation canals with grain.

The highway now took us due south toward Murcia and Andalusia.

"Are the borders marked?" I asked a filling-station attendant.

"You will not need signs," he shrugged. "When you reach Andalusia, you will know it by the quality of the light."

Sunshine is, in fact, a better marker, for though the name Andalusia is now attached to a specific region, the old poetic word sprawls sentimentally across most of southern Spain.

We found other kinds of boundary markers. The swarthy Moors left a strong genetic stamp on this part of Spain. So people grew shorter and darker along the road. The whitewashed town of Elche nestled beneath the spangled shade of date palms; we might have been in Africa. The land was dry and pale, as though bleached by the sun.

Evening fell—and so did my morale, for this is no time to be on Spanish highways. From twilight to starry dark, the countryfolk go home from their fields and markets and create a rural rush hour of bicycles, carts, motor scooters, wagons, and horses.

By the time we crossed the Río Segura, night was secure. We expected to find Murcia asleep but it was just getting its second wind. A speeding young bicyclist passed us. "You need a guide?" he shouted, braking to a stop. "The hotels are full—people in town for the fair. But I can help you. Follow me."

We did, and thus came to know José Damián García Roderas, otherwise Pepe, age 24. After arranging for a hotel room, Pepe mapped out a tour schedule during dinner and darted out to get us two seats for the open-air theater that evening: "A production of Lope de Vega, quite rare in Murcia."

My Spanish is limited, modern, and Mexican. The great Lope de Vega, a contemporary of Shakespeare, seemed a bit much after a hard day of driving. But Martha was firm: "We simply can't disappoint Pepe."

So we went to a pleasant plaza beside the cathedral where a thousand citizens sat in folding chairs before a temporary stage. The lights went up; here was a 16th-century Spanish patio with a troop of costumed actors in the classic comedy *La Bella Malmaridada*, or "The Beautiful, Badly Married Bride."

The dialogue was rich, poetic, and completely over my tired head. During the third scene, my day's drive caught up with me. Martha prodded me awake.

"We'll disgrace ourselves a little less," she said, "if we leave quietly." From my wife's tone I perceived that she felt a certain empathy with the play's heroine.

Alhambra's Spell Defies Time

"We at length emerged from the mountains and entered upon the beautiful Vega [open plain] of Granada ... with the old Moorish capital in the distance, dominated by the ruddy towers of the Alhambra ..."

Those words—true for almost any traveler

entering Granada—were written by our fellow American, Washington Irving. In 1829 he visited this city and redeemed it from touristic obscurity with his romantic *Tales of the Alhambra*. We bought a copy and, reading, "ascended a confined and winding street ... called the Calle of the Gomeres. ..."

At last we entered the Moorish palace itself, with Irving as our guide:

"The transition was almost magical ... we were at once transported into other times ... treading the scenes of Arabian story. We found ourselves in a great court paved with white marble and decorated at each end with light Moorish peristyles. ... In the center was an immense basin ... stocked with goldfish. ... At the upper end of this court rose the great Tower of Comares."

Washington Irving enjoyed moonlight swims in the palace ponds, but we did not follow our countryman slavishly. Nor did we try to breakfast, as he had done, in the Hall of the Ambassadors, once the grand audience chamber of Moslem monarchs. It still evokes a spirit of Spain's eight Moorish centuries.

Christian Knights at Last Prevail

African Moslems began their Spanish invasion in the year 711. Their scimitars swiftly sliced through Visigothic Spain to the Pyrenees and beyond to the battlefield of Tours. After they abandoned hope of conquering Europe, the Moors settled down to bring civilization to their Spanish garden.

They succeeded everywhere but in the northern mountains of Asturias, where rude, embattled Christians held out unconquered. Gradually these knights grew bolder and pressed down from their round stone castles to raid the square fortresses of the Moors.

The bitter terrain slowed these wars, Spain's own Crusades. Finally came triumph with a united crown and army. Ferdinand of Aragon and Isabella of Castile drove out the last Moorish king and moved into the Alhambra on January 2, 1492. They came in the nick of history for Spain to export its Roman strength and Moorish grace to half the world.

Appropriately, our hotel in Granada had been built in 1492. It was the Parador de San Francisco, built within the Alhambra's fortifications as a Franciscan monastery and now one of the government-owned inns that dot the land. These inns were started in the 1920's as a modest beginning for the tourist industry; today they include converted castles and new cottages. All offer delicious regional foods and attractive quarters at a small price.

Furnished with antiques and good reproductions, the Parador de San Francisco delighted Martha more than any other Spanish spot. We lunched on the stone terrace and enjoyed a view of Alhambra towers, gardens, and the Granada plain below.

"And for dinner music," Martha noted, "we have all the fountains of the Alhambra."

Algeciras Offers Tennis and Tea

Through stern mountain scenery we drove south to Málaga and the Costa del Sol, the Sun's Coast. Thanks to tourists, this is the fastest developing area in all Spain.

"Do I know how many hotel rooms?" said a tourist official for that booming coast. "Last month it was 9,000. Last week it was 9,499. Today I do not know."

We dipped south again to Algeciras and the harbor that holds the Rock of Gibraltar. Since the British took it over in 1704, Spain has officially complained about the intrusion. But Algeciras has adjusted nicely. Its hilltop Hotel Reina Cristina affects British-style gardens, the English language, courts for proper tennis, and pots for proper tea.

"The hotel has almost everything—but not quite," complained an American from Newark, New Jersey. "I wanted to send picture postcards to everyone in my office. But, look: no pictures of the Rock."

Wouldn't another scene do? "Hardly. I'm with the Prudential Insurance Company, and this"—his hand swept possessively toward the bulky trademark—"is practically ours."

Behind the bay, the Cádiz highway climbs through cork trees and holm oaks—with evergreen leaves like holly—to a high and windy overlook where the Strait of Gibraltar measures but eight miles wide. We parked on European soil to admire the undulating landfall of Africa. These were the Pillars of Hercules,

Last Moorish stronghold: the mountainous Alpujarras region of Andalusia. Members of the *Guardia Civil*, or rural police, patrol a road on the south slopes of the snow-topped Sierra Nevada, 10 miles from the warm Mediterranean. After the fall of Granada in 1492, the Moors found refuge among these towering peaks.

KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER ALBERT MOLDVAY © N.G.S.

REINA ISABEL

land's end for the old, flat world. Here the Strait of Gibraltar separates continents, seas, and epochs of thought.

Now the road descended to Tarifa, a place of blinding glare and inky shadows, the southernmost town in Europe (see map supplement).

Fine print on my map noted Cabo Trafalgar, so again we turned off the main highway, onto a twisting, rutted farm road leading through grassy cattle pastures. We checked our directions with a young farmer, Manuel Guzmán, and gave him a lift. Manuel owned a small plot of this land and was saving his money to marry his sweetheart. His clothes were the typical garb of rural Andalusia: black flat-top hat, rough shirt and shoes, and baggy pants of amber velveteen—"very strong cloth," he assured us.

At a fork in the road Manuel thanked us and got out. "Stay to the left," he said, "to reach the lighthouse of Trafalgar."

"Do many visitors come here?" I asked. He did not understand, and I added, "To see the place of the famous naval battle?"

"I know nothing of a battle," said Manuel. "I was very young during the Civil War."

But the site answered my question. Beside a gilt beach stood a lighthouse and nothing else save sea, sky, and breeze enough to turn a windmill.

The same prevailing winds filled Horatio Nelson's sails on October 21, 1805. Twelve

miles off this cape, Admiral Nelson quenched Napoleon's sea power and died a hero's death. Trafalgar looms large in history books and noisily in London's Trafalgar Square. But the original Spanish Trafalgar is lonely as a lighthouse and quiet as the tide.

Joint Military Bases Break Precedent

Ten miles north of Cádiz, naval history is being written at Rota, one of four military bases jointly used by Spain and the United States. The 1953 treaty establishing these bases broke precedent. Historically, Spaniards have resisted foreign intrusion.

"Please don't call them our bases," an American naval officer warned. "These are joint bases." Each base—one for the Navy and three for the Strategic Air Command—has a Spanish commanding officer and flies the flag of Spain.

Inland from the Bay of Cádiz, we paused at Jerez de la Frontera, the true home of sherry wine. We walked through cobwebbed warehouses and sampled the triumph of the Andalusian grape.

But if Jerez is the apéritif, then the feast is Seville. The city is delicious. "For not only does Seville produce . . . gallant men but magnificent women as well, with their graceful airs and the mantles and veils that cover such magnificent treasures."

That still-timely comment was published in 1630 by Tirso de Molina in his drama *The Libertine of Seville*, the play that introduced to world literature the dashing and original Don Juan. And though Don Juan has since strolled into Austro-Italian opera, British verse, and theaters of countless nations, Seville remembers him as a home-town boy.

"But *Don Giovanni* is not the only opera inspired locally. You should have seen *Carmen* here last week!" My music critic was the volatile maestro of the hotel barbershop. Trimming my crew cut, he described the production: "They used the bullring! *Precioso!* The last act—the matador—the music—all sung in the Plaza de Toros! You have seen the tobacco factory where the first gypsy Carmen worked in Seville? It is now a part of the university . . ."

One should never excite a working barber. But I forgot until too late that I was being shorn by the Barber of Seville. I bought a black Andalusian hat to hide the damage.

Though Martha was tired, she climbed the Giralda Tower with me. We had to go by twos—to thwart suicides, no one is allowed to climb the 320-foot Giralda alone.

Peering down from the belfry of this 12th-century Moorish skyscraper, the visitor sees all Seville: cathedral, crowded Street of Serpents, garden-garnished Alcazar, flat countryside, and voluptuous Río Guadalquivir.

For generations, the river docks of Seville mothered the New World. This was the chief

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Boom on the Costa del Sol: Along the shore at Fuengirola, a modern hotel rises between the hilltop ruin of a Moorish castle and villagers cleaning the beach of gravel. Growing resort towns of Spain's Coast of the Sun, protected by mountains and sea, offer Europe's mildest winter climate to international vacationers.

KODACHROMES © NATIONAL GEOGRAPHIC SOCIETY

Bent in toil, farm women on the northern *meseta*, or plateau, of Castile scratch the shallow soil to prepare a field for sowing grain. Wide-brimmed hats, cowls, and over-skirted trousers—protection against sun and wind—recapture a medieval mood.

Ready for stuffing with pimentos, pitted olives tumble into a tray at the León y Cos processing plant near Seville (upper). Testing for quality (left), a prospective buyer samples olives drawn from casks with a wire plunger called a "thief." Andalusia's sunny climate helps make Spain the leading producer of olives and olive oil.

port—sometimes the only port—to serve Spanish America. Seville was the headquarters for colonial rule. Some 40,000 bundles of colonial documents are now stored in Seville's Archive of the Indies.

"We get 30 to 40 foreign scholars a day," said Dr. José María de la Peña, the director. He showed us cases of yellowed letters and reports. Balboa announced a discovery—not an ocean, but a large pearl he was sending to King Ferdinand. Cortés scratched his soldier's signature beneath a secretary's

neater script. Cabeza de Vaca, Amerigo Vespucci—many a rare autograph is here.

"Note this one," said Dr. de la Peña, pointing to a letter dated May 21, 1590. The writer was petitioning the king for a bureaucrat's job in La Paz, Bolivia; it was signed Miguel Cervantes. "Fortunately the king refused," said the doctor. "That was 15 years before Cervantes wrote *Don Quixote*."

Another letter was dated Seville, December 29, 1504. The signature, in cryptic form, ended with *X̄p̄o Ferens.*

"That was Christopher Columbus," said Dr. de la Peña. "The symbolism has been lost through the span of time—just one of the mysteries of the man. Scholars have been studying the matter for centuries" (page 340).

To us, Columbus seemed less mysterious when we took a side trip to the little port of Palos de la Frontera and its neighboring Franciscan monastery, La Rábida. These scenes had known the various fortunes of Christopher Columbus: A discouraged man begging the friars to feed his young son . . . a tense but hopeful adventurer, praying on the eve his tiny fleet left Palos . . . and a triumphant hero when he returned here from the voyage that reached a New World.

Great events have left little mark upon the flat countryside. The Rio Tinto still flows by, bloodied by its copper compounds. Villagers still worship at the little Palos church, kneeling before the alabaster Virgin of the Miracles whom Columbus petitioned for success. A brown-frocked Franciscan leads the visitor through La Rábida to a small room where the discoverer waited and planned.

One large landmark has been added: A modern statue of Columbus rises from the flat far bank of the estuary.

Desert Shop Caters to Swimmers

Due north lies a parching region with other ties to the New World—Extremadura.

"Yes, we produced the greatest *conquistadores*—Pizarro, Cortés, and many more," said the owner of a dry-goods store in Badajoz. "Our land was so dry that they had nothing to lose by leaving. But now we have new conquests in Extremadura. Imagine: in this desert I sell snorkels to swimmers!"

The shopkeeper was referring to the Badajoz Plan, a 13-year-old irrigation and development project that is nearing completion. Three dams have been finished on the Rio Guadiana, and one more is nearly done. A quarter of a million dusty acres will be irrigated for truck farms, and 252 million kilowatt-

hours of electricity annually will energize the new industries of the Guadiana Valley: cotton gins, jute factory, alfalfa-drying plant, vegetable canneries.

The still-unfinished project is impressive for its engineering—but far more for the changes it is bringing to 10,000 peasant families. Model villages are springing up outside Badajoz. Some are spanking-clean and already have a settled, lived-in look, from charmingly planted flower gardens to the storks that nest in the new steeples of village churches. Others still appear raw and unfinished.

"These people have not yet learned how to live with water," said the young engineer who showed me around. "They know nothing of irrigation—or did not until a few months ago. Our farm extension agents are showing them. But they are native to this dry country. For generations they have lived on large landholdings owned by others. They are poor, poor."

As I walked one hot afternoon across the still-unwatered earth, the soil was fissured like badly fired ceramics. Underfoot, the earth crackled noisily as I stepped upon these lesions of drought.

But if the problem of Extremadura has been the large, dry landholding, the reverse is true in green Galicia. One day in late summer, while Martha visited the churches of Santiago

Andalusian cowboy in hand-tooled chaps greets pilgrims (left). Silver pendant signifies membership in the Brotherhood of Triana, a religious association of his district.

Caravan of Carts Rumbles Toward the Shrine of El Rocío

Spain's Christian heritage abounds in legends of miracles and discoveries of images of the Virgin. The insistent barking of a sheep dog revealed Nuestra Señora del Rocío, Our Lady of the Dew, in a hollow tree trunk. Carrying the carving to the nearby village of Almonte, the shepherd rescuer fell asleep on the way. Awaking, he found the statue had returned to its hiding place. A shrine erected on the site, 30 miles south of Seville, incorporates the hollow trunk. Each year on the last Sunday in May, costumed pilgrims from surrounding villages arrive in gaily decorated carts to pay homage to the Virgin in a three-day fiesta. Night-long revelry on the campground follows the afternoon religious procession.

de Compostela (page 319), I drove through the countryside, past plump haystacks and granaries sitting high on stilts. My driver, Angel, was a Galician with an Irish face, an anthropological legacy from the days when Celts settled this northern strip of Spain.

Galicians Farm Minuscule Fields

"Have you noticed the size of these farms?" asked Angel. "Small, very small. After centuries of deaths and legacies, a man may own a plot of only one square meter. One family here has title to a single tree. Of course, that family has other plots—all small, and scattered widely."

We passed a large sign: "Zone of Land Consolidation." Here soil scientists, draftsmen, and landowners voluntarily work out new boundaries for farms, swapping

Canopied Madonna of El Rocío Floats on a Sea of Celebrants ▶

plots to get the properties into workable size.

To the pulse of windshield wipers, we drove across northern Spain while I practiced saying *eskarrik asko*, Basque for "thank you." I used the phrase in villages, but in the smoke-smudged industrial city of Bilbao it was of little use. Our burly, bull-shaped guide, Manolo Valle, apologized: "Sadly, I do not know how to speak my national language. Here in the city only old people use it. Even our game of *jai alai* is less favored than *futbol*." Did that mean Basque pride was dying out? "*What!*" At least he could swear in fluent Basque.*

Flash Floods Batter Textile Towns

Martha and I were driving along a mountain road when the car radio announced flash floods in the Barcelona area. Next day the papers gave the grim details: The textile-processing towns of Sabadell and Tarrasa had been engulfed during the night; 400 had died.

Floodwaters had receded, but rain had begun again when I drove alone into stricken Tarrasa. Beyond an olive grove stretched a rubble-strewn valley, a mass of brick and branches. Eroded red clay resembled a fresh wound. I picked my way among half-houses and debris, then went to the hospital, where I talked with Mother Esperanza, a Carmelite nun and nurse.

Through ether-scented corridors, Mother Esperanza took me to see one of the survivors—"a very valiant young man, José Núñez Gómez." We entered his room.

He was 26, with the dark good looks of his home city, Seville. Gently, Mother Esperanza told how José had come here and bought a house for his wife and two children. José picked up the story.

"When the water struck, we started to flee. I picked up our three-year-old boy, and my wife took the baby. Then the wall fell on me."

"That was the moment when his leg was broken," said Mother Esperanza. "A bad break and deeply torn." Wordlessly, José shook his head from side to side. "In his pain, he lost hold of the child. But even with an injured leg, he got his wife and baby into a tree and held them there for three hours."

In a low voice José spoke again. "They found my little son later on the beach. The last thing he had said to me was, 'Papa, I do not want to die.'" The father's eyes filled; he turned his face into the pillow.

*See "Life in the Land of the Basques," By John E. H. Nolan, NATIONAL GEOGRAPHIC, February, 1954.

KODACHROMES © NATIONAL GEOGRAPHIC SOCIETY

Ocher and charcoal bison stands guard on the ceiling of a prehistoric art gallery, the Caves of Altamira near Santander. The lifelike paintings, 12,000 to 15,000 years old, came to light in 1879, the first of their kind discovered by modern man.

Spaniards venerate the celebrated Cathedral of Santiago de Compostela as the tomb of St. James, their nation's patron saint. King Herod decapitated the martyr in Jerusalem. Spanish legend tells how followers returned his body to Spain, where he had preached for seven years; his tomb, lost during Roman persecutions of the third century, was found some 600 years later when a star miraculously pointed to the burial place. Christians immediately flocked to the site, and with western Europeans Santiago ranked for a time with Jerusalem and Rome as a place of pilgrimage. The Spanish believed that St. James took a personal part in the battles to evict the Moors from the land, hence their war cry "*Santiago!*"

SPAIN

HIGH mountains, high seas, high adventure: These summarize Spanish geography and history. Plateaus give Spain Europe's driest climate and an average altitude second only to that of Switzerland; mountains wall the people into strong local regions. Seas have brought invaders and tempted Spanish explorers to see and subdue great parts of the world. Their treasures still ornament a land that will draw 15 million visitors this year.

GOVERNMENT: Kingdom (throne vacant). **AREA:** 194,883 square miles. **POPULATION:** 34,339,000. **LANGUAGE:** Spanish; also Basque and Catalan. **RELIGION:** Roman Catholic. **ECONOMY:** Chiefly agricultural, mining, chemicals, textiles. **MAJOR CITIES:** Madrid (pop. 3,520,000), capital; Barcelona, port, manufacturing. **CLIMATE:** Northern coast—cool and wet; interior plateau—extreme, dry; southern coasts—mild, sunny winters.

Flash floods will bring trouble as long as cloudbursts fall on steep slopes. Yet Spaniards are doing what they can for flood control. More than 300 dams now dot the land with lakes, and annually the nation's foresters plant 250,000 acres in trees.

I was anxious to rejoin Martha in Madrid, so I drove straight through to the capital, arriving at close to midnight—the wrong time to enter any unfamiliar city.

By arc light, headlight, and gaslight, no driver can read a street map and also cope with the dashing traffic on Madrid's broad avenues. I lost my way, then my temper. Finally, I relaxed and followed the crowd.

Families were strolling the broad tree-lined Paseo del Prado. Late as it was, toddlers were still toddling. In mid-avenue loomed the lighted symbol of Madrid, the fountain of Cibeles, or Cybele, the goddess's chariot pulled by wet stone lions (page 333).

I moved toward the brighter, noisier, older part of Madrid, to the Puerta del Sol. Kilometer Zero is marked here, and all distances from Madrid are measured from this spot. A few turns later through narrow streets, and I

Steam rising from molten metal swirls under a steelworker on a catwalk at the state-owned mill in Avilés. The man clutches a face mask.

Smudged with coal dust, weary miners emerge from a shaft elevator at Fabrica de Mieres in Asturias, Spain's principal mining region. The country holds

was trying not to block traffic on Madrid's gay white way, the Gran Via. Some of Europe's greatest skyscrapers towered above the noon-bright theater lights. I was an hour finding our hotel; the city never again seemed so big.

When I finally saw Martha, I found that—in a monetary way—I, too, had suffered flood damage.

"These Galician laces were so cheap," said my wife, "that I got enough for Tina's wedding dress." Our daughter Tina had just turned 7. "And of course I found a few little things for myself." Too late I recalled that Balenciaga, Rodriguez, and other famous fashion designers were Spanish. Nor was that all: inlaid chessboards, damascene jewelry from Toledo, antique Crusader crosses, and bright rugs were heaped around our hotel room.

"The most marvelous place to shop is the Rastro—the flea market," said my wife. "These parchments cost just 25 cents apiece—they're pages from a 16th-century hymnal. You can go with me Sunday. I want to buy some old carved doors, but I can't carry them."

I managed to latch Martha's open-door policy, but I found temptations of my own in Madrid's great restaurants. Ernest Hemingway's favorite little restaurant here had been the *taberna* El Callejón, aptly located on Calle de la Ternera, or Veal Street. I bowed to his taste. Each day of the week, the menu changed to foods of a different region, beginning with Valencian chicken-rice-and-seafood *paella* on Sundays, then Castilian boiled dinners, the baked-bean *fabada* of the north, the Andalusian *gazpacho*—usually called a cold soup, but more accurately a liquid salad. From such research I gained 12 pounds.

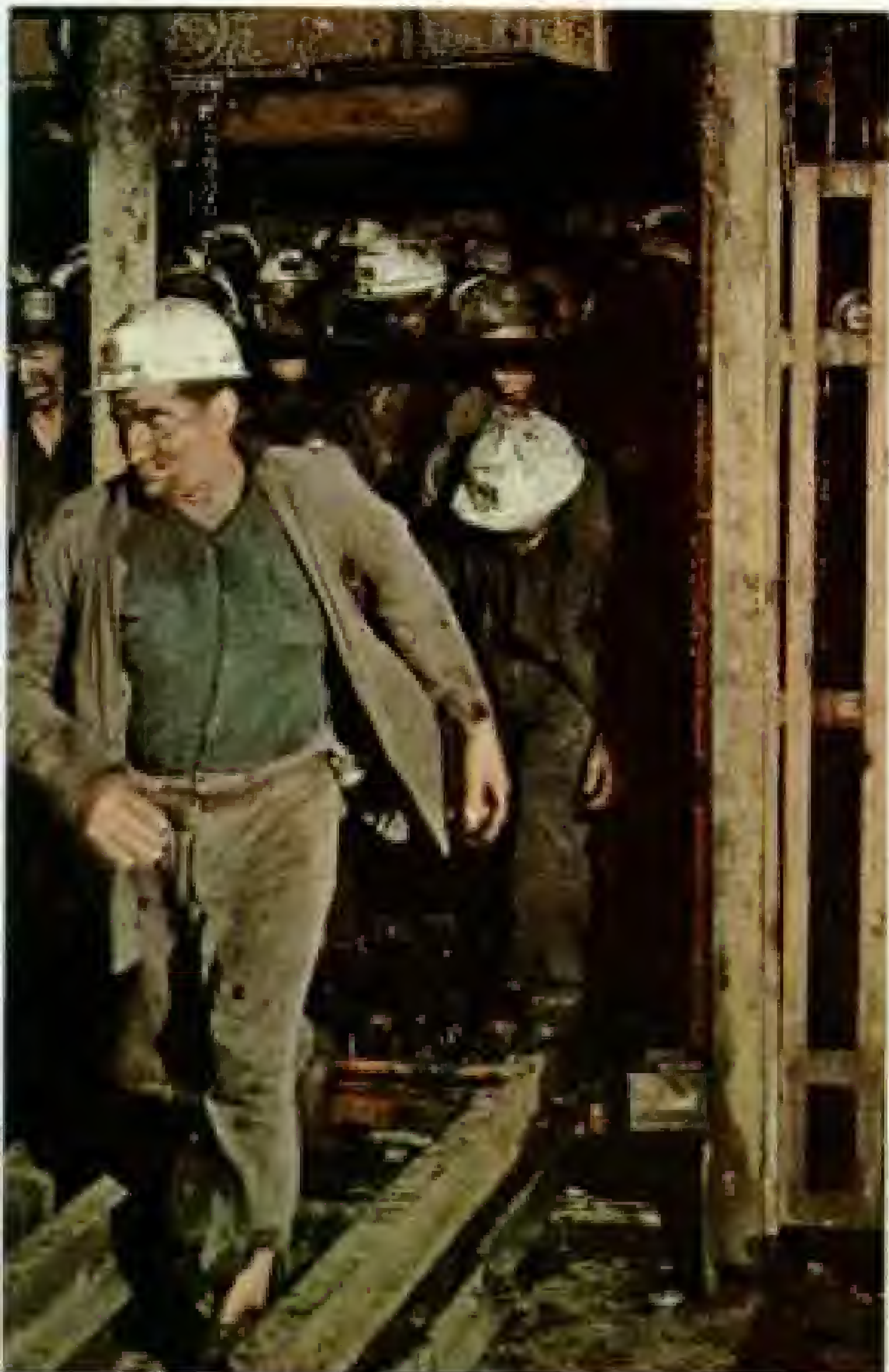
Whether one is searching for food, fashions, or folklore, Madrid offers a synthesis of all Spain. Among the city's two-and-a-half million people, many are newcomers from rural areas; on the streets one hears accents of the entire nation—from the plains of Extremadura to the mountains of Navarre.

The mayor himself is a country squire. He is the most excellent Señor Don José Finat y Escrivá de Romani, Count of Mayalde and Finat, Duke of Pastrana. But for all his titles, he is a man of simple manner.

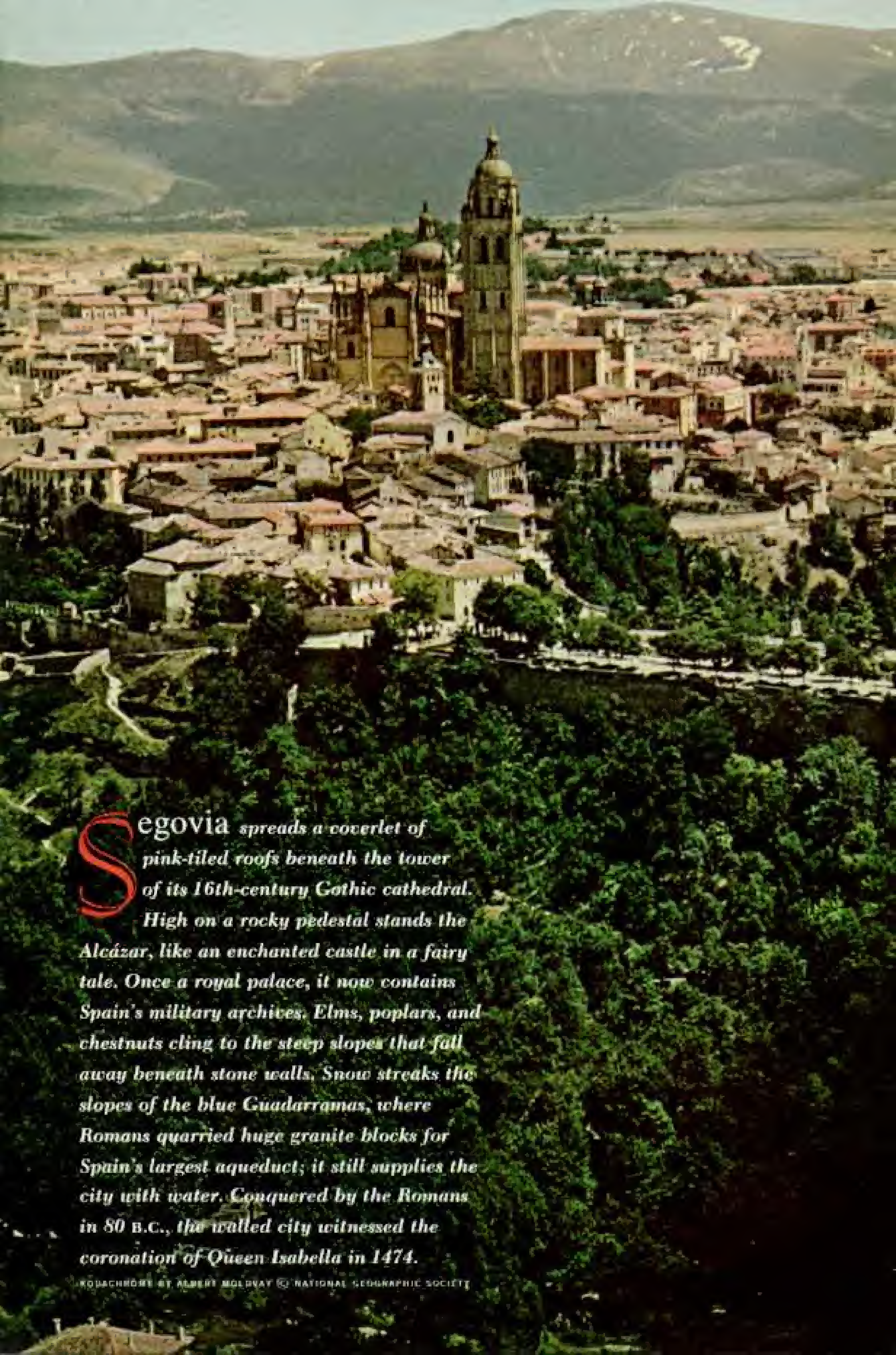
"The population of Madrid has more than

(Continued on page 326)

coal reserves estimated at 4½ billion tons and produces 16 million tons a year. Mines a thousand feet deep yield bituminous coal.



Beret-topped Basques exchange news in the port of Elanchove. A distinct ethnic group, the Basques have a language all their own.



Segovia *spreads a coverlet of pink-tiled roofs beneath the tower of its 16th-century Gothic cathedral. High on a rocky pedestal stands the Alcázar, like an enchanted castle in a fairy tale. Once a royal palace, it now contains Spain's military archives. Elms, poplars, and chestnuts cling to the steep slopes that fall away beneath stone walls. Snow streaks the slopes of the blue Guadarramas, where Romans quarried huge granite blocks for Spain's largest aqueduct; it still supplies the city with water. Conquered by the Romans in 80 B.C., the walled city witnessed the coronation of Queen Isabella in 1474.*

KODACHROME BY ALBERT MOLDVAY © NATIONAL GEOGRAPHIC SOCIETY

Pamplona erupts like a volcano each July for the week-long Fiesta de San Fermín in honor of its patron saint. A setting for Ernest Hemingway's novel *The Sun Also Rises*, Pamplona at fiesta time throbs with excitement.

Exploding rockets at seven o'clock each morning signal the start of the *encierro*, or running of the bulls. Six animals for the day's fights stampede through blockaded streets crammed with fleet-footed young men who dare sharp horns and hoofs. Wearing red scarves, the youths scramble over barricades or play dead to escape injury. Spectators enjoy the melee from the safety of trees, balconies, and windows.

Shouts of *olé* resound from the Plaza de Toros as the matador twirls his cape (opposite, left). Hemingway described the spectacle as "pure, classic beauty . . . by a man, an animal and a piece of scarlet serge. . . ."

A *gigante*, representing a South American Indian, towers and bobs over a procession (upper left).

Children of the 18th century play at bullfighting in a tapestry designed by Francisco Bayeu; it hangs in the Escorial, former palace and tomb of kings and queens, near Madrid.

Inseparable immortals of Spanish literature, Don Quixote (right) and Sancho Panza ride in search of adventure astride lean Rosinante and Dapple, the donkey. Cast in bronze, Cervantes' indomitable idealist and shrewd squire stand in the Plaza de España in Madrid.

Don Quixote's "monstrous giants," windmills of

doubled the past twenty years," he told me. "Eventually, it will be many times bigger. And we must keep pace. We have all the difficulties of Europe's old cities—narrow, crooked streets, many hills. Our 930 traffic police cannot keep up with the growing number of automobiles. We are now studying the system in New York, but I understand that even there all the traffic problems are not solved.

"We now have our first underground parking station beneath the Street of Seville. It can take 400 cars, and we soon will complete others like it."

The mayor talked about the new apartment developments going up around the city.

"Our national housing plan is ahead of the quota, so that by 1973 we will have met the needs of all our people—some 3,713,900 units built throughout Spain. New homes mean new services. So in Madrid we have more than 350 schools under construction."

Then the subject turned to fighting bulls, and the mayor changed from quiet administrator to rapturous poet. He raises bulls himself. He went on at length about the value of mountain air for the bulls' lungs and of long walks for muscles.

If city and country meet in Madrid, so do present and past. Late at night, for example, *madrileños* stand in the street and clap their hands, summoning the *sereno*, or night watchman, who keeps the keys to apartment buildings. The sereno is named for the old town-crier custom of calling out the hour and "all serene." Clocks have replaced his cry, but, like the concierge of Paris, the sereno still keeps the keys—and secrets—of Madrid.

La Mancha, endure as national monuments. The knight charged them, crying, "Fly not, cowards, . . ."

Whether the subject is serenos or castles, Spaniards are quick to defend a tradition. One afternoon I went to the headquarters of an organization called the Friends of the Castles. Presiding over the walk-up office above a busy street was wise, white-haired Don Antonio Prast, who, at 80, is the castles' most intimate Friend.

"Spain used to have 10,000 castles," said Señor Prast. "But now, sadly, we have only 2,000. The last century has been hard. No, not wars—but *quarrying* is the great danger. People use castle stones to build new homes and barns."

To encourage the conservation of castles, the Friends sponsor lectures and tours.

"Lately we have tried something new," said Señor Prast. "We advise people who wish to purchase castles for restoration." So far, the venture has been inconclusive. Señor Prast was still nettled by a woman castle-hunter. "She could have bought the Castle of Canena in Jaén for a mere $15,000. But she preferred a new cottage with running water!"

Solvent romantics who would like to buy a dry castle in Spain may write the Amigos de los Castillos, Felipe V 1, Madrid.

Master Artists Capture Spanish Spirit

Sightseeing is a special pleasure in the compact center of Madrid. An energetic walker can stroll from the zoo in Retiro Park (where a window box of yellow daisies decorates the tiger's cage) to the Royal Palace (with its more than 4½ miles of rare tapestries). But of all Madrid's landmarks, the most powerful magnet for us was the Prado Museum, one of the world's great collections of art.

Toledo, beloved city of El Greco, glows in the afternoon sun, each building etched in the clear light of the Castilian heartland. Springing from a rocky bluff in a bend of the River Tagus (foreground), Toledo shows little change from the 17th-century city the painter knew. The cathedral, its spire piercing the sky behind the austere façade of the Seminary (center), serves as the seat of the Primate of Spain and houses masterpieces of Goya and Velázquez as well as those of El Greco. Higher on the hill (far left), stands the Church of San Ildefonso. Crowning the city's highest point (right), the towered Alcázar rises once again from its ruins. The Spanish Civil War, burning across the land from 1936 to 1939, wrecked the fortress and onetime royal palace for a fourth time.

A living museum, Toledo tells the history of Spain in its stones. Roman wall, Visigothic gateway, and Moorish mosques survived successive conquerors. The center of Spanish cultural life for almost 800 years, the city suppressed no religion. Moslems and Jews practiced their faiths freely until the Inquisition of the 15th century forced all but Christians to flee.

Young artisan (above) applies pigment to a pattern cut in the cup hilt of a Toledo blade. Hand-forged swords tempered in the Tagus have served military men since the first century B.C.

Spain's most titled lady—18 times a grandee and with 42 titles—the Duchess of Alba sits with her consort, the Duke, in the Goya Room of their home, the Liria Palace in Madrid. A portrait of the 13th Duchess of Alba, signed by her friend Goya, dominates the room.

Triple-pegged *almadreñas* of Galician girls clomp to the rhythm of a courtship dance in Madrid's Plaza Mayor. The stilted

"I prefer the Prado to the Louvre," said Martha at the end of our second full day there, "because the collection has just enough from each period and school."

The samplings are wonderfully broad and reflect the widespread royal ties of old Spain with Flanders and Italy—Bosch, Van Dyck, Titian, Tintoretto.

"We are relighting the whole museum," a guard apologized as we stepped over cables and sawhorses. "Soon you will not need a miner's lamp." Certainly the strongest light shines from the genius of great Spanish masters—Velázquez, El Greco, Murillo, Goya. Each in his own way tells something about the spirit of his country (pages 336-7).

There is a Spanish saying: "The Catalan saves, the Galician is homesick, the Andalusian sings, the Basque acts, the Extremaduran fights, and the Castilian dreams." And to that list one may add, "The Aragonese plans, and the Asturian persists."

"We can even find personalities to match the regions," a Spanish friend suggested. "St. Ignatius Loyola, founder of the Jesuits, was a Basque—a man of action! And think of the people of Aragon—so shrewd, yet spontaneous. The Borgia family came originally

footwear keeps feet above the mud. Velvet-suited young men, unencumbered by clogs, step jauntily to win the ladies' favor.

Chains clanking, feet bare, veiled *penitentes* shuffle through the streets of Madrid during Holy Week. By such acts of penance and pain, the nation commemorates the final ordeals of Jesus. Candles with windshields will light the way by night.

from Aragon; so did Goya. And my own Castile—Don Quixote best exemplifies the Castilian temperament."

The great classical guitarist, Andrés Segovia, put it differently. "Spain," he told me, "is only a kind of unity." An Andalusian himself, he was discussing the musical variety of the nation, of the *muñeira* in Galicia, the boisterous *jota* of Aragon, the light *sardana* in Catalonia, the *flamenco* of his Andalusian southland. "With folk songs and dances, the whole of Spain is . . . is . . . boiling!" he said.

With Madrid as our base, we made short side trips into the varied unity of Spain. Beyond the suburbs stands the bleakly impressive Escorial, which Philip II called a cell for himself and a palace for God. Once both a monastery and a royal residence, the Escorial now shelters lavish treasures of art and the mausoleum of Spanish monarchs since Charles V. Near it stands a modern burial place, the quiet Valle de los Caídos—Valley of the Fallen—a shrine for the Civil War dead (see Madrid inset on supplement map).

Beyond the chill Guadarrama Mountains lies Avila, the walled capital of the province that gave Spain two great women: the mystic poet St. Teresa and Queen Isabella. And

Madrid: vibrant heart of the nation. The great unifier, Madrid transforms distinctive Andalusians, Basques, Galicians into Spaniards. From the provinces they come, swelling Spain's largest city. Capping a plateau, Europe's highest capital challenges the businessman and delights the shopper. By night the city blazes with lights as *madrileños* and tourists crowd plazas, restaurants, and theaters. Here traffic wheels about the Plaza de la Cibeles (lower right), with its famous fountain of the nature goddess in her lion-drawn chariot. Bathed in floodlights, the Palacio de Comunicaciones, or Post and Telegraph Office, resembles a four-tiered birthday cake sculptured by a master chef.

The 240-year-old Antigua Casa Sobrino de Botín (below) offers a treat to the discerning palate. The owner's son carves the specialty of the house—roast suckling pig. Prawns, baby eels, and eggs *à la flamenca* complete the feast. Castilian oil lamps cast a warm glow over the basement hideaway.

Señoritas in flouncing skirts clatter their castanets as Antonio leads his Madrid Ballet to flamenco rhythms at the Zarzuela Theater. The stage quivers with the staccato of pounding heels. On periodic tours the dancers fill theaters all over the world.

Avila's neighbor, Segovia, boasts its Alcázar, one of the world's most beautiful castles, the kind you expect in a storybook (pages 322-3).

But of all the tour spots close to Madrid, my favorite was Toledo. The old city stands upon a steep hill moated by a looping gorge of the Tagus River (pages 328-9).

The Moors brought Toledo two special arts. One was swordmaking, and visitors may still watch local craftsmen temper their Toledo steel. The other art was darker: Throughout Christendom, "the Toledo art" once meant black magic. Human genius long ago cleansed the curse with magic of another sort: This was El Greco's home.

Before leaving Madrid and Spain, photographer Al Moldvay and I had one final interview—a meeting with Generalissimo Francisco Franco (opposite). If, in his seventies, the Generalissimo seems less controversial than he was a generation ago, he is no less a legend.

"His Excellency can receive you tomorrow," a Foreign Ministry official told us. "Did you happen to bring formal morning clothes?"

It happened we had not.

"Not absolutely essential," he explained, "but Spain is still a ceremonial country."

We patronized a costume rental service, feeling, as Al said, "like bridegrooms again."

I had one problem: Not knowing my neck size in centimeters, I gave it in inches. My collar suffered in translation. Otherwise, we looked more or less distinguished when we arrived at El Pardo Palace, once a royal hunting lodge and now the official suburban residence

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Student troubadour in medieval velvet costume receives another charm as a token of appreciation for his musical talents. Purple cowl identifies him as a scholar in the university's school of pharmacy.

Clamor of battle gone, the hush of academic life prevails at Madrid's University City, scene of two years of fighting during the Civil War. Triumphal arch commemorates the Nationalist victory. Modern buildings, replacing those destroyed, accommodate 20,000 students.

Spain's Chief of State Welcomes the Author and Photographer

Invited for a rare interview with Francisco Franco, author Bart McDowell (right) and photographer Albert Moldvay donned formal morning clothes. Here the Generalissimo receives them in his official residence, El Pardo Palace near Madrid.

A 16th-century Flemish tapestry decorates the wall behind his desk. The impressive piles of papers prompted Franco's comment, "Everyone wants to leave a paper with the Chief of State."

Victorious commander of the Nationalist forces in the Spanish Civil War, Franco has directed his country's destiny for a quarter of a century.

EKTACHROMES (ABOVE) BY WALTER M. EDWARDS; KODACHROMES BY ALBERT MOLDVAY © N.G.S.

Genius on display: the Prado Museum in Madrid offers one of the richest collections of paintings in the world. Works of art assembled by the Bourbon and Hapsburg kings of Spain form the nucleus of the museum. The Central Gallery (right) contains Spanish paintings of the 16th through 18th centuries, including works by Francisco Zurbarán and José de Ribera. "The Maids of Honor" (above), considered Diego Velázquez' greatest canvas, occupies a room of its own. These visitors view it in a mirror, as the artist painted it.

Goya's "Nude Maja"—inspiration for this copyist—hangs between portraits of the artist's wife Josefa and her brother, Francisco Bayeu.

of the Chief of State. Grave guards ushered us through rooms of tapestries and gilt furniture. Then the Chief of the Civil House announced us, and we entered the red-and-gold grandeur of the Generalissimo's office.

Above the familiar khaki uniform with its red sash, I saw the face that is minted upon Spanish coins and engraved on stamps. Yet I was startled. The surprising first impression of Generalissimo Franco is the mildness—almost shyness—of his manner. He greeted us graciously.

"Ah, yes, from the National Geographic Society," he said. "I recall your marvelous story on the birds of Spain." *

Except for its softness, the Generalissimo's Spanish bore little trace of his native Galicia.

We had promised to confine the interview to a single subject—the Generalissimo's description of the Spanish character. Both friends and enemies concede Francisco Franco's unique understanding of the subject.

Spanish Spirit Tempered in War

Folding his hands in his lap, he began: "Wars have made the Spanish character austere. Through 20 centuries our people have suffered greatly. For this reason they make good soldiers.

"As we look at history—the struggle against the Moor and all the rest—we see that the base of Spanish life has been religion. We could never have conquered the New World without religious zeal.

*See "Rare Birds Flock to Spain's Marismas," by Roger Tory Peterson, NATIONAL GEOGRAPHIC, March, 1958.

Practiced aim shoots a jet of water into the mouth of a Castilian woman drinking from a *botijo*, the community clay water jar.

Aqueduct arches span wheat fields of the Elorz Valley in the province of Navarra. Reminiscent of a massive Roman conduit and often mistaken for one, this 1790 viaduct spans almost three-quarters of a mile with its 97 arches. No longer in use, it once carried water of the Sierra del Perdón to Pamplona. Farmers from the nearby village of Noáin work the fields with a diesel tractor and 40-year-old harvester.

"Spaniards are always the same. Yet there is great variety here. The people of the Mediterranean coast are very much lovers of art, especially music. For example, in Valencia during the festival of Las Fallas, I remember that the country people supplied sixty bands for music. Imagine: sixty!

"In the north of Spain, there is greater sobriety and austerity. The people are harder because the life is harder. Perhaps for this reason the people in the north have a better spirit for work."

The Generalissimo briefly strayed into politics, then returned with this observation: "Spaniards today are proud because they have discovered themselves. Only now are we achieving the aspirations of a century.

"Many people say that the Spaniard is prideful. The statement is partly true, partly not. Often dignity and pride are confused. When a famous lady visited Toledo, a group of children applauded her. She offered a bank note to one boy, but he refused it. 'Thank you, madam,' he said, 'but I don't need this. Instead, I should like to kiss your hand.' That was dignity, not pride.

"It is the same when a farmer brings his ox to pull a stranger's automobile from a ditch; he refuses the tip and explains, 'It is our obligation as men to help you. I need no reward.'

"Each Spaniard is a gentleman, an *hidalgo*. An expression—widely used—is to say, 'It is my *real gana*,' my royal will. Spain is truly a land of thirty million kings."

So it has seemed to us. THE END

FROM SPAIN AND PORTUGAL they set sail toward the unknown—those bold captains of Renaissance times, seeking gold and spices and above all glory, for God and for themselves. Thus they charted southernmost Africa and the Americas, the Pacific and the Indian Oceans.

Now, more than four centuries later, the two countries that put most of the world on the map have themselves been mapped anew by National Geographic Society cartographers. The Society's World Atlas Map, **Spain and Portugal,** a supplement to this issue of the magazine,* recalls the Iberian Peninsula's venturesome past and also mirrors its modern technology.

For example, on the new 11-color Atlas Plate one can readily see how two largely mountainous and arid lands that once reached for riches across the seas today seek wealth at home—in electric power and irrigation.

At first glance, the blue areas dotting the Texas-size peninsula might all be taken for natural lakes. The map shows 64 such areas, but in 40 cases a black line across the blue indicates a dam. Where the River Douro forms the Spanish-Portuguese frontier—oldest unchanged border on the continent—a dam at Aldeadávila, Spain, houses Western Europe's largest hydroelectric plant. Spain and Portugal share its 720,000-kilowatt capacity.

Record-breaking Bridge Spans Tagus

Two insets on the Atlas Map focus on the surroundings of each country's capital.

From Madrid, double lines in red sprout in two directions—Spain's first superhighways. Northwest of the city, in the 7,000-foot-high Sierra de Guadarrama, a black square locates a gigantic memorial: the Valle de los Caídos, or Valley of the Fallen, dedicated to nearly a million Spaniards who died in the Civil War of 1936-39.

The other inset traces Portugal's first superhighway, leading north from Lisbon. To the south, a broken red line across the Tagus

Columbus in granite scans the beckoning sea near Palos, Spain, where his first voyage of discovery began.

Lands of the Bold Captains Mapped Anew

River marks the longest suspension bridge in Europe, now under construction. The 3,323-foot center section will arch 20 stories high.

This year Spain alone expects to welcome 15,000,000 tourists from abroad. The most popular Spanish resort area is the Costa del Sol, the Coast of the Sun, on the southern edge of the Iberian Peninsula. As continental Europe's warmest place in winter, it offers swimming all year round.

Looking inland from here toward the snow-capped Sierra Nevada, one can see the peninsula's loftiest peak, 11,421-foot-high Mulhacén, named for a Moorish ruler of Granada.

Many a name on the map recalls that Berbers and Arabs from North Africa—a scant eight miles away across the Strait of Gibraltar—overran most of Spain in the eighth century, making it a European bastion of Islam. Spanish place names prefixed by "Al" (the) generally stem from Arabic, for instance, Almería, the Outlook. Seville, once Spain's busiest port, straddles the Guadalquivir—originating from Wādi al-Kabīr, meaning the Great Valley.

In North Africa, after Algeria gained independence from France in 1962, many Arabic names replaced French. To cite a few: Nemours changed to Ghazaouet; Orléansville to El Asnam; Lafayette to Bougaa.

Spain drove the last Moorish king from Granada in 1492, a date that changed for all time the map maker's view of the world.

Seafaring's golden age was launched from Portugal, at Sagres, near Europe's southwesternmost corner. Here stood the school for mariners built by Prince Henry the Navigator, the royal landlubber who inspired Vasco da Gama and Magellan.† And from Palos de la Frontera, near the Gulf of Cádiz, Columbus cast off for the New World. THE END

*Additional copies of **Spain and Portugal**—and all other Atlas Series Maps published as supplements to NATIONAL GEOGRAPHIC—may be ordered for 50 cents each, postage prepaid, by writing to Dept. 255, National Geographic Society, Washington, D.C. 20036.

†See "Prince Henry, the Explorer Who Stayed Home," by Alan Villiers, GEOGRAPHIC, November, 1960.

Iberian Peninsula—jump-off point for the New World. Adventurous seafarers of the 15th and 16th centuries set sail from Spain and Portugal, shown here in a 1486 translation of Claudius Ptolemy's *Cosmographia* atlas, now in the National Geographic Society's library. The map, little changed from the Greek geographer's original chart of A.D. 150, marks mountains in brown shadings.

Columbus's cryptic signature (left) baffles scholars. Some suggest the initials SSAS stand for *Servus Sum Altissimi Salvatoris*, Servant I Am of the Most High Savior; XMY, probably an invocation to Christ, Mary, and Joseph; and Xp̄o Ferens, a Greco-Latin form of Christopher.

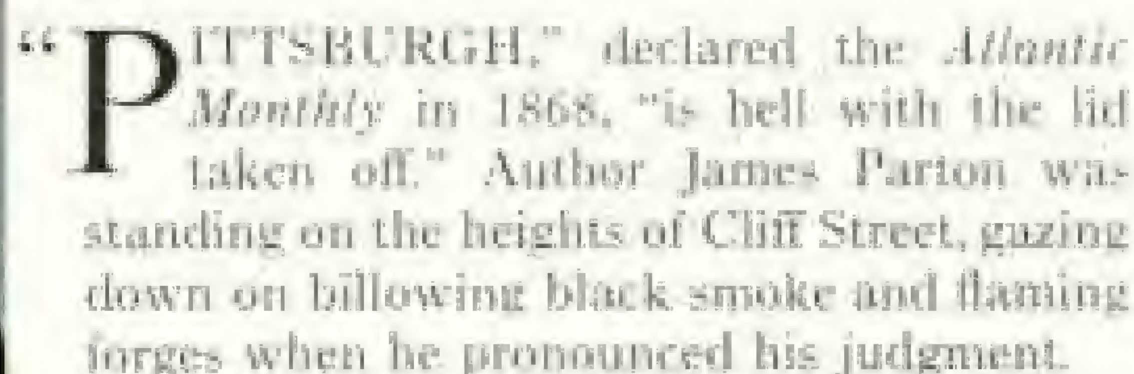
Pittsburgh, Pattern for Progress

By WILLIAM J. GILL

Photographs by CLYDE HARE

IN A WEB OF STEEL, *human spiders climb the towering frame of the new IBM Building, a 13-story addition to Pittsburgh's Golden Triangle. The Steel City, transformed from gloom to glitter by a 20-year revitalization program, glows today with industrial diversity and cultural vision.*

KODACHROME © N.G.S.



"PITTSBURGH," declared the *Atlantic Monthly* in 1868, "is hell with the lid taken off." Author James Parton was standing on the heights of Cliff Street, gazing down on billowing black smoke and flaming forges when he pronounced his judgment.

He could hardly make the same pronouncement today. But 20 years ago architect Frank Lloyd Wright concurred, declaring, "It would be cheaper to abandon it. . . ."

Yet even the caustically critical Wright, an advocate of decentralizing all big cities, was moved to remark: "What a fist this city has! What great power! But so has a rhino. There's a great animal impulse here, but very little of the spirit."

Perhaps Wright never stayed long enough to grasp Pittsburgh's true spirit. But he did sense its most compelling attributes. Few people who have seen this swaggering, muscle-bound city have failed to be impressed by its raw power, the dynamic pulse of its industries, the bold scope of its dreams.

Paul Bunyan Would Feel at Home

When I first moved to Pittsburgh ten years ago, I drove out one night along the ridge above the Monongahela River and looked down into the blazing muzzles of the soaring steel-mill stacks. I felt then, as I do now, that this is one city where Paul Bunyan would have felt at home. Indeed, Pittsburgh has created its own mythical hero to match the legendary giant of the North Woods. Joe Magarac, fabled idol of the steelworkers, stood seven feet tall and clamped white-hot steel bars in his teeth while he bent them with his bare hands. The terrain itself appears to have been worked over by angry giants ramming mammoth bulldozers against sheer cliffs and slashing deep gullies everywhere.

My latest return to Pittsburgh came after a sojourn in the searing heat of a Mexican desert. I landed at 2:30 a.m. at Greater Pittsburgh Airport, with the thermometer reading minus 18° F.—the coldest recorded temperature in 64 years. Despite this frosty homecoming, I reveled in my rediscovery of Pittsburgh. I found that its fist is bigger than ever, that its citizens are driving hard, after a prolonged economic recession, to bring the city back as the capital of U. S. industry.

In three months of re-exploring my city, I cruised up the Monongahela on a towboat,

The Author: William J. Gill, a native New Yorker who adopted Pittsburgh as his home town, won a number of awards for his reporting with the Pittsburgh *Press*. He is now a free-lance writer.

shoveled dolomite into a steel-mill furnace, talked with millionaires and unemployed workers. I interviewed the men who are reshaping the city and scientists intent upon conquest of the stars.

On the lighter side, I tried the Highland fling at a Scottish party and joined a lively kolo with a Slavic dance troupe. At the Masonic Shrine's Syria Mosque in Oakland, which serves as symphony hall, grand opera house, twist emporium, and Shriner convention headquarters, I watched Pittsburghers of varied national heritages perform songs and dances of their ancestral lands: Serbia, Italy, Israel, Slovakia, Poland, the Ukraine.

Research Opens New Realms of Power

Since coming to Pittsburgh, I have seen the city and the industrial complex that surrounds it undergo great and sometimes painful changes. Once it thought of itself in terms of the sheer might of its heavy industry. Now it is leaning more and more on science.

"There's no doubt about it. Pittsburgh is the nuclear power capital of the world," Dr. W. E. Shoupp, vice president and general manager of Westinghouse Research Laboratories, told me. "It is also one of the great industrial research centers of America."

In the office next door, Dr. Shoupp's associate, Dr. J. K. Hulm, plopped a doughnut-shaped coil of threadlike wire onto his desk (page 356). "That little thing should help seed a whole new generation of powerful atom smashers," he informed me with a smile.

"What is it?" I asked Dr. Hulm, a Cambridge scholar and wartime radar expert.

"The world's first superstrength, superconducting magnet," he replied. "We developed it here four years ago. We're making much bigger ones now, and by 1970 we'll triple *their* strength. But even that little thing can create a magnetic field twice as strong as you'd get from a conventional iron-core electromagnet as big as an automobile. It will revolutionize the generation of electricity and offer a key to long-distance space travel.

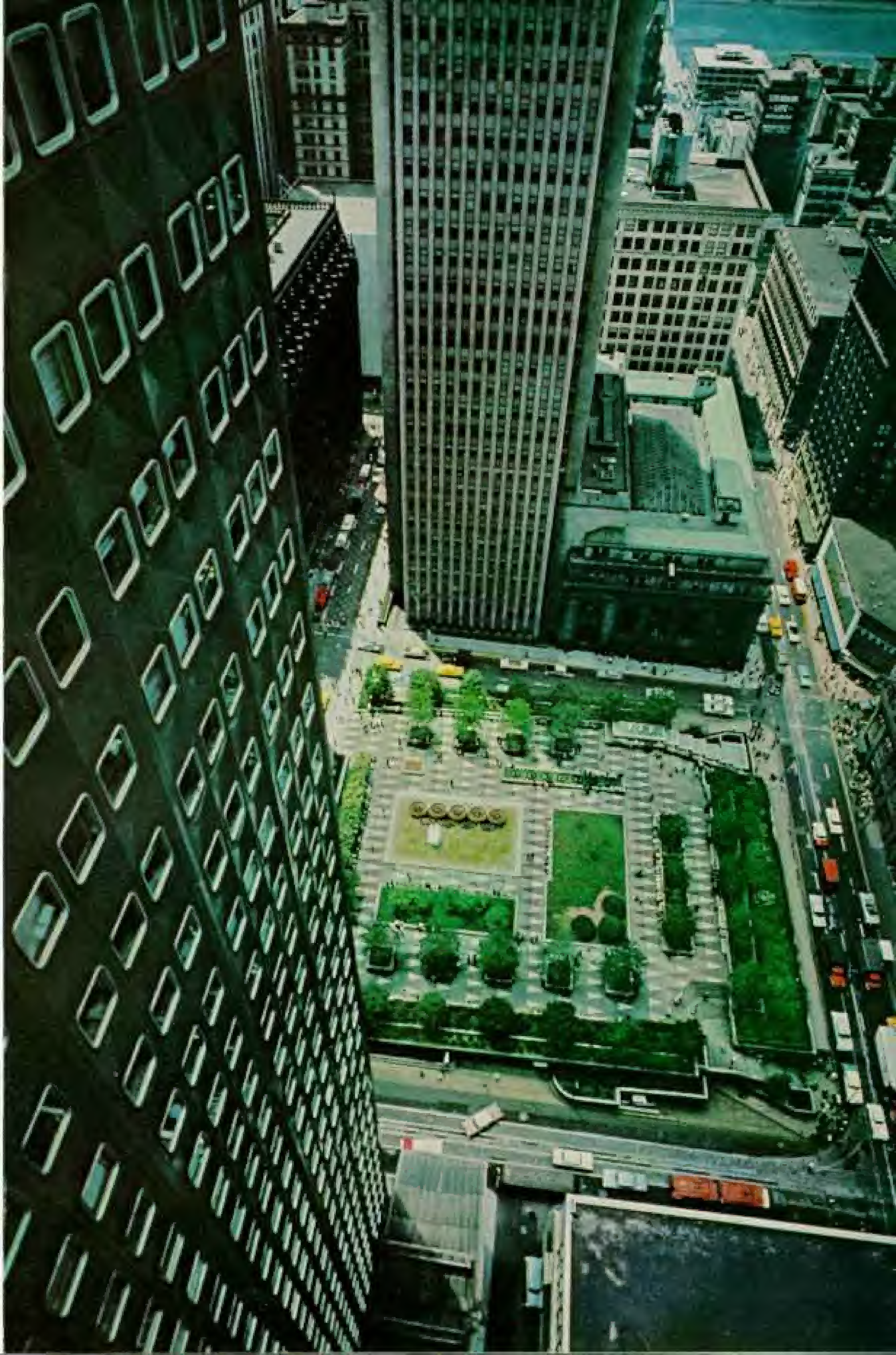
"We can push only a certain amount of current through an iron-core electromagnet. After that, we would melt the coil's copper windings. But this new magnet has no iron core. The coil is a new alloy, and by immersing it in liquid helium, we can keep it near absolute zero—minus 459.69° F.—where it becomes a superconductor."

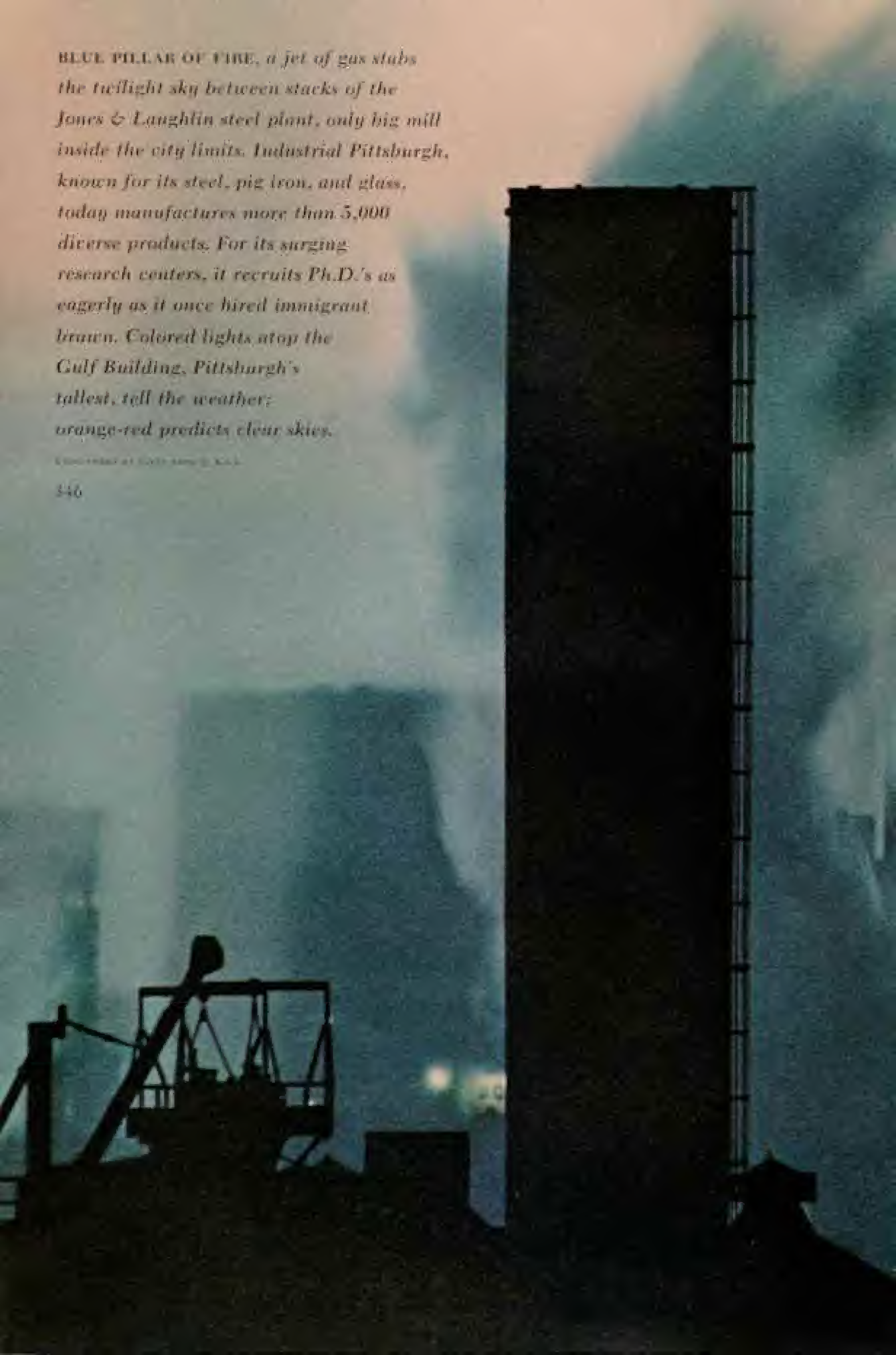
Dr. Shoupp elaborated: "Once the magnet has been energized, its power supply can be disconnected, and the original current will flow on and on without losing strength. Its

"Smoky City." "Grimesville." "Three-shirt-a-day town." For a century and a half Pittsburgh's choking smog made it a target of quipsters and a sorrow for residents. As late as 1945 (upper view), street lights burned 24 hours a day. But Pittsburgh plotted a transformation, and in the postwar years an almost magical thing happened (lower view). A smoke-abatement drive wiped the black shroud from the skies and converted the city from ugliness to beauty.

COURTESY, CITY OF PITTSBURGH; KODACHROME (OPPOSITE) © N.G.S.

Tranquil terrace in a muscular metropolis, Mellon Square Park tops a multilevel garage for 900 cars. To Pittsburghers it represents more than a subterranean parking lot: On its opening in 1955 it became a symbol of the urban rejuvenation that won the city a new look at the sun. This view from the aluminum-sheathed Alcoa Building looks across to the offices of U. S. Steel and the Mellon National Bank and Trust Company.





BLUE PILLAR OF FIRE, *a jet of gas stabs the twilight sky between stacks of the Jones & Laughlin steel plant, only big mill inside the city limits. Industrial Pittsburgh, known for its steel, pig iron, and glass, today manufactures more than 5,000 diverse products. For its surging research centers, it recruits Ph.D.'s as eagerly as it once hired immigrant brawn. Colored lights atop the Gulf Building, Pittsburgh's tallest, tell the weather: orange-red predicts clear skies.*

ability to run indefinitely and its light weight make feasible some of the far-out ideas for space travel. For trips to Saturn and Jupiter, for example, small engines with low, continuous thrust and little or no consumption of electric power may be the only answer."

The Golden Triangle: Symbol of Renewal

Pittsburgh's transition from a heavy-industry center to a research-oriented city has been accompanied by startling physical changes.* Before my eyes a new city within a city has sprouted in the Golden Triangle. This is the crowded, 330-acre wedge of office buildings and hotels, theaters and department stores that tower on the pie slice of land where the Monongahela and Allegheny Rivers merge to form the Ohio (pages 360-61).

The face lifting had barely begun when I flew from New York on a warm spring day in 1955 to meet my new boss, Wally Forster, editor of the Pittsburgh *Press*. We stood in his office above the Boulevard of the Allies and looked across a wasteland of cleared ground—temporarily parking lots—to the first three tall buildings of Gateway Center.

"You should have seen it a few years ago," he said. "It was an unholy mess. The old Wabash Railroad terminal stood right over there. The rest was a slum."

Today the parking lots have given way to clean-lined skyscrapers of blue and green and gold. But perhaps the outstanding symbol of Pittsburgh's renewal is the Civic Arena,

*See "Pittsburgh: Workshop of the Titans," by Albert W. Atwood, NATIONAL GEOGRAPHIC, July, 1949.

Looking like astronauts, two workers at Universal-Cyclops Steel Corporation in Bridgeville lower a glowing bar of molybdenum steel into a forging hammer. Their $6,000 suits protect against heat and supply air in a chamber filled with argon gas, which keeps oxygen and nitrogen from contaminating the metal.

Fiery violet-gold slabs of steel fresh from the blooming mill await a cooling water spray outside the Jones & Laughlin plant. Forged in 2,400° F. temperatures, slabs would otherwise retain their heat for hours, even in frigid 8-below-zero January weather.

four-fifths of a mile away at the base of the Triangle. From the air its massive dome dominates the city.

"Even at night that big thing shines," helicopter pilot Ray Custer shouted as we hovered noisily over the city one bright afternoon.

On summer evenings when the Civic Light Opera performs, the dome slides back at the push of a button, bringing skyline, moon, and stars into view (pages 352-3).

The Arena, completed in 1961, stands like a colossus amid blocks of cleared land. But soon it will be part of a new cultural center.

One afternoon I went to see H. J. Heinz II, prime mover behind the proposed center and new president of the Allegheny Conference on Community Development, the citizens' group that has sparked Pittsburgh's renaissance. I met him in the striking new research building from which he directs the worldwide operations of the food firm founded in 1869 by his grandfather. Under Jack Heinz's guidance, the original "57 Varieties" have multiplied to more than 300 (page 363).

Jack, a dark-haired man in his mid-fifties who looks ten years younger, characteristically had something new to show me. He led the way past the skeletal Giacometti sculpture that stands guard at his office door and down a long corridor to a dark and cavernous room.

He flicked a wall switch, and a city of high-rise apartments, offices, and parks sprang suddenly to life. It was a model for the area that fans eastward from the base of the Triangle to Oakland nearly two miles away, a section that has been almost all slum.

"Mellon's Miracle." The nickname has frequently been employed to describe Pittsburgh's renaissance. In many ways it proves apt. Richard King Mellon (nearest camera) is the third-generation overseer of the vast Mellon financial domain. In 1943 he helped found the Allegheny Conference on Community Development and rallied city leaders to arrest Pittsburgh's physical decay. Here, under the gaze of Andrew Mellon (portrait at far right), he presides at a directors meeting of the Mellon National Bank and Trust Company.

Veteran union executive David J. McDonald (below) has served the United Steelworkers as president for 13 years. Pittsburgh-born, he attended Carnegie Institute of Technology.

Rehearsing for a holiday concert, Conductor William Steinberg (center, bottom) of the celebrated Pittsburgh Symphony Orchestra studies a Beethoven score with two of his violists.

Chancellor of the University of Pittsburgh since 1955, Dr. Edward H. Litchfield has quadrupled endowments, doubled faculty salaries, and spent $100,000,000 for buildings.

"And this," said Jack Heinz, turning on another switch, "is the 'Acropolis.'"

On a big platform a larger-scale model of the cultural center, focus of the redevelopment, twinkled with a hundred lights.

"This will be a thousand feet long," he told me. "The symphony hall at the end will have an illuminated ceiling and seats on all four sides of the stage. Underneath will be a six-level parking garage."

Bold Plans Keep Builders Busy

The $40,000,000 Acropolis is typical of Pittsburgh's daring planning.

"Before they're done, they'll tear down the whole Triangle and build it up again," a man who runs a cigar store near Gateway Center predicted ruefully to me. "Then they'll start all over."

He exaggerated the facts, of course, but correctly gauged the city's spirit, as I confirmed that same morning when I met Carl Jansen. A kindly giant of a man, he serves as chairman of the Allegheny Conference and also of the Dravo Corporation, a large shipbuilding and construction company.

From his office near Gateway Center, we looked northeast toward Smithfield Street, a quarter of a mile away. Jansen waved his huge hand toward Fifth Avenue, one of the city's main shopping streets. "All this is coming out next. Within 20 years the whole Triangle will have been rebuilt. All the old dilapidated buildings will be gone."

Few of the really old ones are worth saving, but, ironically, only the planned demolition of the County Jail drew protests. Designed by architect Henry Hobson Richardson in the 1880's, it resembles a Romanesque fortress. The protests were successful. But when I mentioned this to an inmate, he grew indignant.

"I'll tell you one thing," he said, "no member of our alumni association was on that protest committee!"

Most Pittsburghers are proud of their city's rebirth, which has been acclaimed and imitated in many parts of the world. But across the Monongahela in a South Side tavern, a

jobless steelworker shook his head as we chatted about the erstwhile "Smoky City."

"We loved the smoke," he confided sadly. "It meant everyone was working. They got rid of the smoke all right. But a lot of jobs in the mills have vanished, too."

Of course, smoke control and unemployment are unrelated. Automation in steelmaking, as in other American industries, as well as diversification and the growth of research-oriented enterprises—all are helping to shift Pittsburgh's economic foundations.

Iron deposits were worked out long ago in western Pennsylvania, and for decades Pittsburgh has had to import its ore, mostly from the Mesabi Range in Minnesota and lately from Labrador. The city became an important steel center, because it straddled one of earth's richest seams of bituminous coal. However, its growth as a management and research center plus its varied new industries are lessening its dependence on steel.

Giant mills still sprawl along the rivers. But the only basic plant within city limits is the Jones & Laughlin Works (pages 346-7).

At J&L's South Side Works last autumn, I met Gene Lees. A strapping six-footer of 56 with twinkling blue eyes, Mr. Lees has a

good-paying job as first helper in the open hearth. He owns a home in the Country Club Estates in suburban Whitehall and was planning to leave on a Florida vacation.

"It's rough work in a mill," he admitted as we sought refuge from the noise and heat in a control booth facing the open-hearth furnaces. "But it's nowhere near as rough as it used to be. See that. . . ." He pointed through the thick glass to a cannonlike machine that was spraying something into one of the big furnaces. "That gun is shooting double-burnt dolomite in there to fill up a hole in the furnace wall. We used to shovel it by hand."

I observed that it looked as if machines did most of the heavy work now.

"So that's what you think?" Gene laughed. "Come on! I'll show you!"

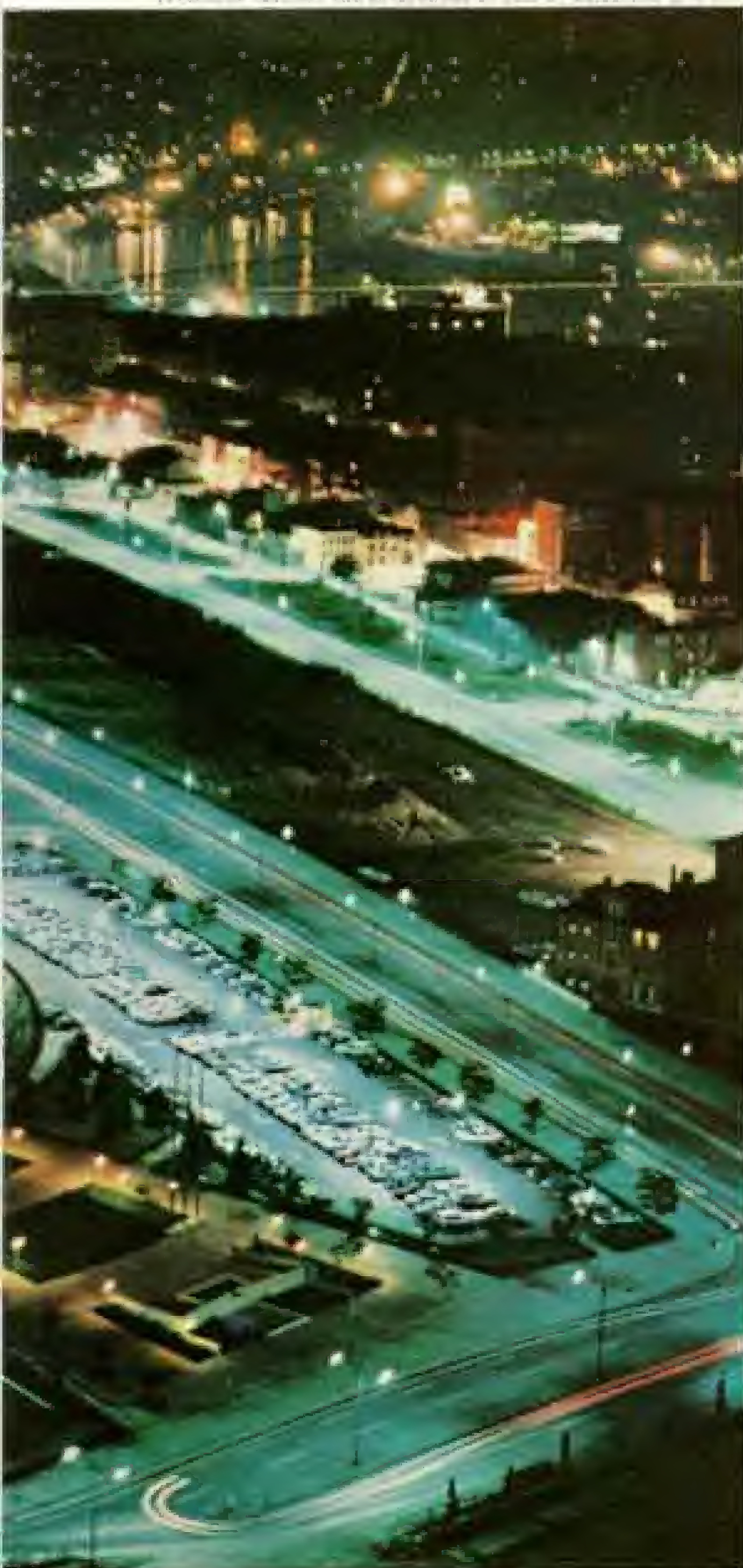
Out on the floor we joined a crew armed with shovels. The sliding door of the furnace in front of us rose a few feet, and I squinted into the blinding-hot innards.

Over the roar of the furnaces Gene Lees shouted in my ear: "This one we can't leave to the gun. We have to hit that patch there at the back. With raw dolomite."

How Not to Tend a 3,000° F. Furnace

I watched the men walk almost up to the door and heave the grayish gravel in. The target was only about eight feet away, and it looked deceptively easy. One of the men asked whether I wanted to try it. I got a good shovelful and marched to the furnace door.

As I leaned into my pitch, a sudden wave of searing heat leaped at me. Recoiling, I sprayed the dolomite over the floor.



Folding like a Japanese fan, the retractable roof of the new Civic Arena opens for a concert under the summer stars. The 13,600-seat showcase, built at a cost of $22,000,000, converts into an open-air arena at the push of a button; elapsed opening time, 2 minutes 25 seconds. The handsome structure stands near the base of the Golden Triangle in a section called the Lower Hill, long notorious for its noisome slums. Cleared by urban authorities, the 95-acre site soon will house an arts center, a hotel, high-rise apartments, and lofty office buildings. Brilliantly lit Boulevard of the Allies streaks beside the Monongahela River in the background.

Sealed in winter, the Arena defies frigid, snow-choked northwest winds that periodically sweep down on Pittsburgh. Both President Johnson and Senator Goldwater spoke here during last fall's election campaign.

The crew roared with laughter. Sheepish, I asked to try again.

This time I managed to get the shovelful into the furnace. But the dolomite still fell far short of the target. I touched my safety helmet as I walked away. It seemed hot enough to blister my fingers. "How hot is that furnace anyway?" I asked Gene Lees.

"Only about 3,000 degrees," he smiled. "Why don't you come back in the winter? It feels awful good then."

Winter or summer, the city bustles with busy humanity, for Pittsburgh is the focus of the eighth largest metropolitan area in the Nation. The Census Bureau estimated in 1960 that 3,355,000 people lived within a 50-mile radius of the Golden Triangle. Although the city's population had decreased by 70,000—to 604,000 during the 1950's—the suburbs continued to grow. About 1,600,000 people now live in the 129 municipalities, including Pittsburgh, that make up Allegheny County.

An important rail center, Pittsburgh is also one of America's largest inland river ports. But at the junction of the rivers it does not have the look of a port city.

It is hard to believe that this was once a rootin'-tootin' steamboat town. And before that, home port for the wild and woolly keelboatmen led by Mike Fink, self-styled "half horse, half alligator," who claimed the title "King of the Rivers." Today the flamboyant

Skirts aswirl, the Tamburitzans of Duquesne University perform a lively Croatian dance. Founded in 1937, the all-student group of dancers, singers, and musicians perpetuates the cultural folk art of the Slavic and Balkan nations. They have performed hundreds of times throughout the United States, Canada, and Europe.

[illegible] BY CLYDE HARE © NATIONAL GEOGRAPHIC SOCIETY

riverfolk have all but vanished. Charles Zubick, who bravely anchors his fleet of battered barges across from Gateway Center in defiance of civic planners, is one of the few left.

I inspected miles of the waterfront from the decks and pilothouse of the *Franklin Pierce*, an ultramodern towboat. At noon on a sparkling spring day, this flagship of the Thomas Petroleum Transit Company touched near the Triangle's tip to carry me on the last lap of its long journey from Louisiana and Texas.

Capt. William P. Jackson held forth on the changes in river navigation in the 25 years he has been making the run between New Orleans and Pittsburgh.

"Used to be, you'd run by watching the top of these hills," he drawled. "If you didn't know the hills, you'd have to stop. The smoke was that thick along the water. But with radar and all, this boat will do anything you want except tie up and collect for you."

Built in Dravo yards just down the Ohio from Pittsburgh, the *Franklin Pierce* can push a tow of barges 100 feet wide, 1,000 feet long, and carrying 20,000 tons of cargo.

Change Blurs "Nice Little Villages"

Nostalgia is a rare sentiment in renaissance Pittsburgh, but I found a touch of it in a Victorian house in Shadyside, east of Oakland. Two sisters, Miss Sarah McClelland and Mrs. Rachel McClelland Sutton, have lived there for almost 75 years.

Mrs. Sutton is an artist; Miss McClelland is active in local politics. Though neither sister is content to live in the past, they have a special feeling for the old Pittsburgh.

"Change is inevitable," says Mrs. Sutton, "but it is not necessarily progress. Pittsburgh used to be a group of nice little villages. Here in Shadyside when we were growing up everyone knew everyone else. There was a friendly policeman, an organ-grinder, and the cable cars ran right in front of our house. We cried when they took them away."

Today Shadyside is Pittsburgh's Left Bank. Many stately mansions built by the steel barons survive. But within the past decade the neighborhood has changed.

On a Saturday night I strolled along Shadyside's Walnut Street and watched college students, the young suburban set, and a few remnants of the beatnik generation prowl the pubs. Here a short, two-block strip, mostly intimate little bistros with small jazz ensembles, has become the city's night-life center.

Gateway to the west, Pittsburgh grew around Fort Pitt, founded in 1758. George Washington chose the site at the Y-shaped confluence of the Monongahela and Allegheny Rivers, where they merge to form the Ohio. Geography plays an all-important role in the city's industrial greatness. Rich deposits of coal, gas, and limestone, essential for steelmaking, stud the nearby countryside. Lake and rail transportation bring in iron ore from Minnesota and Labrador.

Today Greater Pittsburgh (lower map) mushrooms far beyond its original city limits. Yellow blocks mark the Golden Triangle and Oakland, centers of architectural and cultural advance. Scores of satellite communities house modern research laboratories.

The many artists in Shadyside don't seem to mingle in the cafes. "This is not a Left Bank in the sense of a rendezvous for escapist artists," Vienna-born painter Henry Koerner told me.

Artist Feels Alive to Pittsburgh's Past

We talked in his studio on the top floor of a rambling old home on Murray Hill Avenue where he lives with his pretty wife Joan and their two small children. Artist Koerner came to Pittsburgh twelve years ago from New York to teach "for a year or two" at Chatham College for women. Struck by the power and artistic potential of this hustling city, he decided to stay.

"This is the place," Henry Koerner insisted. "Great painting is being done here. Pittsburgh is the truly creative city. There is no other place in the country where you can take a walk and feel America at its greatest from the pioneer days to the industrial era."

No city between Boston and San Francisco claims a more colorful history than Pittsburgh. I dropped by to talk about it with Robert Christie, the executive director of the Historical Society of Western Pennsylvania.

"George Washington himself selected the site," he reminded me. "When he first came here in 1753, there was not a single habitation, aside from an Indian village up the Allegheny, about where 33d Street is now. The French had set up a string of forts south of Lake Erie. To warn them away, Governor Dinwiddie of Virginia sent Washington—a 21-year-old surveyor and planter,

Phenomenon of superconductivity could keep electricity flowing undiminished in the coiled wire atop this magnet when it is immersed in one of the tanks of liquid helium (background). There the temperature stands at minus 452° F., less than 8 degrees above absolute zero. Developed in Westinghouse Research Laboratories, the apparatus creates high magnetic fields for study and someday may help power spaceships to the moon and beyond.

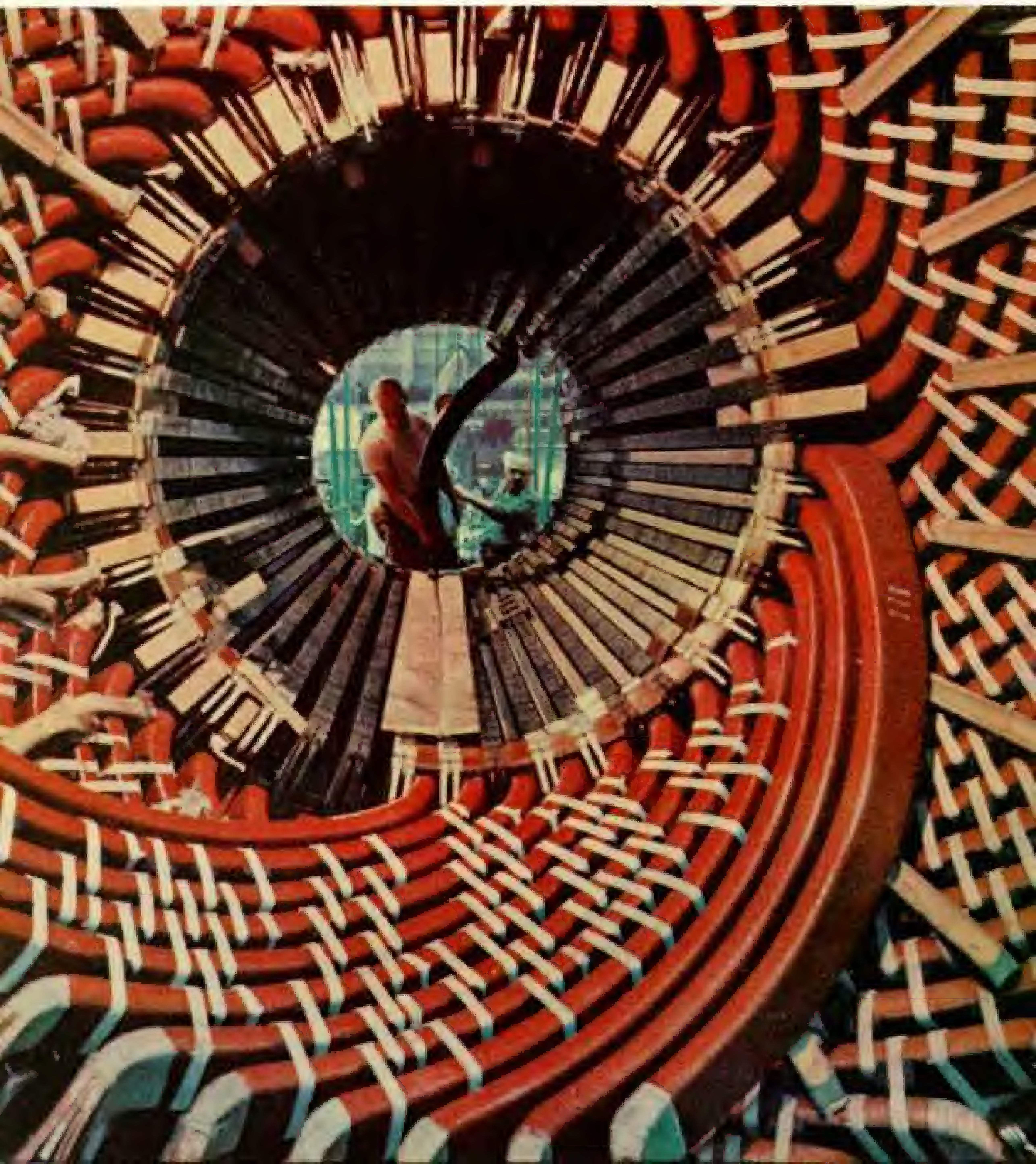
Miles of wire, intricately spliced and positioned, spiral from a turbine generator that will supply power to light an entire suburban development in Texas. The machine takes shape at Westinghouse Electric.

who had no previous military experience."

On this and three subsequent trips over the next five years, Washington almost drowned in the Allegheny near present-day 40th Street, fired the first shots in the French and Indian War in a clash with a scouting party some 40 miles to the south, and tried to rally Braddock's defeated army in what is now a Pittsburgh suburb.

In 1758 Washington commanded a wing of the army led by Scottish Gen. John Forbes that drove the French from Fort Duquesne and secured the West for British and, later, American expansion.

Forbes named the site Fort Pitt in honor of the English statesman William Pitt. For several decades it served as the western bastion in the recurring Indian wars. All that remains of the old fort is one blockhouse of brick, standing in lonely seclusion in 36-acre Point State Park. Above it, traffic speeds over ramps to the Fort Pitt Bridge, leading through a new tunnel under Mount Washington to South Hills and the airport to the west.



When the War of 1812 broke out, Pittsburgh was on its way to becoming an industrial colossus of the West. Glass factories, iron-fabricating forges, and shipbuilding yards blossomed black along the riverfronts, and by 1840 the city was launching nearly 100 steamboats a year. Oddly, it imported its pig iron until 1859, when the first important blast furnace was built along the "Mon." During the Civil War, Pittsburgh came into its own as the great arsenal of freedom, a role it continued to play through both World Wars.

In the latter decades of the last century, Pittsburgh was the fountainhead of some of the Nation's greatest fortunes. Andrew Carnegie, Henry Clay Frick, George Westinghouse, the Mellon brothers—these and many other men of enterprise built their wealth on

Triangular three-watt amplifier contains all the electronics equipment needed for a high-fidelity phonograph. Conceived by scientists at the Westinghouse Research Laboratories, the device appears seven times actual size; each of its three parts would fit inside this capital letter "O". The design craftsman above hand-cuts the master circuits, which are then reduced photographically. Though not yet marketable in phonographs, the miniature circuits serve missiles and computers.

Research ranks as Pittsburgh's fastest growing industry, with an annual payroll exceeding $100,000,000. Westinghouse pioneered nuclear power plants for the Navy's first atomic vessels and made Pittsburgh the first city to utilize atomic electricity.

Wrap-around windshields emerge from tanks that wed glass and shatter-resistant plastic at the Pittsburgh Plate Glass Company.

EKTACHROMES (UPPER LEFT AND BELOW) AND KODACHROME © N.G.S.

coal and steel, railroads and oil, inventions and investments.

In this period Pittsburgh also saw some of the most violent labor disputes in America's history. The 1892 Homestead steel strike slashed a wound across the city's labor-management relations that to this day remains raw and sensitive.

The strike culminated in a pitched gun battle along the Monongahela in which 10 men were killed and at least 60 wounded. Two weeks later a self-proclaimed anarchist stalked into the office of Henry Clay Frick of the Carnegie Steel Corporation, shot Frick twice in the neck, and then attacked him with a knife. Miraculously, Frick lived. Refusing any anesthetic, he directed the surgeon who probed for the bullets and finished his day's work propped at his desk.

After this incident public opinion turned against the strikers, and the hopes of unionism in the steel industry were dashed. Not until the mid-1930's did the late Philip Murray, president of the United Steelworkers and a founder of the CIO, finally manage to organize the mills.

Mellon Family Helps Reshape City

Many Pittsburgh millionaires moved out early in this century. But the Mellons stayed on. The late Andrew Mellon, Secretary of the Treasury under Presidents Harding, Coolidge, and Hoover, and his brother, Richard Beatty Mellon, were determined to improve the city where they had made their millions. R. B.'s son, Richard King Mellon, has followed in their footsteps.

An erect man in his mid-sixties, Mr. Mellon watches over his many civic and business interests from an office high above Mellon Square Park. He was a founder of the influential Allegheny Conference, and though extremely shy, he is outspokenly proud of his city (page 351).

"The real test of a Pittsburgher," he once told a banquet, "is whether or not he gets mad when someone makes slurring remarks about his town. You should feel much as though someone had insulted your wife."

I have rarely encountered a native of the Pittsburgh region who has any desire whatever to live anyplace else. But many were forced to move out during the economic recession that began in 1958 and continued through 1961.

At the Pennsylvania State Employment Service, I talked with George McGill, district manager, about recurring unemployment among steelworkers and coal miners.

"Most of these men can't do another darn thing," he said, shaking his head sadly. "They quit high school to work in the mills and mines at fairly high wages. Now we're trying to retrain them for other jobs. Progress is being made, but we still have a long way to go."

Millwright Wins Orators' Contest

Samuel Robert Glass, a millwright in a steel-fabricating plant, has taken the unhappy lesson of poor education to heart. I drove out to see him on his farm west of the city. In the living room of his big farmhouse, Bob, a husky, smiling man with snow-white hair, brought me up to date on his family.

"My oldest boy—the one who graduated from Yale—is working now on his Ph.D. at the University of Maryland," he said with quiet pride. "Another boy is down in Guatemala with the Peace Corps after two years in business college. And my oldest daughter took her degree from Chatham and is planning to study toward her master's."

Bob, who came to Pittsburgh from Northern Ireland as a young man, is making up for the education he failed to get. He is a voracious reader, and a few years ago, after taking a public-speaking course, emerged as the winner of the Dale Carnegie international speaking contest, competing against lawyers and other professional men.

Long before Bob Glass, thousands of European immigrants came to Pittsburgh to help man the mills and mines. Those from eastern and central Europe have left a particular stamp. When Nikita Khrushchev visited the city in 1959, he pointed in recognition—whether jeering or joyful, only he could tell—to the onion-shaped Byzantine domes of the churches along the highway to Homestead.

A remarkable dance troupe at Duquesne University has done much to keep the Slavic heritage alive. Known as the Tamburitzans, the troupe takes its name from a family of stringed instruments common in south-central Europe (page 354). The Tamburitzans award scholarships to students who qualify for the troupe, but they need not be of Slavic descent.

"The Tammies are all mixed up," laughed Vincent Aleandri, who was the troupe's accordion player when I talked with him at their annual dinner-dance. "I'm of Italian ancestry, and so is one of the girls. There are a couple

Golden Triangle's Gleaming Towers Reshape the Skyline of a City Reborn

The Pittsburgh of today bears scant resemblance to the frontier town that forged weapons and tools for the pioneers who opened western America. With its amazing transformation, it has become a model for city planners all over the world. Gateway

PHOTOGRAPHY © NATIONAL GEOGRAPHIC SOCIETY

Center, a 23-acre development in the Golden Triangle, contains nine new office buildings, an 800-room hotel, an apartment building, and spacious underground garages. At the apex, Point State Park replaces a dilapidated warren of warehouses, sheds, and railway trestles. "Bridge to nowhere," Pittsburghers call the unfinished Fort Duquesne Bridge over the Allegheny. The span awaits building of its northern approaches. A residential area blankets Mount Washington in the foreground.

of Pennsylvania Germans, an Irish girl, several kids of English heritage. You know, we're all Americans."

The Tamburitzans have strong ties to the troupe even after they leave the university. "Whenever a Tammie gets married, he can count on the orchestra showing up to play on the church steps and serenade him through the reception," Charles Cubelic told me. "When I was married, they started the night before the wedding and played right on through the following day and night."

A history instructor at Robert Morris Junior College, Chuck Cubelic directs the Pittsburgh Folk Festival. He credits the Tamburitzans and the festival with keeping the city's diverse nationality groups thriving.

"They were dying out," he claims. "But since the Tammies and Duquesne started the annual festival in 1956, there has been an amazing revival. Instead of splitting people into separate groups, as the old-time lodges did, the festival brings them together. We assign locations for the food and display booths by picking numbers out of a hat. The Croatians, Serbs, and Slovenes all wound up next to one another this time. Once that could have caused a civil war, but no more."

Another kind of international flavor stems from the universities and the big companies headquartered in Pittsburgh. Both attract scientists from all over the world. The largest of Westinghouse's dozen research-oriented facilities, in Churchill Borough, employs 1,500 people from 30 nations and most of the 50 states. Projects range from making fresh water from the sea to designing lasers capable of bouncing light beams off the moon.

Westinghouse owns or operates a quarter of a billion dollars' worth of research, development, and engineering facilities in the area. Its Astronuclear Laboratory in Large, Pennsylvania, five miles south of Pittsburgh, is hard at work on nuclear propulsion systems to drive rockets to the moon, Mars, and perhaps beyond.

A. L. Bethel, until recently manager of advanced projects at the laboratory, told me: "We are also developing plans for a nuclear power plant on the moon for the many bases that will one day be built there."

Pittsburgh Leads in Building Reactors

Westinghouse pioneered in the field of nuclear power. In 1938 it built the world's first industrial atom smasher in Pittsburgh. Since then the company has provided virtually all the reactors for the U. S. Navy's nuclear submarines and surface ships. And it has completed or is building a dozen nuclear-powered generating plants.

King of the dinosaurs, fang-toothed *Tyrannosaurus rex* leads the march of bones in the Carnegie Museum, part of Carnegie Institute. The 20-foot-tall carnivore, largest and fiercest of all flesh-eating dinosaurs, looms over armor-plated *Stegosaurus* in foreground. Along the wall stretches the fossil skeleton of *Apatosaurus*. At upper left emerge the head and neck of *Diplodocus carnegiei*, named for Pittsburgh steelmaker and philanthropist Andrew Carnegie.

Famed pickle maker H. J. Heinz II samples the output of his Pittsburgh plant. Though renowned as the home of "57 Varieties," the company today offers some 300 kinds of soups, baby foods, baked beans, and condiments, as well as pickles. It is the largest ketchup maker in the world. A native of Pittsburgh, Mr. Heinz plays a major role in his city's rebuilding.

Hill-conquering trolleys. Pittsburgh's incline cars command the same nostalgic veneration as San Francisco's cable cars. Gliding up Mount Washington, the Duquesne Incline ascends 800 feet at a 30-degree angle. One end stands high to keep passengers level. For 88 years the historic funicular, recently repaired and restored by the Duquesne Heights Civic Association, has operated with its original cable drum.

The first such plant, built for the Atomic Energy Commission and the Duquesne Light Company 40 miles down the Ohio at Shippingport, came from Westinghouse.

I well remember the night in December, 1957, when that plant lit the skyline of Pittsburgh. It was a prophetic event. Atomic power now seems to be turning the corner from costly experiment to a competitive source of electricity.

"It has happened so quickly, the Nation is scarcely aware of it," former Westinghouse Chairman Gwilym A. Price told me. "In just one 45-day period, four utilities announced plans to invest more than four hundred million dollars in four large atomic stations."

Far-ranging research is not new to Pittsburgh. Mellon Institute in Oakland, founded half a century ago, was the first nonprofit research center in America. Its scientists have developed several hundred processes and products. These include significant contributions in industrial health and smoke control, as well as the charcoal-containing gas mask, developed during World War I by Dr. James B. Garner, a neighbor of mine in suburban Bethel Park until his death in 1961.

Smoke Control Made Profitable

Not all the industrial research in the area is done in the big labs. In an old ceramics plant in Carnegie, I found myself staring at a curious Rube Goldberg contraption.

"This baby is going to make smoke control profitable," said Bill Butterbach. A former airline executive, he teamed with Harold T. Stirling, a scientist from Nova Scotia, to form the new Stirling Sintering Company.

"Industry spends millions every year just dumping the fly ash that is collected by electric precipitators in smokestacks," Mr. Butterbach explained. "But with this thing we can make pellets of the ash that are far purer in iron content than the ores that go into the furnaces originally. We can recover iron and manganese. We can even make pellets from the iron taken from coal dust. We just built the first fly-ash sintering plant in the Pittsburgh area. It is adjacent to a Duquesne Light power station down the Ohio."

The universities are also in the forefront of Pittsburgh's research renaissance. Carnegie Institute of Technology has advanced into the front rank of the Nation's scientific and engineering colleges under the aegis of Dr. John C. Warner, who served as Tech's president from 1950 until his retirement last month. Dr. Warner coordinated chemistry and metallurgy research for the Manhattan Project and for a dozen years was a member of the AEC's advisory committee.

At the University of Pittsburgh, in a spacious office on the ground floor of the 42-story Cathedral of Learning, I talked with Chancellor Edward H. Litchfield (pages 350 and 366). A combination educator-entrepreneur, he spoke of Pitt's new Space Research Center, to open this year in cooperation with the National Aeronautics and Space Administration.

"We are bringing in leading space scientists from all over the world," Dr. Litchfield said, "and this is only one area in which we are moving. We have spent more than a hundred million dollars on campus development since

1955, and we probably will have to spend at least that again by 1970. But we're not limiting ourselves to Pittsburgh. We have undertaken teaching programs in Chile, Ecuador, Nigeria, and Hawaii.

"Pittsburgh—the city as well as the university—is still our prime concern, however. You should get the story on the Panther Hollow project here in Oakland."

How to Make 75 Acres Out of Air

With Edward Magee, director of the Allegheny Conference, I walked along the railroad tracks at the bottom of the wide ravine between the Pitt and Carnegie Tech campuses, site of one of the most ambitious construction projects ever conceived. It is being financed through the Oakland Corporation, which Dr. Litchfield organized to guide the section's renewal.

From the bottom of the hollow will rise a series of immense multilevel platforms that will support new buildings.

"They will stretch for more than a mile," Ed Magee said as we paused beside the rails. "At this end there will be seven levels; at the other, five. The railroad and a superhighway will run down here beneath the buildings."

I looked up at the steep sides of the ravine, which widens to nearly a third of a mile across at one point.

"Down here there are not more than 15 level acres in this hollow," Ed went on. "But we will manufacture 75 acres—about 3.2 million square feet of building space—right out of the air. Each box of air will be sold or rented for offices or labs just as if it were ground-level real estate."

Despite the emphasis on industrial research and construction, medical science has not been neglected in Pittsburgh. At the University of Pittsburgh School of Medicine, Dr. Jonas Salk developed the first successful polio vaccine, and other medical researchers there have won world recognition (page 367).

At the university's Addison H. Gibson Laboratories, Dr. Campbell Moses briefed me on a science project in Pittsburgh-area high schools. "We'll have more than 200 students from 41 schools doing research this summer," he told me. "The National Science Foundation is helping with a grant. Go out to North Hills High and see what some of these kids are doing. They'll amaze you."

Skyscraper schoolhouse, 42-story Cathedral of Learning dominates the University of Pittsburgh campus. Classrooms, laboratories, libraries, and offices fill the lofty structure. If spread out across the campus, they would crowd the 14 surrounding acres. In the lofty Commons Room, social center for Pitt's 17,500 students, pillars rise four floors to a high-vaulted ceiling.

Graduation on the green. Gothic spire of the Heinz Memorial Chapel towers above ceremonies at the University of Pittsburgh in this view from the Cathedral of Learning. Columned Mellon Institute, modeled after the temples of Greece, rises between the chapel and twin-spired St. Paul's Cathedral.

EKTACHROMES © NATIONAL GEOGRAPHIC SOCIETY

Noted biochemist Klaus Hofmann spurns the traditional white coat while working at the University of Pittsburgh School of Medicine. He leads a threefold life—as administrator, teacher, and scientist—but his test tubes remain his first love. Of his laboratory, he says, "I like the bottles, the glass, and the smell of it." Dr. Hofmann experimented for seven years to re-create ACTH, a hormone that activates the adrenal glands. His synthesis of this most complex proteinlike molecule has been hailed as one of the greatest achievements of modern chemistry.

Buggy replaces baton in an unusual relay during the Spring Carnival at the Carnegie Institute of Technology. Budding engineers design such cars for top efficiency and push them on the uphill sections of a one-mile course. Student inside, lying prone, steers this ground-hugging buggy on the downhill runs, at times coasting at 40 miles an hour.

In a greenhouse behind a classroom at the school, I chatted with Terry Liersaph, a 16-year-old junior, and Mrs. Carolyn Gibson, the inspired teacher who started this program with the help of Dr. Moses' labs and who now directs the program for Pitt.

"I'm giving these plants tumors," Terry said, showing me the periwinkles, or *Vinca rosea*, he had been experimenting with. "I'm trying to show that a bacterium transmitted by insects causes a crown gall to form."

Mrs. Gibson told me, "Dr. Howard Hausman of the National Science Foundation came here to watch the students in action. He was so impressed, he said, that he wished to transmit the excitement these young people have in learning to every school in America. A number of schools around the country have since picked up this idea of students conducting original scientific investigation."

Pittsburghers take sports as seriously as science. Each summer thousands of fans die a million deaths at Forbes Field in Oakland, watching the perennial underdog Pirates. Though the Pirates made up for 33 pennantless years in 1960 by whipping the Yankees in the World Series, they are once again causing the fans as much grief as the National Football League's hapless Pittsburgh Steelers.

Stephen Foster Penned Songs Here

Golf, another Pittsburgh passion, "is not a country-club sport," according to golf writer Bob Drum. "Steelworkers are as nuts about it as executives. Arnold Palmer's father is now the pro at the Latrobe Country Club, east of Pittsburgh. But he worked in a steel mill when he was teaching Arnie the game."

The arts are addressed with equal vigor. George (Buzzy) Kountz, dance-band leader in the 1930's and now owner of a men's shop in Shadyside, reminded me that Pittsburgh

Young sportsmen play hard, root hard for Pirates and Steelers.

Over the hill, yet another

has always been a "great musical town."

"Stephen Foster was born over in the Lawrenceville section," Buzzy said. "Most people don't realize that he wrote almost all his famous songs here, not down along the 'Swanee River.' He never saw the Suwannee. He grew up on the banks of the Allegheny."

Under Conductor William Steinberg, the Pittsburgh Symphony has become one of America's leading orchestras (page 350). Last year it toured Europe and the Middle East, visiting 14 countries.

"More than half the $350,000 we collect each year for the symphony comes from individual contributions," Zane Knauss, Pittsburgh's leading theatrical publicist, told me. "No one can say Pittsburghers aren't interested in culture."

We had just sampled parts of three different shows at the Pittsburgh Playhouse in Oakland. Now, over a midnight cup of coffee, Zane expounded on his favorite theme.

"You saw how jammed all three of our theaters were tonight?" he began. "That's not at all unusual. We drew 120,000 people to our productions last season.

"There are two buildings here, though they're now joined. One used to be a synagogue and the other was a German drinking club. We make all our own sets and costumes, and this year we staged 17 separate shows. There are about 100 people working full time, and we have 400 avocational actors on call. We also have 1,700 full- and part-time students in the Playhouse School. A lot of people have gone out of here to Broadway and Hollywood. Gene Kelly, Shirley Jones, and Lisa Kirk are just a few."

A healthy share of Pittsburgh's vast wealth has in the past gone into art for other cities, most notably the National Gallery of Art in Washington, endowed by Mellon millions,

hill. Pittsburgh, complained columnist Ernie Pyle, "must have been laid out by a mountain goat."

and the Frick Collection in New York City. Oddly, however, Pittsburgh has never had a first-rate art museum of its own, although the venerable Carnegie Institute's Museum of Art is currently building an important permanent collection through the generous gifts of Mrs. Sarah Mellon Scaife. And financier G. David Thompson owns one of the world's notable private collections of modern art.

I have been in few cities where people get so excited about art. The opening of the triennial Pittsburgh International Exhibition of Contemporary Art at the Carnegie invariably touches off fierce controversy.

At the museum's dinner for the International opening a few years ago, Roy A. Hunt, former president of the Aluminum Company of America and a member of the Carnegie's board, said with a smile, "This is the age of the lunatics. If you don't believe me, wait until you get upstairs and see this show!"

My own observation is that Pittsburgh, with one of America's oldest contemporary art exhibitions, despises modern art. But I'm sure that if its International were to move elsewhere, the city would go into mourning.

Immigrant Sums Up City's Strength

Pittsburgh's new cosmopolitan milieu complements the older, more established internationalism left over from the great tides of immigration. And in 1956 the city once more

Man-made Milky Way of glowing windows presents a glittering spectacle above the Point.

opened its doors—to more than 1,000 refugees from the Hungarian revolt.

One of them was Laszlo Pasztor, a strikingly handsome young scientist from Budapest. Now supervisor of analytical chemistry at Jones & Laughlin's Graham Research Laboratory, Laszlo has lost none of his determination to continue working, as he once fought, for a world conceived in freedom.

"I believe we had to show the people of Pittsburgh that we were not only good Freedom Fighters, but good workers and good citizens," he told me one night. We were dining with his lovely wife Adel in a restaurant atop Mount Washington.

Looking down at the lights that sparkled like a thousand diamonds from skyscrapers in the Golden Triangle, Laszlo Pasztor almost echoed words I'd heard from another Pittsburgher, Gwilym Price, the Welsh immigrant's son who rose to board chairman of Westinghouse, had told me why he devoted long hours to his city's rebuilding.

"I've lived here all my life," Mr. Price said, "and when a town has been as generous to you as Pittsburgh has been to me, you just can't take all these things without giving something in return."

Laszlo Pasztor put it this way: "Pittsburgh has been good to me. I hope I can repay it someday. Pittsburgh and America. The world owes them much."

THE END

Red beacon on top of the Grant Building (right) blinks "P-I-T-T-S-B-U-R-G-H" in Morse code.

EKTACHROME BY CLYDE HARE © NATIONAL GEOGRAPHIC SOCIETY

Tree Snails, Gems of the Everglades

Cornucopia castles, once housing tree snails, shine on a mirror under the eyes of the author's granddaughter (right). A wrinkled inhabitant emerges from its lustrous shell (above). Today *Liguus fasciatus,* threatened over most of its limited range by the pressure of suburban building, finds protection only in Everglades National Park

Article and photographs by

TREAT DAVIDSON

THE FLAT SNARL of the airboat's engine shattered a primeval dawn in the vast shallows of Everglades National Park. Lacy spider webs, strung from blades of saw grass and pickerelweed, glistened with morning dew as we skimmed by.

Park Ranger Erwin Winte sat at the helm of our flat-bottomed craft, biology teacher Laymond Hardy beside me. Our approach startled a night heron still stalking his fishy prey before retiring to the willow thickets that border the Tamiami Trail. Overhead, flocks of American egrets winged to feeding grounds deep in the swamp. An alligator splashed into the water from a mudbank.

We paid them little heed. Our quarry in this wet wilderness was neither bird nor reptile. We sought a lesser creature—slow-moving, harmless, and clad in a shell: a simple snail. But what a snail!

Here in the timeless swamp, under National Park Service protection, lies perhaps the

only hope for survival in this country of a brilliantly colored, tree-climbing mollusk, *Liguus fasciatus*, of southernmost Florida's Everglades and Keys. Even in the park's hardwood hammocks, favored by *Liguus*, the snail's future remains in doubt; drainage of adjacent lands is changing the water level, threatening the very environment that sustains the Everglades' creatures and plants.

I first met *Liguus* years before in a memorable article on shells.* This rainbow of a creature—aptly called "the gem of the Everglades"—is as rare as it is spectacular. Now, thanks to a suggestion of National Geographic Society Trustee Conrad L. Wirth, then director of National Park Service, we were seeking the tree snails in this last United States refuge to capture their beauty on film.

I came to Florida during a summer wet spell. Indeed, I arrived at Miami International

*See "Shells Take You Over World Horizons," by Rutherford Platt, NATIONAL GEOGRAPHIC, July, 1949.

Roaring across watery wilderness, a Park Service airboat searches for hammocks, clumps of hardwoods suitable for snail colonies.

Love of beauty inspires Park Ranger Erwin Winte to devote his spare time to saving tree snails. He and Archie Jones, a Miami businessman, have explored hundreds of hammocks and transplanted varieties of *Liguus* that are disappearing from their home ranges. Thus they have saved a score of color forms. Eventually the men hope to preserve all varieties in established colonies.

Islandlike hammocks splotch Everglades National Park. Winte and Jones map potential snail habitats from the air, then slog to the trees through brush and limestone potholes treacherous with slime and saw grass. After introducing a color form into a hammock, they return year after year to check on the immigrants.

Airport just as a thunderstorm broke. My host Laymond, a devoted conservationist, met me with a smile at my drenched appearance and remarked on my perfect timing.

"When it's warm and wet like this, tree snails move about. We should find a few."

It was Laymond who had arranged with Erwin Winte—one of the country's foremost authorities on *Liguus*—for the snail safari that now carried us deep into the Everglades.*

For such a trip an ideal craft is the airboat (opposite). Presently Erwin pointed to a long hammock, an island grove of hardwood trees. As we drew near it, he cut the motor.

Liguus Lives in a Candy-striped Cone

Wearing leggings against snake bite, I stepped off into ankle-deep water and waded with the others to the spongy humus of the hammock. Through tangled subtropical growth, we struggled to a clump of lysiloma, or wild tamarind trees. Luck was with us.

There! Peering up a smooth-barked trunk, I spotted a conical candy-striped shell. Laymond's "lig" pole—a rod with a cup at the tip (page 378)—dislodged the prize.

I turned it in my fingers as a jeweler would a precious stone. Shimmering highlights danced on its whorls of pale yellow streaked with gray. Delicate green and brown lines spiraled the polished cone.

"You won't find anything prettier in the Everglades," Laymond said. He identified the snail as the color form—or variety—*delicatus*,

*See "Haunting Heart of the Everglades," by Andrew H. Brown, NATIONAL GEOGRAPHIC, February, 1948.

Emerging for a stroll, a snail extends its broad foot and anchors it to the tree's branch (upper). Retractable tentacles tipped with weak eyes extend like periscopes. On the move, the snail uses its smaller, lower tentacles as feelers, tapping along like a blind man with a cane. The body of this young *Liguus fasciatus pictus* equals a man's little finger in length. Its colorful home, firmly attached, sways gently.

one of 52 *Liguus* color forms in Florida so far described by scientists. Fully grown, it measured 2½ inches in length (page 384, number 11). *Delicatus* could be found only on Lower Matecumbe Key before Laymond and his friends began to establish new colonies as a safeguard against extinction. After admiring the snail, I carefully placed it back on the tree and watched it inch up the trunk.

There are more than 1,200 varieties of land snails in the continental United States, but few of them climb trees, and no other wears as bright a shell as this Everglades jewel. Its tree-climbing Florida relative *Orthalicus* has a comparatively plain, brownish shell.

Liguus comes from a word meaning "banded"—and what lovely bands! They range from solid hues to variegations that span the spectrum. I was not surprised that collectors have paid $50 or more for rare shells.

Why the snail occurs in so many color forms, no one knows. Its gleaming bands do not camouflage, warn enemies, or lure mates. Perhaps the secret may be found in Robert Browning's words in "Fra Lippo Lippi":

If you get simple beauty and nought else,
You get about the best thing God invents.

Liguus's range in Florida once extended from Pompano Beach to Key West and across the Everglades to Marco Island (map, page 380). In lush hammocks scattered in sawgrass swamp and pinelands, they fattened on minute algae, fungi, and lichens, which grow on such smooth-barked trees as lysiloma, Jamaica dogwood, bustic, and pigeon plum. They have no taste for foliage and do not harm the trees.

The snails prospered despite depredations by birds, opossums, raccoons, hermit crabs, and rats. They weathered hurricanes and fires and even the raids of relentless shell collectors. Then came man's crushing bulldozers.

Steel blades leveled hammock after hammock for housing and highways. Scarcely a corporal's guard of tree snails remains in huge Brickell Hammock, and I could see why. It is already part of Miami. Where silent groves

once grew, a torrent of traffic flows along U.S. Highway 1.

The seven color forms that flourished on Lower Matecumbe Key have seen their hammocks all but destroyed by real estate development. And that magnificent snail with a porcelainlike shell and a jawbreaker name, *Liguus fasciatus septentrionalis* (page 385, number 39), is virtually extinct in the Fort Lauderdale-Pompano Beach area.

Laymond Hardy raises tree snails on the sapodilla and avocado trees in his Miami yard and then transplants colonies of them to wild groves. He inadvertently started a few colonies along his own street when some of his pets strayed into neighbors' citrus trees.

One morning as Laymond and I were driving through the Florida Keys, I called his attention to a hammock that seemed a safe refuge for *Liguus*. Why, I asked, shouldn't we stock it with snails?

"It's useless," he replied. "I've planted them in hammocks like that before. Sooner or later the bulldozers come."

One place where the bulldozers cannot come is Everglades National Park. In this 1,404,000-acre wildlife sanctuary, tree snails thrive. Their success, I learned, is due largely to years of work by four snail collectors turned conservationists: Ranger Erwin Winte, Miami drug executive Archie L. Jones, sculptor Ralph H. Humes, and retired Coast Guard Capt. C. C. Von Paulsen.

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Slow-motion wiggle on its single foot moves *Liguus* across a glass table. Round mouth holds a rasplike tongue that scrapes off food as the head swings to and fro. Glands in the body secrete a sticky fluid on which the snail glides.

More than a decade ago these men met with the founding superintendent of the park, Daniel B. Beard,* and other park officials, and drew up plans to preserve, protect, and propagate *Liguus* and to crossbreed certain color forms. The park offered encouragement, the occasional use of its airboats, and a few days each year from Ranger Winte's working schedule. But park funds for the project were unavailable. The men would have to donate their own time and spend their own money.

Repeated flights over the area pinpointed many hammocks that seemed suitable for snail colonies (page 374). Erwin and Archie have explored more than 500 of these, many with colorful names. Atoll Hammock, of course, looks like an atoll. The Tony Group of hammocks was named in honor of Captain Tony, a Seminole Indian who led Ralph Humes and Archie Jones to the area. Bloodhound Hammock was so dubbed because "it would take a bloodhound to find it."

Twenty-five or thirty times a year Archie and Erwin check hammocks they have

*See "Wildlife of Everglades National Park," by Daniel B. Beard, NATIONAL GEOGRAPHIC, January, 1949.

Prize in sight, Carol Whitmoyer nudges a tree snail from its perch into a cup on the tip of her pole. Wife of a park ranger, Mrs. Whitmoyer helped collect snails for the photographer; she later returned them unharmed to the tree. Her hunting ground is not altogether happy: chiggers, mosquitoes, ants, poison ivy, poisonwood trees, and snakes make snail study hazardous.

Most spectacular of more than 1,200 varieties of land snails in the continental United States, *Liguus fasciatus* alone develops such handsome colors. Gold and brown bands, with a lacquerlike sheen, mark *pictus*, shown twice life-size on a Jamaica dogwood. Today this variety survives only in two colonies planted in the Federal park.

Brilliant banding on fabric stitched by Seminole Indian matriarch Mary Tommy echoes the designs found on tree-snail shells.

Yellow shows the range of Florida's tree snails. Related species live on the islands of Cuba and Hispaniola.

stocked with new colonies. So far they have introduced 26 color forms of *Liguus* into Everglades National Park. Ten of them, believed now extinct in their original southern Florida habitats, owe their very survival to the project.

"Someday," Erwin told me, "we want this park to have all the known varieties. Then malacologists can come here and study the entire range of color forms."

He is working to establish colonies of rare color forms, such as *splendidus* (page 385, number 43), at several hammocks. Fire insurance, you might call it. If one hammock goes up in smoke, wiping out its snail colony, that variety will still survive in its other homes.

Snail's Pace Quickens in Summer

Not *Liguus*'s brilliant shell but its unmistakable trail of feeding is what the experienced snailer usually sees first. Parading in slow motion up and down a lichen-coated tree trunk, the snail scrapes off food with a rasplike tongue called a radula, leaving wriggly paths of cleaned surface (pages 382-3). Archie Jones once compared *Liguus*'s gastronomic trail blazing to a lawn mower cutting a swath through tall grass.

The tree snail moves by rippling, muscular contractions on the surface of its large "foot." Its head, located on the front of the foot, has two pairs of retractable tentacles. The longer tentacles have a round feeble eye in the end of each; the snail probably can distinguish little more than light and dark, and perhaps close objects. The smaller tentacles are sensing organs—"feelers." Tapping them alternately, the snail proceeds up a tree much as a blind man walks using a cane (page 376).

Snails exude a pathway of slime as they crawl, a carpet of mucus on which they glide. This is laid down by special glands on the sole of the foot. When dry, the trail resembles that left by a common garden slug.

Liguus is most active during Florida's rainy season, late spring through early summer. At its snail's pace (it can sprint up to 4½ inches a minute) it browses about 25 feet a day, alternately gorging itself and resting. Little by little the animal secretes the calcareous substance that hardens into shell. Most shells spiral to the right as they grow, but occasionally a rare "left-handed" shell is found.

During the first growing season the snail adds two or three whorls to its shell; about half that the second year; the amount is halved again the third year; and so on, until the shell is between two and three inches long

(Continued on page 387)

Weight-lifting snail shows off muscle power. For five minutes, this *castaneus* held a lemon 16 times its own weight.

In a parade of color, *ornatus* leads *fuscoflammellus* and *pictus*. Extremely rare, *fuscoflammellus* was revived when Mr. Winte mated two dissimilar color forms. Their offspring now thrive in the park.

KODACHROMES © NATIONAL GEOGRAPHIC SOCIETY

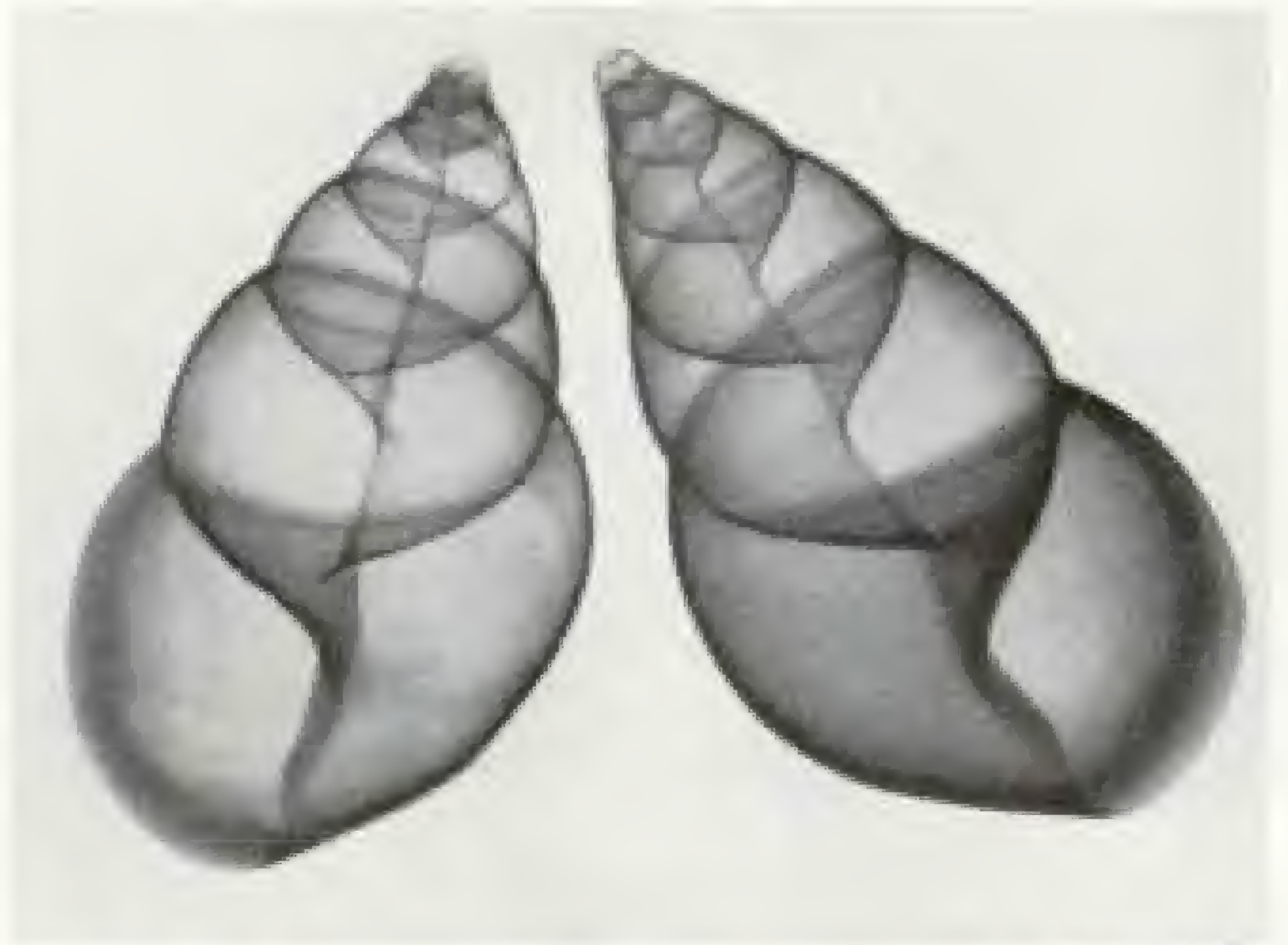
Creeping across a razor's edge, light-footed *castaneozonatus* roams without injury. Suction against the side of the highly polished blade allows the sole of the foot to flow lightly over the cutting edge.

Sealed to a branch, a *roseatus* snoozes the dry season away. Hardened mucus at the shell's opening keeps the dormant mollusk moist and comfortable. Spring rains reactivate it.

Spring: Newly hatched snails crawl from their eggshells and climb a tree to find their first meal.

Fall: Depositing its eggs in leaf mold, *dryas* covers them snugly before departing for a winter nap.

X-rays reveal the convolutions of the shell's exquisite architecture.



Swinging its head like a scythe, *pseudopictus* eats its way through sooty mold, leaving a clean but wiggly wake on a concrete wall. In the wild, the harmless tree snail consumes lichens, fungi, and algae on smooth-barked trees. Deforestation has doomed many snail forms and threatens the entire species.

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Rainbow spirals glorify tree-snail shells

No two snails are alike. These pages show representative examples of all 52 color forms of *Liguus fasciatus* found in Florida.

1 *alternatus*, 2 *aurantius*, 3 *barbouri*, 4 *capensis*, 5 *castaneozonatus*, 6 *castaneus*, 7 *cingulatus*, 8 *clenchi*, 9 *crassus*, 10 *deckerti*, 11 *delicatus*, 12 *dohertyi*, 13 *dryas*, 14 *eburneus*, 15 *elegans*, 16 *elliottensis*, 17 *farnumi*, 18 *floridanus*, 19 *fuscoflammellus*, 20 *gloriasylvaticus*, 21 *graphicus*, 22 *innominatus*, 23 *lignumvitae*, 24 *lineolatus*, 25 *livingstoni*, 26 *lossmanicus*, 27 *lucidovarius*, 28 *luteus*, 29 *marmoratus*, 30 *matecumbensis*, 31 *miamiensis*, 32 *mosieri*, 33 *nebulosus*, 34 *ornatus*, 35 *osmenti*, 36 *pictus*, 37 *pseudopictus*, 38 *roseatus*, 39 *septentrionalis*, 40 *simpsoni*, 41 *solidulus*, 42 *solisoccasus*, 43 *splendidus*, 44 *subcrenatus*, 45 *testudineus*, 46 *vacaensis*, 47 *versicolor*, 48 *violafumosus*, 49 *walkeri*, 50 *wintei*, 51 *solidus*, 52 *vonpaulseni*.

KODACHROMES © NATIONAL GEOGRAPHIC SOCIETY

Cannibal on the Prowl: Hungry *Euglandina rosea*

Sensing *Liguus*, streamlined *Euglandina* "displayed a most unsnail-like ferocity," the author reports. "The attacker brandished a pair of elongated lips shaped like scimitars and moved swiftly on its prey. Thrusting its head into the aperture of *delicatus*'s shell, it literally ate the tree snail out of house and home [right]. Thus I learned that a pretty spiraled castle is not always an impregnable fortress."

Greedy Hermit Crab Digs for Its Dinner

Living in a faded *lignumvitae* shell, the crab was placed alongside a *roseatus* shell, bright as fresh paint and holding a tasty tenant. After taking the photograph, Mr. Davidson pried the crab loose and saved the snail.

and barely growing at all. At this rate of growth, Erwin Winte calculates that some snails live eight or nine years, "but the average life is probably three or four."

In late summer *Liguus* seeks a mate. The courtship ritual of caressing, with intermittent resting, may last several hours or even a day; the act of mating, another day. Being bisexual, the snails then switch roles, so that both are fertilized.

Snail Comes to Earth to Lay Eggs

Three to six weeks later *Liguus* crawls down to the base of the tree—one of the few times it ever touches the ground. There it digs a pear-shaped hole, cutting through the leaf mold with its tongue and removing the debris with its foot.

In about 24 hours the three-inch-deep vault is ready. The snail deposits from 15 to 50 pea-size brown eggs, then covers the nest and crawls back up the tree.

Warm spring rains call forth the baby snails, or "buttons." Tiny replicas of their parents, they push up through the protective leaf mold and instinctively crawl up the nearest tree (page 382).

Erwin and Archie, experimenting with genetics, have hopes of restoring some of *Liguus*'s lost color forms through selective breeding. The *fuscoflammellus*, a gem in tortoiseshell, is a case in point (page 381 and page 384, number 10).

Fuscoflammellus has been found in but one or two hammocks in the Redlands district near Homestead, and then very rarely. In the mid-1940's, noticing that it occurred only in areas inhabited jointly by *alternatus* and *marmoratus*, Erwin collected and transplanted a few of these two forms to one of his "private" hammocks. And lo, their matings begat *fuscoflammellus*. By segregating these offspring, Erwin developed over the years a race that now breeds true to type.

Similarly, he has produced a new and as yet unnamed race of pink-tipped "fuscos" that appear to breed true. Both of his forms are now thriving in the park.

After the egg-laying season, the tree snail settles down for a long nap. Some kind of built-in barometer warns it that dry weather is coming, so after gorging on food and water to carry it through, the snail pulls tightly against a tree branch and fastens its shell to the bark with mucus. This hardens into a weather-tight seal, which bottles in the life-sustaining body moisture.

Not until the warm rains of spring soften the mucus seal will the snail poke its head out of the shell. A dormant snail that is pulled off a tree before then usually dies.

After I returned home to Warren, Pennsylvania, I received a shipment of a dozen tree snails from Erwin Winte. *Liguus*'s barometer worked as well in my studio as in Florida. When I unwrapped the box, I found that each had sealed the opening of its shell with a thin covering resembling tissue paper. The snails were estivating; they had assumed a listless torpor.

I put them in a "snailarium"—a 25-gallon aquarium inside a slightly larger one, with an electric heating cable between the two—and kept the temperature at 80° F. Soon my snails were crawling about the wet peat moss on the bottom of the inner tank. When rainstorms approached, they became more active.

As the weather cleared, ushering in drier air, they would cling to the underside of the snailarium's glass cover and remain suspended for hours, even days.

Light-footed *Liguus* Roams a Razor

I tested a snail's suction grip on a lemon (page 381) and learned that *Liguus* could lift many times its weight. Now I wondered how sensitive, how "touchy" its foot might be. To find out, I placed a snail on the handle of a straight razor. Presently *Liguus* began to crawl—up, down, and over the sharp blade. I repeated the experiment again and again, using several snails. None was cut.

After my tree snails had eaten the lichens on the Jamaica dogwood that accompanied them, I concocted a cornstarch paste—Laymond Hardy's recipe—and brushed it on the branches in the tank. The snails ate it with apparent gusto.

I enjoyed watching them eat, often studying them from beneath a pane of glass (page 377). The ribbonlike tongue, barbed with thousands of microscopic "teeth," rasps food into the mouth.

I can't say whether my snails lived because of this fare or in spite of it. Voracious when hungry, *Liguus* will eat rotten wood, glue, paper, or cloth. But I do know that when I took them back to Everglades National Park the next spring, Erwin was surprised to see them alive. We placed the snails on trees at the ranger station.

Later Erwin would find them permanent homes in the park. There, safe from bulldozer and builder, they would add to the simple beauty Browning praised, for all visitors to enjoy. THE END

National Geographic's latest book reveals the fascinating ways of fishes found in and around North America and Hawaii

Doorway to Watery Wonderlands

By MELVILLE BELL GROSVENOR, LL.D., Sc.D.
President and Editor, National Geographic Society

OF ALL NATURE'S MARVELS, few offer more delight than the fascinating ways of the fishes. The mirrored surface of a pond . . . the rippled glisten of a stream . . . the restless face of the ocean . . . each is the doorway to a wonderland inhabited by strange and beautiful creatures.

And now your Society opens this realm to you with *Wondrous World of Fishes*, the latest volume of its Natural Science Library. Here is a book (368 pages and 371 full-color illustrations) rich in new knowledge and enjoyment for you.

Most of us have had memorable experiences with fish. One of my earliest came as a boy of 10 when my father took me swordfishing in his yawl *Alexander* on Aspy Bay, Nova Scotia.

The veteran harpooner who accompanied us chilled my blood with a tale of how a swordfish had rammed and pierced his dory, pinning his leg with its sword. Then, after he harpooned a 500-pound broadbill, I followed him uneasily into a dory—and thrilled to a "Nantucket sleigh ride" behind the enraged monster as we fought to tire him out and haul him alongside.

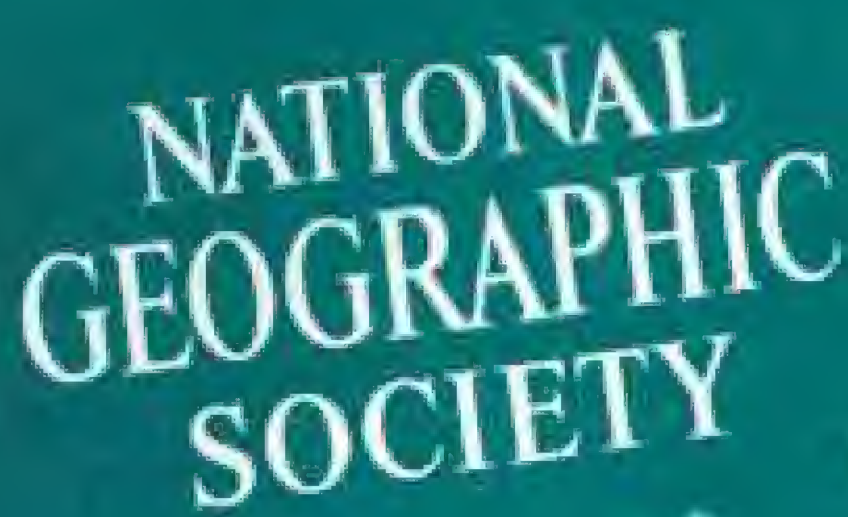
In Nova Scotia, too, F. W. (Casey) Baldwin, the Canadian associate of my grandfather, Alexander Graham Bell, taught me the fine art of fly-fishing. I would squirm and fidget while Casey patiently watched a stream to see which insects the fish were feeding on. Then from his tackle box he fashioned feathers and hook into a fly to match—and sometimes caught a trout or two.

Bored with such perfection, I skipped out one day with a can of worms and a cane pole. Jubilantly I returned with a string of trout—to be severely reproved

[illegible]

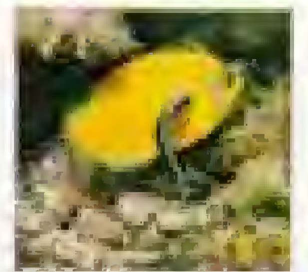
Cloud of Atlantic spadefish sweeps past a diver on the dust jacket of *Wondrous World of Fishes*. This striking volume portrays 340 species of North American and Hawaiian fishes.

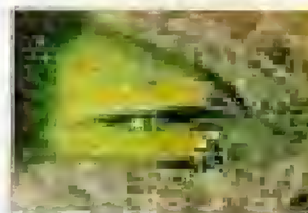
Kissing gouramis do just that. They don't care who sees or what they kiss, whether another fish or their own reflection on the glass wall of the tank. The kiss may last a few seconds or as long as 25 minutes. The biological significance, if any, is not clear.



WONDROUS WORLD OF FISHES

Giant Fish Bowls: Windows in the Ocean





EKTACHROME BY RALSTON PRINCE © N.G.S.

Two-faced Atlantic guitarfish snubs the camera. Oval nostrils resemble eyes that are hidden by the upturned snout. Gill clefts on the underside tag the fish as a ray. Pages from *Wondrous World of Fishes* (left, from top) show porpoises, bass, squirrelfish, yellow butterflyfish, and moray eel.

for my unsporting method. But I suspect that Casey secretly was proud of my new-found enthusiasm for fishing—a sport that today attracts more than fifty million Americans.

One Fish Question Poses Another

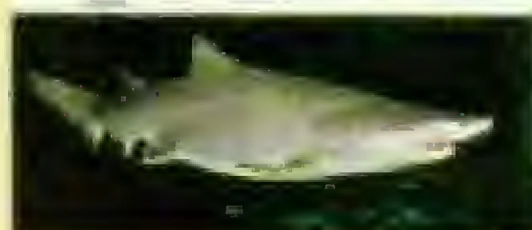
Yes, most of us know about fishes and their ways through our experiences. But how much do we really know? A young friend surprised me one evening recently when I was studying proofs of *Wondrous World of Fishes*.

"I know that fish make noises," he said, "and so they must be able to hear. But do they have ears?"

It was a good question. And there are others. Do fishes sleep? Do they drink water? How do they swim? How old do they get? How big? Why doesn't the change from fresh water to salt kill a migrating young salmon, as it would most fishes? And how can a salmon, after traveling thousands of miles in the ocean, so unerringly find its way back to its birth stream when it comes time to spawn?

This newest National Geographic book answers those questions, and many more.

Fishes do make noise; they croak, squeak, toot, grunt, sound off with musical whistles. But they need no external ears to hear this underwater cacophony. Sound waves traveling through the water strike the flesh and



KODACHROME BY JOHN H. GERARD © N.G.S.

Fangs embedded, a fisher spider sucks juices of a minnow after hoisting it from the water. An apt angler, the spider—here seen three times life-size—grabs its victim and drags it up the stalk to feed. Sharks, seahorses, and Atlantic salmon swim across other pages in the new volume.

bone of the fish's head; these body parts relay the sounds to inner ears, which in turn pass the message to the brain. Fishes also boast a sixth sense, something of a cross between touch and hearing. Sensitive nerve endings, strung in a line along the length of the fish's body, can *feel* sounds—the vibrations of a fisherman's footfalls on the bank, of an insect dropping into the water, of the fluttering of an injured fish.

Do fishes sleep? Many do—and with their eyes open, since fishes lack eyelids, which in other creatures aid slumber by shutting off visual images to the brain. Some fishes sleep on the bottom; they may lie on their sides, rest upright on their bellies, or bury themselves to their snouts in sand. Many sleep suspended in water. Others, like the bluefin tuna, sweep restlessly through the seas and apparently never even doze.

Do fishes drink water? Those that live in fresh water, yes, a little; they swallow a small amount with their food. Salt-water species are heavier drinkers. Their body fluids tend to seep from their tissues into the surrounding sea. To counteract this, they drink large amounts of sea water, some of which their blood absorbs to maintain its salt content.

But answers to questions form only a part of the storehouse of knowledge you will find

Water missiles of an archerfish bag a beetle. The rapid-fire marksman can hit a fly on the wing.

in *Wondrous World of Fishes.* Sample with me some of the facts from its pages:

Fishes have rings on scales that tell age, just as growth rings tell the age of trees.

Some fishes set up "cleaning stations" in the ocean where other species come to have them gnaw away diseased or damaged tissues, pluck off parasites, even pick teeth free of particles of food. The cleaners get a meal and—usually—immunity from being swallowed by the predators who visit them.

So oily is the flesh of the eulachon, a type of smelt, that Indians dried the fish and used them as candles.

Black sea bass when young are preponderantly females, but, at five years or so, many switch sex, becoming functional males.

There's an archerfish that knocks down above-the-surface insects by shooting blobs of water at them through a riflelike groove in the top of its mouth (above). An anglerfish lures its victims with "bait" dangled from a

Teacher of chefs, James A. Beard lifts a striped bass at his cooking school in Manhattan, one of New York City's oldest. In *Wondrous World of Fishes*, the noted cookbook author introduces readers to savory delicacies. The simple court bouillon described below adds flavor to many kinds of fish:

Poached Striped Bass

Prepare a court bouillon of:

2 quarts water
1 cup white wine
1 tablespoon salt
1 onion
1 carrot
10 or 12 peppercorns
sprig of parsley

Bring to a boil and cook 10 minutes. Add 3- to 4-pound fish. Poach gently, 5 minutes per pound. Serve with hollandaise sauce.

KODACHROME BY NATIONAL GEOGRAPHIC CHIEF PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

built-in fishing rod atop its snout. A parrotfish wraps itself in a nightgown of mucus, secreted each time it beds down for sleep. A lungfish can curl itself up in a drying puddle and live a year out of water.

There's wonder, too, even in the loathsome hagfish—blind, boneless, scaleless, and covered with slime—which writhes from mud burrows to suck the juices of dead or disabled fish. Scientists find the heart system of the hagfish ideal for dissection and study because part of it functions without regulation by the nervous system.

We could go on with this sampling through 20 absorbing chapters, unfolding the life histories of fishes of North American and Hawaiian waters.

Anglers will find sections on such topics as ice fishing, on hooking that leaping fury, the tarpon, on the history of angling in the United States, and such nuggets of knowledge as the kinds of food game fishes eat, their ranges, and record rod-and-reel catches.

Hobbyists can learn pointers on setting up and maintaining home aquariums. Housewives can turn to a chapter on buying, cleaning, cooking, and serving fish, written by one of the Nation's foremost culinary experts.

Other authorities supply you with memorable accounts—subjects as varied as solving life secrets of the sailfish, the incredible ways of the little seahorse, undersea life around a coral reef, white-water streams of the West, and oceanariums that serve as picture windows into the mysteries of the deep.

In the book's preparation, Dr. Leonard P. Schultz, distinguished curator of the Smithsonian Institution's Division of Fishes, served as our consultant. Under the editorial guidance of Leonard J. Grant, NATIONAL GEOGRAPHIC writers and artists worked meticulously to perfect text and illustrations. Walter A. Weber even kept a live catfish in his bathtub to assure accuracy in his painting.

Wondrous World of Fishes joins a proud list of National Geographic titles. Adding to your understanding of that marvelous creature, the fish, this volume takes you deep into a realm where man is still an alien intruder: the teeming world beneath the surface of ocean, lake, and stream. THE END

Order your first-edition copy of *Wondrous World of Fishes* (368 pages, 371 full-color illustrations, hard covers bound in blue buckram) from the National Geographic Society, Dept. 220, Washington, D. C. 20036. Postpaid anywhere in the world, $8.75. Request later billing if desired.

"**Lift up thine eyes** round about, and behold: all these gather themselves together, and come to thee," prophesies the Book of Isaiah. A boy waits in hope; the joy of reunion overwhelms Israelis meeting his immigrant ship at Haifa. In 17 years, the fledgling state has welcomed more than a million new citizens from 100 nations.

ISRAEL Land of Promise

AROUND A BEND in the road an astonishing sight appeared. Where I remembered only bare rock and a few shallow pits scratched by prospectors, I saw the towers and tanks of an immense copper-processing plant. Huge cavities pockmarked the desert floor, and racing earthmovers trailed plumes of dust as they sped ore to clattering crushers and concentrators.

Twelve years before, on my first visit to Israel, I had come to this uninhabited valley near the infant state's southern tip to see the remains of copper mines worked in King Solomon's time.

By JOHN SCOFIELD
Assistant Editor
Illustrations by
B. ANTHONY STEWART
National Geographic Chief Photographer

Famed American archeologist Nelson Glueck had discovered elaborate smelting furnaces of 3,000 years ago, built with flues oriented to harness the searing winds that blow almost constantly down the desolate Wadi Araba.*

"If an archeologist had not told us these were King Solomon's mines," a plant engineer suggested half seriously, "this might still be the empty wilderness you saw here in 1952."

So far, Timna's 20th-century miners have located an estimated 20 million tons of commercial-grade ore (page 410). Last year the plant shipped 7,000 tons of copper—enough to earn more than four million dollars in the foreign exchange Israel so urgently needs.

Since that first stay in 1951 and '52, I have come back twice to Israel—in 1959 and again only last year. Both times there were surprises—almost shocks. Lively suburbs cover slopes I remember as bare. Villages have grown into towns, and towns into cities. Whole industries have risen. Smooth new highways hum with traffic, and pipelines pulse silently with oil and a far more precious commodity—water. Fields of soft green gleam amid the old desert wastes. Israeli scientists have even turned their stripling nation into one of the first of the "little great powers" through their work with Israel's two nuclear reactors—for peaceful purposes, they have emphasized.

Israeli "Pilgrims" Arrive on *Artsa*

The reactors and the mines, the booming cities and the throbbing ports represent the going concern that is Israel today. But before seeing too much of this, I wanted to start at the beginning. And the beginning, for most Israelis, was the ship that brought them—often penniless and with only a suitcase or two—to their new homeland.

What started out as a simple plan to interview some newcomers turned into an experience I shall never forget. When I returned to Israel in 1959, officials suggested that I might like to board a ship at sea and talk to a group of immigrants. It would be a little like meeting the *Mayflower* offshore, they suggested, and stepping onto a strange new shore with the Pilgrims.

A week later, aboard a pilot's launch a few miles out from the port of Haifa, I struggled to keep my footing as we bobbed beneath the bow of the 3,200-ton *Artsa*, outbound from Marseille, and tried to match her speed. The pilot motioned me up a rope ladder that dangled just within reach.

I grabbed it and for a moment swung helplessly above the rushing bow wave as the pilot boat pulled away. Then I clambered up the ladder and flopped ungracefully onto the crowded deck. The scene about me was strangely familiar. I remembered it from old photographs of immigrant ships arriving at Ellis Island—the same jumble of belongings, the same children sandwiched amid suitcases and bulging parcels, and the same ex-

*See, in NATIONAL GEOGRAPHIC: "An Archeologist Looks at Palestine," December, 1947; "On the Trail of King Solomon's Mines," February, 1944; and "Geography of the Jordan," December, 1944, all by Nelson Glueck.

Border Settlers Carry Tools of Peace and War

Young soldiers labor at Kibbutz Almagor, a collective farm where residents share work and wealth. Members of Nahal, the Pioneering Fighting Youth, they combine military training with agricultural toil. Such settlers form the backbone of Israel's program to establish villages near Arab borders. After completing their army service, the young men and women may become civilian members of a kibbutz, return to school, or take up other work. Clips hold a submachine gun in readiness on the tractor's mudguard. The Jordan River flows into the Sea of Galilee (right); Syria lies beyond the river.

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

pressions on the faces of the adults: looks of expectancy mingled with fear as they approached a new homeland.

An old man elbowed his way desperately through the crowd that jammed the ship's rail so that he could glimpse the sunlit hills of Israel, still several miles away. Behind him, he told me, lay nine years as a political prisoner and 11 months of weary travel from Moscow to packed refugee camps in Poland, Germany, and France. Ahead lay a land and a language he had never known.

Immigrant Tide Exceeds a Million

I asked him why a 72-year-old man would leave the city where he had been born to start life anew in Israel. He turned a bearded face to me and I saw on it a look of utter disbelief.

"What a question!" he shouted, almost angrily. "This is my country. I'm coming home!"

In the 17 years since a United Nations resolution created the State of Israel from most of what had been British-administered Palestine, more than a million Jews have echoed that same cry: This is my home, this land I've never seen! And still they arrive—the Rumanian architect and the Moroccan beggar, the idealistic young pioneer from Argentina and the old man from Moscow, the family with 17 children from India's little Jewish community on the Malabar Coast.

But why?

Still seeking my answer, I turned to a Polish woman who sat atop an enormous pile of bundles and worn suitcases. She clasped two little girls tightly to shield them against the chill morning air.

Thriving Commercial Center, Tel Aviv Lifts Shining Skyscrapers Beside the Wind-swept Mediterranean

Founded in 1909 as a residential suburb of Yafo—better known today as Jaffa, the ancient seaport from which Jonah set sail—Tel Aviv soon engulfed its parent. On these beaches, viewed from the Jaffa side, daring blockade runners grounded their ships in the 1940's to disembark exiles and help the young

KODACHROME BY NATIONAL GEOGRAPHIC CHIEF PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

nation stake out her independence, proclaimed here in 1948. At the time, Jerusalem, now the capital, was besieged by Arab forces, and foreign nations established their embassies in Tel Aviv. Most embassies have remained here, including that of the United States, the large-windowed, seven-story building at left. A family group (foreground) enjoys the springtime breezes in a Jaffa park, while the youngster at right naps peacefully in the warming sun. Nearly 400,000 people—one out of every six Israelis—live and work in the vibrant twin cities, Israel's largest metropolitan area.

This time I got no puzzled look, no angry outcry, but a clear statement from a woman who believed that the future would be better than the past.

"We are tired of being wandering Jews," she told me firmly, but in a voice so quiet I could barely hear it above the clatter around us. "I want to raise my children in their own country, with their own people, and with their own language."

In the main lounge of the little ship I talked with Kalman Levin, whose job—Director of the Absorption Department, Northern District—gave him the responsibility for all immigrants arriving through Haifa, the largest of Israel's ports (map, page 402).

The *Artsa*, he told me, carried 299 settlers from a dozen countries: 86 from Rumania, 80 from Poland, 39 from Tunisia, Algeria, and Morocco, and 62 young idealists from Argentina, destined eventually to found a settlement of their own somewhere in Israel. Brazil had sent 20, England, five, Switzerland, one. From Bulgaria and France came five more. And the old man from Russia.

Settlers Range From Doctors to Laborers

What are these people, I asked, and what will Israel do with them?

Levin ran his finger down a list of occupations and skills, written in Hebrew.

"An architect, with an actress wife," he read. "An economist, married to a doctor. A lawyer. Engineers, three of them. Four biologists. A dermatologist. A radiologist. A journalist. A dentist."

"And the others?" I asked.

"Unskilled," Levin told me. "A month from now they'll be picking cotton in the Negev, or staying with relatives in Tel Aviv, or mixing concrete in Beersheba, or clearing land in Galilee. But wherever they are, they'll be learning Hebrew, and becoming a part of the country. After a year, they'll act as if they've been here for ten."

Ashore, outside the customs shed, I watched as a family from the island of Jerba, off the North African coast, clambered into a truck. I liked their looks: the bearded grandfather's quiet acceptance of this strange new land, his son's eagerness, and the smile of a granddaughter as she dragged a doll after her into the truck. I asked their names. The old man was Shalom Cohen, and his son was Mordechai—he spelled it Meredakee. Don't forget them, for I'd like you to meet them again.

"Who pays for all this?" I asked Levin.

"In the end, the newcomers do," he said. "They sign for everything: their fare on the ship, transportation to their new home, their food parcels, even the little packages of sweets given to the children.

"This gives the immigrants a sense of responsibility. We don't want them to feel that everything in Israel is free," Levin continued. "Of course, we won't try to collect until they are well established—perhaps five or six years from now."

White-smocked vendor stuffs spicy *naknikiot chamot*—kosher hot dogs—into flat *pita* bread, a treat for strollers on Allenby Road in Tel Aviv.

Pulsing with life, Dizengoff Street sees a throng celebrating Purim, a festival commemorating the Jews' deliverance from slaughter in the Old Testament story of Esther. Purim calls for parties, parades, and the wearing of masks and hats, such as that of the baby in the stroller. Tel Aviv's cool February weather, around 50° F., brings out heavy stockings and woolen skirts. Sign reading "Miami" advertises American fashions.

KODACHROME (ABOVE) AND EKTACHROME © NATIONAL GEOGRAPHIC SOCIETY

93
כרטיסים
MIAMI
סלון פוקס
145

Wedge in an Arab world, Israel clings tenaciously to its foothold in the Middle East. Only 6½ miles wide at its narrowest point, the young nation occupies an area smaller than Vermont.

ISRAEL

ATHWART lines of conquest both ancient and modern, the Jewish homeland has suffered 3,000 years of invasion and subjugation. Assyrian and Persian, Greek and Roman, Arab and Turk held sway in their time over the tiny crossroads of continents—Holy Land to Jew, Moslem, and Christian.

A sovereign Jewish State, nonexistent for more than 18 centuries, became a reality in 1948, following upheavals of two World Wars and fierce conflict with Arab neighbors, with whom peace has never been signed.

GOVERNMENT: Parliamentary democracy. **AREA:** 7,993 square miles. **POPULATION:** 2,428,000. **LANGUAGE:** Hebrew, official, also English, Arabic, Yiddish. **RELIGION:** Jewish; also Moslem, Christian, and Druze minorities. **ECONOMY:** Industry—machinery and metal products, foodstuffs, textiles, chemicals, diamond cutting; agriculture—grains, dairying, citrus and other fruits, vegetables. **MAJOR CITIES:** Tel Aviv-Jaffa (pop. 400,000), port, industry; Haifa (pop. 187,000), port, refining; Jerusalem (pop., Israeli section, 171,000), capital. **CLIMATE:** Coast, subtropical; Negev, extremely hot summers and cool winters; northern uplands, hot summers and mild winters; rainfall, moderate in north, rare in south.

Map by David L. Moore and James A. Taylor © N G S

"So," I persisted, "who pays for it now?"

"Jews all over the world," he told me. "Their contributions have made possible what we call 'the ingathering of the exiles.' "

It has been a fantastic migration, this human tide that has flooded the new state, nearly trebling its population—now 2.4 million. A third of a million Jews fled to Israel from the scenes of Hitler's persecutions, most of them arriving as stateless "DP's," displaced persons left in the wake of World War II. All of Yemen's Jews, 46,000 of them, arrived in an airlift dubbed "Operation Magic Carpet." Almost the whole of Bulgaria's Jewish community, some 38,000, were brought to Israel; 120,000 left their homes in Iraq to resettle in the new land.

"In all," Levin told me, "people have settled in Israel from nearly 100 countries. They have come to us from the Congo and the Malagasy Republic, from Costa Rica and Japan. The miracle is that they have so quickly become a part of the nation. After a year or two, most of them are homeowners and taxpayers—in short, Israelis."

And that brings us back to Shalom Cohen. Five years went by after I watched him struggle with his brood into that truck in Haifa. Then, last year, a friend in the Israeli Prime Minister's office helped me trace them to a pair of tiny houses in Qiryat Gat, a sprawling, untidy immigrant town an hour's drive south of Tel Aviv.

Child Born in Israel Stirs Pride

I recognized the old man instantly. Wearing woolen slippers turned under at the heels and the same bulky overcoat I remembered, he stood in his front yard killing a chicken for one of his neighbors. He had set himself up as a *shochet*, a ritual slaughterer, and earned 40 or 50 Israeli pounds ($13 to $16) a month at ten *agorot*—about three cents—a bird.

Inside the house, Mordechai peered from behind thick-lensed spectacles and put his arm around four-year-old Nurit. Unlike her sisters, she was a *real* Israeli—born in Israel, he said proudly. Mordechai, working as a handyman for the municipality, earned another 300 pounds a month.

"We work, we eat, we live," he said. "No problems. I manage by doing extra work when I can."

It was not a brilliant success story. Yet it was typical of so large a part of this young nation. Six years ago, Tunisian Jews living—never quite at ease—among hostile neighbors in a Moslem land. Today, Israelis, living and working in a land of their own and, though not thinking much about it, each contributing his bit to the nation's future.

Kibbutzim, the communal farms by which the people of Israel have sought to conquer their stubborn land, have captured imaginations more than any other feature of this lusty young nation. And logically so, for in these Spartan settlements and their dedicated workers lies much of the story of how Israel has wrested new farmlands from the swamps and deserts of old Palestine.

Deganya Loses Pioneer Flavor

An Israeli friend suggested, in 1959, that I go to Deganya, in the lush Jordan Valley where the river flows from the Sea of Galilee.

"Deganya was started in 1909 by immigrants from Russia," he told me, "long before anyone thought seriously there would ever be a modern nation called Israel."

But Deganya disappointed me. It was a kibbutz, but it was also a town in its own right, functioning as smoothly as if it had been there for 500 years instead of 50. There were smooth green lawns and cow barns packed with fat cattle. The kibbutz shared a partnership with six other settlements and private investors in a building-materials factory. Chickens and eggs streamed from efficiently managed henhouses. There was even a museum and a little zoo, with monkeys and a camel.

Later, in Tel Aviv, I mentioned my feeling to white-haired Joseph Baratz. He had come from Russia more than half a century before to become first a stonecutter and then one of Deganya's pioneers.

"Naturally you were disappointed," he said. "Deganya can no longer be called a pioneer settlement.

"But it was when we started," he continued thoughtfully. "Deganya was the experiment station for much of what you see in Israel today. Now there are 228 kibbutzim, with 78,000 inhabitants. And Deganya is one of the most successful of them all."

For a moment the old man sat lost in his reveries. "Go to the Negev," he said finally. "There you'll find people fighting the desert the way we struggled 50 years ago."

And that was why, on that 1959 visit, I went south again to see Yotvata, which lies hard against the Jordan frontier in the Wadi

Harsh hills of the Negev cradle Yotvata. Barbed wire protects the pioneering kibbutz against infiltrators, who sometimes slip across the frontier from nearby Jordan and

Araba, one of the hottest, most inhospitable valleys on earth. This was what I had been looking for. The settlement resembled a Hollywood set for a Western movie.

Rifles Dot the Night With Flame

Yotvata lay cupped in a natural amphitheater of stony desert hills that flamed red and orange in the sun's dying rays. Coils and fences of barbed wire ringed its buildings and barns, and a diesel pump thumped heavily in the hollow.

Supper that night consisted of unlimited quantities of hard-boiled eggs, fresh tomatoes, onions, radishes, *tahina* (a tasty spread of ground sesame seeds, something like thin peanut butter), and coarse bread. Later I noticed two of the settlement's tireless youngsters disappearing into the gathering gloom with rifles. For half an hour I watched the little jabs of flame and heard the hard crack of their weapons: target practice after dark. Here Israel is less than 20 miles wide and lies sandwiched between two unfriendly nations, Egypt and Jordan. The borders were quiet, but one could never tell . . .

Standing atop one of the hills ringing Yotvata, where a swimming pool created a

Egypt. Yotvata's adults, whose average age is 24, raise chickens and cattle and farm the once sere land. Solar heaters on roofs provide winter warmth and year-round hot water.

rectangle of cool sapphire amid the hot yellows and browns of the desert, I looked out over the fields. Below me, where a short time ago had been nothing but a waterless wilderness, spread green acres of tomatoes, cucumbers, onions, eggplants, and leeks.

Cactus Gives Name to Native Born

"In the Bible," said one of Yotvata's bearded teen-agers, "the Israelites complained because Moses had taken them out of the land of the onion and the leek. Now," he said, "we grow leeks where those very tribes wandered in the wilderness."

For nearly a week I walked in the fields of Yotvata, sat in on the settlement's discussions and meals, and—with the help of curly-haired, 20-year-old Isaac Livneh—talked to many of its members.

In this land where nearly everybody is from somewhere else, it came as a surprise that Yotvata's young pioneers were almost all *sabras*—native-born Israelis, named for the sweet but prickly fruit of the cactus. The youngest at that time was a darkly attractive girl of 18½ named Naomi Schweid. I asked Isaac what her job was.

"A cork," he said, "and today the kitchen

is the bottle. For many of the girls there are no full-time jobs. we call them corks, and put them on duty wherever they are needed."

The oldest man in the settlement, in 1959, was the 21-year-old electrician. "A curiosity," Isaac explained. "He's the only married man among us. But next fall there will be other marriages."

Pioneers Share Means and Talents

More than anything else, I was curious about the communal organization of these pioneering settlements. How does it work?

"All men are equal in need," Isaac said. "I get as many cigarettes as I want. If I need a particular book, I go to the library council and ask for it. If the kibbutz can afford it, the library buys it.

"We get no salary," he went on, "but we don't need one. My hobby is photography; the kibbutz is not yet rich, so I must use a camera I brought with me when I joined, but the film is furnished."

The kibbutz provides clothing—from shoelaces to hats—plus all the food one can eat and a few pounds a year for vacations and other personal expenses. If a couple marries, they receive larger quarters.

"Every man gives what he can," Isaac summed up, "and gets what he needs." He said it with conviction.

Yotvata stands out in my memory almost as a symbol of Israel itself. In 1952, when I first passed that way, there had been only a huddle of army tents and the dream of planting a settlement in this desolate valley. Seven years later the settlement was there—tentative and raw about the edges, but it was there.

KODACHROME BY BRIAN BRAKE, MAGNUM © NATIONAL GEOGRAPHIC SOCIETY

Liquid lifeline makes the desert blossom at Yotvata. Irrigation begins at dusk to prevent evaporation and keep the brackish water from building up harmful salts in the soil. Rains come only in winter. Average rainfall varies from 40 inches in the north to one inch in the southern Negev.

Last year, when I went back for a third time, Yotvata was no longer a raw settlement. Soft green lawns and neat sidewalks linked rows of attractive houses (pages 404-5). Cattle stirred beneath long dairy sheds. Fields were bright with wheat and tomatoes, with melons and gladioli, and thousands of birds fattened in its henhouses.

Naomi Schweid, the teen-age "cork" of 1959, was married and a mother—one of 45 in the kibbutz. A nursery was jumping with healthy, tanned children. The oldest was 3½; a kindergarten was under construction.

"Wonderful," I said, and meant it. But I missed the old look of a pioneer settlement, and said so.

"The old spirit isn't dead," an intense young kibbutznik insisted. "It has only moved."

He hopped into my car, and we drove four miles north to a place that looked much as Yotvata had looked when I first saw it 12 years before. But there was more activity. Earthmovers raised cream-colored clouds of limestone dust as they leveled a hilltop for barns and a dining hall; far below, men cultivated two tiny green rectangles, hewn from the desert floor.

"It will be a kibbutz called Grofit," he said. "And if it succeeds, after four or five years there will be still another, even deeper in the wilderness."

And if I come back in another ten years, I said to myself, Grofit, too, will have become settled and prosperous, and Yotvata will be another Deganya. But for a long time new settlements will carry on this pioneer tradition, until this whole desolate valley has felt the bite of a plow.

From Yotvata the road leads south into

Rural nuptial chariots bring a bridal party to an outdoor wedding at Yotvata. Bride rides tractor-pulled wagon with boys, groom with girls.

Israel's flag, upheld by pitchforks, forms a ceremonial canopy over the bridal couple. Rabbi holds ritual wine that the newlyweds will share.

Oil for the engines of Israel flows through Eilat on the Gulf of Aqaba, near the Biblical port where King Solomon brought in "gold, and silver, ivory, and apes, and peacocks" (I Kings 10:22). From a Liberian-flag tanker, the crude petroleum pumped into this

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

pipeline head will travel almost the length of the country to a refinery at Haifa. To Israel, whose shipping cannot use Egypt's Suez Canal, Eilat provides a gateway to trade with the nations of East Africa and the Far East by way of the Red Sea.

more desert, coiling through thorny scrub like East Africa's big-game country, and past the Timna copper mines. Here Israel narrows dramatically as Egypt and Jordan squeeze it from west and east until it ends in a six-and-a-half-mile crescent of beach on the impossibly blue Gulf of Aqaba.

I can understand an Israeli's fascination with this southernmost shore of his land. For, excepting diminutive swimming pools at Yotvata and a neighboring kibbutz to the south, the gulf is the first visible body of water a traveler glimpses after leaving Beersheba, 150 dusty miles away.

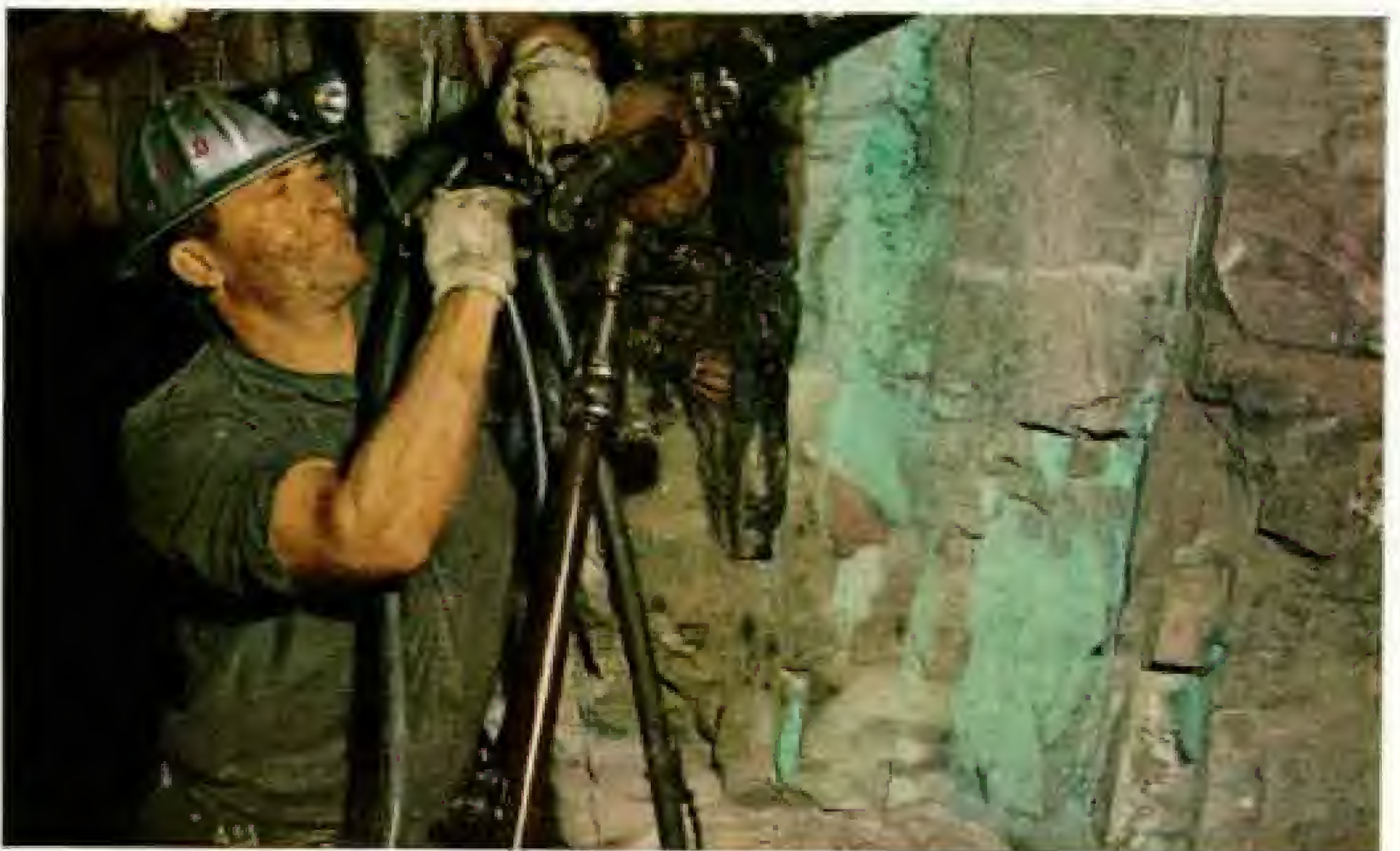
Eilat: Key to Trade With Two Continents

But the water sparkling in this arm of the Red Sea means more than mere opportunity to go swimming. Here, in the booming port of Eilat, lies Israel's key to trade with Africa and Asia.

Before the Sinai Campaign of 1956, when the Israeli Army drove Egyptian forces back across the Suez Canal and captured the guns that had blocked Israeli access to the gulf, Eilat had been a sweltering hamlet of fewer than a thousand people. Today Eilat's population has soared to 15,000.

Miners scrape the shore of the opalescent Dead Sea for minerals. Plants at Sedom, which takes its name from the Sodom of the Bible, extract bromine and potash from the salts for Israel's agriculture and industry, and for export.

"A land whose stones are iron, and out of whose hills thou mayest dig brass" (Deuteronomy 8:9). Solomon Weiss drills a rich copper vein at Timna, only two miles from the site of King Solomon's mines. The Negev holds most of Israel's minerals.



"That's a lot of immigrants for a desert town to absorb," I said to Harvey Goodman, a friendly Canadian-born Israeli who had volunteered to show me around.

"Only half of them are newcomers," he said. "For every immigrant, we try to take in one Israeli—someone who has been in the country eight or ten years. That's so we won't turn into an immigrant town, like so many up north, with cafe signs in Arabic, Rumanian, and every language but Hebrew."

Goods Flow From "Workshop of Israel"

The young nation looks toward a rising commerce through Eilat with Africa and the Far East, Goodman explained, bringing in raw materials for processing in "the workshop of Israel" and exporting them as finished products. "We're already shipping automobiles assembled in the north," he said, "plus building materials, citrus, textiles, and plenty of potash from the Dead Sea. And now we have a 16-inch oil pipeline all the way to the refinery at Haifa. So you can see," he concluded, "Eilat is important to Israel's future."

Despite its obvious destiny as a major Israeli city, Eilat today is still a too-big-for-its-age village with a bad case of growing pains. Housing rises as fast as men can assemble locally made prefabricated panels, but the town cannot keep up with the steady flow of new residents.

Even with a dozen hotels, this pocket-size Riviera on the Red Sea is short of visitor accommodations. Work has been started on a series of artificial lagoons along which more "sea-front" hotels can crowd. Pilot units of a huge new desalinization plant, converting sea water to sweet, struggle to augment Eilat's inadequate water supply.

But Eilat's city fathers—and mothers—are determined to overcome all the disadvantages

Scorning the tempo of modern times, Bedouin play an age-old game with stone counters near an air-conditioned hotel in Beersheba. About 30,000 of the nomads live in Israel, two-thirds of them in the stark wastes of the Negev. Some who have settled near towns light their tents with electricity.

of pioneer life in a desert outpost. Already they have given the city a zoo, complete with cows, chickens, and monkeys—"so our children can know what living things look like," an Eilat father explained—and a municipal park kept green by lavishing the port's scarce water on it. Every bush and tree, I learned, came by truck across the desert from Tel Aviv!

Hardly less a frontier town than Eilat is the "capital" of the Negev—busy, booming Be'er Sheva', the Beersheba of the Bible (map, page 402). Here, on the northern edge of a desolate and almost uninhabited wasteland, I found new housing developments rising on acre upon acre of desert. Swimming pools were crowded with bathers; a luxury hotel and a 550-bed hospital had appeared. Bedouin, dark desert men in long robes, still lent color to the crowded streets (right).

Beersheba's Wild West Flavor Fades

But the town had lost some of its Wild West character since I had seen it last. One old-timer confided that he didn't like to come to Beersheba any more. "You even need a permit to carry a gun," he grumbled.

"I can remember Beersheba when it was a dusty town of only three or four thousand people," I told David Touviyahu. This outspoken, dynamic man had been the city's mayor during 12 hectic years of growth and struggle. Today they fondly call him "the father of Beersheba."

The peppery ex-mayor topped me easily. "If you had been here on October 21, 1948," he said, "you would remember it with no people at all." This was during the Arab-Israel War; the Egyptians withdrew that day, and the Israeli forces had not yet moved in. It was not until the next year, he said, that the first settlers, about 150 families, arrived.

From an abandoned outpost a few years earlier, Beersheba had mushroomed into a city of 62,000 people. I asked Mr. Touviyahu where he thought it would stop.

"By 1968," he said, "I think Beersheba will have reached 100,000. And I'm being pessimistic. The government wants it to have half again as many."

"Where will they put them?" I asked. Already, I knew, housing lagged far behind the demand, even though one out of every five adult males in the city had a hand in Beersheba's construction boom, and nearly 2,500 apartments a year were going up.

"The question is not building houses and streets and stores," Touviyahu said. "This is only getting the money. The question is changing the mentality of these people—these Persians and Moroccans and Poles and Bulgarians who come here—to be industrial laborers, to

KODACHROME BY NATIONAL GEOGRAPHIC STAFF PHOTOGRAPHER B. ANTHONY STEWART © NATIONAL GEOGRAPHIC SOCIETY

bring all of them into the main stream of Israeli life." To speed this vital process, he told me, the city spends nearly half its income on education.

"But that takes teachers. David Ben-Gurion, when he was prime minister, came here one day and I told him our problem. So, thanks to him, single girls can come to Beersheba to teach new immigrants, and it takes the place of their compulsory army service."

As we talked, the strains of a piano drifted toward us on the desert wind that fans the panting city when the sun drops. "Ten years ago," he said, "I brought the first piano to Beersheba. Now there are dozens. So you see, we are growing up."

One Israeli in Ten an Arab

I asked others about Touviyahu's background. "He came from Poland 44 years ago," I was told. "At first he worked as a laborer, digging ditches. Then he built a city."

One of the things I wanted to learn more about in this Israeli southland was the "Arab

Concrete dome appears to float over Churchill Auditorium at the Technion, the Israel Institute of Technology at Haifa. The auditorium, named for Britain's famed wartime leader, is part of a modern 300-acre campus on

Gems sparkle on a sorting table in Netanya, Israel's "diamond capital." The nation imports rough stones and exports them as polished jewels. Diamonds earned $104,000,000 in 1963, one-third of Israel's export income.

Sleek Sabras roll from the assembly line of Autocars Company, Ltd., in Haifa. Custom-built mostly for export, the fiberglass-bodied sports cars take their name from the prickly but sweet fruit of the cactus. Native-born Israelis are also called sabras as a symbol of their character and toughness. Sussita pickup truck perches on the rack at left.

...AND EKTACHROMES (BELOW, LEFT) BY B. ANTHONY STEWART © N.G.S.

historic Mount Carmel. Most of Israel's engineers, technicians, and architects earned their degrees at the Technion, whose students number 5,300.

Eye surgeons operate at Tel Hashomer (Hill of the Watchman) Hospital, a medical center near Tel Aviv that also specializes in heart surgery.

Famous Jaffa oranges, picked and packed in the fragrant groves of Tel Mond, bring in vital revenue from foreign markets. Orange picker at right came to Israel from Morocco. Tel Mond's name honors Sir Alfred Mond, an enthusiastic British Zionist. At Tel Mond's latitude, the nation is barely 12 miles wide.

Bananas by the truckload grow in Deganya, a natural hothouse near the Sea of Galilee, more than 600 feet below sea level. Russian immigrants founded this first of the kibbutzim in 1909. New settlers and members of the original kibbutz, now called Deganya A, founded Deganya B in 1920, less than a mile away.

problem." Before 1948, nearly a million Arabs lived in what is now Israel. More than 250,000 remain; they make up roughly 10 percent of the new state's population.

Many of them live in Nazareth, which looks out from its hilltop perch as it did in Jesus' time to the fertile Plain of Esdraelon (pages 422-3). The rest are mostly scattered in towns and villages throughout Israel. But the Arabs of the parched hills round about Beersheba, the nomadic Bedouin, interested me the most. Many of these colorful wanderers pasture their flocks in the Negev and make Israel's desert crossroads their headquarters. I wanted to see how life in a 20th-century state is

EKTACHROME (ABOVE) AND KODACHROME BY B. ANTHONY STEWART © N.G.S.

affecting these conservative tribesmen whose ways, until a few years ago, had changed little since the days of Abraham.

Superficially, I found them little different from the nomads I had so often visited in Syria and Jordan. On Thursday mornings, Beersheba's Bedouin market becomes a wondrous chaos of arguing traders and bawling animals, where women of the tribes still hide behind believe-it-or-not arrangements of coral and dangling coins (page 425). In the swiftly evolving world of Israel, they sometimes cradle a sleeping child on one arm and sling a Japanese transistor radio from the other.

At "campsites" outside the city, where

Green Nahalal's Pie-slice Fields Show the Pattern of a Cooperative

Each family in this *moshav ovdim*, a cooperative of independent smallholders, owns a 25-acre slice and decides its use, in contrast to strict controls of the more rigidly communal kibbutzim. Members buy supplies and sell their products as a group, however, and help each other in times of trouble. Jewish settlers established this moshav in 1921, the first of its kind in Israel, in a malarial swamp six miles west of Nazareth. They built their houses in a circle for defense, a practice reminiscent of American frontier stockades. Today Nahalal markets beef, milk, poultry, eggs, fruit, and vegetables.

Sunken harbor and tumbled ruins mark the grave of Caesarea. Herod the Great spent 12 years building the sumptuous city, dedicating it in 10 B.C. to his patron, Caesar Augustus.

As capital of Judaea, Caesarea served as the official residence of Pontius Pilate; St. Peter and St. Paul both knew it, the latter as a prisoner. In the 13th century, Moslems seized the city from Crusaders and destroyed it. Some of the ruins appear to the right of toppled seawalls. Dark outline on the sea floor marks the ancient harbor; Edwin A. Link's research ship *Sea Diver* (left) anchors beside its narrow mouth.

Soaring arches frame a watchtower at the citadel in Caesarea. Crusaders erected the fortress with stones from dismantled Roman structures. Israel works to uncover and restore the 2,000-year-old city.

Profile of a port. Twin towers and walls at the entrance to Caesarea's harbor appear on the upper half of this coinlike bit of metal, whose purpose puzzles scholars. Some believe it served as a receipt. Two ships, sails ballooning, approach the port from the lower half. Holes pierce the eroded, dime-size piece recovered from the harbor bottom in 1960 by Edwin A. Link's underwater archeological expedition.

the government has created a year-round supply of water, the Bedouin and their flocks of sheep, goats, and camels still cluster in Biblical tableaux. And visitors to tribal encampments are still entertained with the traditional bitter coffee and the massive tray of rice heaped with the cut-up and boiled meat of a whole sheep.

Arabs Sit in Israel's Congress

I asked Beersheba's busy district commissioner what prospects these traditionalists have in a state that is galloping helter-skelter into the future.

"The same as any other Israeli," Yitzhak Vardimon told me. He pointed out that Israel's Knesset, its counterpart of Congress, includes eight Arabs among its elected members. While none of them is a Bedouin, he commented, there is no reason to suppose that the nomads may not one day have elected spokesmen of their own.

"It's only a question of time," he said. "Time and education. Already about 2,000 Bedouin work in the orange groves of the north, and another few hundred work here in Beersheba as skilled builders."

An Arabic-speaking army major whose assignments took him often among the Bedouin was less optimistic.

"Getting these people to settle down is no problem," he told me. "In ten or 15 years they will all be living in houses and working for a living.

"The real problem? Loyalty. Israel gives the Bedouin their rights as citizens. We have

brought them medicine and schools and voting rights. On the other hand, the more we move them forward, the more their own nationalistic tendencies are developed. Their loyalties waver between King Hussein of Jordan and President Nasser of Egypt, and Israel doesn't really enter into it.

"If the day should come when there will be peace between Israel and the Arabs, that may blunt the sting of these sharp differences. But we can't expect Arabs to stop being Arabs just because they live in Israel."

Beersheba has much else to offer a wandering correspondent. In the buildings and gardens of the Negev Institute for Arid Zone Research, I appreciated anew the seriousness with which Israel is going about its conquest of the desert. Here dedicated men seek new plants to tame the sand dunes of the Negev, and inexpensive ways to desalt brackish water for irrigation. Others experiment with hydroponics—soilless gardening—and look for ways to harness the abundant solar energy of the scorched desert.

If audacity and determination can carry a project through, I thought, Israel's Negev will bloom again one day as it did in the past. Archeologist Nelson Glueck has discovered that thriving communities dotted the Negev from earliest historical times into the Middle Ages. There is no reason, he thinks (and thousands of Israelis echo his belief), why the

Vegetable and fruit stalls jam the narrow streets of Nazareth's bazaar, little changed since Biblical days. The childhood home of Jesus, now a predominantly Christian-Arab community of almost 30,000, Nazareth remains a quiet backwater nestled in the hills of Galilee.

Rock that sheltered Mary forms the Grotto of the Annunciation in Nazareth, where, says a Christian tradition, the Angel Gabriel told her that she would give birth to Jesus: "Hail, thou that art highly favoured, the Lord is with thee: blessed art thou among women" (Luke 1:28).

Bible's prophecy for the Negev should not be fulfilled in the 20th century:

"And they shall say, This land that was desolate is become like the garden of Eden . . . and ruined cities are become fenced, and are inhabited" (Ezekiel 36:35).

Little Pittsburgh Pulses in North

If Eilat, Beersheba, and the parched Negev are Israel's Wild West, the opposite extreme lies in Haifa and the hallowed hills of Galilee.

Just outside Haifa, on the road to the picturesque fishing port of Acre—which fell to Crusaders in the 12th century—rises a little Pittsburgh, with tall stacks reaching toward the sky and factories clattering noisily. Here, on a narrow strip of saline coast unsuitable for agriculture, stands the Kaiser Ilin plant, where local mechanics assemble Jeeps, Studebaker Larks, and Japan's neat little Contessas. At the start, practically every bolt and screw for these vehicles had to be imported; today, 65 percent of every Jeep is manufactured domestically, and Israel strives to equal that percentage with the other makes.

Daughter of Moroccan immigrants, army Private Yael Butbul serves at an outpost in the Negev.

"So plain, so strong, so old-fashioned—just like a woman out of the Bible," an admirer once said of Israel's Foreign Minister, Mrs. Golda Meir. Born in the Ukrainian city of Kiev, she once taught school in Milwaukee, Wisconsin. Since 1921, when she arrived in Palestine, Mrs. Meir has risen from a kitchen and field worker in a kibbutz to her present role as the nation's ranking diplomat.

Tobacco grows here beside the sea, and a mill dyes and finishes textiles loomed from local cotton. Glass, cement, chemicals, structural steel, and pipes of concrete and metal all originate here.

Dominating this throbbing area are the twin cooling towers of the Haifa oil refinery. Until 1948 this was the biggest in western Asia, but the pipelines that fed it came from Arab lands. The Arabs refused to recognize the existence of the state, much less to sell it oil. For ten years the refinery limped along at a fraction of capacity, sometimes with a trickle of crude oil brought by tanker from Venezuela. Now the first oil strikes in the south have buoyed Israel's hopes, and crude oil flows north from Eilat docks through an all-Israeli pipeline (page 408-9). The Haifa plant steams happily, turning out enough gasoline for Israel's needs plus a bit for export.

On a pine-clad hillside within sight of the refinery, I spent an exciting day in what Israel's first prime minister, David Ben-Gurion, dubbed "a cornerstone of our development"—the Technion. Its full name is Technion-Israel Institute of Technology; English-speaking faculty members call it "the M.I.T. of Israel" (page 414). But Nathan Freedman, an American radio journalist who came to Israel to cover the Eichmann trial and stayed on to become a member of the Technion staff, characterized it even better.

"Cross the Massachusetts Institute of Technology with the U. S. Bureau of Standards," he said, "and you have the Technion."

Technion Trains a Nation's Builders

Gen. Yaakov Dori, who was first chief of staff of the Israeli Army, runs the institute with the precision of a military organization. Thanks to philanthropists the world over, he has plenty to work with.

Gerard Swope, longtime head of General Electric, left $7,000,000 to the Technion in 1957. "All of it is invested in the States," Freedman said. "We get the income for scholarships, professorships, and research. Harry Fischbach of New York gave us the electrical engineering building. Call it a New York building. The aeronautics laboratory is a 'Texas

Brightest blooms in Israel's garden, youngsters summon a vision of the future.

Tattooed Bedouin wears her wealth on her forehead (above) as she sits in the market in Beersheba, the Negev's ancient caravan crossroads.

Concentration reigns in a kibbutz schoolroom (top, left). Primary education is free and compulsory between the ages of 5 and 14.

Smiling Laniya Barkai (top, right) epitomizes the sabras.

Springtime, making an artist's palette of Jerusalem's hillsides, brings out pretty flower pickers Gina and Carmella (right).

The Israeli capital's holy places attract crowds of pilgrims. Shrines associated with Jewish and Christian tradition crown Mount Zion (right): the Tomb of David, the Coenaculum, scene of the Last Supper; and the Church of the Dormition, marking the site

KODACHROMES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

where the Virgin fell asleep and, according to Catholic dogma, ascended to heaven. Arab Jerusalem's walls, at center, overlook a narrow no man's land where intrusions may be met by bullets from Israeli or Jordanian soldiers patrolling the uneasy frontier.

building.' This one is from Philadelphia," he said, and pointed to the Albert Einstein Institute of Physics. "Hydraulics is a 'Chicago building'; others are gifts from Britain, Canada, South Africa, and Singapore."

A surprising number of girls attend this college, most of them specializing in architecture and chemistry. "Eight percent," Freedman told me, "compared with 3 percent at

"He brought them out of darkness and the shadow of death, and brake their bands in sunder" (Psalms 107:14). Aged worshiper reads a psalm of thanksgiving near King David's Tomb. Other Jewish holy sites in Jerusalem, including the famed Wailing Wall, lie in Jordanian territory, forbidden to Jews.

M.I.T." And a woman heads the Technion's building-research center.

On the roof of the physics institute stands a station for cosmic-ray research. In the electrical engineering department I watched students building an electronic computer. And at the hydraulics lab, Nate Freedman showed me a complex model of the Yarqon River, as well as newer, smaller models of two river systems in western Nigeria.

"The Yarqon was one of our most critical problems. The river was the key to irrigation of the Negev. Our Yarqon model had to tell us many things: How much water could be diverted, where dams should be built, how the water could be divided between settlements and agriculture."

I asked about the two Nigerian rivers.

"Many nations have shared their technical know-how with Israel," Freedman said. "Now we hope to prove that international aid can be a two-way street. Those models will let us share with one of the developing nations of West Africa what we have learned on our own Yarqon."

Soil Survives Under Jagged Stones

Moving north from Haifa on my 1959 trip, I came to the Lebanese border. Here, within 200 yards of the frontier of an Arab nation, a crew was busy clearing a hillside of jagged limestone boulders.

"There is soil under these stones, as much as three feet of it," foreman Simon Dahan told me. "If it had not been for the stones, rain would have washed away the earth centuries ago."

The workmen around me were new immigrants from Tunisia, Libya, and Morocco. Most had been in Israel only a few months. Some of them would become members of this *moshav ovdim*, or smallholders' cooperative—at first as wage earners while they cleared the fields, then as tillers of their own soil.

In a month, Dahan said, they would start building houses, and water would be piped from a reservoir a mile and a half away. A school would rise. And contour plowing would hold the hard-won fields. A stony and disused hilltop would be transformed into a village rich with life and hope.

I stood again on that windswept height in 1964. Around me, in the grayness of a soft winter rain, I saw a settlement called Even Menahem. Men whom I remembered pushing boulders and leveling soil clustered around me again, pointing out their houses and their fields and the yellow school bus disgorging a stream of their children.

Self-sufficiency has not yet come to Even Menahem; that takes time. But already a few chickens have gone to market from the wire enclosures that stand behind nearly every house in the settlement, and promisingly, the

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Observing the Seder, the eve of Passover week, an Israeli family reads from the *Haggadah*, a devotional book, thus obeying the Biblical command to retell on that day each year the story of the Israelites' miraculous Exodus from bondage in Egypt.

Sinewy power in this clay study of a hand marks the work of sabra Rachel Winter, a student at the Bezalel School of Arts and Crafts in Jerusalem

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Skull-capped youngsters, children of intensely orthodox Jews, play in Jerusalem's Mea Shearim quarter. Hair of their temples is never cut, following the admonition in Leviticus 19:27: "Ye shall not round the corners of your heads. . . ."

first baskets of peaches have been picked from its hillside orchards.

Everywhere in Israel I saw such dramatic transformations. But I think the most surprising sight of all was the one that awaited me in the Hula Valley.

Armored Bulldozers Reclaim Swamp

In 1951, I had been a military observer with the United Nations. I was stationed for several months with a corps of French, Belgian, and U. S. colleagues in a disused Syrian frontier post not far from where the headwaters of the Jordan River flow into Lake Hula. Several times border fighting broke out here. Even then the Israelis, in whose territory both lake and river lie, were hard at work. Their plan was to drain the "lake"—actually a vast, reeking swamp of reeds and papyrus, and the breeding ground, until only a few years ago, of one of the highest malaria rates in the world.

Even though this was familiar territory—I remember watching armored Israeli bulldozers deepening the channel of the upper Jordan and building a dam across the river despite the menace of Syrian guns on the hills above—I was unprepared for the magnitude of the finished job. Here, where stagnant water had lain since Biblical times, were broad fields, most of them of peat land so rich it needs no fertilizer.

"Some plots yield as much as 7,000 pounds of rice an acre," Arye Drimer pointed out. As secretary of the Hula Development, he had the figures at his fingertips; the best rice fields of Italy's rich Po Valley, he said, produce no more than that.

"We can plant sugar beets," Drimer said, "and a week or so after harvesting, we can plant corn." He showed me where 500 acres had been planted in peanuts, and 750 each in cotton and rice. Peppermint grew on another 75 acres; tomatoes and flower bulbs on 75 more. The rest produced winter wheat and barley and, in summer, corn and sorghum.

Gradually, as more copper flows from Timna and wheat from the Hula fields, beef from Negev pasturelands and automobiles from Haifa's assembly plants, Israel will move ahead in self-sufficiency and, correspondingly, in economic stability. One dramatic testimonial to that process has been the appearance all over the nation of lavish, American-style supermarkets.

I remember the debut in 1959 of the first

"Supersol" on Tel Aviv's busy Ben Yehuda Road. For days newspapers in a dozen languages had heralded this one-stop shopping center, amid a growing storm of protest from the city's smaller merchants. On the day of the opening, most of Tel Aviv's grocers, butchers, and bakers closed their doors, and partisans of old-fashioned shopping threw stones.

Made-in-Israel Label Takes Over Shelves

When I came again last year, Israeli housewives had obviously taken supermarkets to their hearts. The stores were, I found, practically duplicates of their suburban U. S. counterparts, complete with speedy checkout counters and automatic doors for bundle-laden shoppers. They stocked everything from live carp in oversize aquariums to paperback novels, records, and plastic clothes hangers.

The tribute to Israeli self-sufficiency came when I looked for imported foods in Jerusalem's newest Supersol. I finally found some British cornflakes, a few packets of frozen fish from Norway, and some pineapple—and even that had been packed in Tel Aviv. That was all. In the whole of that vast store, from beef sausage (the sale of pork is unlawful except in Israel's Christian communities) to soft drinks and canned beans, not another item of food had come in at the expense of Israel's foreign-exchange balance.

I stopped to chat with an English-speaking customer. "Our home-packed products aren't always the best," she admitted candidly, "but we've made a start. And there's no reason why a can of Israeli applesauce shouldn't be as good as one from anywhere else."

Except for its supermarket and a new building tucked away here and there, Israel's capital—the "new" half of divided Jerusalem—remained much as I remembered it. New suburbs, the mushrooming campus of Hebrew University, government office buildings, and a new national museum all but ring the city. But its heart preserves a sameness unknown elsewhere in this land of the quick change.

Dead Sea Scrolls absorb students at Hebrew University in Jerusalem. Discovered by a Bedouin boy in 1947, the 2,000-year-old scrolls antedate previously known Hebrew books of the Old Testament by nearly a millennium. An apocalyptic Jewish group, probably the Essenes, inscribed and hid the manuscripts in a cliffside cave overlooking the northwest coast of the Dead Sea. Jars like those in background preserved the scrolls.

Israel Philharmonic packs Jerusalem's Convention Center. Based in Tel Aviv's Mann Auditorium, the orchestra tours the country, playing some 200 concerts a year. It counts 32,500 subscribers in Tel Aviv, Haifa, and Jerusalem.

Queen of Sheba's meeting with Solomon stirs one of her bodyguards to jealousy. The queen's maid restrains him in this ballet by the Yemenite Inbal Dance Theatre. The same performers sing, dance, speak, and play instruments.

Even here, however, the hand of the builder has been stayed for only a moment. Mordechai Ish-Shalom, the mayor of the City of Peace (curiously, his name means "man of peace"), made that clear the minute I met him.

"Of course our sector of Jerusalem has problems," he said, and led me to a window overlooking the venerable heart of Israel's capital. One- and two-story buildings crowded narrow thoroughfares, sheltering tiny shops and minuscule apartments.*

"That is the most valuable real estate in Jerusalem," the mayor said. "We can do nothing with it unless this whole section of the city can be torn down and built again."

I must have shuddered visibly, for in Israel, where so much was built last year or even last month, I have come to love the medieval look of Jerusalem's streets and its unchanging façades of beige limestone. But I was jumping to conclusions.

Israel a Nation of Music Lovers

"Only here in the heart of the city do we make such plans," he reassured me. "Even this will cost $80,000,000. So there will be more than enough of Jerusalem left as it is."

Strangely enough, for all its 4,000 years of history, Jerusalem attracts only one out of three visitors to Israel. I have yet to hear of

*See "Jerusalem, the Divided City," by John Scofield, NATIONAL GEOGRAPHIC, April, 1959.

one, though, who skipped Tel Aviv, which before 1909 was only empty sand. Even among Israelis, it is often difficult to find a good word for this sprawling, almost completely unplanned metropolis. But I suspect their shrugs and half apologies—"Well, it isn't my favorite city"—cloak a genuine fondness for this often ugly, but always lively, place. And Tel Aviv's liveliness shows in many ways. The Israel Philharmonic, for example (above).

One frustrated music lover complained to me, "The orchestra used to play in a hall with only 1,087 seats, and you could never get a ticket. Now they have a hall seating 2,800—and you can never get a ticket."

One out of every 30 of the Tel Aviv area's 750,000 residents crowds into the Philharmonic's ultramodern Fredric R. Mann Auditorium for each concert of its subscription series. Seating them all requires a series of nine identical programs.

If New Yorkers supported their Philharmonic with the same degree of enthusiasm, Philharmonic Hall would have to present each concert roughly 100 times!

I was surprised to find that the Israel Philharmonic has no permanent conductor, after nearly 30 years in Tel Aviv.

"We are looking for one," the orchestra's secretary-general said. "Meanwhile, we can draw on the best the world has to offer." He

ticked off a list of guest conductors that has included Arturo Toscanini and, for extended periods, Dimitri Mitropoulos and Leonard Bernstein.

This remarkable orchestra is only part of Tel Aviv's active cultural life. I can't recall a city anywhere else in the world where bookshops are so much in evidence. And increasingly they feature home-grown publications. Last year more than 2,000 books in Hebrew—both translations and original works—appeared in Israel.

Gem Cutters Fatten National Till

To its books, its art, and its music, Tel Aviv adds factories. Oddly enough, a recent year's output of the city's—and Israel's—chief industrial export (104 million dollars' worth) would fit comfortably into one good-size steamer trunk. The young nation has established itself as one of the world centers for the cutting and polishing of small gem diamonds. If you're wearing a diamond of a half carat or less, and bought it during the past half dozen years, it may well have acquired its glitter in Tel Aviv or Netanya, Israel's "diamond capital," a few miles up the coast (page 414).

I watched diamond polishers at work in a crowded building in downtown Tel Aviv. Their skill was astonishing. Eyes alone gauged the precise angle at which the stone must be held against a revolving cast-iron disk coated with diamond powder to create each of the 58 facets that give even a tiny gem its rainbow splendor.

Diamond-polishing plants and apartment houses, automobile repair shops and movie theaters, art galleries and warehouses rub shoulders on the same Tel Aviv streets—the result of the city's almost completely unplanned youth. But gradually newer and taller structures, including a dramatic 34-story office building, are raising their heads above the city's untidy skyline (pages 398-9).

New roads will follow (a smooth dual highway already starts motorists on their way north toward Haifa), and zoning laws will gradually sort Tel Aviv's commercial goats from its residential sheep. Its people are determined that it will eventually have the same "everything-new" look that already marks so much else in Israel.

In spite of such venerable institutions as the Philharmonic and Kibbutz Deganya, Israel enters its 18th year still a pioneer land and still facing problems that would give an older, more experienced nation premonitions of utter disaster.

Many of the industries that seem to have risen miraculously from the desert have been started with government loans; many still operate under subsidies to bring costs down to competitive levels. German reparations payments, which helped Israel's economy enormously during the first shaky decade, are all but a thing of the past.

Surrounded by Arab neighbors who still threaten to drive her into the sea, Israel must continue to support an outsize army. There are shortages of manpower, of vital raw materials, of hard currency. Housing is insufficient and costly.

Meanwhile, immigration goes on apace. And who is to say that Russia or Rumania may not suddenly open the gates to emigration and flood this warmhearted little country? For, by its Law of the Return, Israel must accept every Jew who seeks admission.

Life Too Easy, Some Israelis Complain

But the Israelis remain confident. I found no one who feared for the future, or who grumbled seriously about the present. Indeed, the one real complaint I heard was not that there had been too much hardship, but that there had been too little.

"We're getting soft," a member of a kibbutz in Galilee told me. "Japanese radios! Italian phonograph records! Why should our shops tempt us with imported luxuries when the foreign exchange they cost could build another cement plant or help develop more grazing lands in the Negev?

"If we had more austerity instead of less," he growled, "there wouldn't be all this talk about Israel's economic future."

You've got to give Israel a pretty good chance, I thought, when its ordinary citizens talk with that kind of determination.

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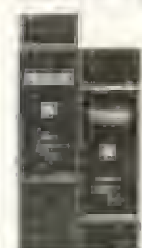

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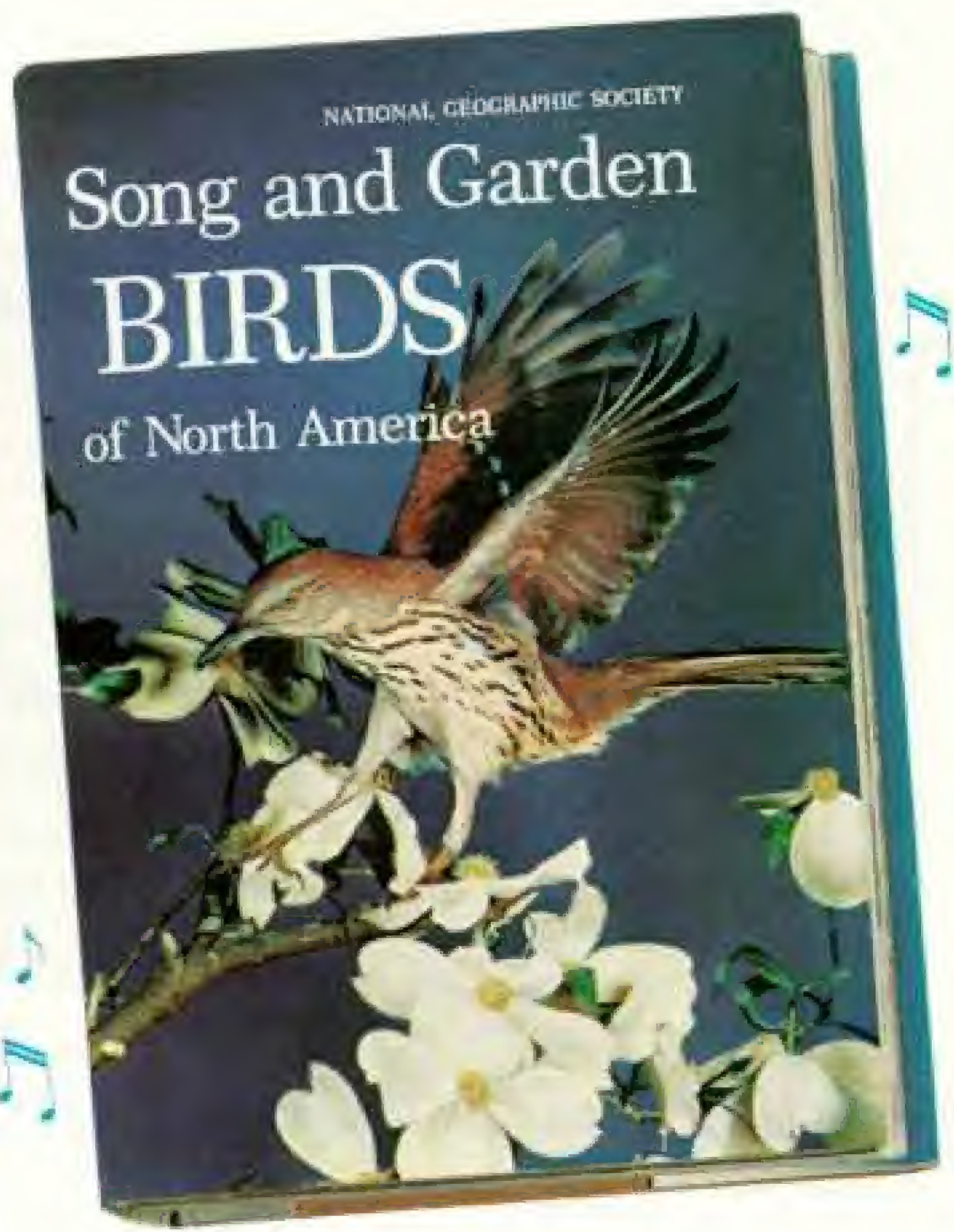

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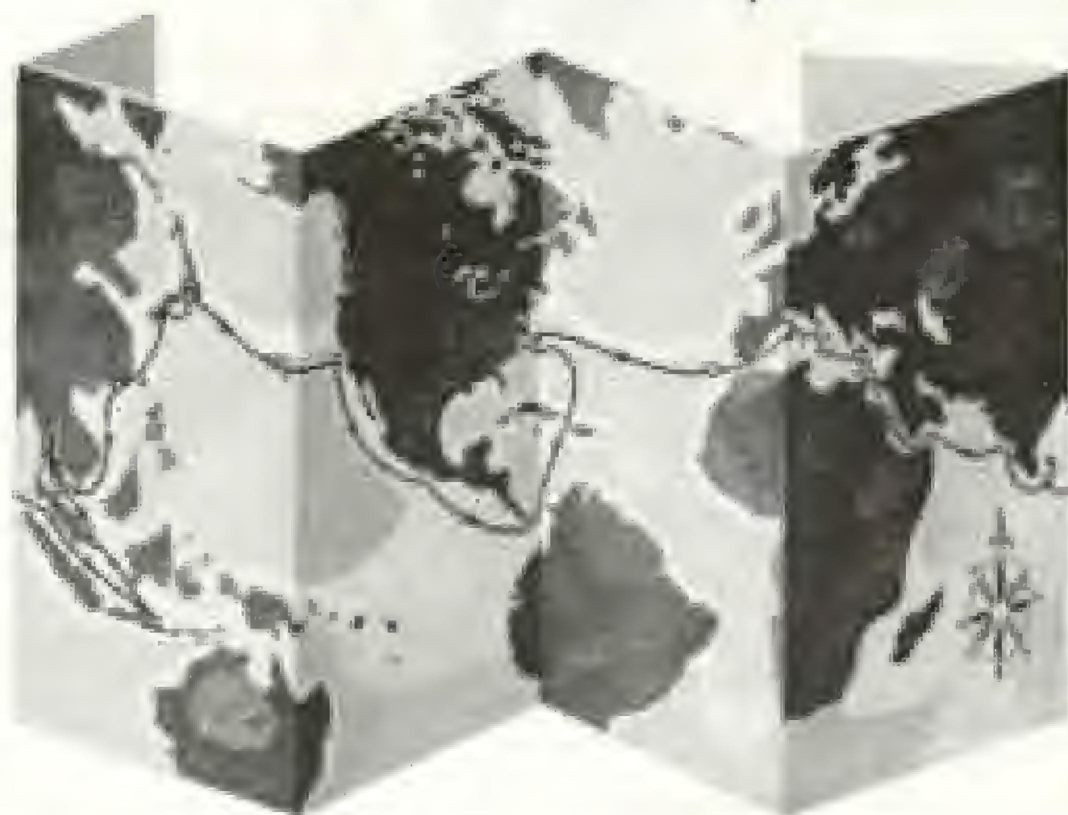

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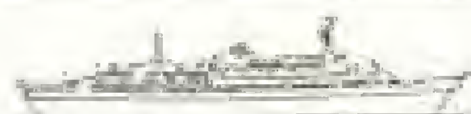

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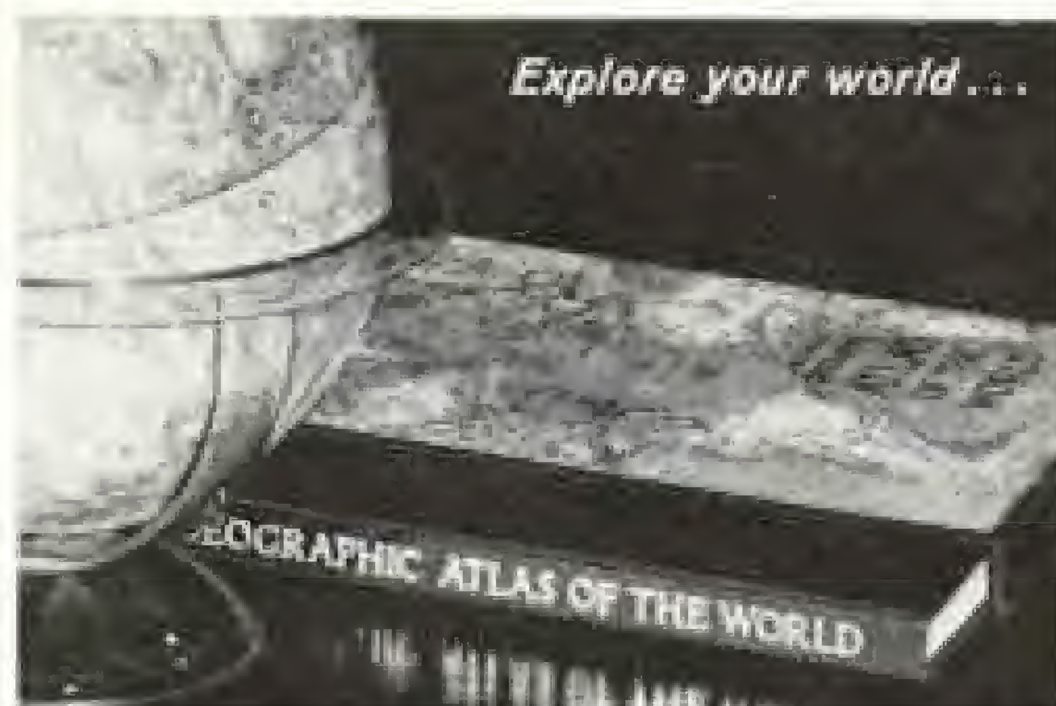

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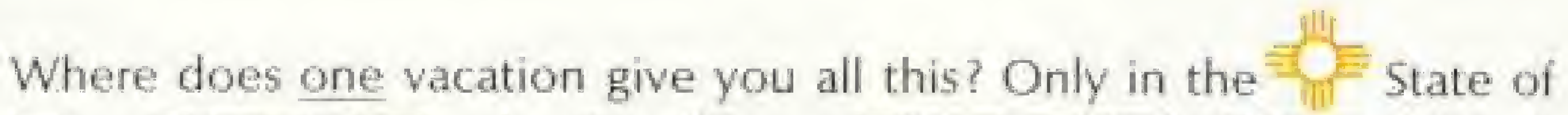

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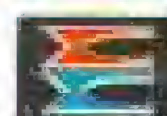

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